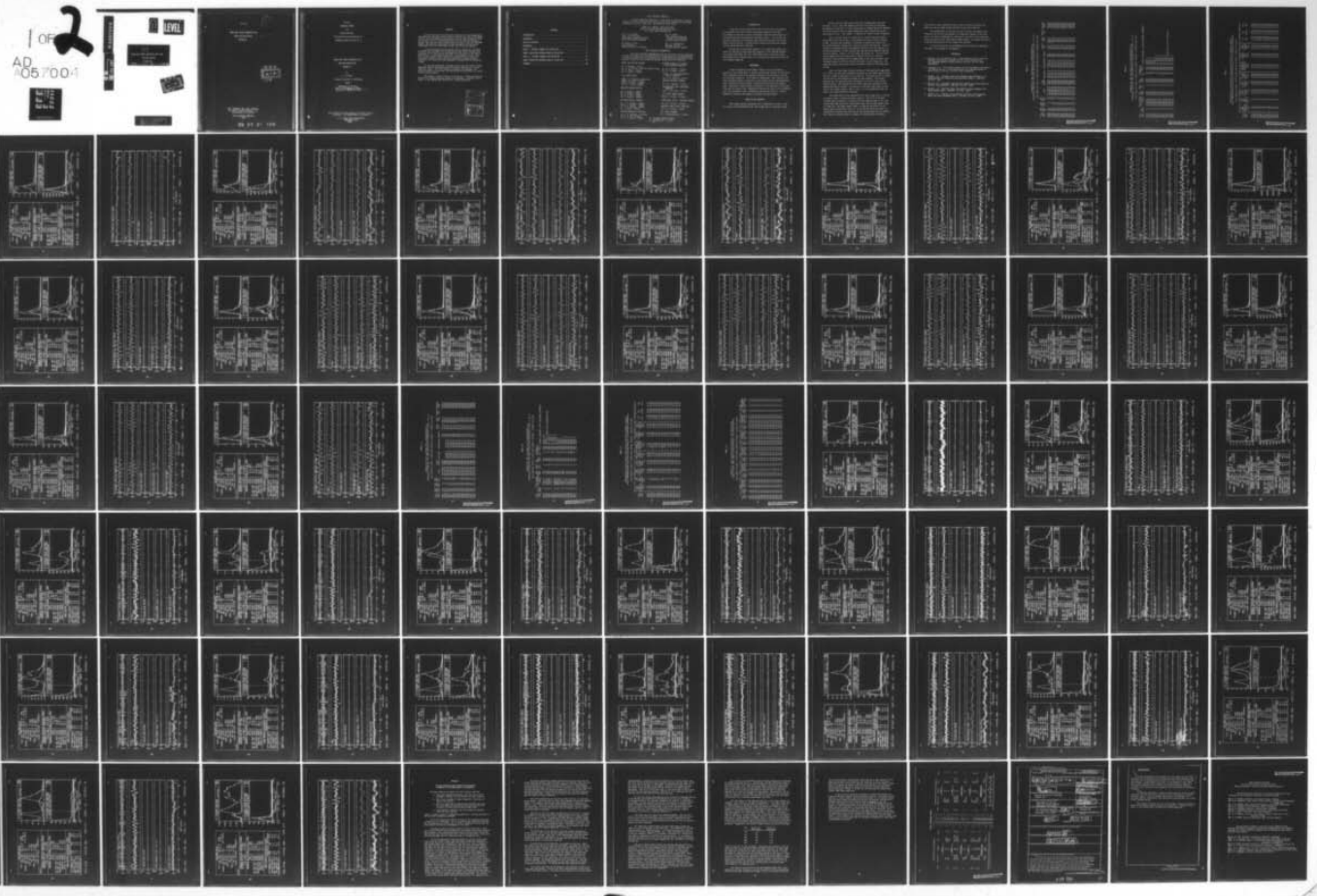
AD-A057 004 STEVENS INST OF TECH HOBOKEN N J DAVIDSON LAB F/G 8/3
RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND MCLEAN - VOYAGE 6--ETC(U)
AUG 78 J F DALZELL N00024-74-C-5451
UNCLASSIFIED SIT-DI-77-1942 SSC-SL-7-21 NL



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(1)

RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND McLEAN VOYAGE 60

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SHIP STRUCTURE COMMITTEE
1978

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SL-7-21

TECHNICAL REPORT

on

Project SR-1221

"Correlation and Verification of

Wavemeter Data from the SL-7"

RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND McLEAN VOYAGE 60

by

J. F. Dalzell

Stevens Institute of Technology

under

Department of the Navy
Naval Ship Engineering Center
Contract No. N00024-74-C-5451

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U. S. Coast Guard Headquarters
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1978

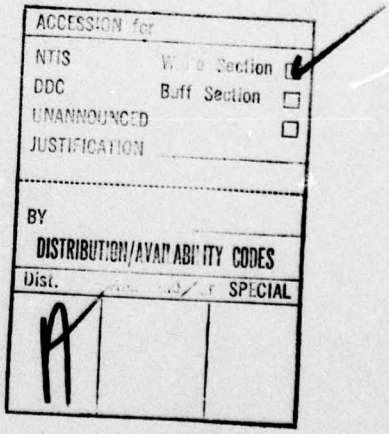
ABSTRACT

So that more precise correlations between full scale observations and analytical and model results could be carried out, one of the objectives of the instrumentation program for the SL-7 class container ships was the provision of instrumental measures of the wave environment. To this end, two wave meter systems were installed on the S.S. SEA-LAND McLEAN. Raw data was collected from both systems during the second (1973-1974) and third (1974-1975) winter data collecting seasons.

It was the purpose of the present work to reduce this raw data, to develop and implement such corrections as were found necessary and feasible, and to correlate and evaluate the final results from the two wave meters. In carrying out this work it was necessary to at least partly reduce several other channels of recorded data, so that, as a by-product, reduced results were also obtained for midship bending stresses, roll, pitch, and two components of acceleration on the ship's bridge.

As the work progressed it became evident that the volume of documentation required would grow beyond the usual dimensions of a single technical report. For this reason the analyses, the methods, the detailed results, discussions, and conclusions are contained in a series of ten related reports.

This report is one of the six in the series in which the detailed results of the data reduction process are presented. Included in this report is the reduced data from the Third Season Voyage 60.



CONTENTS

INTRODUCTION 1

BACKGROUND 1

NOTES ON CONTENTS 1

REFERENCES 3

TABLE I, INTERVAL SUMMARY FOR VOYAGE 60E 4

CHARTS CONTAINING REDUCED RESULTS, VOYAGE 60E 8

TABLE II, INTERVAL SUMMARY FOR VOYAGE 60W 40

CHARTS CONTAINING REDUCED RESULTS, VOYAGE 60W 44

APPENDIX 82

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INTRODUCTION

It was one of the objectives of the SL-7 full-scale instrumentation program to provide a direct instrumental measure of the wave environment so that more precise correlations could be made between full-scale observations, and analytical and model results. To this end the ship was fitted with a micro-wave radar relative wave meter and various motion sensing devices. A "Tucker Meter" pressure actuated wave height sensing system was also installed.

The purpose of the present project is to reduce and analyze the resulting radar and Tucker meter data obtained on the SEA-LAND McLEAN in the second (1973-1974) and third (1974-1975) winter recording seasons. The purpose of the present report is to present the reduced data from the Third Season Voyage 60.

BACKGROUND

Since the purpose of the present report is only to document a portion of the reduced data, it should be noted that details of the experiments themselves, and of the analyses leading up to the present results, are contained elsewhere. To be specific, References 1 and 2 contain, for both recording seasons in question, a full account of the instrumentation, basic recording, and the nominal circumstances surrounding the present data. References 3 and 5 contain the detail of the reduction of the original data to digital form. Reference 4 contains the detail of the analyses and of the procedures used in generating the present results. Finally, Reference 6 contains the summary, discussion and conclusions.

NOTES ON THE CONTENTS

Each voyage leg was processed, and is presented, as a unit. The first part of the presentation for each voyage leg is a four-part table.

Parts a and b of each table contain the log-book data extracted from Ref. 1 or 2. With the exception of the first column of each page, the meaning of each entry is that established by Teledyne Materials Research. The first column is the run number assigned to each interval during the digitization at D.L. This number is retained for identification throughout.

Part c of each table is a comparison of results from the present digitization with that at TMR. Five columns are stress results obtained at TMR. Stresses are presented in thousands of pounds per square inch. The columns marked 6 through 8 are from the present digitization. Column 6 "range of recorded extremes" was computed from the first pass analysis by scaling the extremes in each interval and subtracting the smallest extreme from the largest. Column 7 is $2\sqrt{2}$ times the process rms. This estimate should compare with the value given by TMR for "rms P to T stress,". Column 8 is the difference of the sample mean of the interval noted, from the sample mean of the first interval digitized in each voyage leg. The remaining columns are various ratios of present results to those obtained by TMR.

Part d of the tables involves indices of the magnitude of raw radar, roll, pitch, vertical and transverse acceleration, and Tucker meter signals. The first index in each case is 4.0 x the rms. The second and third indices are the positive and negative extremes for each channel. The extremes observed for roll and pitch were corrected for electrical zero on tape before scaling. The extremes for all other items were corrected to the sample mean before scaling. The senses of pitch and Tucker meter are not correct for reasons noted in Ref. 4, and it is to be emphasized that all data is raw (uncorrected for anything).

The second part of the presentation for each voyage leg is a series of charts, a pair of charts for each interval. The first of the pair includes plots of spectra of midship vertical bending stress, roll, corrected radar wave elevation, Tucker meter wave, and the mean dynamic head at frame 119. The "mean dynamic head" is a partial correction of the Tucker meter as detailed in Ref. 4. At the left of the first chart is a tabulation of various data; portions of the log book data from the tables, two indices of midship stress, a summary of the magnitude of motions,

and finally a table summarizing wave height statistics obtained from spectra as well as peak-trough analyses of the time histories.

The second chart of the pair for each interval are sample time histories for five of the channels of information treated in the first chart. As noted in Reference 4, there was at the end of data reduction 16-1/2 minutes of valid radar wave elevation data. To produce the charts an 8-1/2 minute portion of this sample was selected.

A fuller discussion of the background and conventions employed in the charts is presented in the Appendix.

REFERENCES

1. Wheaton, J.W. and Boentgen, R.R., "Second Season Results from Ship Response Instrumentation Aboard the SL-7 Class Containership S.S. SEA-LAND McLEAN in North Atlantic Service," SL-7-9, 1976, AD-A034162.

2. Boentgen, R.R., "Third Season Results from Ship Response Instrumentation Aboard the SL-7 Class Containership S.S. SEA-LAND McLEAN in North Atlantic Service," SL-7-10, 1976, AD-A034175.

3. Dalzell, J.F., "Original Radar and Standard Tucker Wavemeter SL-7 Containership Data Reduction and Correlation Sample," SSC-277, SL-7-14. 1978.

4. Dalzell, J.F., "Wavemeter Data Reduction Method and Initial Data for the SL-7 Containership," SSC-278, SL-7-15. 1978.

5. Dalzell, J.F., "Modified Radar and Standard Tucker Wavemeter SL-7 Containership Data," SSC-279, SL-7-20. 1978.

6. Dalzell, J.F., "Results and Evaluation of the SL-7 Containership Radar and Tucker Wavemeter Data," SSC-280, SL-7-23. 1978.

TABLE Ia

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 1 OF 2)

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 60 EAST

D.L. RUN NO.	TMR TAPE NO.	TMR INDX NO.	TMR INTV NO.	DATE	TIME (GMT)	LATITUDE	LONGITUDE	COURSE	SPEED KT.	PROP RPM	DRAFT FT.	SEA/AIR TEMP
2126	211	7	26	02-08-75	0400	36-46 N	73-44 W	094	29.5	120.7		66/56
2130	211	8	30	02-08-75	0800	36-46 N	73-44 W	094	29.4	120.5		70/58
2133	211	9	33	02-08-75	1200	36-46 N	73-44 W	094	29.5	120.7		64/59
2138	211	10	38	02-08-75	1600	36-02 N	60-14 W	094	29.5	121.0		63/68
2205	213	17	5	02-09-75	2000	35-12 N	46-42 W	072	19.5	79.8		62/62
2209	213	18	9	02-09-75	2400	35-12 N	46-42 W	072	19.6	80.7		60/59
2213	213	19	13	02-10-75	0400	35-12 N	46-42 W	072	19.7	80.9		61/59
2217	213	20	17	02-10-75	0800	35-12 N	46-42 W	072	19.6	80.6		61/59
2221	213	21	21	02-10-75	1200	37-20 N	37-40 W	073	19.8	81.3		60/60
2225	213	22	25	02-10-75	1600	37-20 N.	37-40 W	073	20.7	84.9		59/65
2229	213	23	29	02-10-75	2000	37-20 N	37-40 W	073	20.7	84.8		54/58
2233	213	24	33	02-10-75	2400	37-20 N	37-40 W	073	20.8	85.3		57/57
2237	213	25	37	02-11-75	0400	37-20 N	37-40 W	073	20.8	85.2		59/58
2241	213	26	41	02-11-75	0800	37-20 N	37-40 W	073	20.8	85.4		58/58
2245	213	27	45	02-11-75	1200	39-40 N	27-50 W	073	20.8	85.3		56/60
2249	213	28	49	02-11-75	1600	39-40 N	27-50 W	073	20.9	85.8		57/60

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TABLE Ib

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 2 OF 2)

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 60 EAST

D.L. RUN NO.	SEA STATE	<REL WIND> DIR/SPEED /(KT)	REL WAVE DIR	WAVE HT. FT.	REL SWELL DIR	<-SWELL-> HT FT.	<-SWELL-> LENGTH FT.	VISUAL WEATHER /TMR LOG-BOOK COMMENTS
2126	6	161P/25	161P	3	139P	10	600	OCAST /
2130	7	139P/30	139P	3	139P	10	600	OCAST /
2133	6	139P/25	139P	3	139P	10	600	OCAST /
2138	7	161P/30	161P	3	161P	10	600	OCAST /
2205	4	139P/15	139P	2	139P	8	600	OCAST /
2209	3	117P/10	117P	3	139P	8	600	PT CLDY /
2213	2	117P/ 5	117P	3	139P	12	800	PT CLDY /
2217	4	117P/15	117P	3	139P	12	800	PT CLDY /
2221	4	118P/15	118P	3	140P	16	800	PT CLDY /
2225	2	163P/ 5	163P	2	140P	16	800	PT CLDY /
2229	3	163P/10	163P	3	140P	16	800	PT CLDY /
2233	3	152S/10	152S	3	118P	18	800	PT CLDY /
2237	3	174S/10	174S	3	118P	18	800	PT CLDY /ROLLING IN 18 FT SWELLS
2241	5	174S/20	174S	4	118P	16	800	PT CLDY /
2245	6	174S/25	174S	4	118P	16	800	PT CLDY /
2249	5	152S/20	152S	4	118P	14	700	PT CLDY /

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TABLE Ic

COMPARISON OF TMR RESULTS FOR MIDSHIP VERTICAL BENDING STRESS
WITH CORRESPONDING RAW DIGITIZATION RESULTS AT DAVIDSON LABORATORY

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 60 EAST

	<----------TMR RESULTS---------->					<----D.L. DIGITIZATION--->			<--COLUMN RATIOS-->		
D.L. RUN NO.	NO. WAVE INDUCED CYCLES (1)	NO. 1ST MODE BURSTS (2)	MAX P-TO-T STRESS KPSI (3)	RMS P-TO-T STRESS KPSI (4)	MAX 1ST MODE STRESS KPSI (5)	RANGE OF RECORDED EXTREMES KPSI (6)	2.83X (SAMPLE RMS) KPSI (7)	REL MEAN STRESS KPSI (8)	(7) / (4)	(6) / (3+5)	(6) / (3)
2126	65	0	5.45	2.49	0.00	8.51	3.17	0.74	1.27	1.56	1.56
2130	63	0	8.02	2.94	0.00	8.74	3.45	1.01	1.17	1.09	1.09
2133	72	0	5.72	2.35	0.00	6.63	3.02	0.95	1.29	1.16	1.16
2138	70	0	4.29	2.06	0.00	6.65	2.64	1.54	1.28	1.55	1.55
2205	71	0	5.25	2.78	0.00	5.93	2.68	1.87	0.96	1.13	1.13
2209	73	0	5.45	2.91	0.00	6.24	2.76	1.67	0.95	1.14	1.14
2213	79	0	6.59	2.81	0.00	7.24	3.07	1.55	1.10	1.10	1.10
2217	78	0	6.80	3.09	0.00	7.71	3.20	1.46	1.04	1.13	1.13
2221	77	0	5.77	3.18	0.00	7.71	3.17	1.68	1.00	1.33	1.33
2225	66	0	8.57	3.83	0.00	8.94	3.55	2.02	0.93	1.04	1.04
2229	65	0	9.10	4.27	0.00	9.15	3.98	1.38	0.93	1.01	1.01
2233	65	0	6.97	3.49	0.00	8.35	3.53	1.22	1.01	1.20	1.20
2237	76	0	6.82	3.13	0.00	7.28	3.16	1.04	1.01	1.07	1.07
2241	61	0	6.98	3.23	0.00	7.65	3.30	0.98	1.02	1.10	1.10
2245	70	0	7.17	3.53	0.00	7.92	3.40	1.87	0.96	1.11	1.11
2249	67	0	5.74	3.21	0.00	6.61	3.22	1.78	1.00	1.15	1.15

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TABLE Id

SUMMARY OF RAW DIGITIZATION RESULTS FOR RADAR RANGE
ROLL, PITCH, DECK HOUSE ACCELERATIONS, AND TUCKER METER

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 60 EAST

	<--- RADAR --->			<--- ROLL ---->			<--- PITCH --->			<--VERT ACCEL->			<--LAT ACCEL-->			<-- TUCKER -->		
D.L. RUN NO.	4.0 (RMS) FT	RECORDED EXTREMES FT	FT	4.0 (RMS) DEG	RECORDED EXTREMES DEG	DEG	4.0 (RMS) DEG	RECORDED EXTREMES DEG	DEG	4.0 (RMS) (G)	RECORDED EXTREMES (G)	(G)	4.0 (RMS) (G)	RECORDED EXTREMES (G)	(G)	4.0 (RMS) FT	RECORDED EXTREMES FT	FT
2126	29.	30.	-63.	10.7	6.	-13.	0.8	0.3	-2.8	0.28	1.7	-0.4	0.21	0.2	-0.4	3.	2.	-3.
2130	29.	29.	-23.	12.0	12.	-13.	0.7	0.2	-1.0	0.16	0.1	-0.1	0.23	0.2	-0.3	2.	2.	-2.
2133	25.	22.	-20.	10.1	7.	-8.	0.7	0.1	-1.2	0.17	0.2	-0.1	0.19	0.1	-0.2	2.	2.	-2.
2138	19.	16.	-16.	8.9	8.	-8.	0.7	0.2	-1.0	0.18	0.2	-0.1	0.18	0.2	-0.2	2.	2.	-2.
2205	16.	13.	-14.	10.5	7.	-8.	0.7	0.1	-1.2	0.21	0.2	-0.2	0.21	0.2	-0.2	3.	2.	-3.
2209	16.	15.	-13.	10.4	9.	-7.	0.7	0.3	-1.2	0.23	0.2	-0.2	0.21	0.1	-0.2	4.	3.	-4.
2213	17.	14.	-13.	12.0	10.	-10.	0.8	0.2	-2.5	0.54	1.8	-0.3	0.25	0.2	-0.3	5.	4.	-5.
2217	19.	16.	-16.	12.7	10.	-9.	0.8	0.3	-1.2	0.26	0.2	-0.3	0.25	0.2	-0.2	6.	5.	-5.
2221	20.	16.	-19.	12.7	12.	-11.	0.9	0.3	-1.3	0.27	0.3	-0.3	0.25	0.2	-0.2	8.	7.	-6.
2225	23.	18.	-20.	17.4	14.	-13.	0.8	0.2	-1.2	0.23	0.2	-0.2	0.33	0.3	-0.3	9.	10.	-6.
2229	23.	23.	-21.	18.6	17.	-14.	0.8	0.3	-1.1	0.22	0.2	-0.2	0.35	0.3	-0.3	8.	10.	-7.
2233	20.	16.	-15.	15.7	12.	-12.	0.8	0.2	-1.2	0.21	0.2	-0.2	0.30	0.2	-0.2	6.	4.	-5.
2237	21.	20.	-19.	15.3	11.	-13.	0.8	0.3	-1.1	0.22	0.2	-0.2	0.30	0.3	-0.2	8.	6.	-6.
2241	21.	19.	-18.	16.1	12.	-14.	0.8	0.3	-1.1	0.19	0.2	-0.2	0.30	0.3	-0.2	8.	6.	-8.
2245	25.	21.	-19.	20.5	15.	-15.	0.9	0.3	-1.0	0.22	0.2	-0.2	0.38	0.3	-0.3	9.	6.	-7.
2249	20.	15.	-15.	16.8	13.	-14.	0.7	0.2	-1.0	0.17	0.1	-0.2	0.31	0.3	-0.3	6.	5.	-5.

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LOG BOOK DATA

DATE AND TIME	02-08-75 0400
POSITION	36-46 N 73-44 W
COURSE AND SPEED	094 , 29.5 KNOTS
SEA STATE	6
WAVE HEIGHT	3 FEET
" REL DIR	161 PORT
SWELL HEIGHT	10 FEET
" REL DIR	139 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

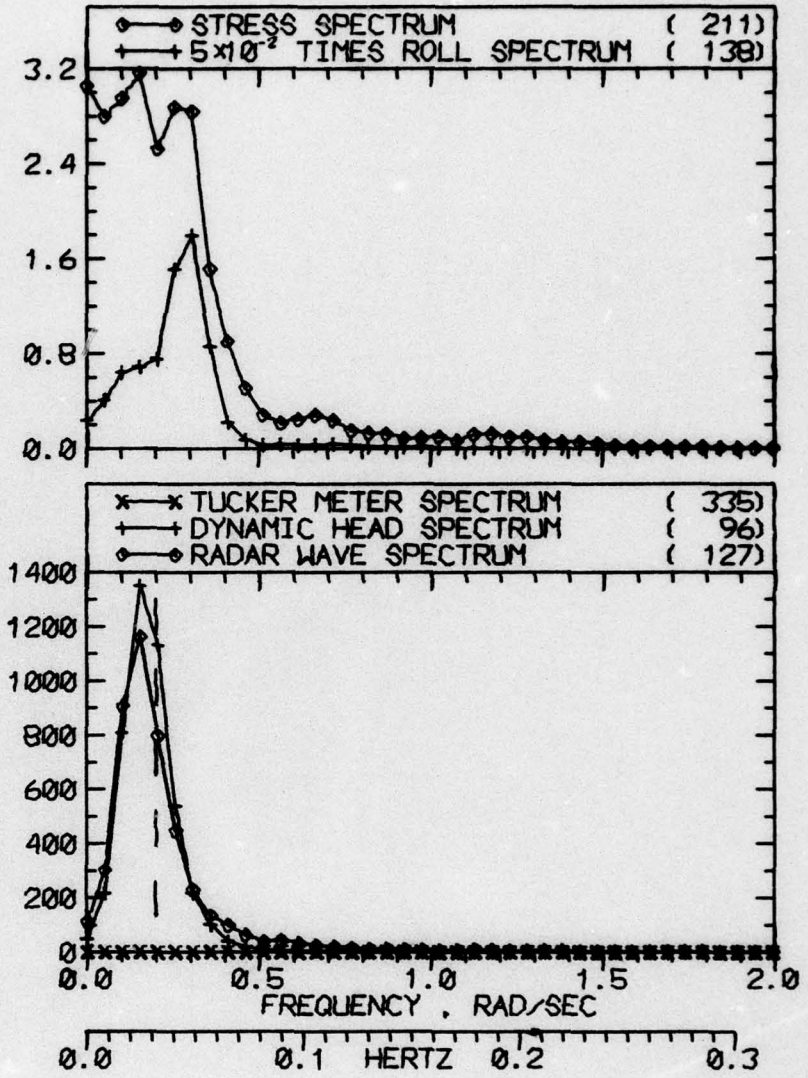
MAXIMUM PK-TR	5.5 KPSI
4.0 X RMS	4.5 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

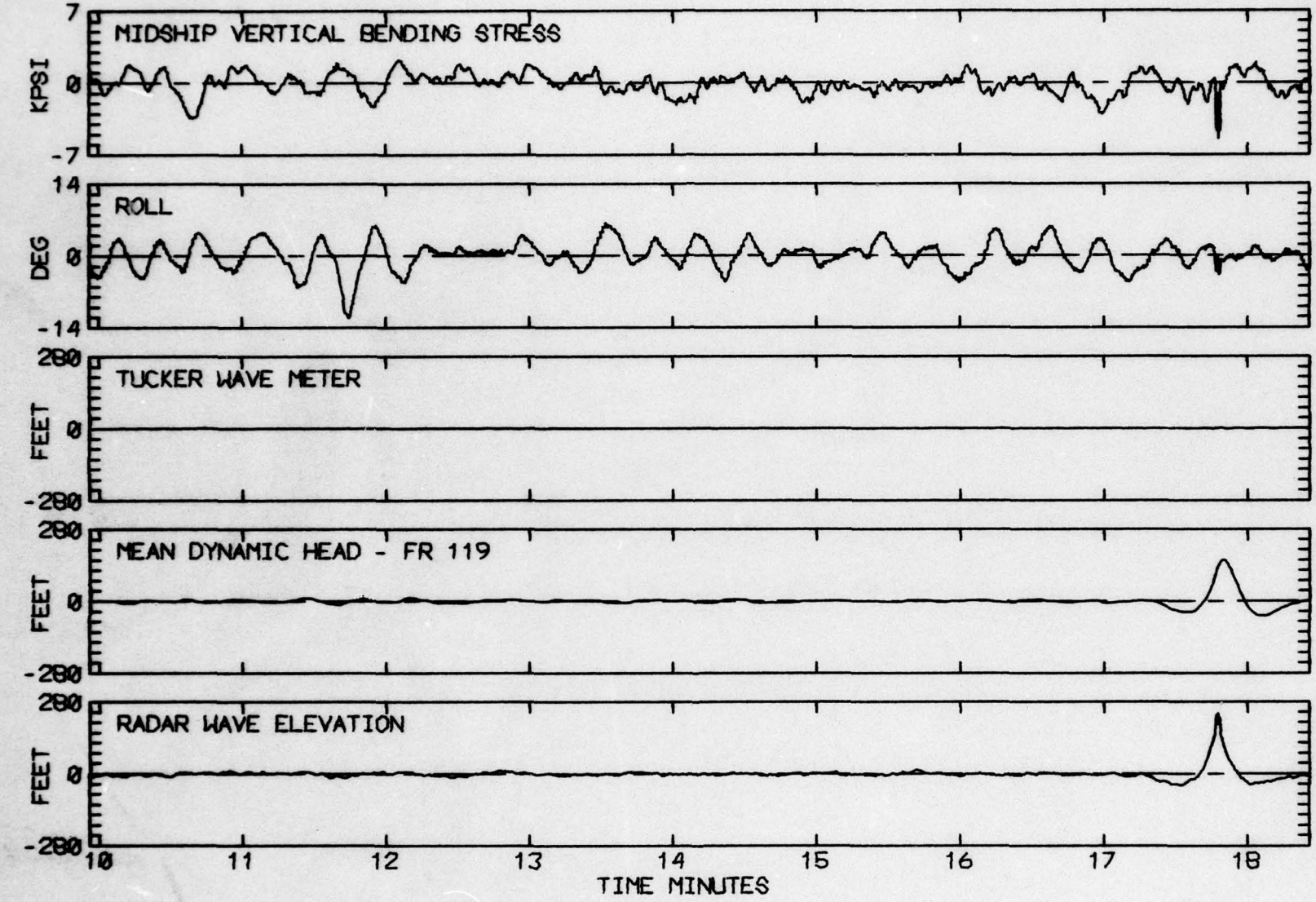
ROLL	11.0 DEG
PITCH	0.80 DEG
DK HSE VERT ACCEL	0.28 G
DK HSE LAT ACCEL	0.21 G
RADAR SLANT RANGE	28.8 FEET
VERTICAL RANGE	26.1 FEET
DISPL AT RADAR	55.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	276	47	161
MAXIMUM HEIGHT	3.9	215.5	47.8
10TH HIGHEST HTS	2.6	58.2	19.5
3RD HIGHEST HTS	1.8	30.3	13.2
4.0 RMS(SPECTRA)	2.8	60.5	60.8



RUN 2126 -- VOYAGE 60E -- TAPE 211 -- INDEX 7 -- INTERVAL 26



RUN 2126 -- VOYAGE 60E -- TAPE 211 -- INDEX 7 -- INTERVAL 26

LOG BOOK DATA

DATE AND TIME	02-08-75 0800
POSITION	36-46 N 73-44 W
COURSE AND SPEED	094 . 29.4 KNOTS
SEA STATE	7
WAVE HEIGHT	3 FEET
" REL DIR	139 PORT
SWELL HEIGHT	10 FEET
" REL DIR	139 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

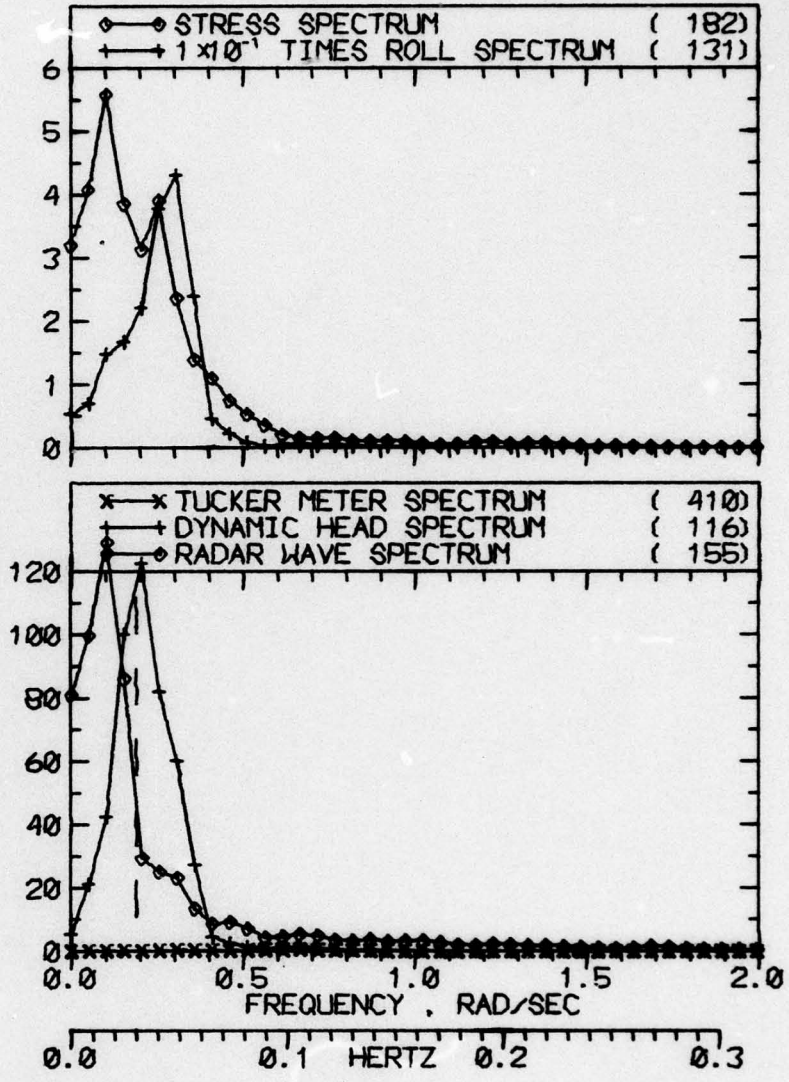
MAXIMUM PK-TR	8.0 KPSI
4.0 X RMS	5.0 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

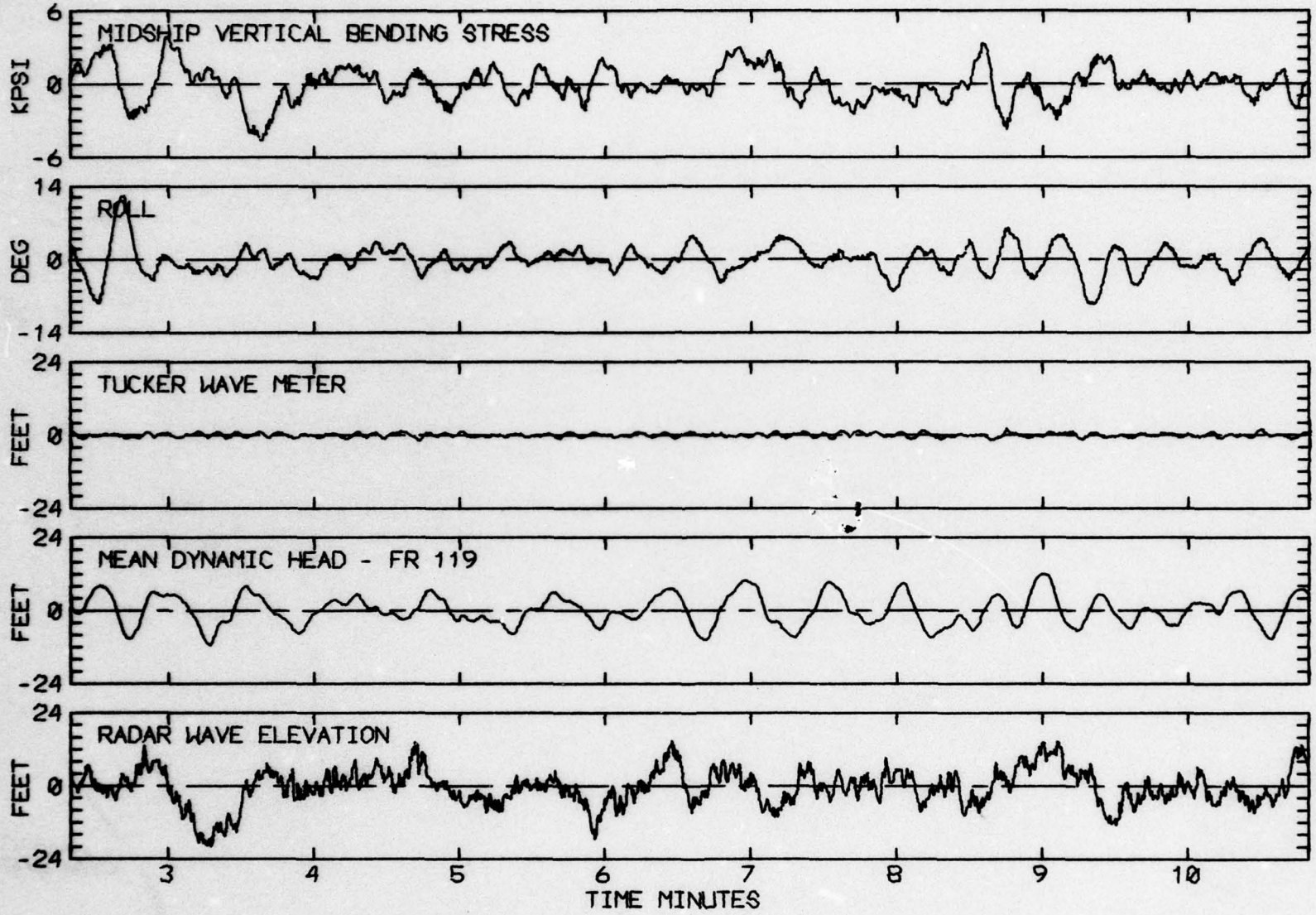
ROLL	12.1 DEG
PITCH	0.69 DEG
DK HSE VERT ACCEL	0.16 G
DK HSE LAT ACCEL	0.23 G
RADAR SLANT RANGE	28.6 FEET
VERTICAL RANGE	24.6 FEET
DISPL AT RADAR	20.8 FEET

WAVE HEIGHT STATISTICS (FEET)

		TUCKER/DYN.	HEAD/RADAR
P-T SAMPLE SIZE	323	39	232
MAXIMUM HEIGHT	3.3	30.8	33.2
10TH HIGHEST HTS	2.0	21.1	14.9
3RD HIGHEST HTS	1.4	17.9	10.0
4.0 RMS(SPECTRA)	2.3	19.7	21.4



RUN 2130 -- VOYAGE 60E -- TAPE 211 -- INDEX 8 -- INTERVAL 30



RUN 2130 -- VOYAGE 60E -- TAPE 211 -- INDEX 8 -- INTERVAL 30

LOG BOOK DATA

DATE AND TIME	02-08-75 1200
POSITION	36-46 N 73-44 W
COURSE AND SPEED	094 . 29.5 KNOTS
SEA STATE	6
WAVE HEIGHT	3 FEET
" REL DIR	139 PORT
SWELL HEIGHT	10 FEET
" REL DIR	139 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

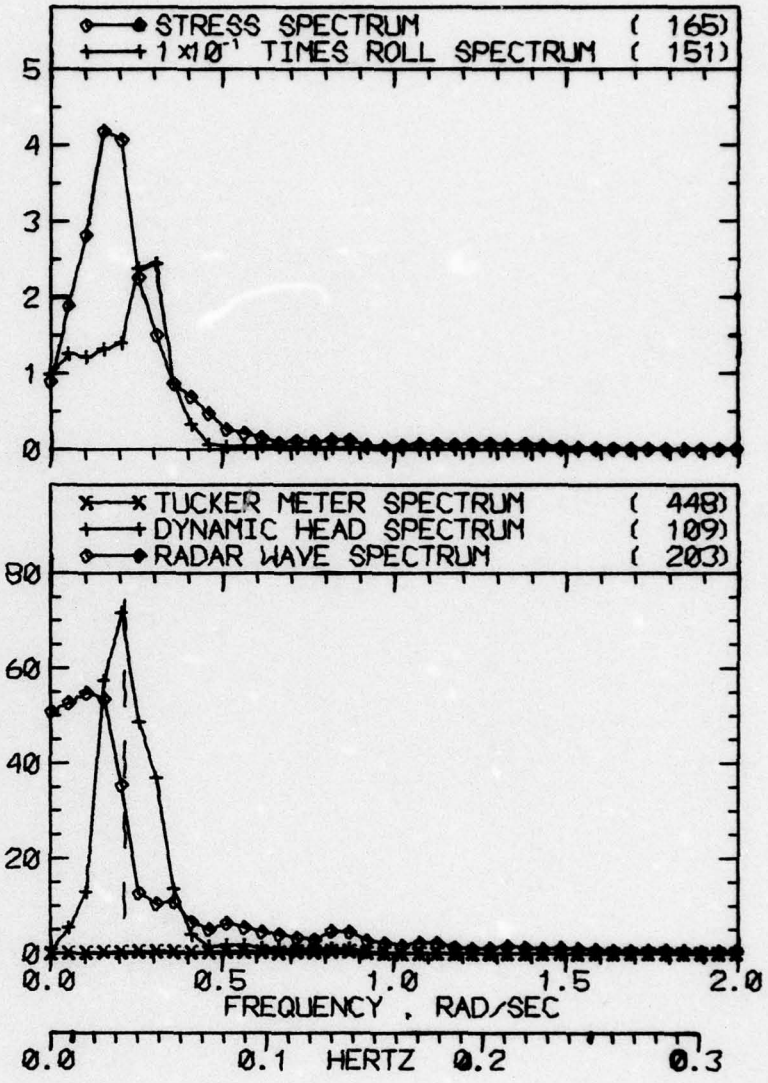
MAXIMUM PK-TR	5.7 KPSI
4.0 X RMS	4.2 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

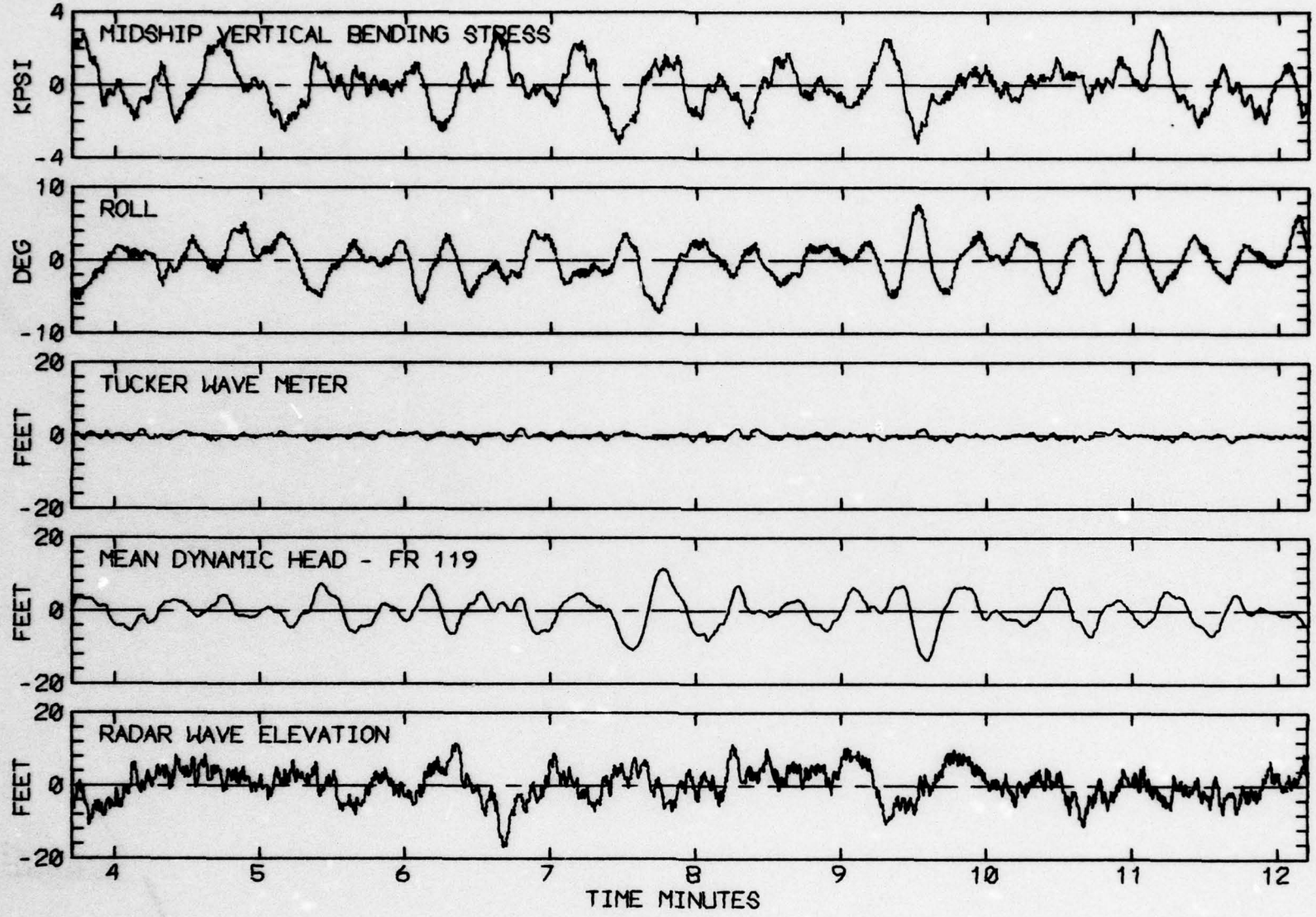
ROLL	10.0 DEG
PITCH	0.68 DEG
DK HSE VERT ACCEL	0.17 G
DK HSE LAT ACCEL	0.19 G
RADAR SLANT RANGE	25.3 FEET
VERTICAL RANGE	21.6 FEET
DISPL AT RADAR	16.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	347	62	275
MAXIMUM HEIGHT	3.4	20.3	17.1
10TH HIGHEST HTS	2.3	16.2	11.6
3RD HIGHEST HTS	1.5	11.8	8.2
4.0 RMS(SPECTRA)	2.5	14.7	16.9



RUN 2133 -- VOYAGE 60E -- TAPE 211 -- INDEX 9 -- INTERVAL 33



RUN 2133 -- VOYAGE 60E -- TAPE 211 -- INDEX 9 -- INTERVAL 33

LOG BOOK DATA

DATE AND TIME	02-08-75 1600
POSITION	36-02 N 60-14 W
COURSE AND SPEED	094 , 29.5 KNOTS
SEA STATE	7
WAVE HEIGHT	3 FEET
" REL DIR	161 PORT
SWELL HEIGHT	10 FEET
" REL DIR	161 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

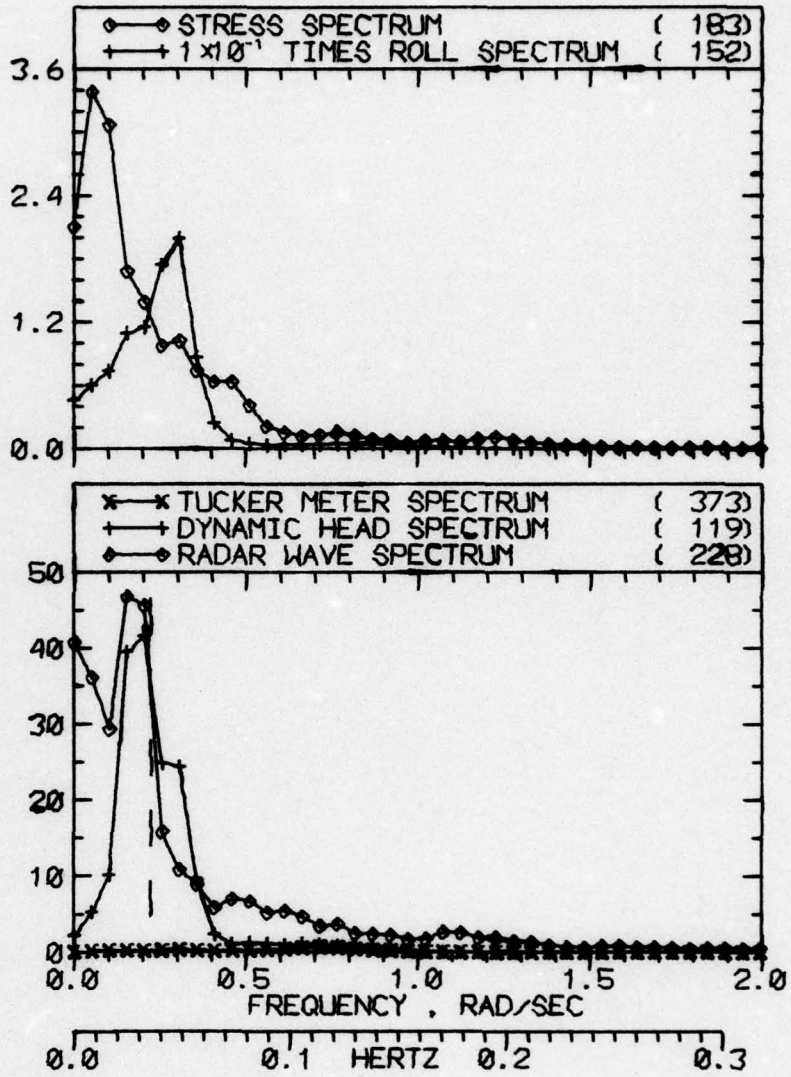
MAXIMUM PK-TR	4.3 KPSI
4.0 X RMS	3.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

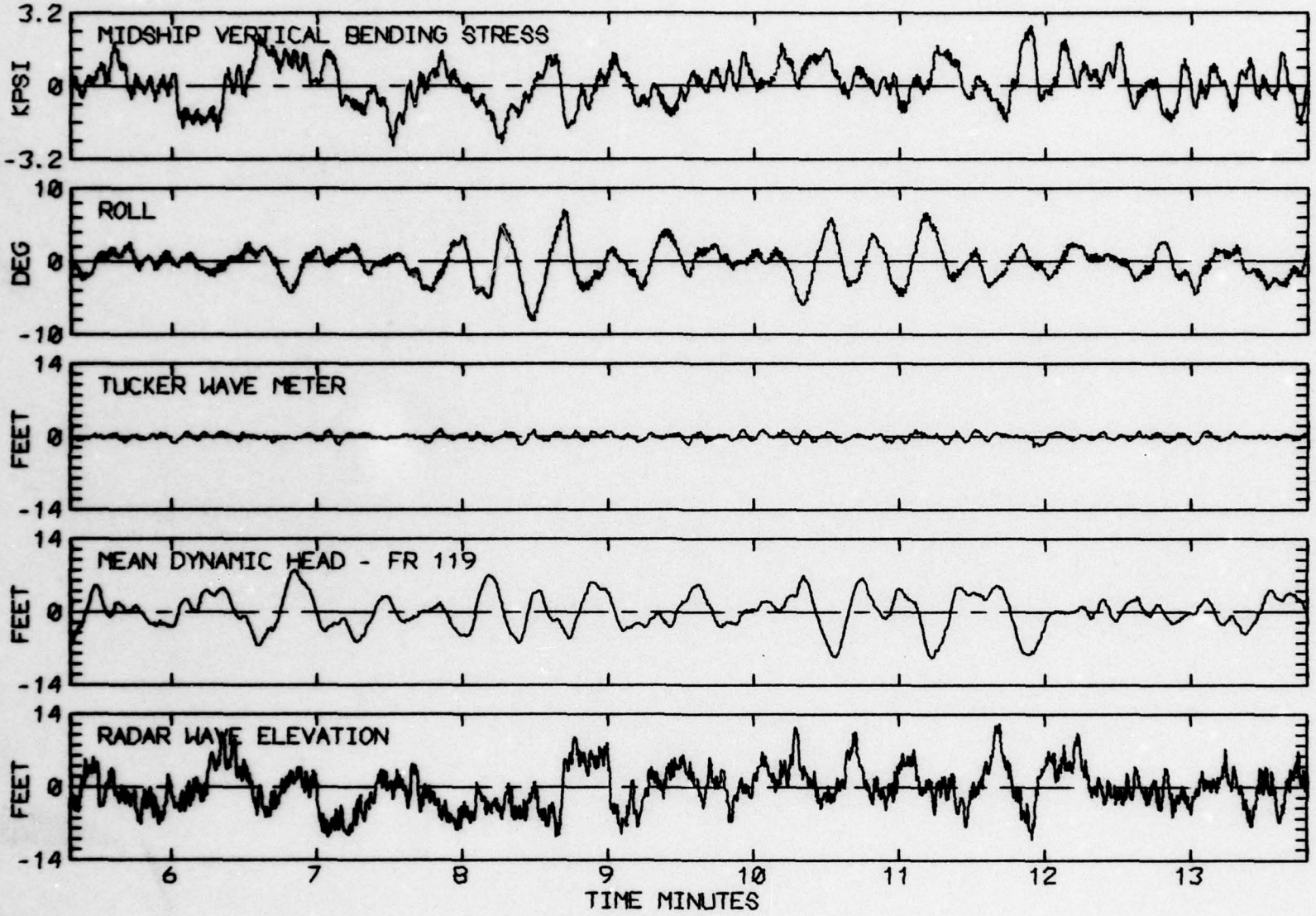
ROLL	8.7 DEG
PITCH	0.72 DEG
DK HSE VERT ACCEL	0.18 G
DK HSE LAT ACCEL	0.18 G
RADAR SLANT RANGE	19.3 FEET
VERTICAL RANGE	16.9 FEET
DISPL AT RADAR	13.8 FEET

WAVE HEIGHT STATISTICS (FEET)

		TUCKER/DYN. HEAD/RADAR	
P-T SAMPLE SIZE	411	71	263
MAXIMUM HEIGHT	3.0	15.5	19.0
10TH HIGHEST HTS	2.1	12.4	12.1
3RD HIGHEST HTS	1.4	9.0	8.6
4.0 RMS(SPECTRA)	2.3	11.7	15.7



RUN 2138 -- VOYAGE 60E -- TAPE 211 -- INDEX 10 -- INTERVAL 38



RUN 2138 -- VOYAGE 60E -- TAPE 211 -- INDEX 10 -- INTERVAL 38

LOG BOOK DATA

DATE AND TIME	02-09-75 2000
POSITION	35-12 N 46-42 W
COURSE AND SPEED	072 . 19.5 KNOTS
SEA STATE	4
WAVE HEIGHT	2 FEET
" REL DIR	139 PORT
SWELL HEIGHT	8 FEET
" REL DIR	139 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

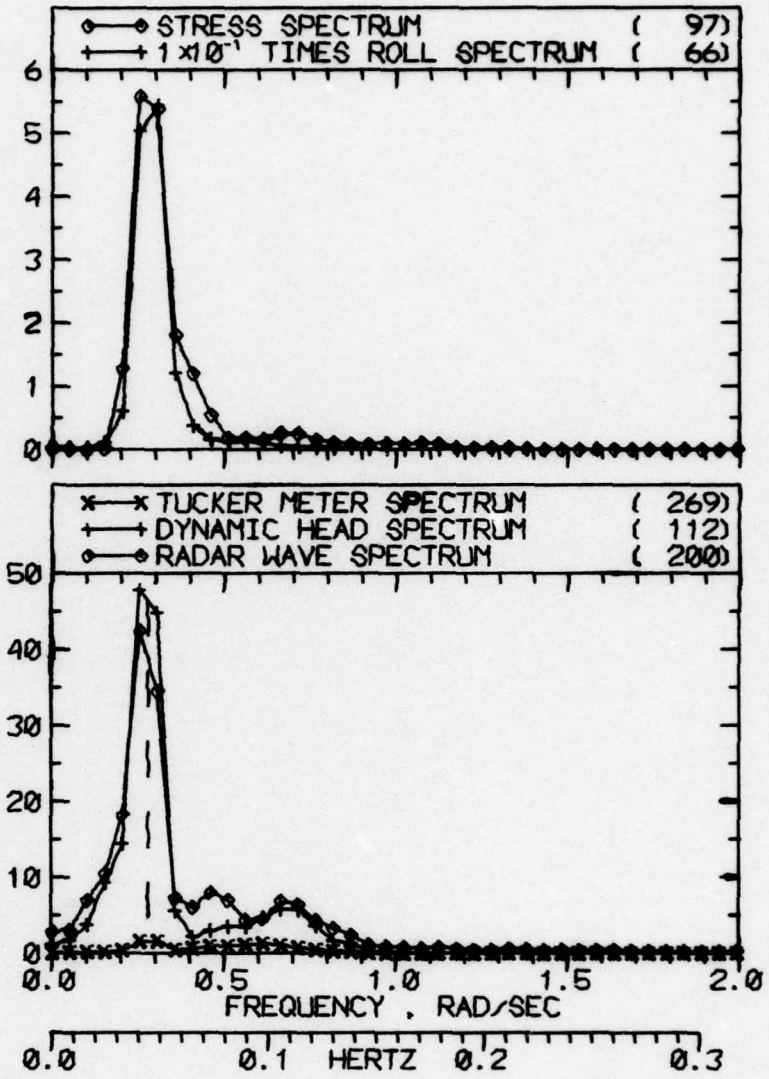
MAXIMUM PK-TR	5.3 KPSI
4.0 X RMS	3.8 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

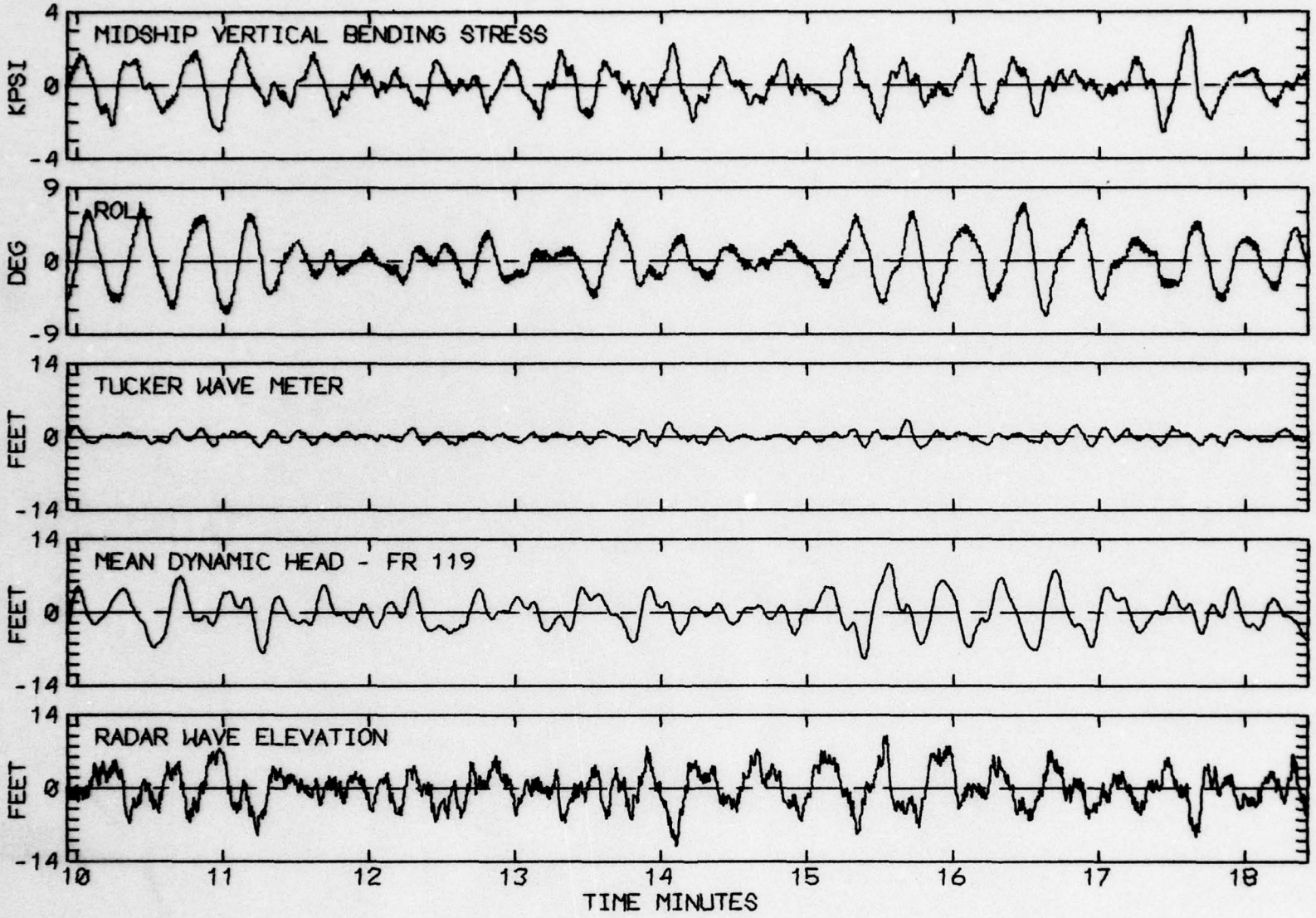
ROLL	10.6 DEG
PITCH	0.69 DEG
DK HSE VERT ACCEL	0.21 G
DK HSE LAT ACCEL	0.21 G
RADAR SLANT RANGE	15.6 FEET
VERTICAL RANGE	13.5 FEET
DISPL AT RADAR	15.2 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	278	78	285
MAXIMUM HEIGHT	5.3	15.2	17.3
10TH HIGHEST HTS	2.9	13.7	11.3
3RD HIGHEST HTS	1.9	10.0	7.1
4.0 RMS(SPECTRA)	3.3	11.6	12.7



RUN 2205 -- VOYAGE 60E -- TAPE 213 -- INDEX 17 -- INTERVAL 5



RUN 2205 -- VOYAGE 60E -- TAPE 213 -- INDEX 17 -- INTERVAL 5

LOG BOOK DATA

DATE AND TIME	02-09-75 2400
POSITION	35-12 N 46-42 W
COURSE AND SPEED	072 . 19.6 KNOTS
SEA STATE	3
WAVE HEIGHT	3 FEET
* REL DIR	117 PORT
SWELL HEIGHT	8 FEET
* REL DIR	139 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

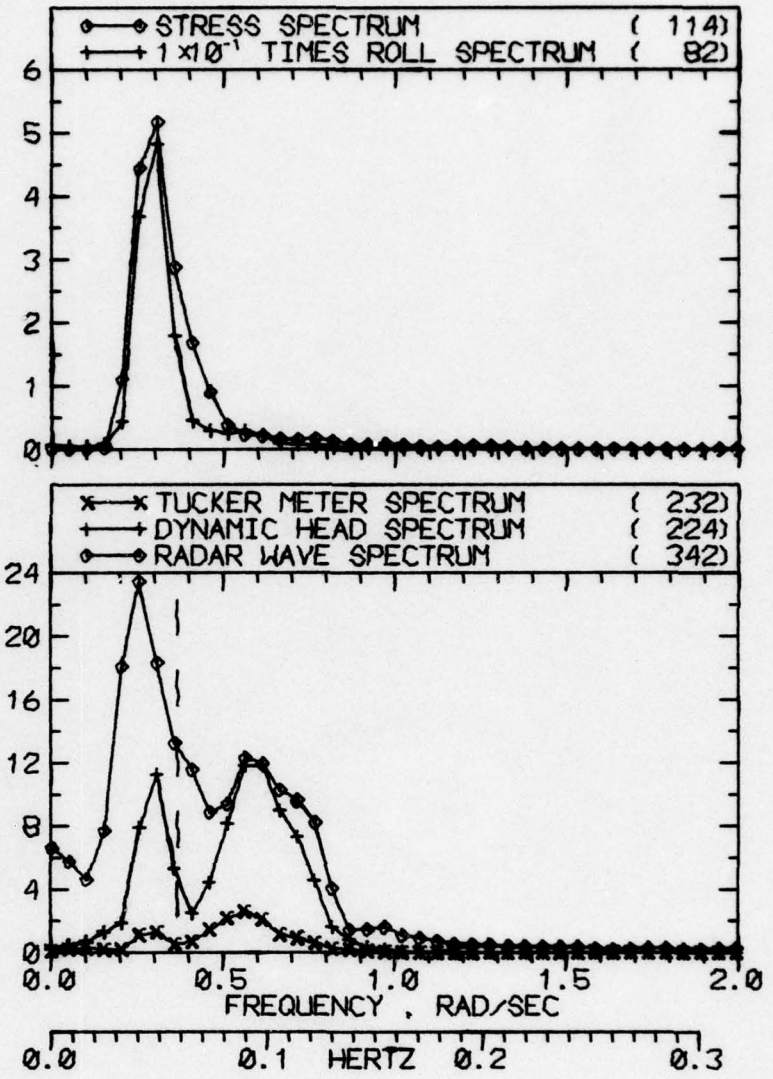
MAXIMUM PK-TR	5.5 KPSI
4.0 X RMS	3.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

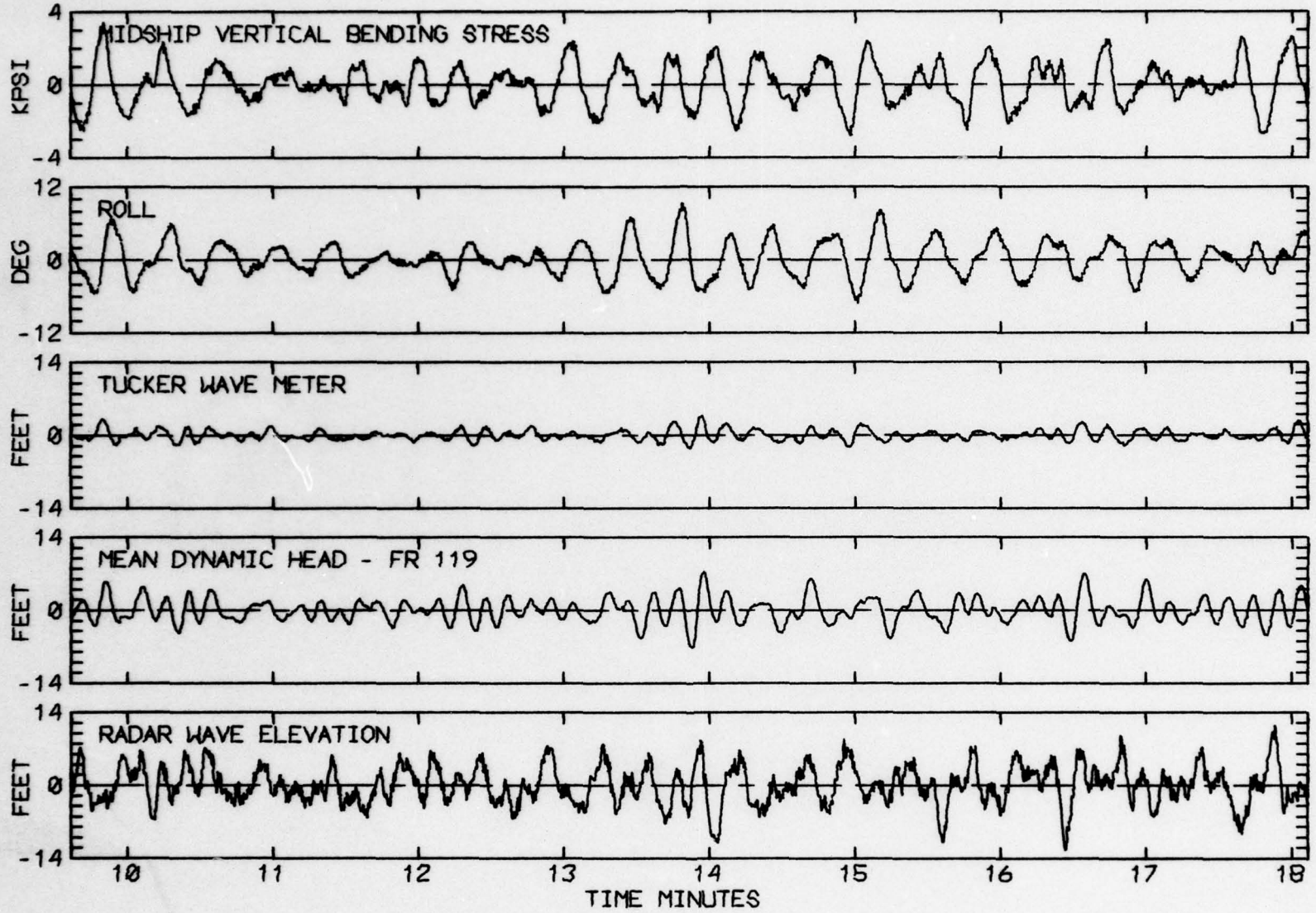
ROLL	10.3 DEG
PITCH	0.74 DEG
DK HSE VERT ACCEL	0.23 G
DK HSE LAT ACCEL	0.21 G
RADAR SLANT RANGE	16.3 FEET
VERTICAL RANGE	14.3 FEET
DISPL AT RADAR	15.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	239	104	309
MAXIMUM HEIGHT	5.3	11.7	20.3
10TH HIGHEST HTS	3.5	9.6	10.5
3RD HIGHEST HTS	2.3	7.8	7.1
4.0 RMS(SPECTRA)	3.7	8.7	12.9



RUN 2209 -- VOYAGE 60E -- TAPE 213 -- INDEX 18 -- INTERVAL 9



RUN 2209 -- VOYAGE 60E -- TAPE 213 -- INDEX 18 -- INTERVAL 9

LOG BOOK DATA

DATE AND TIME	02-10-75 0400
POSITION	35-12 N 46-42 W
COURSE AND SPEED	072 . 19.7 KNOTS
SEA STATE	2
WAVE HEIGHT	3 FEET
" REL DIR	117 PORT
SWELL HEIGHT	12 FEET
" REL DIR	139 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

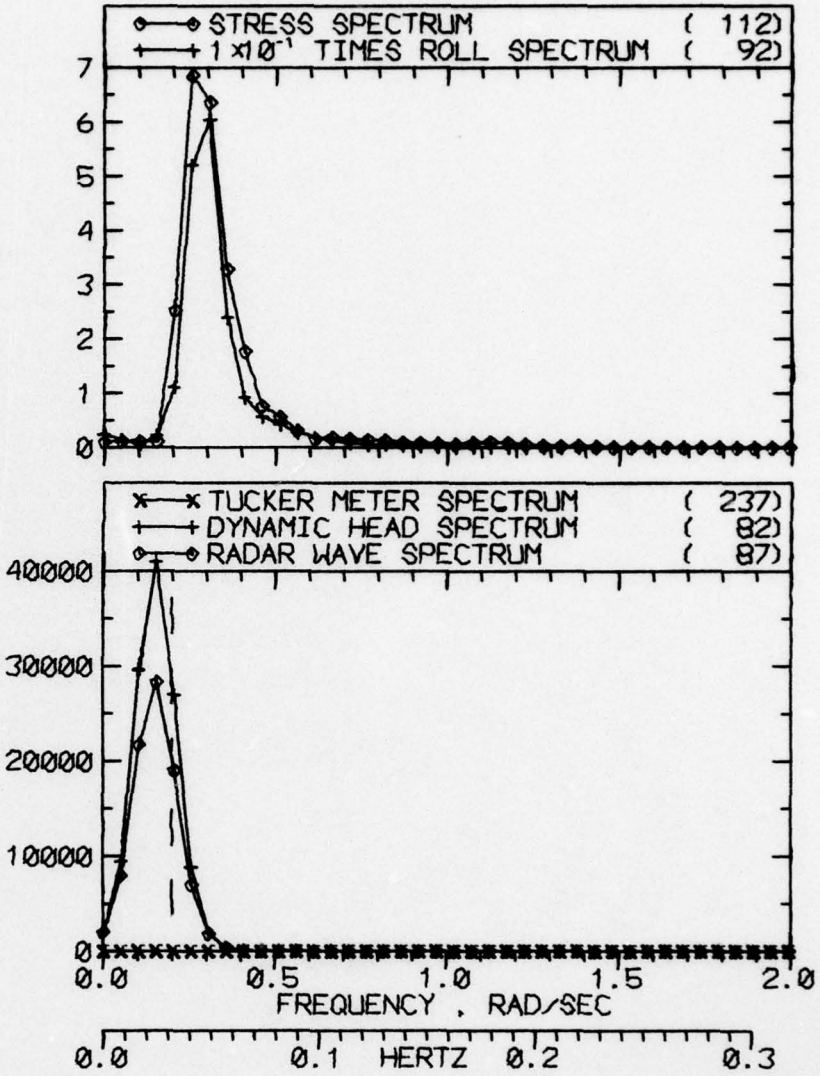
MAXIMUM PK-TR	6.6 KPSI
4.0 X RMS	4.5 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

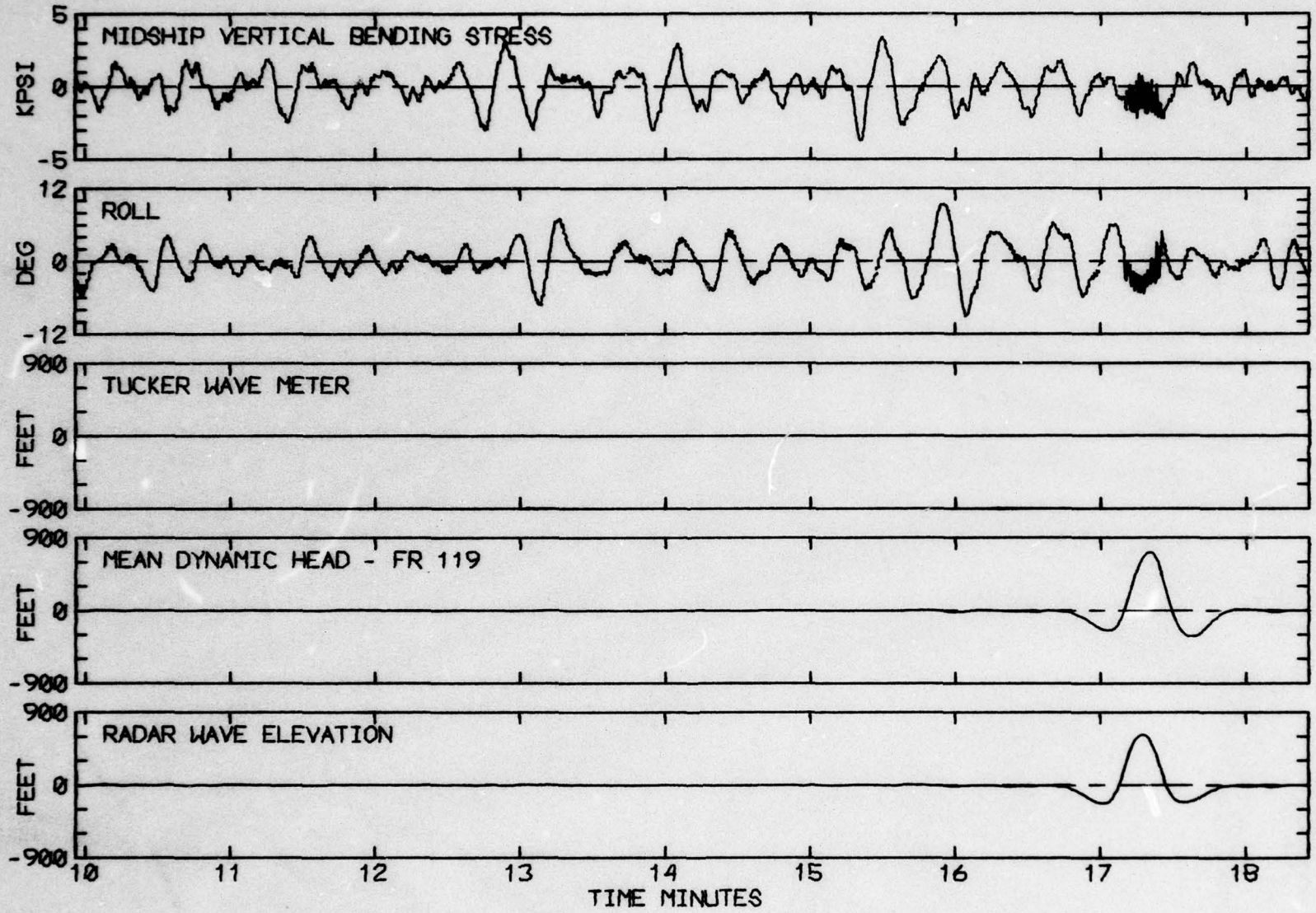
ROLL	12.2 DEG
PITCH	0.78 DEG
DK HSE VERT ACCEL	0.54 G
DK HSE LAT ACCEL	0.25 G
RADAR SLANT RANGE	17.2 FEET
VERTICAL RANGE	14.8 FEET
DISPL AT RADAR	268.5 FEET

WAVE HEIGHT STATISTICS (FEET)

		TUCKER/DYN. HEAD/RADAR	
P-T SAMPLE SIZE	180	52	187
MAXIMUM HEIGHT	7.6	1037.8	836.7
10TH HIGHEST HTS	5.2	229.5	68.8
3RD HIGHEST HTS	3.5	84.8	27.7
4.0 RMS(SPECTRA)	5.1	312.2	267.6



RUN 2213 -- VOYAGE 60E -- TAPE 213 -- INDEX 19 -- INTERVAL 13



RUN 2213 -- VOYAGE 60E -- TAPE 213 -- INDEX 19 -- INTERVAL 13

LOG BOOK DATA

DATE AND TIME	02-10-75 0800
POSITION	35-12 N 46-42 W
COURSE AND SPEED	072 . 19.6 KNOTS
SEA STATE	4
WAVE HEIGHT	3 FEET
* REL DIR	117 PORT
SWELL HEIGHT	12 FEET
* REL DIR	139 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

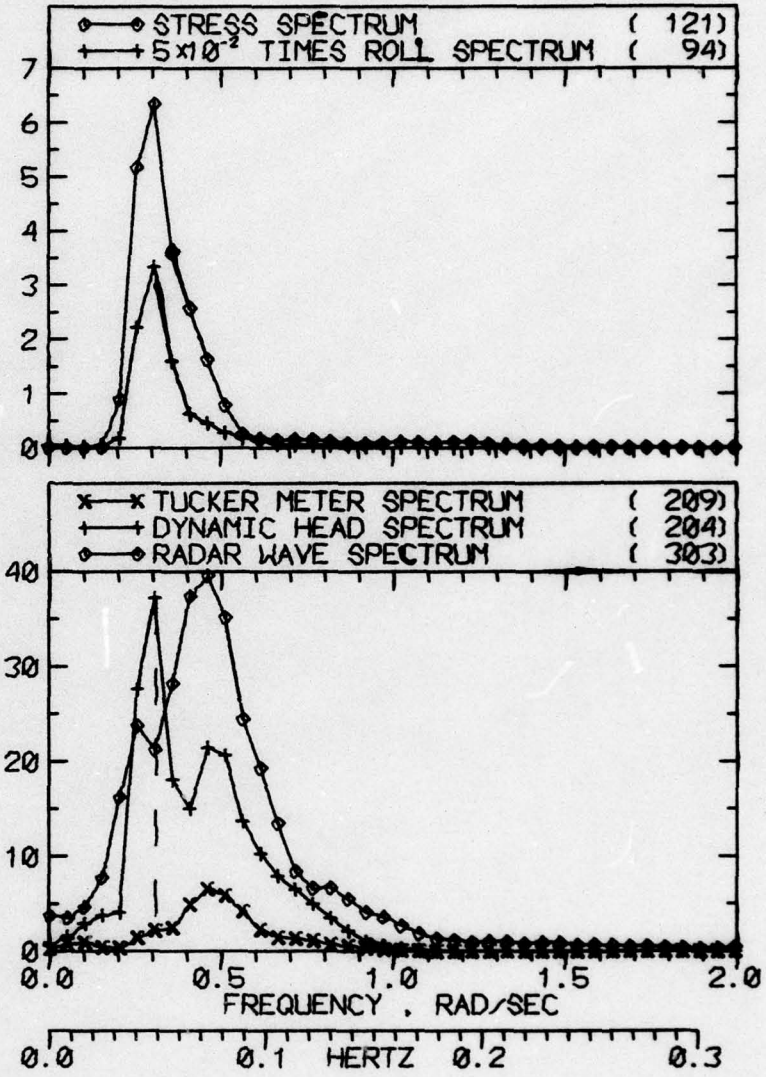
MAXIMUM PK-TR	6.8 KPSI
4.0 X RMS	4.4 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

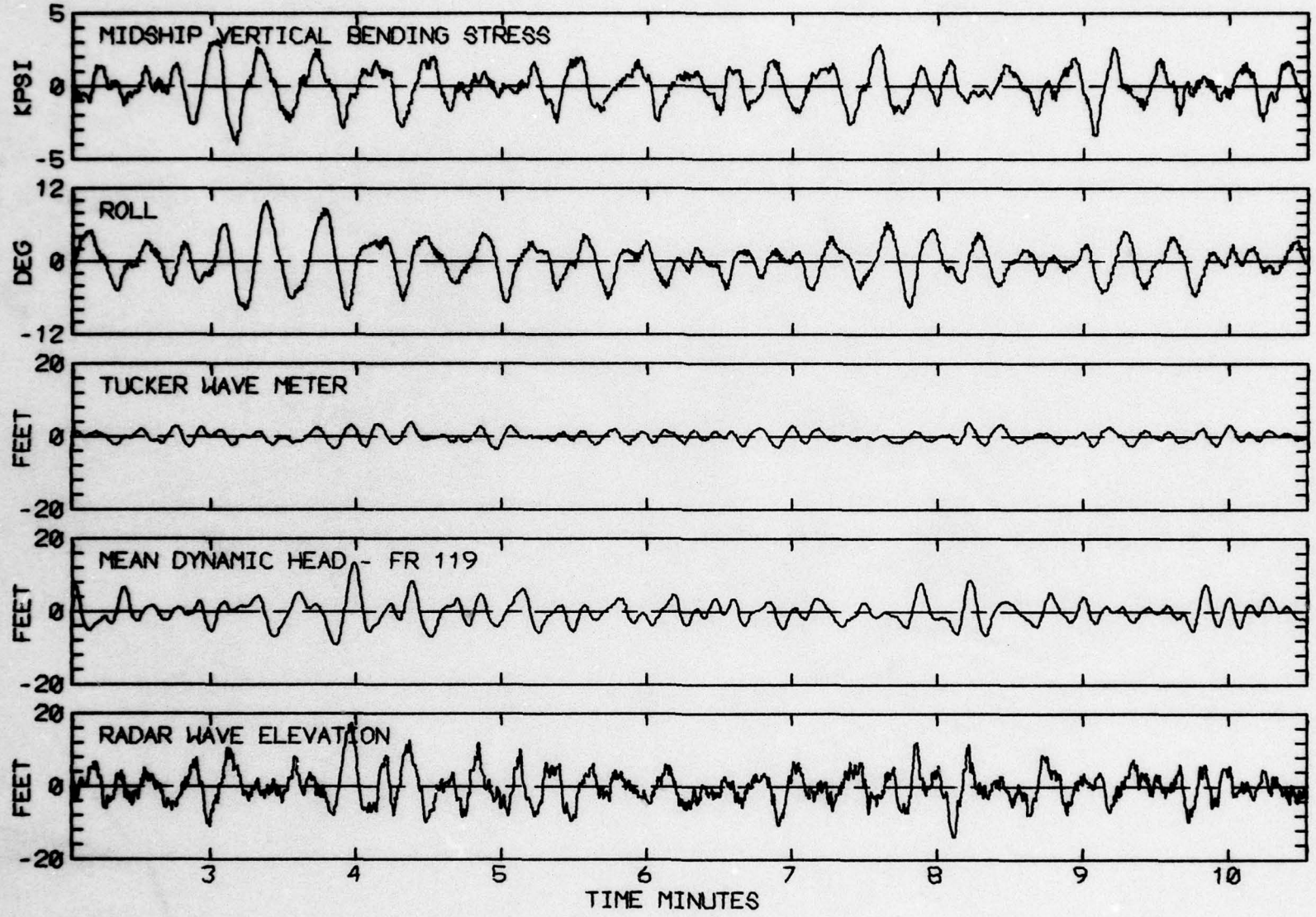
ROLL	12.5 DEG
PITCH	0.79 DEG
DK HSE VERT ACCEL	0.26 G
DK HSE LAT ACCEL	0.25 G
RADAR SLANT RANGE	18.8 FEET
VERTICAL RANGE	16.2 FEET
DISPL AT RADAR	19.4 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	177	85	263
MAXIMUM HEIGHT	8.5	19.2	24.2
10TH HIGHEST HTS	5.9	14.6	15.5
3RD HIGHEST HTS	4.1	11.6	10.6
4.0 RMS(SPECTRA)	5.7	12.9	16.8



RUN 2217 -- VOYAGE 60E -- TAPE 213 -- INDEX 20 -- INTERVAL 17



RUN 2217 -- VOYAGE 60E -- TAPE 213 -- INDEX 20 -- INTERVAL 17

LOG BOOK DATA

DATE AND TIME	02-10-75 1200
POSITION	37-20 N 37-40 W
COURSE AND SPEED	073 . 19.8 KNOTS
SEA STATE	4
WAVE HEIGHT	3 FEET
" REL DIR	118 PORT
SWELL HEIGHT	16 FEET
" REL DIR	140 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

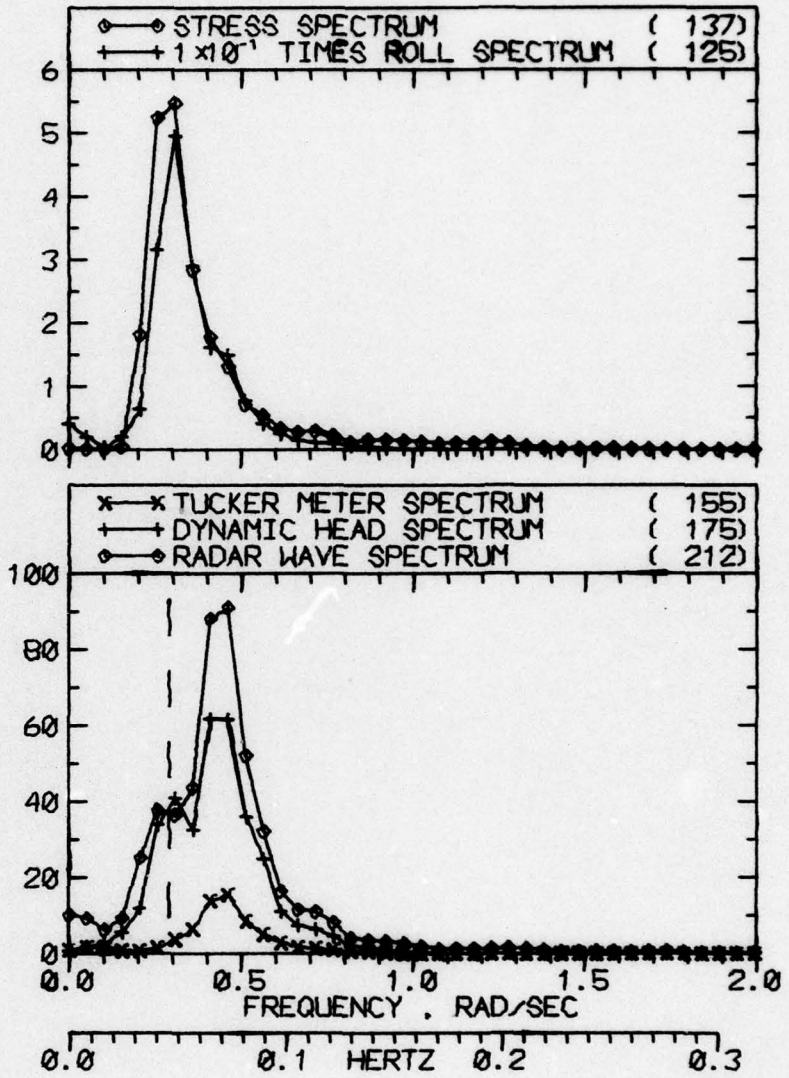
MAXIMUM PK-TR	5.8 KPSI
4.0 X RMS	4.3 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

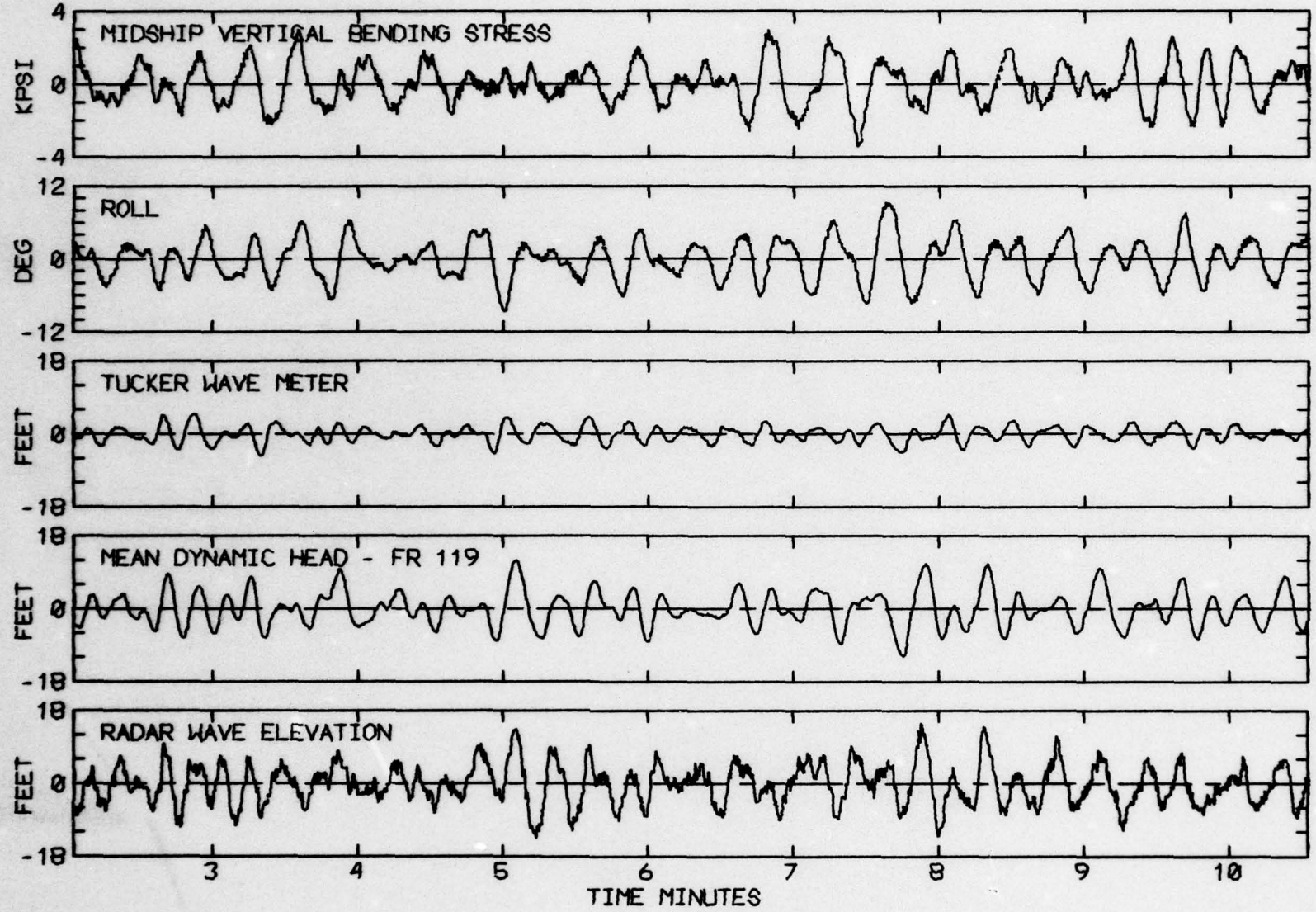
ROLL	12.0 DEG
PITCH	0.91 DEG
DK HSE VERT ACCEL	0.27 G
DK HSE LAT ACCEL	0.25 G
RADAR SLANT RANGE	20.0 FEET
VERTICAL RANGE	17.3 FEET
DISPL AT RADAR	23.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	138	80	195
MAXIMUM HEIGHT	10.6	19.5	28.2
10TH HIGHEST HTS	7.9	18.0	20.7
3RD HIGHEST HTS	5.7	15.2	14.4
4.0 RMS(SPECTRA)	7.5	16.9	20.8



RUN 2221 -- VOYAGE 60E -- TAPE 213 -- INDEX 21 -- INTERVAL 21



RUN 2221 -- VOYAGE 60E -- TAPE 213 -- INDEX 21 -- INTERVAL 21

LOG BOOK DATA

DATE AND TIME	02-10-75 1600
POSITION	37-20 N 37-40 W
COURSE AND SPEED	073 . 20.7 KNOTS
SEA STATE	2
WAVE HEIGHT	2 FEET
" REL DIR	163 PORT
SWELL HEIGHT	16 FEET
" REL DIR	140 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

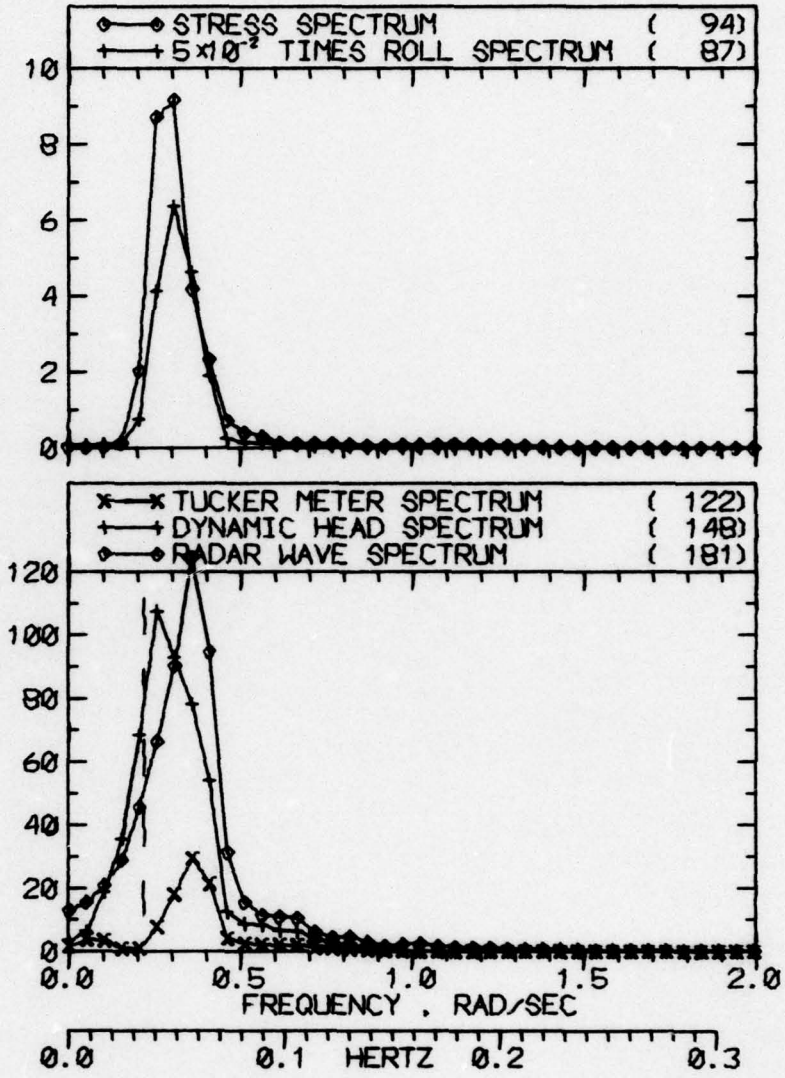
MAXIMUM PK-TR	8.6 KPSI
4.0 X RMS	4.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

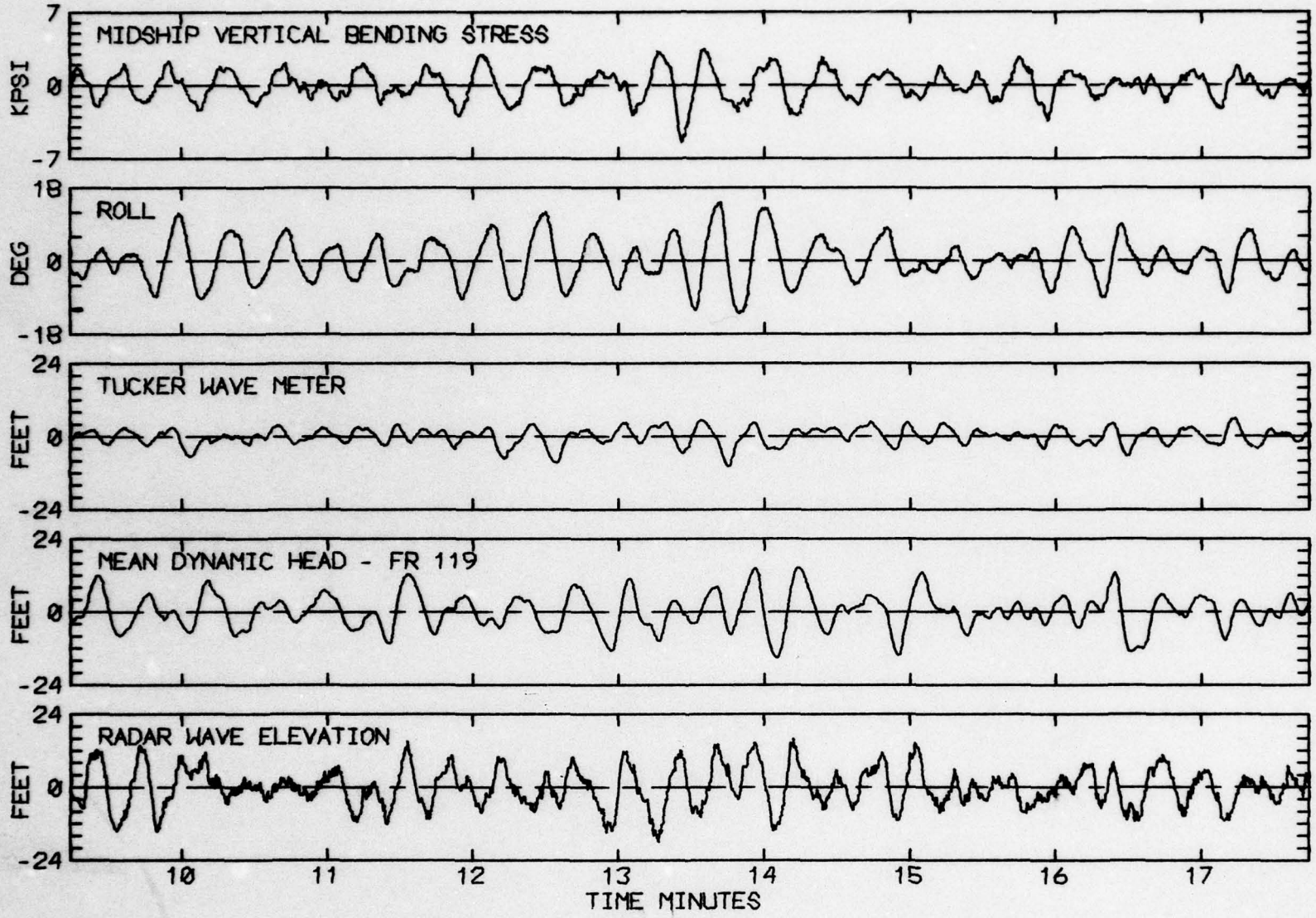
ROLL	17.7 DEG
PITCH	0.85 DEG
DK HSE VERT ACCEL	0.23 G
DK HSE LAT ACCEL	0.33 G
RADAR SLANT RANGE	22.8 FEET
VERTICAL RANGE	18.3 FEET
DISPL AT RADAR	24.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	105	60	191
MAXIMUM HEIGHT	12.9	29.4	30.0
10TH HIGHEST HTS	10.4	23.7	22.7
3RD HIGHEST HTS	7.1	18.8	14.1
4.0 RMS(SPECTRA)	9.2	20.6	22.5



RUN 2225 -- VOYAGE 60E -- TAPE 213 -- INDEX 22 -- INTERVAL 25



RUN 2225 -- VOYAGE 60E -- TAPE 213 -- INDEX 22 -- INTERVAL 25

LOG BOOK DATA

DATE AND TIME	02-10-75 2000
POSITION	37-20 N 37-40 W
COURSE AND SPEED	073 . 20.7 KNOTS
SEA STATE	3
WAVE HEIGHT	3 FEET
" REL DIR	163 PORT
SWELL HEIGHT	16 FEET
" REL DIR	140 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

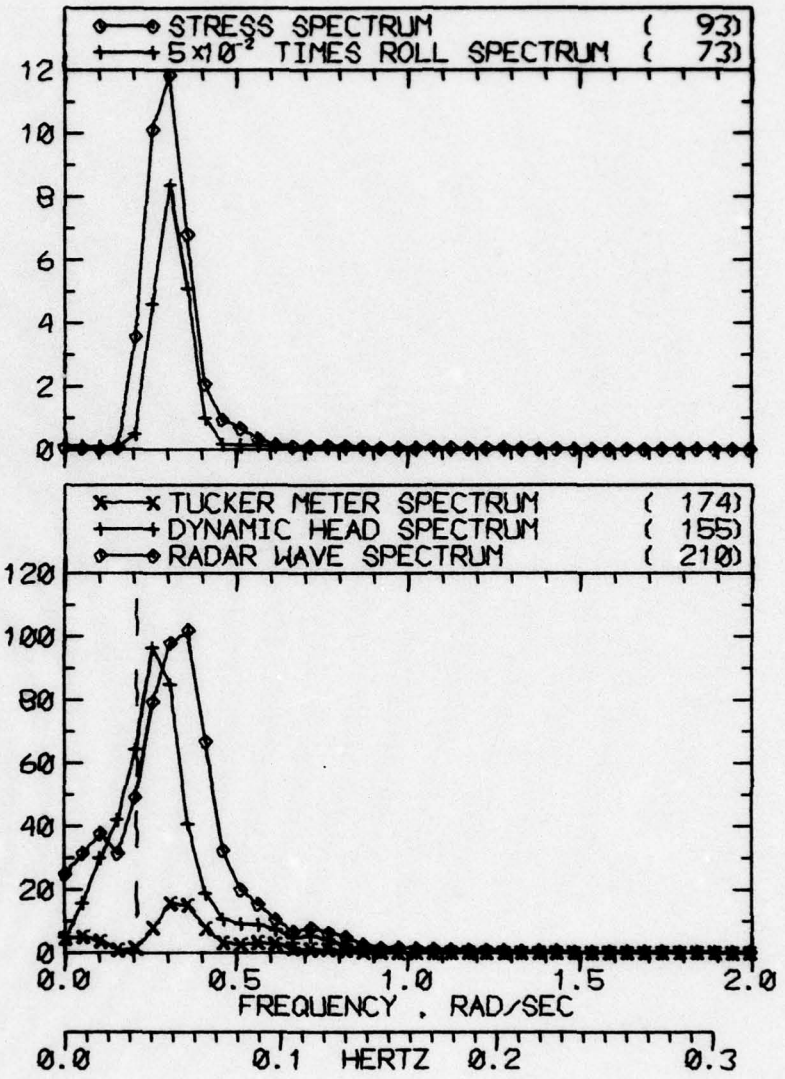
MAXIMUM PK-TR	9.1 KPSI
4.0 X RMS	5.6 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

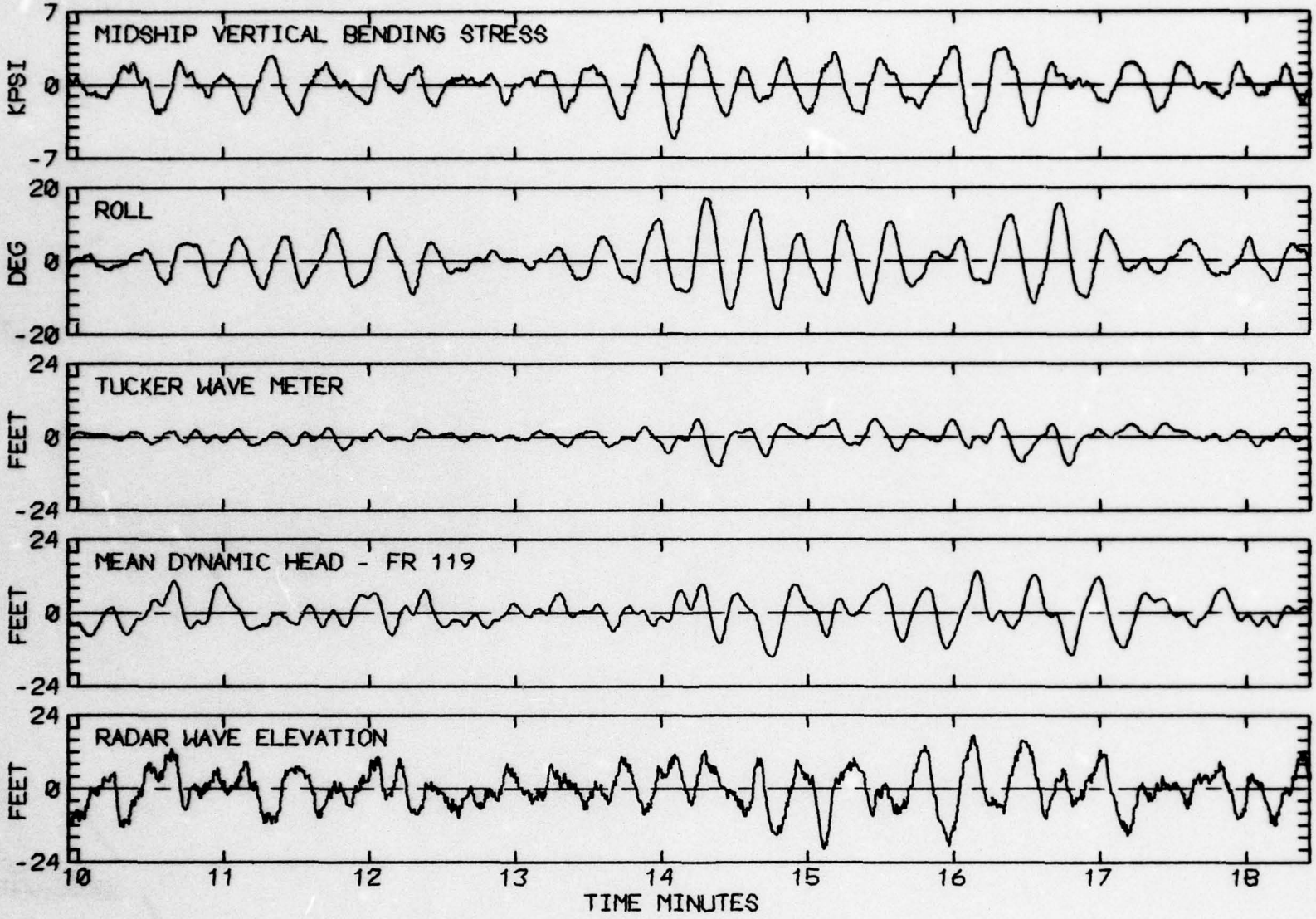
ROLL	18.5 DEG
PITCH	0.85 DEG
DK HSE VERT ACCEL	0.22 G
DK HSE LAT ACCEL	0.35 G
RADAR SLANT RANGE	23.0 FEET
VERTICAL RANGE	18.9 FEET
DISPL AT RADAR	22.2 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	144	60	169
MAXIMUM HEIGHT	15.3	26.1	32.5
10TH HIGHEST HTS	8.8	21.7	21.5
3RD HIGHEST HTS	5.1	17.8	14.4
4.0 RMS(SPECTRA)	8.0	19.2	22.9



RUN 2229 -- VOYAGE 60E -- TAPE 213 -- INDEX 23 -- INTERVAL 29



RUN 2229 -- VOYAGE 60E -- TAPE 213 -- INDEX 23 -- INTERVAL 29

LOG BOOK DATA

DATE AND TIME	02-10-75 2400
POSITION	37-20 N 37-40 W
COURSE AND SPEED	073 . 20.8 KNOTS
SEA STATE	3
WAVE HEIGHT	3 FEET
" REL DIR	152 STBD
SWELL HEIGHT	18 FEET
" REL DIR	118 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

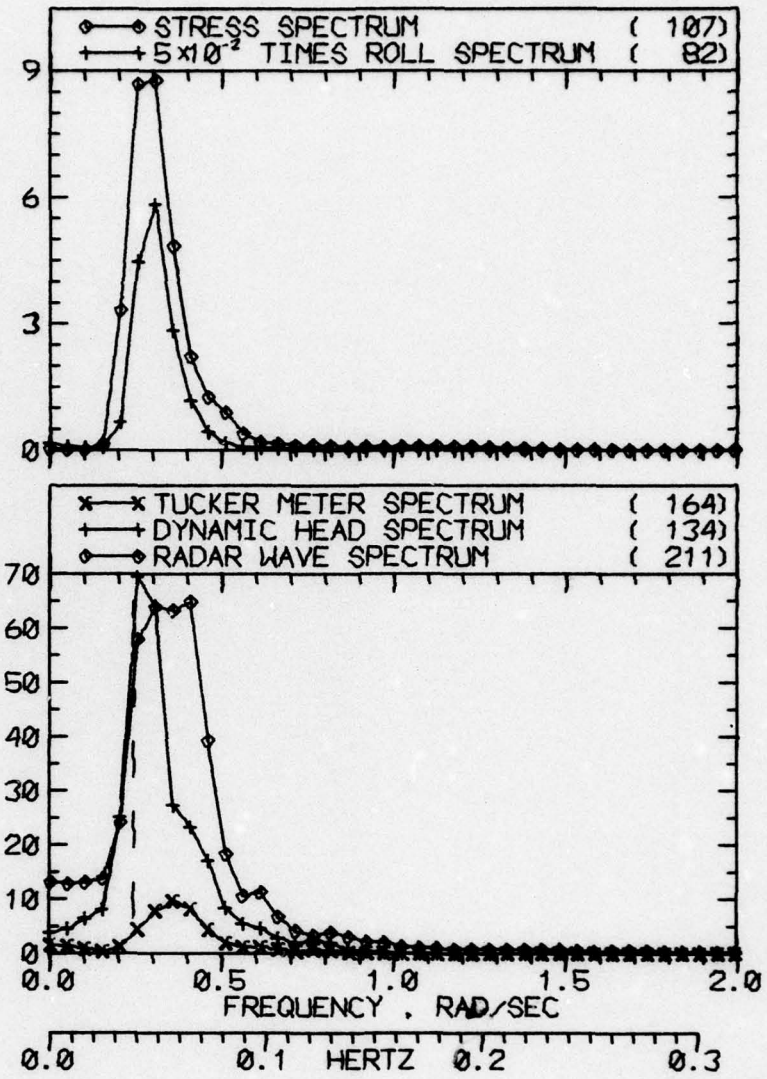
MAXIMUM PK-TR	7.0 KPSI
4.0 X RMS	5.1 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

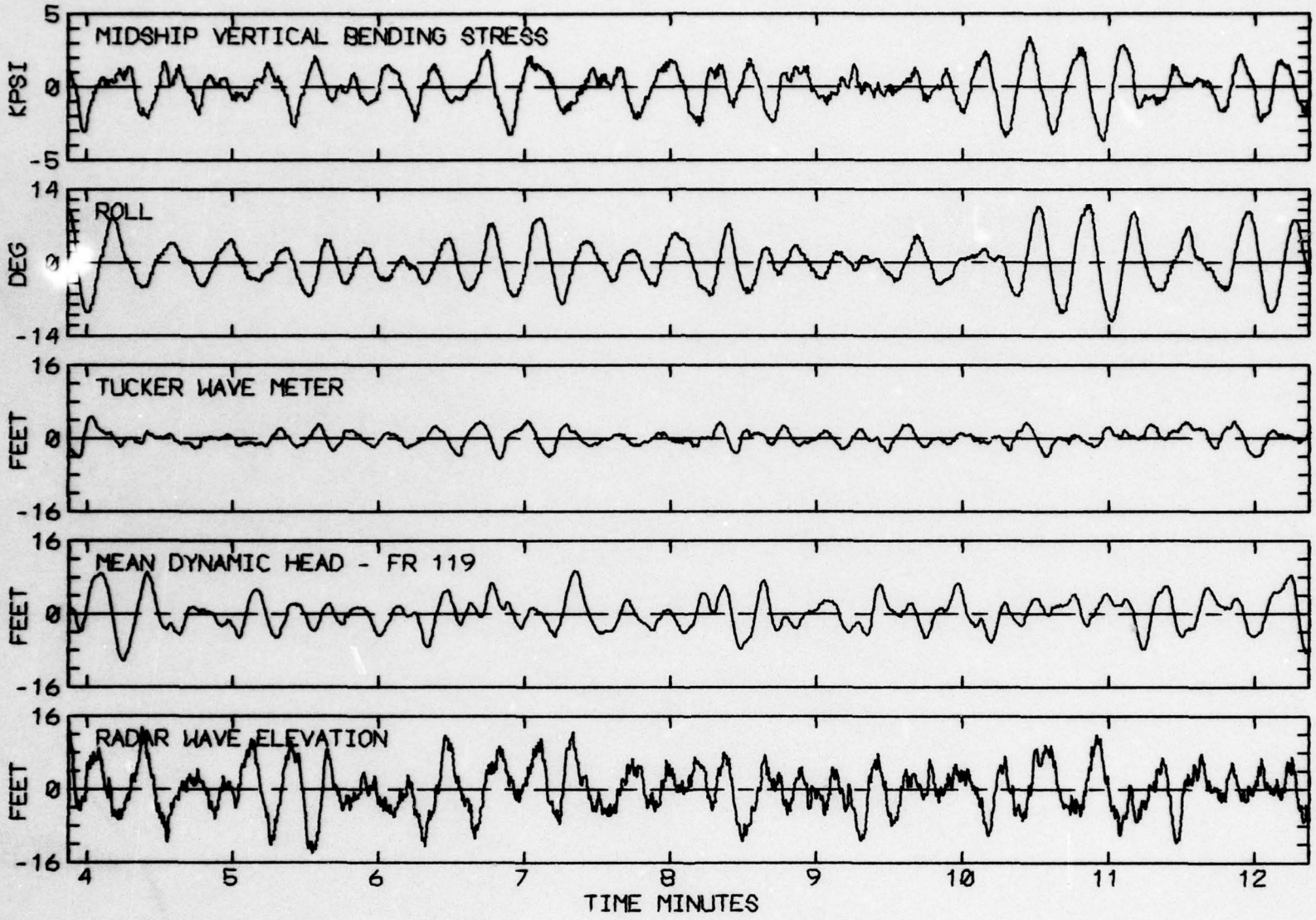
ROLL	16.3 DEG
PITCH	0.82 DEG
DK HSE VERT ACCEL	0.21 G
DK HSE LAT ACCEL	0.30 G
RADAR SLANT RANGE	20.1 FEET
VERTICAL RANGE	16.8 FEET
DISPL AT RADAR	20.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	157	62	215
MAXIMUM HEIGHT	8.8	22.9	25.0
10TH HIGHEST HTS	6.6	17.5	17.9
3RD HIGHEST HTS	4.3	13.2	11.8
4.0 RMS(SPECTRA)	6.3	15.1	19.2



RUN 2233 -- VOYAGE 60E -- TAPE 213 -- INDEX 24 -- INTERVAL 33



RUN 2233 -- VOYAGE 60E -- TAPE 213 -- INDEX 24 -- INTERVAL 33

LOG BOOK DATA

DATE AND TIME	02-11-75 0400
POSITION	37-20 N 37-40 W
COURSE AND SPEED	073 . 20.8 KNOTS
SEA STATE	3
WAVE HEIGHT	3 FEET
" REL DIR	174 STBD
SWELL HEIGHT	18 FEET
" REL DIR	118 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /ROLLING IN 18 FT SWELLS

MIDSHIP VERTICAL BENDING STRESS

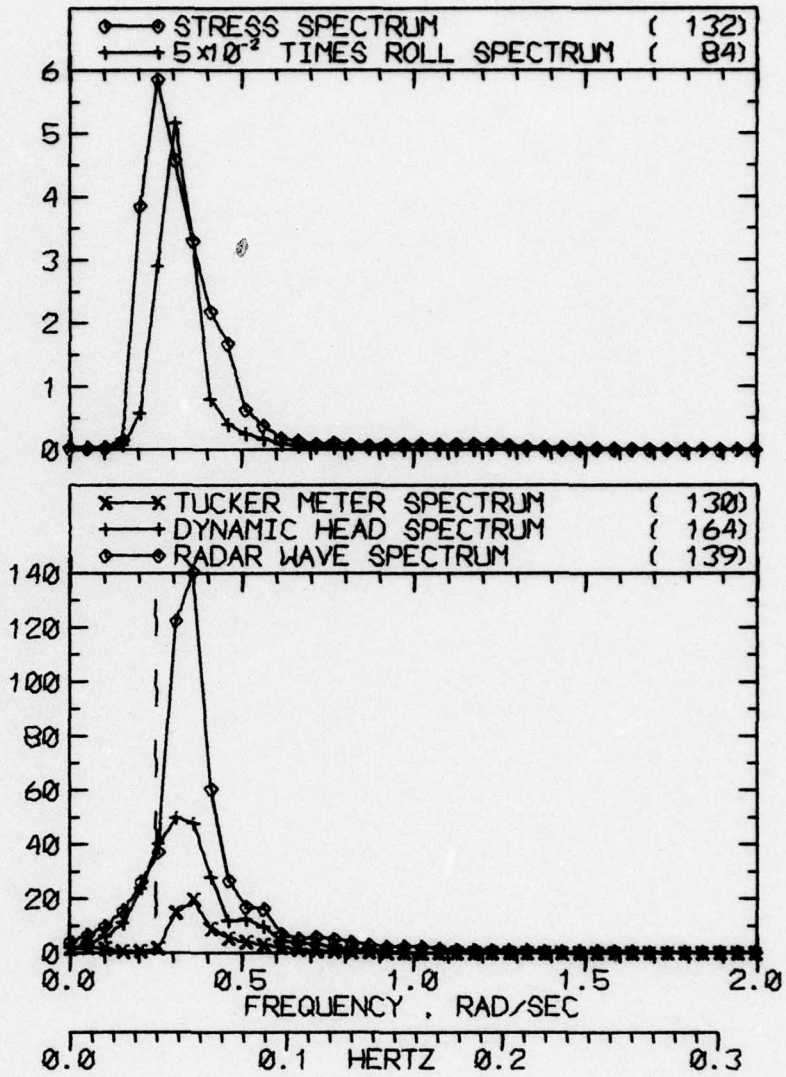
MAXIMUM PK-TR	6.8 KPSI
4.0 X RMS	4.5 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

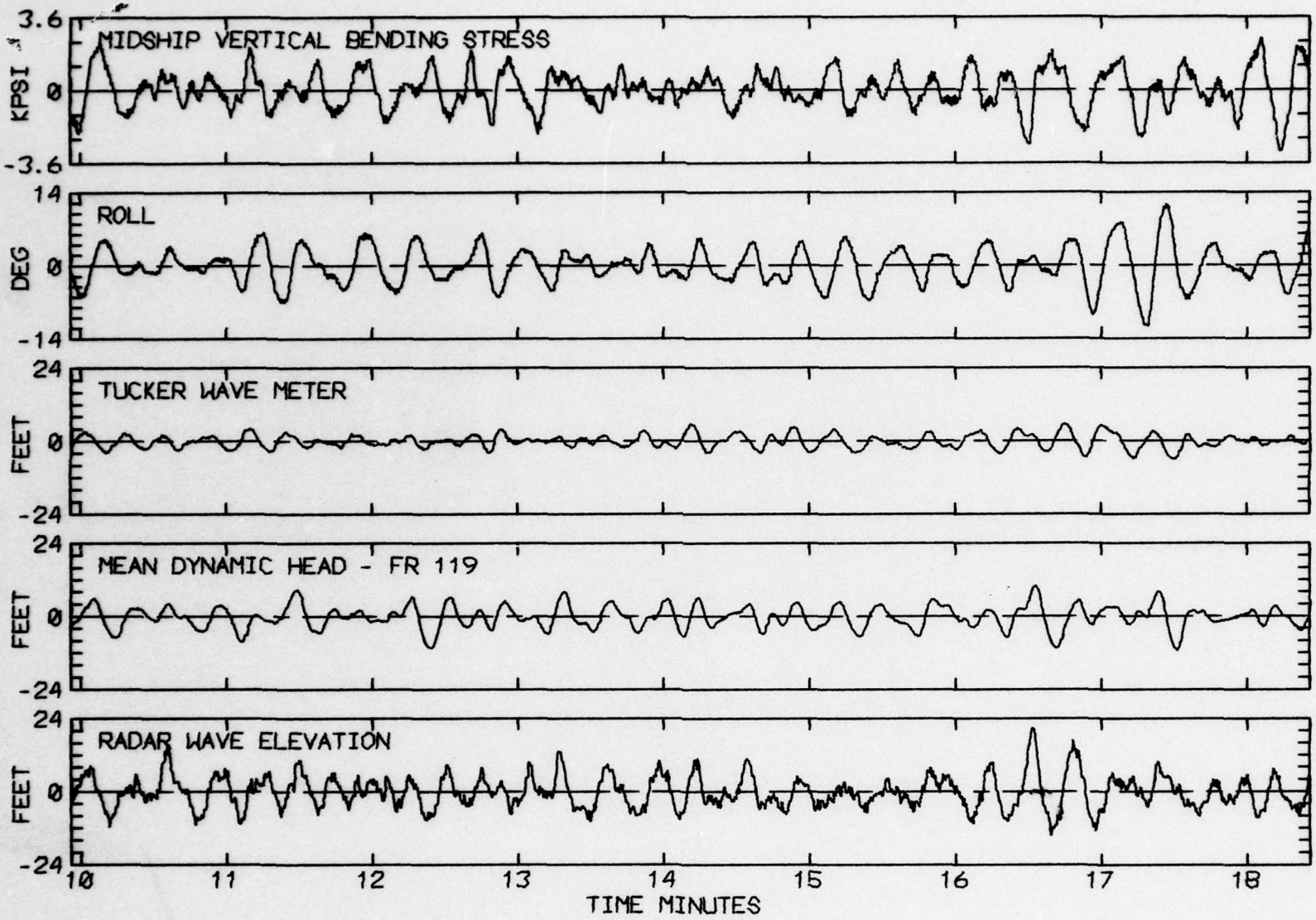
ROLL	15.2 DEG
PITCH	0.81 DEG
DK HSE VERT ACCEL	0.22 G
DK HSE LAT ACCEL	0.30 G
RADAR SLANT RANGE	21.0 FEET
VERTICAL RANGE	17.2 FEET
DISPL AT RADAR	19.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	138	79	194
MAXIMUM HEIGHT	11.1	20.4	35.6
10TH HIGHEST HTS	8.2	16.7	19.6
3RD HIGHEST HTS	5.5	12.4	12.8
4.0 RMS(SPECTRA)	7.6	14.6	21.1



RUN 2237 -- VOYAGE 60E -- TAPE 213 -- INDEX 25 -- INTERVAL 37



RUN 2237 -- VOYAGE 60E -- TAPE 213 -- INDEX 25 -- INTERVAL 37

LOG BOOK DATA

DATE AND TIME	02-11-75 0800
POSITION	37-20 N 37-40 W
COURSE AND SPEED	073 . 20.8 KNOTS
SEA STATE	5
WAVE HEIGHT	4 FEET
" REL DIR	174 STBD
SWELL HEIGHT	16 FEET
" REL DIR	118 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

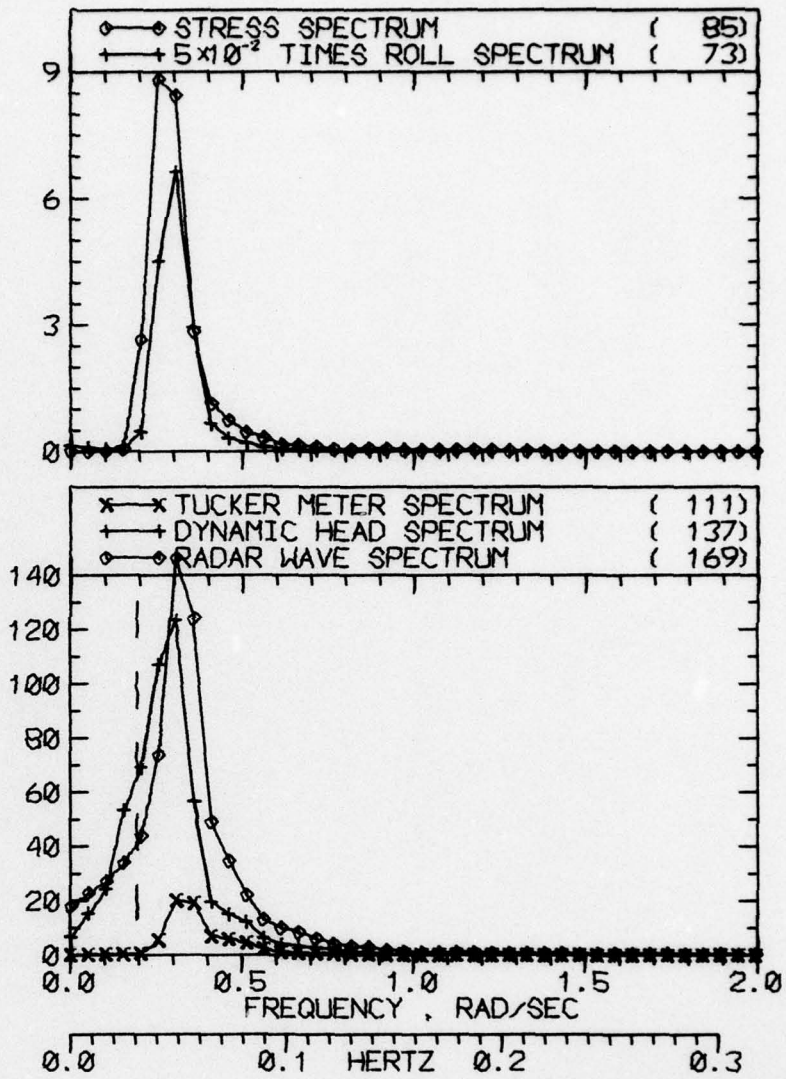
MAXIMUM PK-TR	7.0 KPSI
4.0 X RMS	4.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

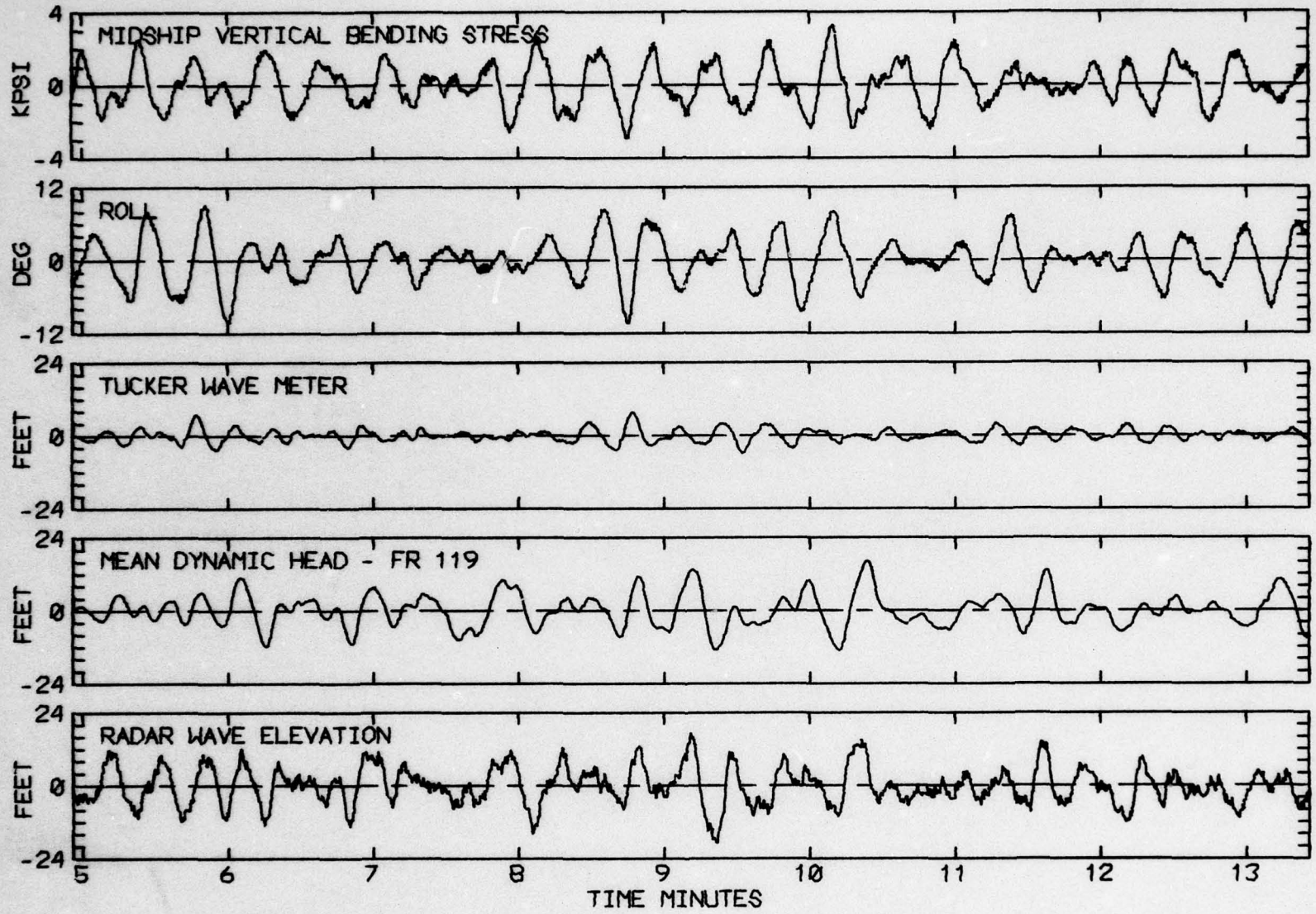
ROLL	16.4 DEG
PITCH	0.81 DEG
DK HSE VERT ACCEL	0.19 G
DK HSE LAT ACCEL	0.30 G
RADAR SLANT RANGE	21.4 FEET
VERTICAL RANGE	16.9 FEET
DISPL AT RADAR	23.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	144	57	179
MAXIMUM HEIGHT	11.6	26.2	36.2
10TH HIGHEST HTS	8.2	23.0	21.1
3RD HIGHEST HTS	5.4	18.8	13.9
4.0 RMS(SPECTRA)	7.6	20.6	23.2



RUN 2241 -- VOYAGE 60E -- TAPE 213 -- INDEX 26 -- INTERVAL 41



RUN 2241 -- VOYAGE 60E -- TAPE 213 -- INDEX 26 -- INTERVAL 41

LOG BOOK DATA

DATE AND TIME	02-11-75 1200
POSITION	39-40 N 27-50 W
COURSE AND SPEED	073 . 20.8 KNOTS
SEA STATE	6
WAVE HEIGHT	4 FEET
" REL DIR	174 STBD
SWELL HEIGHT	16 FEET
" REL DIR	118 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

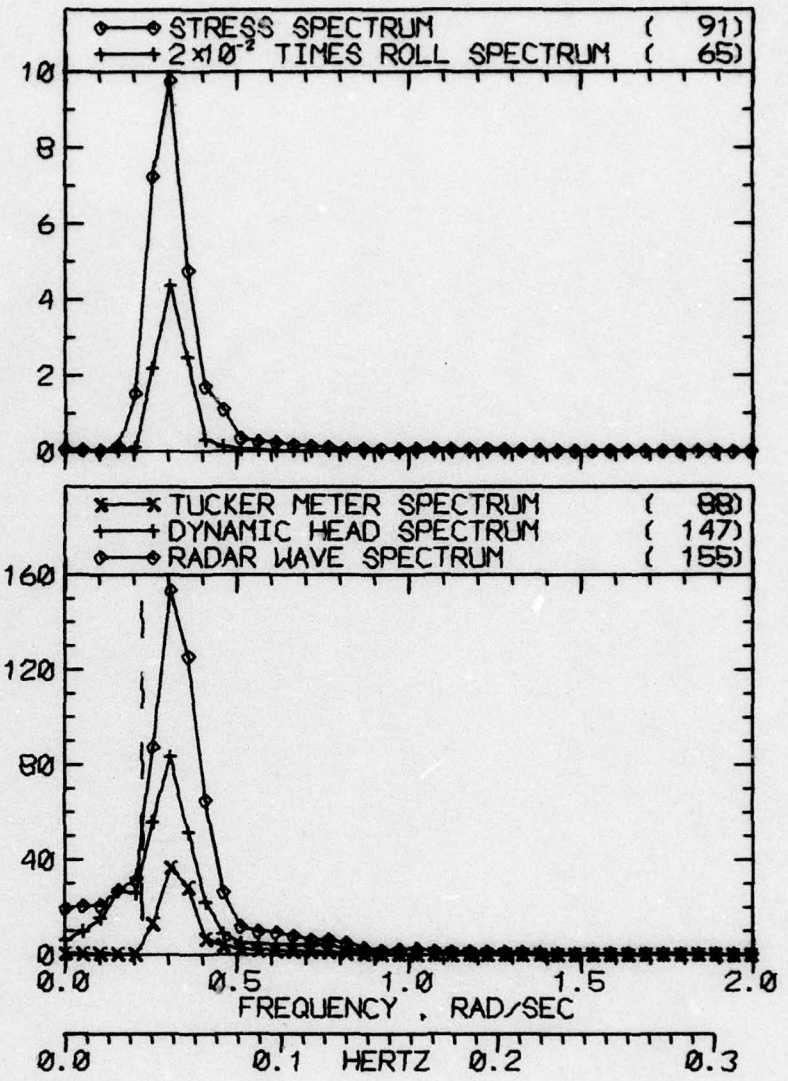
MAXIMUM PK-TR	7.2 KPSI
4.0 X RMS	4.8 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

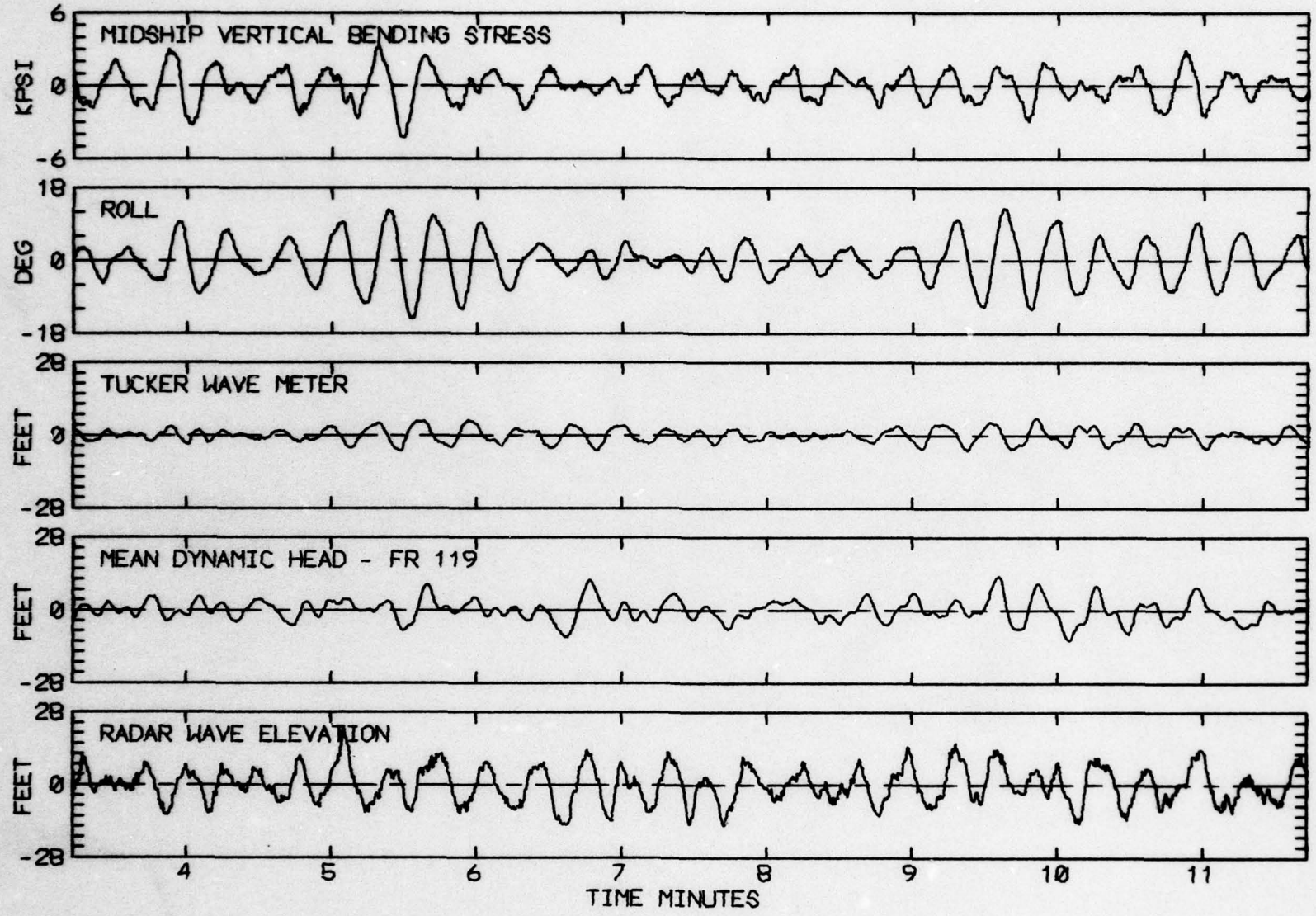
ROLL	20.2 DEG
PITCH	0.86 DEG
DK HSE VERT ACCEL	0.22 G
DK HSE LAT ACCEL	0.38 G
RADAR SLANT RANGE	24.7 FEET
VERTICAL RANGE	18.9 FEET
DISPL AT RADAR	20.9 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	102	77	166
MAXIMUM HEIGHT	11.3	21.7	32.4
10TH HIGHEST HTS	10.3	18.5	22.7
3RD HIGHEST HTS	7.5	13.6	14.9
4.0 RMS(SPECTRA)	9.2	16.5	23.2



RUN 2245 -- VOYAGE 60E -- TAPE 213 -- INDEX 27 -- INTERVAL 45



RUN 2245 -- VOYAGE 60E -- TAPE 213 -- INDEX 27 -- INTERVAL 45

LOG BOOK DATA

DATE AND TIME	02-11-75 1600
POSITION	39-40 N 27-50 W
COURSE AND SPEED	073 . 20.9 KNOTS
SEA STATE	5
WAVE HEIGHT	4 FEET
" REL DIR	152 STBD
SWELL HEIGHT	14 FEET
" REL DIR	118 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

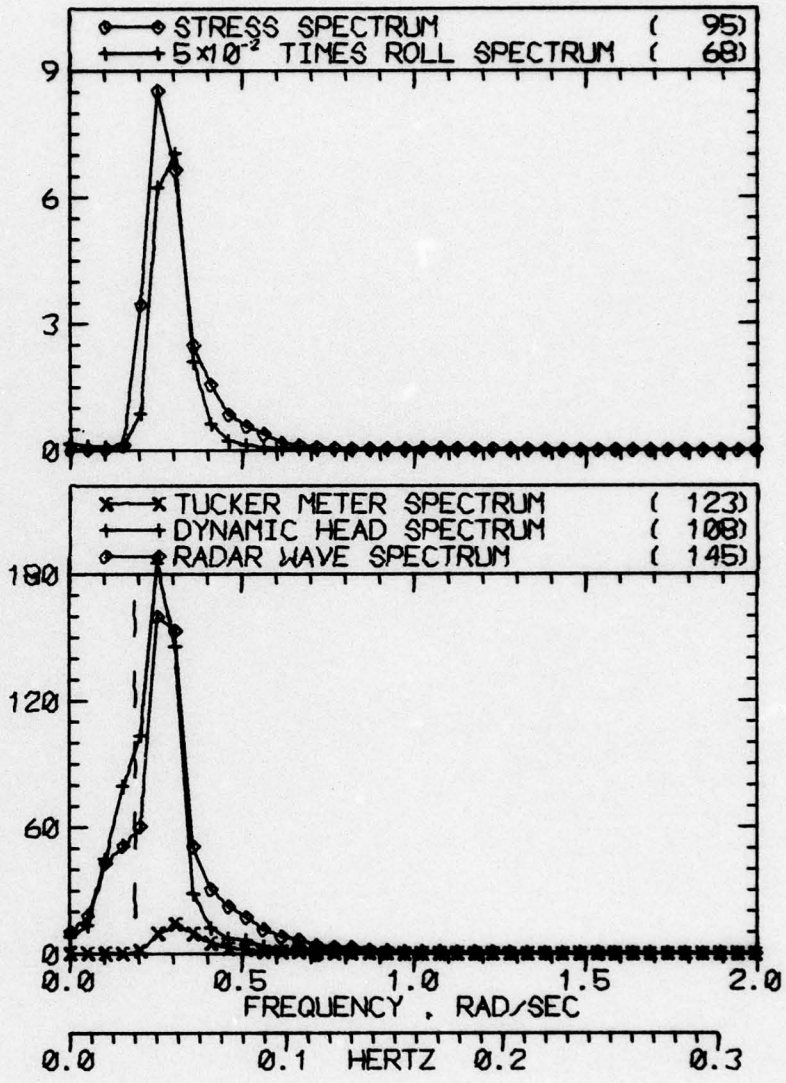
MAXIMUM PK-TR	5.7 KPSI
4.0 X RMS	4.6 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

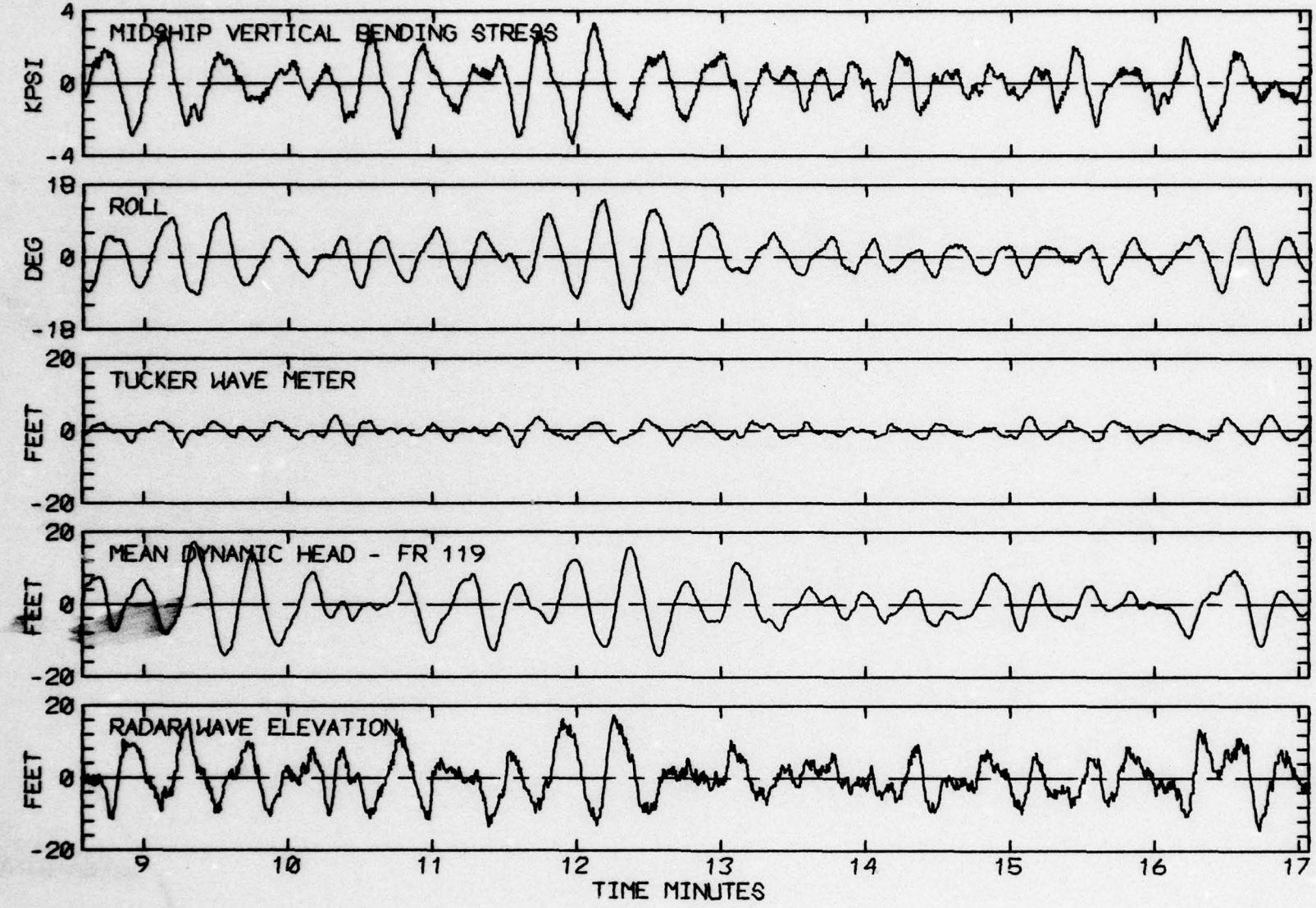
ROLL	17.1 DEG
PITCH	0.73 DEG
DK HSE VERT ACCEL	0.17 G
DK HSE LAT ACCEL	0.31 G
RADAR SLANT RANGE	19.8 FEET
VERTICAL RANGE	16.0 FEET
DISPL AT RADAR	25.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	143	44	167
MAXIMUM HEIGHT	8.9	31.4	28.4
10TH HIGHEST HTS	6.9	26.7	20.9
3RD HIGHEST HTS	4.6	21.3	13.7
4.0 RMS(SPECTRA)	6.5	22.9	23.4



RUN 2249 -- VOYAGE 60E -- TAPE 213 -- INDEX 28 -- INTERVAL 49



RUN 2249 -- VOYAGE 60E -- TAPE 213 -- INDEX 28 -- INTERVAL 49

TABLE IIa

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 1 OF 2)

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 60 WEST

D.L. RUN NO.	TMR TAPE NO.	TMR INDX NO.	TMR INTV NO.	DATE	TIME (GMT)	LATITUDE	LONGITUDE	COURSE	SPEED KT.	PROP RPM	DRAFT FT.	SEA/AIR TEMP
2301	217	1	1	02-18-75	1600			295	27.8	113.6		48/53
2318	217	5	18	02-19-75	0800			229	32.6	133.8		53/55
2329	217	8	29	02-19-75	2000	43-08 N	14-40 W	255	31.6	129.6		56/55
2333	217	9	33	02-19-75	2400	43-08 N	14-40 W	255	31.5	129.0		57/53
2337	217	10	37	02-20-75	0400	43-08 N	14-40 W	255	31.4	128.9		56/53
2341	217	11	41	02-20-75	0800	43-08 N	14-40 W	270	31.5	129.3		57/53
2348	217	12	48	02-20-75	1200	39-52 N	31-00 W	288	31.6	129.5		55/56
2350	217	13	50	02-20-75	1600	39-52 N	31-00 W	270	31.4	128.5		57/61
2401	219	16	1	02-21-75	0400	39-52 N	31-00 W	270	27.7	113.4		58/55
2409	219	18	9	02-21-75	1200	39-53 N	45-20 W	270	21.3	87.4		62/49
2413	219	19	13	02-21-75	1600	39-53 N	45-20 W	270	21.8	89.5		62/50
2420	219	20	20	02-21-75	2000	39-53 N	45-20 W	270	22.6	92.8		66/54
2424	219	21	24	02-21-75	2400	39-53 N	45-20 W	270	21.8	89.3		67/57
2426	219	22	26	02-22-75	0400	39-53 N	45-20 W	270	22.3	91.6		66/55
2430	219	23	30	02-22-75	0800	39-53 N	45-20 W	270	22.3	91.6		66/55
2433	219	24	33	02-22-75	1200	39-53 N	45-20 W	270	22.4	91.7		60/48
2437	219	25	37	02-22-75	1600	39-44 N	57-05 W	270	21.8	89.6		59/49
2442	219	26	42	02-22-75	2000	39-44 N	57-05 W	272	21.6	88.6		70/50
2448	219	27	48	02-22-75	2400	39-44 N	57-05 W	272	22.2	90.9		60/50

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TABLE IIb

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 2 OF 2)

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 60 WEST

D.L. RUN NO.	SEA STATE	<REL WIND> DIR/SPEED /(KT)	REL WAVE DIR	WAVE HT. FT.	REL SWELL DIR	<-SWELL-> HT FT.	LENGTH FT.	VISUAL WEATHER /TMR LOG-BOOK COMMENTS
2301	2	70P/ 5	70P	1	70P	4	300	OCAST FOG /
2318	2	4P/ 5	4P	2	4P	3	300	OCAST /
2329	6	60S/25	60S	5	30P	4	400	PT CLDY /SEAS OFF STARBOARD BOW
2333	6	71S/25	71S	6	60S	7	600	PT CLDY /
2337	2	37S/ 5	37S	4	60S	8	600	PT CLDY /
2341		/	22S	1	22S	8	600	PT CLDY /
2348	4	63P/15	63P	3	4S	6	600	PT CLDY /
2350	5	68P/20	68P	3	22S	3	500	PT CLDY /
2401	6	68P/25	68P	5	22S	12	600	RAIN /
2409	7	22S/30	22S	5	22S	14	800	RAIN /
2413	1	67S/ 2	67S	2	67P	8	800	OCAST /
2420	1	90P/ 2	90P	1	22S	8	800	OCAST /
2424	3	0 /10	0	2	67S	5	500	OCAST /
2426	2	67S/ 5	67S	2	45S	8	600	OCAST /
2430	2	67S/ 5	67S	2	45S	10	600	OCAST /
2433	7	45S/30	45S	5	45S	10	600	OCAST /
2437	8	67S/35	67S	7	45S	10	600	OCAST /
2442	8	43S/35	43S	7	43S	6	600	OCAST /
2448	4	43S/15	43S	4	43S	6	600	OCAST /

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TABLE IIc

COMPARISON OF TMR RESULTS FOR MIDSHIP VERTICAL BENDING STRESS
WITH CORRESPONDING RAW DIGITIZATION RESULTS AT DAVIDSON LABORATORY

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 60 WEST

	<---TMR RESULTS--->					<---D.L. DIGITIZATION--->			<--COLUMN RATIOS-->		
D.L. RUN NO.	NO. WAVE INDUCED CYCLES (1)	NO. 1ST MODE BURSTS (2)	MAX P-TO-T STRESS KPSI (3)	RMS P-TO-T STRESS KPSI (4)	MAX 1ST MODE STRESS KPSI (5)	RANGE OF RECORDED EXTREMES KPSI (6)	2.83X (SAMPLE RMS) KPSI (7)	REL MEAN STRESS KPSI (8)	(7) / (4)	(6) / (3+5)	(6) / (3)
2301	172	4	6.54	2.62	0.98	7.29	2.67	0.00	1.02	0.97	1.11
2318	154	0	3.66	1.61	0.00	4.38	1.69	0.61	1.05	1.20	1.20
2329	177	38	8.40	3.17	2.42	10.42	3.25	1.13	1.03	0.96	1.24
2333	179	26	7.99	3.39	2.24	10.76	3.50	1.01	1.03	1.05	1.35
2337	171	12	7.97	2.86	2.47	8.66	2.91	0.97	1.02	0.83	1.09
2341	180	35	7.23	3.18	2.29	9.49	3.09	1.02	0.97	1.00	1.31
2348	199	15	3.91	1.61	0.91	5.03	1.91	1.17	1.19	1.04	1.29
2350	176	7	2.99	1.12	0.87	4.46	1.46	1.61	1.30	1.16	1.49
2401	199	44	4.29	1.75	1.66	18.93	2.61	1.28	1.49	3.18	4.41
2409	184	37	8.49	3.47	2.62	10.03	3.44	1.94	0.99	0.90	1.18
2413	180	0	4.77	2.16	0.00	5.55	2.21	1.73	1.03	1.16	1.16
2420	186	3	4.85	2.48	1.13	6.12	2.61	1.67	1.05	1.02	1.26
2424	194	2	4.05	1.70	0.82	4.95	1.77	0.49	1.04	1.02	1.22
2426	182	0	2.79	1.32	0.00	3.95	1.50	0.33	1.14	1.42	1.42
2430	185	7	2.16	0.98	0.91	3.34	1.21	0.54	1.24	1.09	1.55
2433	185	6	2.46	1.24	0.93	4.24	1.58	0.52	1.27	1.25	1.73
2437	194	50	7.50	3.37	2.94	8.82	3.48	0.44	1.03	0.84	1.18
2442	206	8	3.72	1.64	0.98	5.65	2.03	0.53	1.24	1.20	1.52
2448	139	0	1.25	0.61	0.00	1.99	0.83	0.16	1.36	1.60	1.60

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TABLE IId

SUMMARY OF RAW DIGITIZATION RESULTS FOR RADAR RANGE
ROLL, PITCH, DECK HOUSE ACCELERATIONS, AND TUCKER METER

SEA LAND MC LEAN : 1974-1975 WINTER SEASON : VOYAGE 60 WEST

	<--- RADAR --->			<--- ROLL ---->			<--- PITCH --->			<--VERT ACCEL->			<--LAT ACCEL-->			<-- TUCKER -->		
D.L. RUN NO.	4.0 (RMS) FT	RECORDED EXTREMES FT	FT	4.0 (RMS) DEG	RECORDED EXTREMES DEG	DEG	4.0 (RMS) DEG	RECORDED EXTREMES DEG	DEG	4.0 (RMS) (G)	RECORDED EXTREMES (G)	(G)	4.0 (RMS) (G)	RECORDED EXTREMES (G)	(G)	4.0 (RMS) FT	RECORDED EXTREMES FT	FT
2301	9.	30.	-13.	1.5	2.	-1.	1.6	1.1	-1.7	0.38	0.3	-0.3	0.07	0.0	-0.1	2.	2.	-3.
2318	20.	16.	-17.	5.9	5.	-6.	1.2	0.7	-1.5	0.31	0.3	-0.2	0.14	0.1	-0.1	4.	4.	-4.
2329	35.	49.	-55.	3.7	1.	-5.	2.0	1.2	-2.1	0.48	0.4	-0.5	0.10	0.1	-0.1	4.	3.	-3.
2333	29.	40.	-29.	3.8	1.	-5.	1.9	1.2	-2.1	0.45	0.4	-0.4	0.10	0.1	-0.1	3.	2.	-4.
2337	37.	56.	-56.	3.8	2.	-4.	1.9	1.2	-2.0	0.46	0.4	-0.4	0.10	0.1	-0.1	4.	3.	-3.
2341	36.	34.	-31.	3.6	2.	-4.	2.0	1.3	-1.9	0.49	0.4	-0.4	0.10	0.1	-0.1	4.	3.	-4.
2348	25.	65.	-38.	3.1	4.	-2.	1.2	0.6	-1.6	0.30	0.3	-0.3	0.10	0.1	-0.1	3.	2.	-2.
2350	14.	14.	-12.	3.8	4.	-3.	0.8	0.5	-1.2	0.21	0.2	-0.2	0.10	0.1	-0.1	3.	3.	-2.
2401	38.	68.	-46.	4.4	6.	-2.	1.1	0.9	-1.6	0.30	0.3	-0.3	0.12	0.1	-0.1	3.	2.	-3.
2409	42.	62.	-60.	4.7	2.	-5.	1.6	0.8	-1.7	0.43	0.3	-0.3	0.12	0.1	-0.1	3.	2.	-3.
2413	42.	38.	-40.	3.3	2.	-3.	1.1	0.7	-1.4	0.30	0.3	-0.3	0.09	0.1	-0.1	2.	2.	-2.
2420	24.	23.	-19.	3.4	3.	-3.	1.3	0.7	-1.5	0.34	0.3	-0.3	0.10	0.1	-0.1	2.	2.	-3.
2424	16.	14.	-13.	2.5	2.	-2.	1.0	0.5	-1.3	0.25	0.2	-0.2	0.09	0.1	-0.1	2.	1.	-2.
2426	14.	13.	-12.	3.4	2.	-4.	0.8	0.4	-1.1	0.20	0.2	-0.2	0.09	0.1	-0.1	2.	1.	-2.
2430	12.	13.	-12.	2.8	0.	-5.	0.7	0.1	-1.0	0.17	0.2	-0.1	0.09	0.1	-0.1	1.	1.	-1.
2433	25.	24.	-21.	4.3	0.	-8.	0.8	0.2	-1.3	0.22	0.2	-0.2	0.11	0.1	-0.1	2.	2.	-2.
2437	32.	45.	-54.	5.6	2.	-8.	1.6	1.1	-1.8	0.45	0.4	-0.4	0.14	0.1	-0.1	4.	3.	-4.
2442	16.	19.	-14.	3.1	1.	-4.	0.8	0.3	-1.2	0.20	0.2	-0.2	0.09	0.1	-0.1	2.	2.	-2.
2448	10.	14.	-10.	2.6	2.	-2.	0.6	0.1	-0.9	0.12	0.1	-0.1	0.08	0.1	-0.1	1.	1.	-1.

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LOG BOOK DATA

DATE AND TIME	02-18-75 1600
POSITION	
COURSE AND SPEED	295 . 27.8 KNOTS
SEA STATE	2
WAVE HEIGHT	1 FEET
" REL DIR	70 PORT
SWELL HEIGHT	4 FEET
" REL DIR	70 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST FOG /

MIDSHIP VERTICAL BENDING STRESS

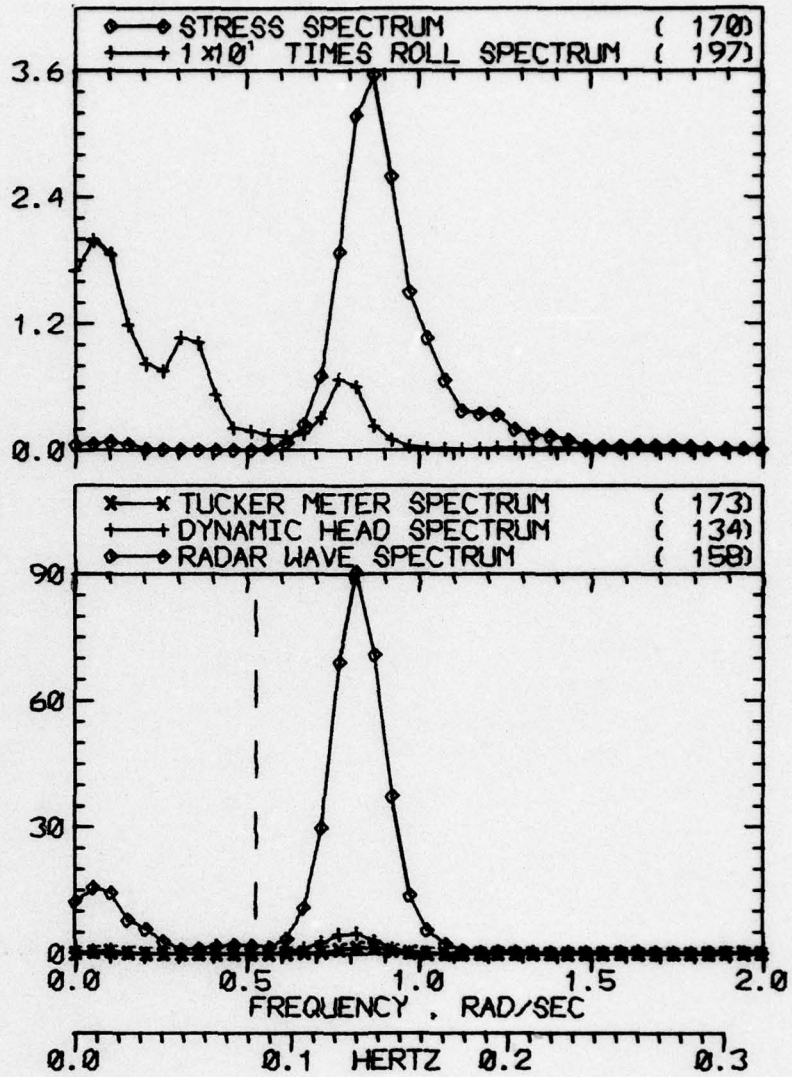
MAXIMUM PK-TR	6.5 KPSI
4.0 X RMS	3.8 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

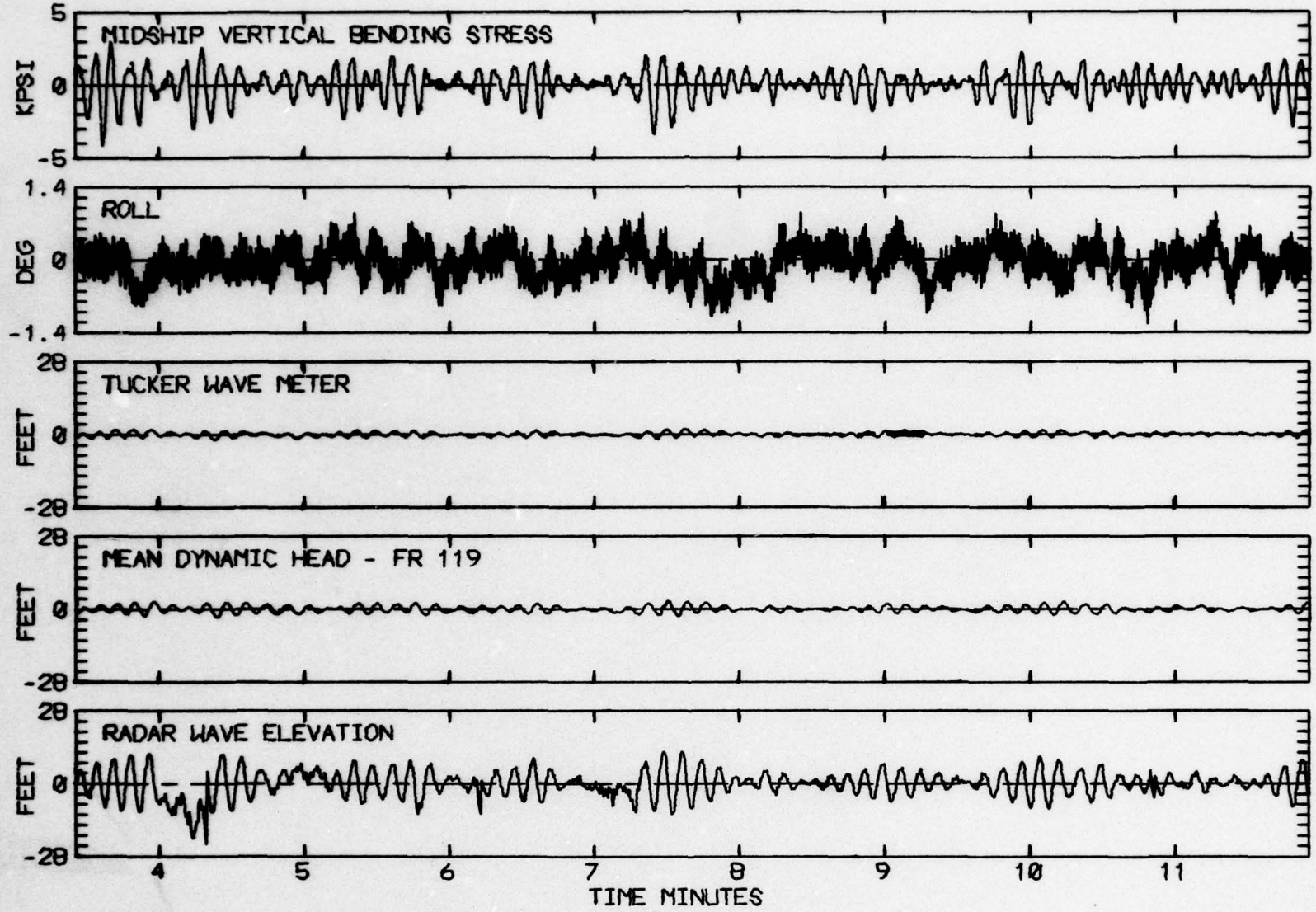
ROLL	1.5 DEG
PITCH	1.57 DEG
DK HSE VERT ACCEL	0.38 G
DK HSE LAT ACCEL	0.07 G
RADAR SLANT RANGE	8.6 FEET
VERTICAL RANGE	8.6 FEET
DISPL AT RADAR	17.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	392	182	246
MAXIMUM HEIGHT	3.3	7.0	35.3
10TH HIGHEST HTS	2.2	5.0	21.2
3RD HIGHEST HTS	1.5	3.7	14.3
4.0 RMS(SPECTRA)	2.5	4.1	18.3



RUN 2301 -- VOYAGE 60W -- TAPE 217 -- INDEX 1 -- INTERVAL 1



RUN 2301 -- VOYAGE 60W -- TAPE 217 -- INDEX 1 -- INTERVAL 1

LOG BOOK DATA

DATE AND TIME	02-19-75 0800
POSITION	
COURSE AND SPEED	229 . 32.6 KNOTS
SEA STATE	2
WAVE HEIGHT	2 FEET
" REL DIR	4 PORT
SWELL HEIGHT	3 FEET
" REL DIR	4 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

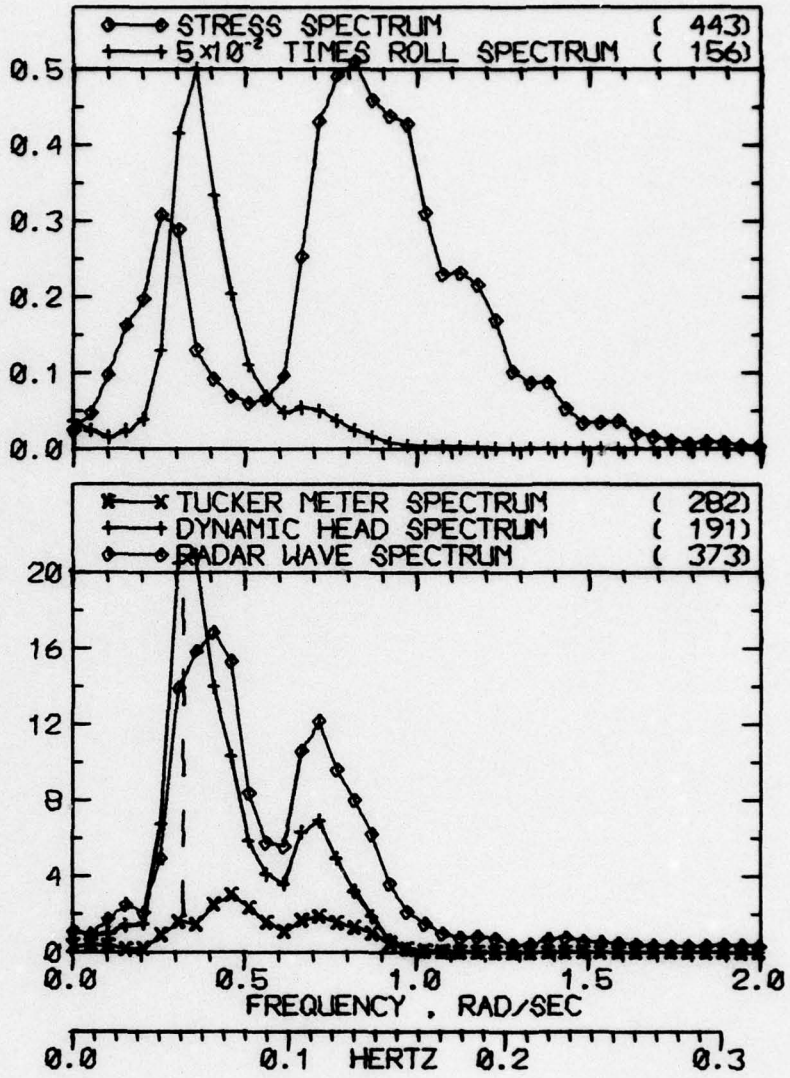
MAXIMUM PK-TR	3.7 KPSI
4.0 X RMS	2.3 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

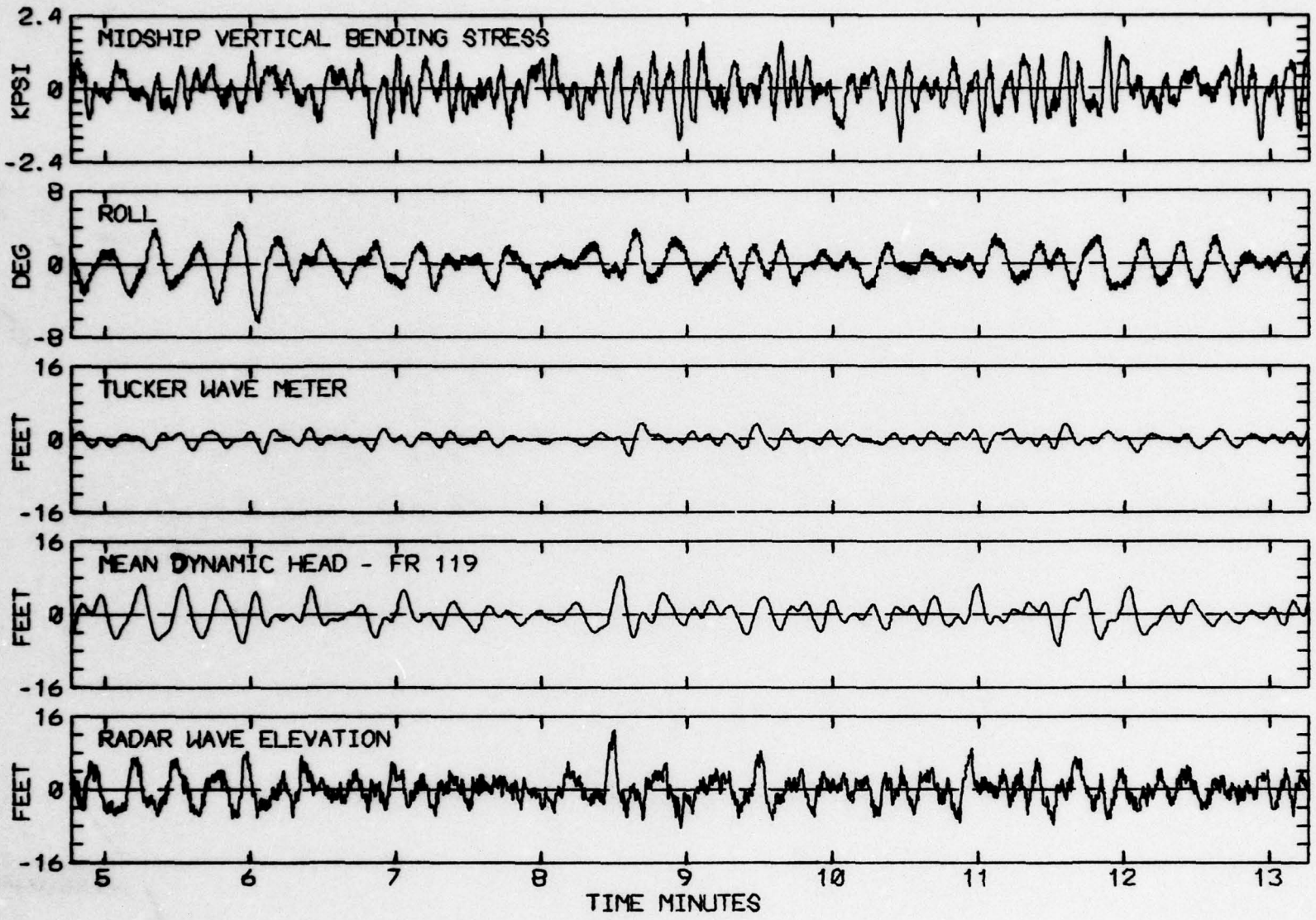
ROLL	6.0 DEG
PITCH	1.21 DEG
DK HSE VERT ACCEL	0.31 G
DK HSE LAT ACCEL	0.14 G
RADAR SLANT RANGE	19.6 FEET
VERTICAL RANGE	17.7 FEET
DISPL AT RADAR	18.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	230	108	369
MAXIMUM HEIGHT	7.0	13.4	15.0
10TH HIGHEST HTS	4.4	11.0	10.6
3RD HIGHEST HTS	2.9	8.4	7.3
4.0 RMS(SPECTRA)	4.5	9.7	11.9



RUN 2318 -- VOYAGE 60W -- TAPE 217 -- INDEX 5 -- INTERVAL 18



RUN 2318 -- VOYAGE 60W -- TAPE 217 -- INDEX 5 -- INTERVAL 18

LOG BOOK DATA

DATE AND TIME	02-19-75 2000
POSITION	43-08 N 14-40 W
COURSE AND SPEED	255 . 31.6 KNOTS
SEA STATE	6
WAVE HEIGHT	5 FEET
" REL DIR	60 STBD
SWELL HEIGHT	4 FEET
" REL DIR	30 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /SEAS OFF STARBOARD BOW

MIDSHIP VERTICAL BENDING STRESS

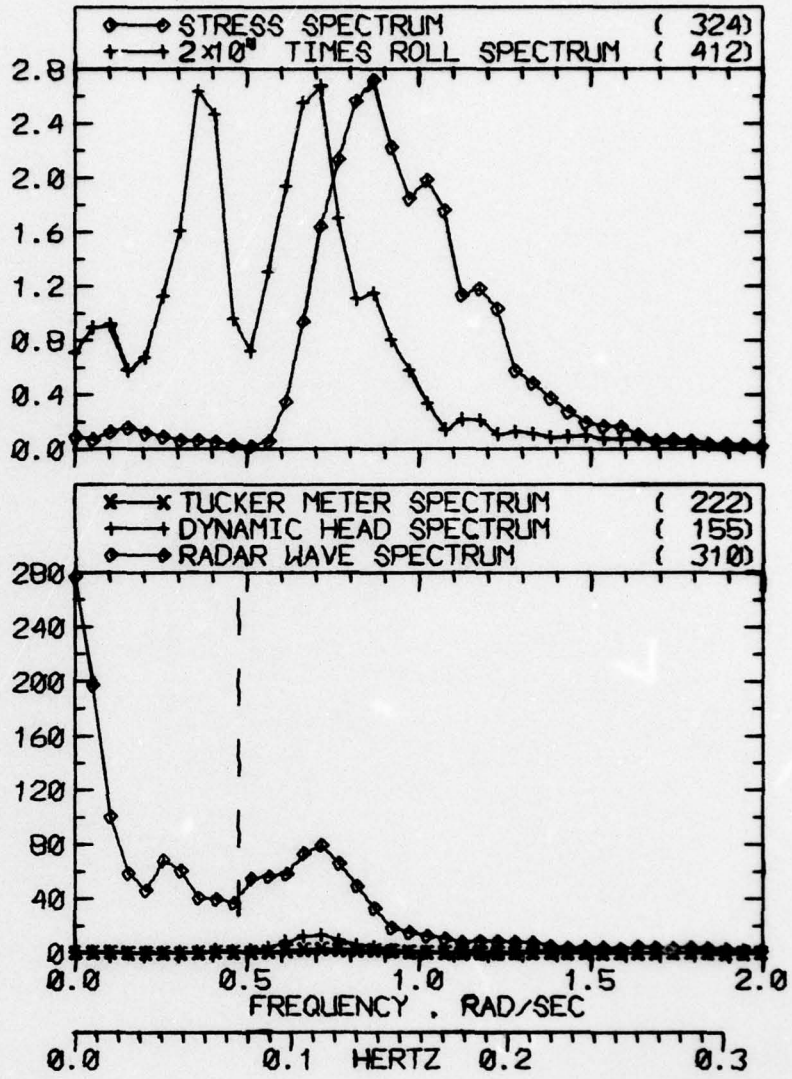
MAXIMUM PK-TR	8.4 KPSI
4.0 X RMS	4.6 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

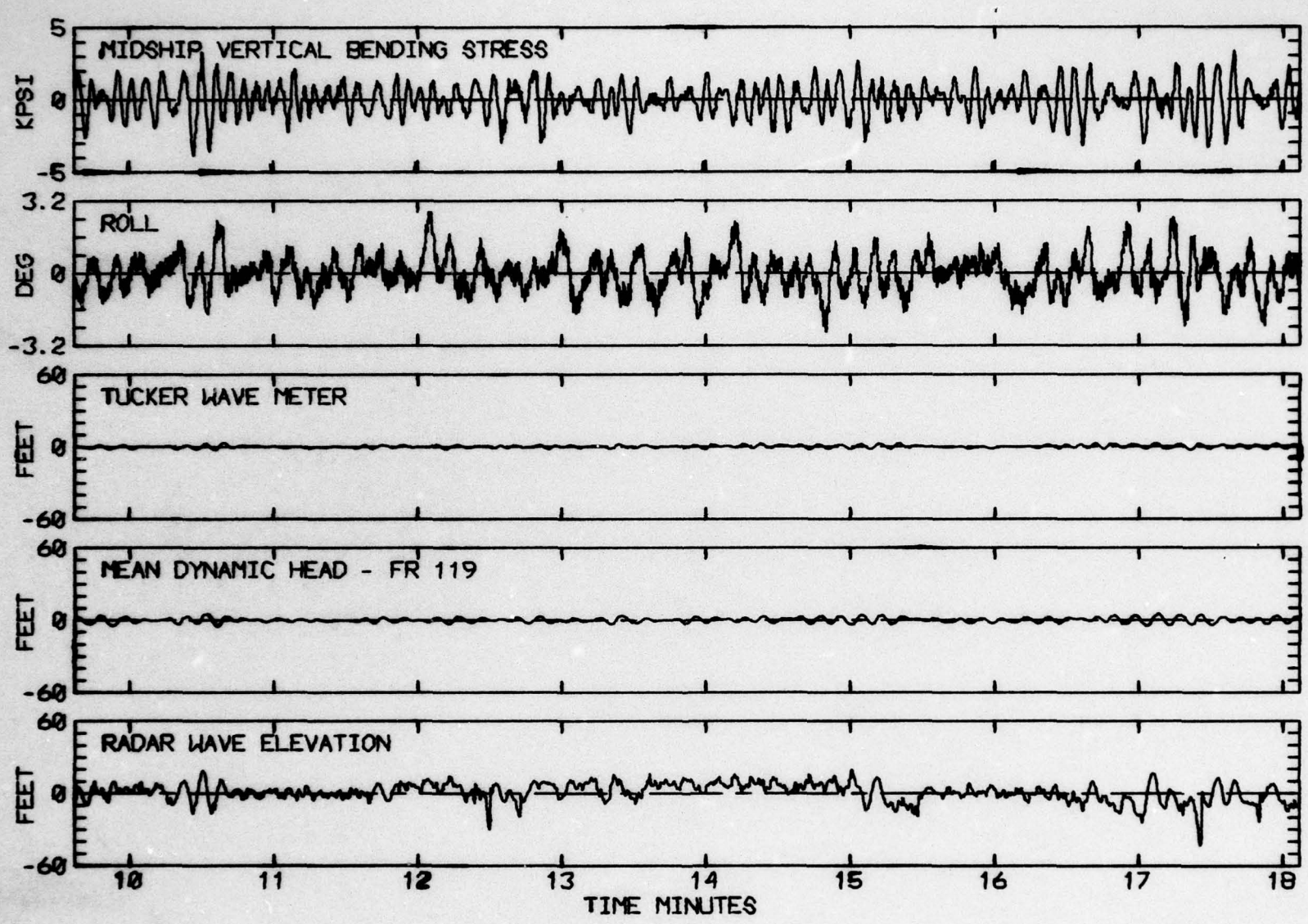
ROLL	3.6 DEG
PITCH	1.98 DEG
DK HSE VERT ACCEL	0.48 G
DK HSE LAT ACCEL	0.10 G
RADAR SLANT RANGE	35.2 FEET
VERTICAL RANGE	34.2 FEET
DISPL AT RADAR	23.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	252	143	161
MAXIMUM HEIGHT	5.6	10.2	46.2
10TH HIGHEST HTS	4.1	8.2	34.9
3RD HIGHEST HTS	3.0	6.6	24.7
4.0 RMS(SPECTRA)	4.0	7.2	34.5



RUN 2329 -- VOYAGE 60W -- TAPE 217 -- INDEX 8 -- INTERVAL 29



RUN 2329 -- VOYAGE 60W -- TAPE 217 -- INDEX 8 -- INTERVAL 29

LOG BOOK DATA

DATE AND TIME	02-19-75 2400
POSITION	43-08 N 14-40 W
COURSE AND SPEED	255 . 31.5 KNOTS
SEA STATE	6
WAVE HEIGHT	6 FEET
* REL DIR	71 STBD
SWELL HEIGHT	/ FEET
* REL DIR	60 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

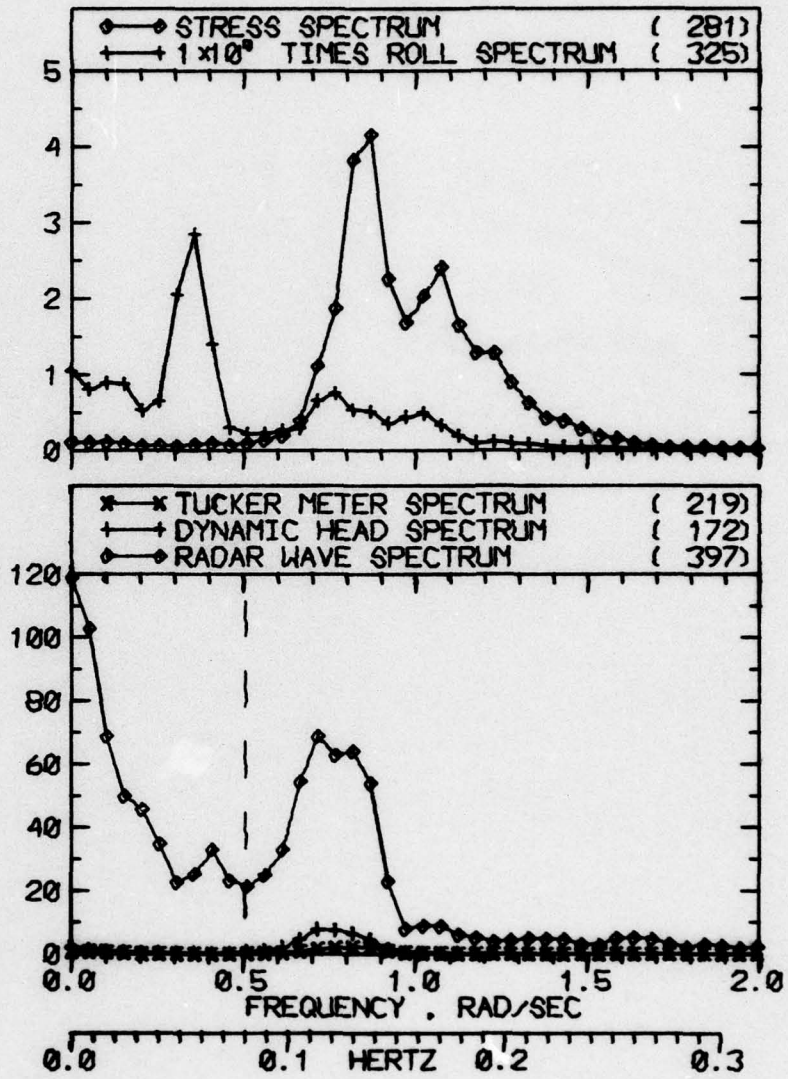
MAXIMUM PK-TR	8.0 KPSI
4.0 X RMS	4.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

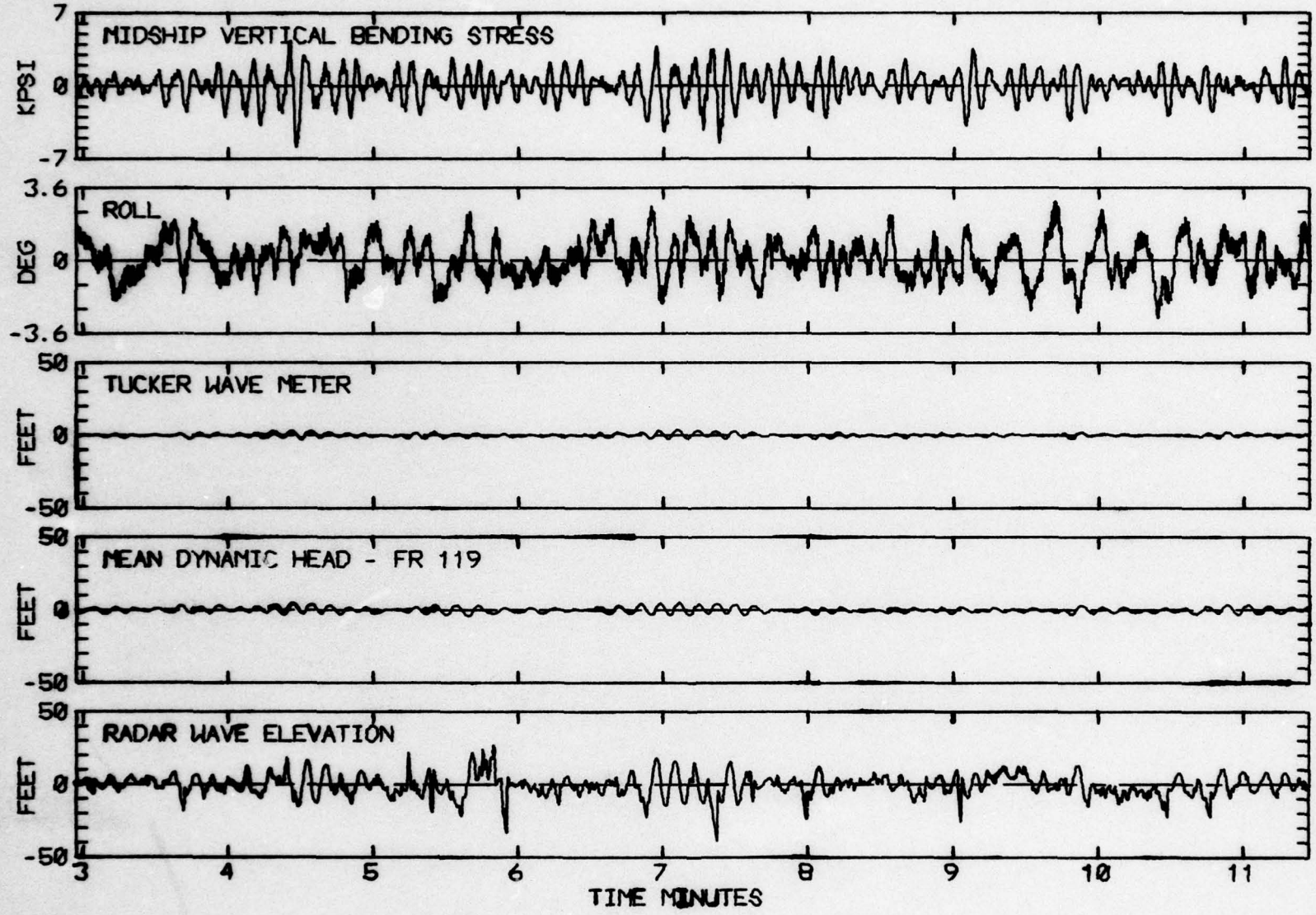
ROLL	3.9 DEG
PITCH	1.86 DEG
DK HSE VERT ACCEL	0.45 G
DK HSE LAT ACCEL	0.10 G
RADAR SLANT RANGE	28.7 FEET
VERTICAL RANGE	27.3 FEET
DISPL AT RADAR	21.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	259	142	227
MAXIMUM HEIGHT	5.8	8.4	42.5
10TH HIGHEST HTS	3.6	6.8	28.8
3RD HIGHEST HTS	2.5	5.4	20.2
4.0 RMS(SPECTRA)	3.4	5.9	29.0



RUN 2333 -- VOYAGE 60W -- TAPE 217 -- INDEX 9 -- INTERVAL 33



RUN 2333 -- VOYAGE 60W -- TAPE 217 -- INDEX 9 -- INTERVAL 33

LOG BOOK DATA

DATE AND TIME	02-20-75 0400
POSITION	43-08 N 14-40 W
COURSE AND SPEED	255 . 31.4 KNOTS
SEA STATE	2
WAVE HEIGHT	4 FEET
" REL DIR	37 STBD
SWELL HEIGHT	8 FEET
" REL DIR	60 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

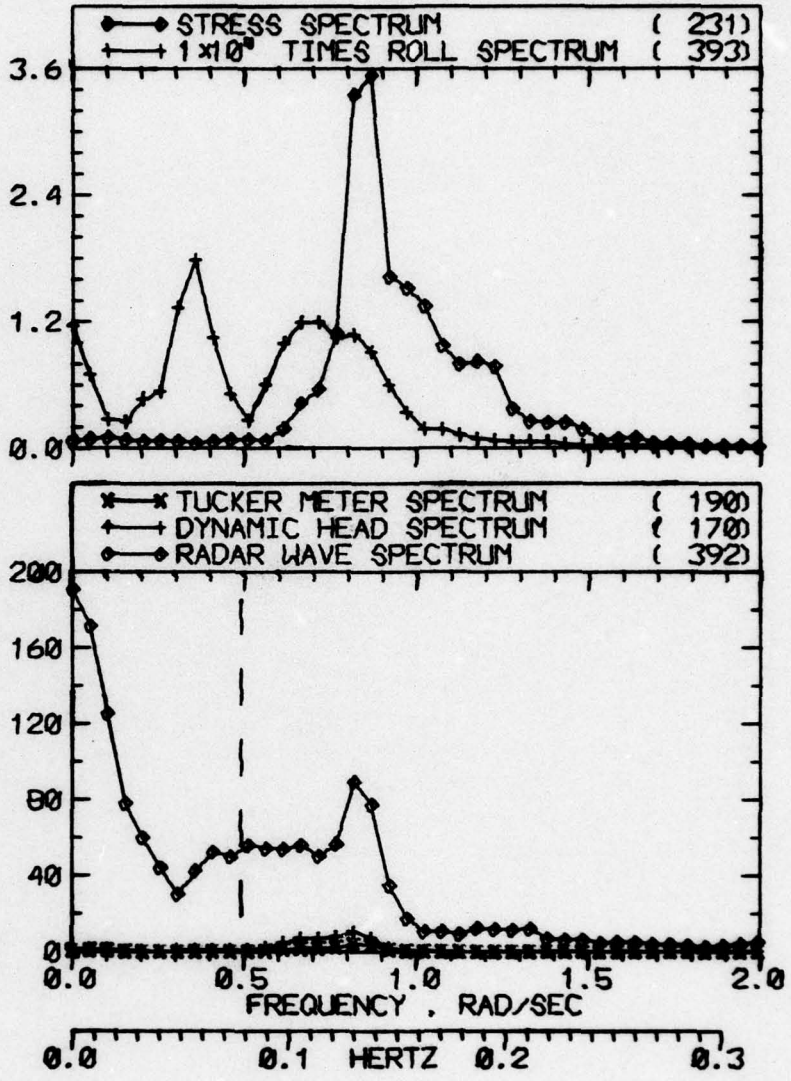
MAXIMUM PK-TR	8.0 KPSI
4.0 X RMS	4.1 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

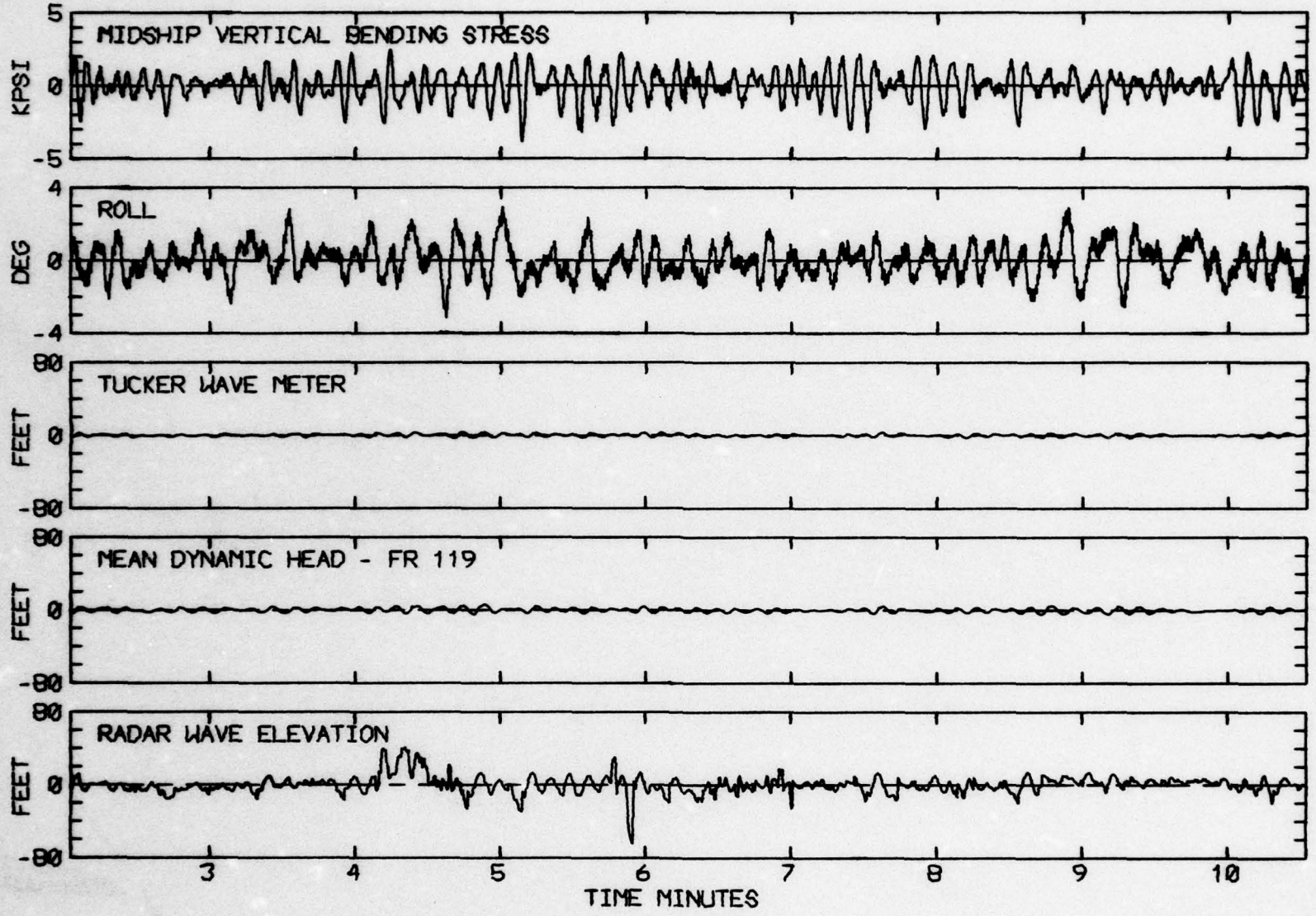
ROLL	3.8 DEG
PITCH	1.86 DEG
DK HSE VERT ACCEL	0.46 G
DK HSE LAT ACCEL	0.10 G
RADAR SLANT RANGE	37.2 FEET
VERTICAL RANGE	34.5 FEET
DISPL AT RADAR	21.7 FEET

WAVE HEIGHT STATISTICS (FEET)

		TUCKER/DYN. HEAD/RADAR	
P-T SAMPLE SIZE	193	133	212
MAXIMUM HEIGHT	5.5	8.9	73.8
10TH HIGHEST HTS	4.4	7.5	33.3
3RD HIGHEST HTS	3.5	6.4	23.1
4.0 RMS(SPECTRA)	4.1	6.7	35.2



RUN 2337 -- VOYAGE 60W -- TAPE 217 -- INDEX 10 -- INTERVAL 37



RUN 2337 -- VOYAGE 60W -- TAPE 217 -- INDEX 10 -- INTERVAL 37

LOG BOOK DATA

DATE AND TIME	02-20-75 0800
POSITION	43-08 N 14-40 W
COURSE AND SPEED	270 . 31.5 KNOTS
SEA STATE	
WAVE HEIGHT	1 FEET
" REL DIR	22 STBD
SWELL HEIGHT	8 FEET
" REL DIR	22 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

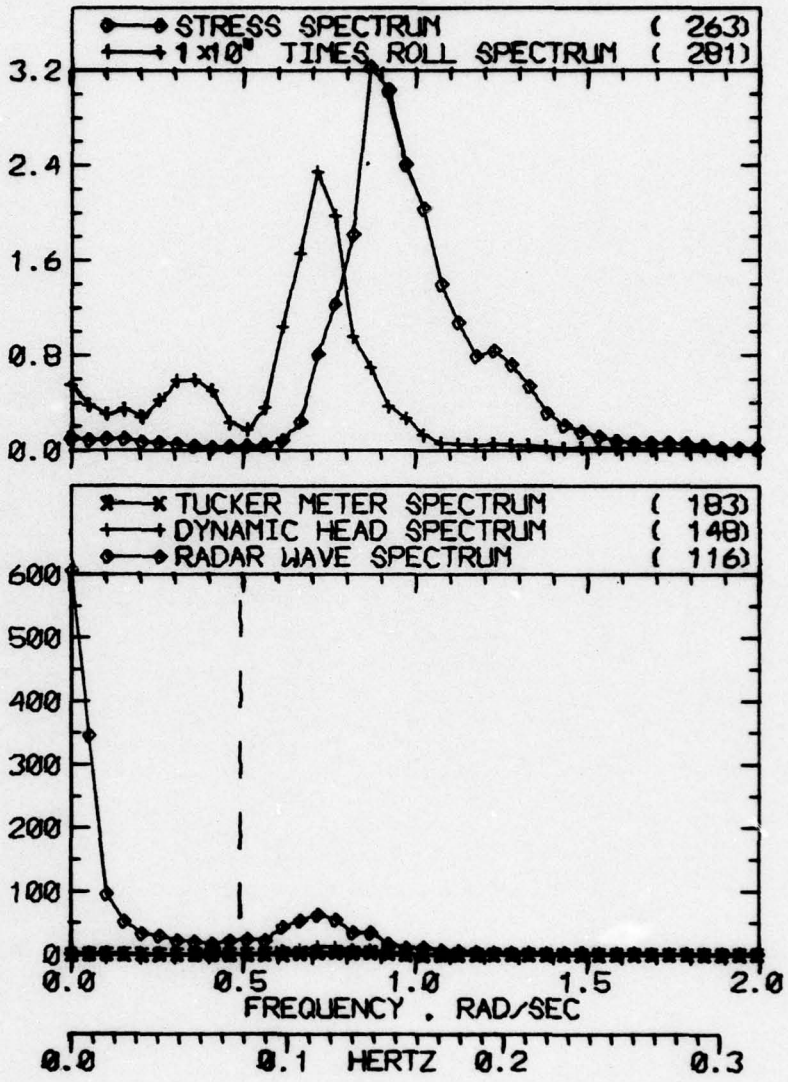
MAXIMUM PK-TR	7.2 KPSI
4.0 X RMS	4.3 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

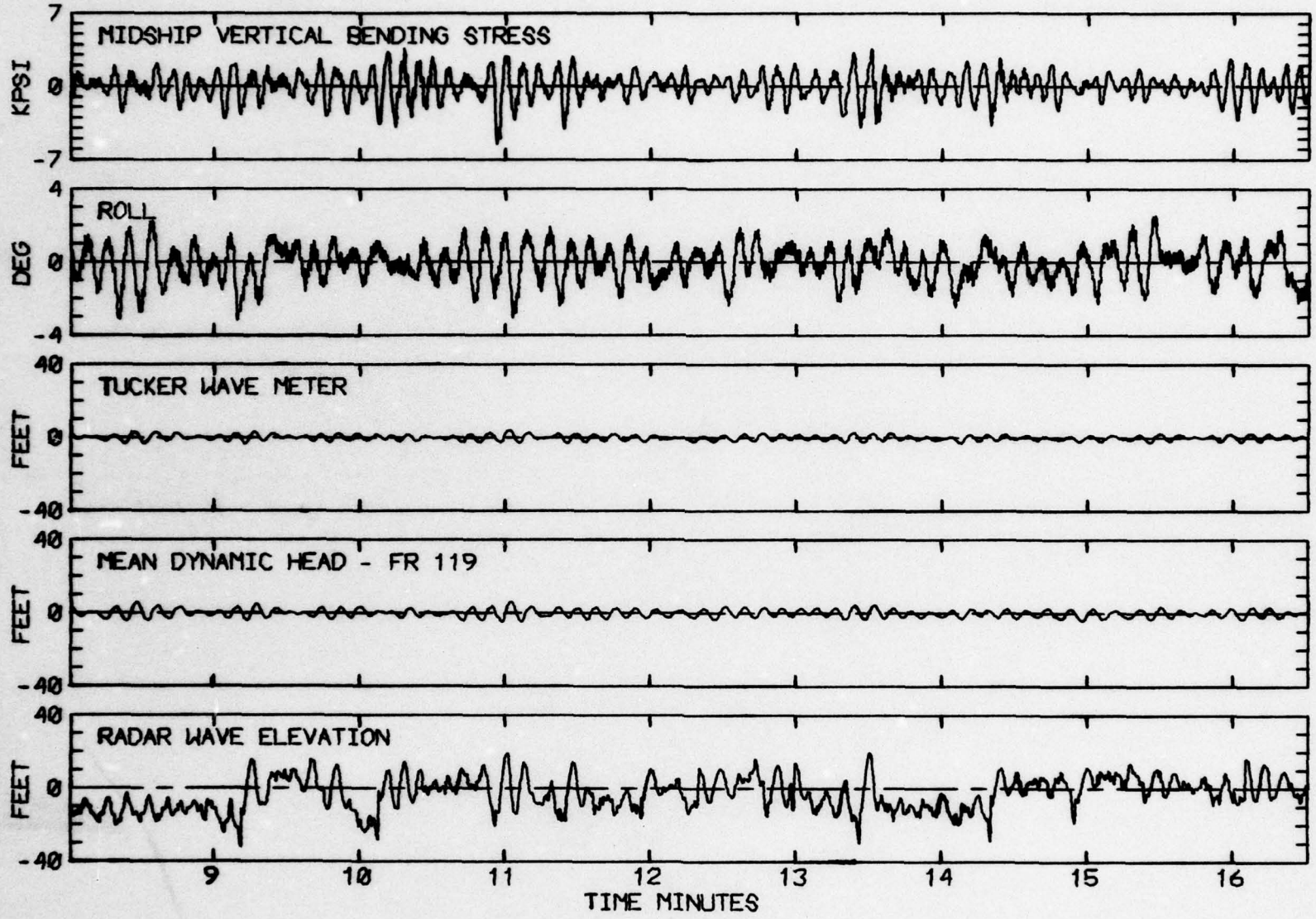
ROLL	3.6 DEG
PITCH	1.96 DEG
DK HSE VERT ACCEL	0.49 G
DK HSE LAT ACCEL	0.10 G
RADAR SLANT RANGE	36.2 FEET
VERTICAL RANGE	34.6 FEET
DISPL AT RADAR	22.0 FEET

WAVE HEIGHT STATISTICS (FEET)

		TUCKER/DYN. HEAD/RADAR	
P-T SAMPLE SIZE	201	143	187
MAXIMUM HEIGHT	6.8	10.6	48.3
10TH HIGHEST HTS	4.8	8.0	29.6
3RD HIGHEST HTS	3.5	6.3	18.7
4.0 RMS(SPECTRA)	4.3	6.9	33.8



RUN 2341 -- VOYAGE 60W -- TAPE 217 -- INDEX 11 -- INTERVAL 41



RUN 2341 -- VOYAGE 60W -- TAPE 217 -- INDEX 11 -- INTERVAL 41

LOG BOOK DATA

DATE AND TIME	02-20-75 1200
POSITION	39-52 N 31-00 W
COURSE AND SPEED	288 , 31.6 KNOTS
SEA STATE	4
WAVE HEIGHT	3 FEET
" REL DIR	63 PORT
SWELL HEIGHT	6 FEET
" REL DIR	4 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

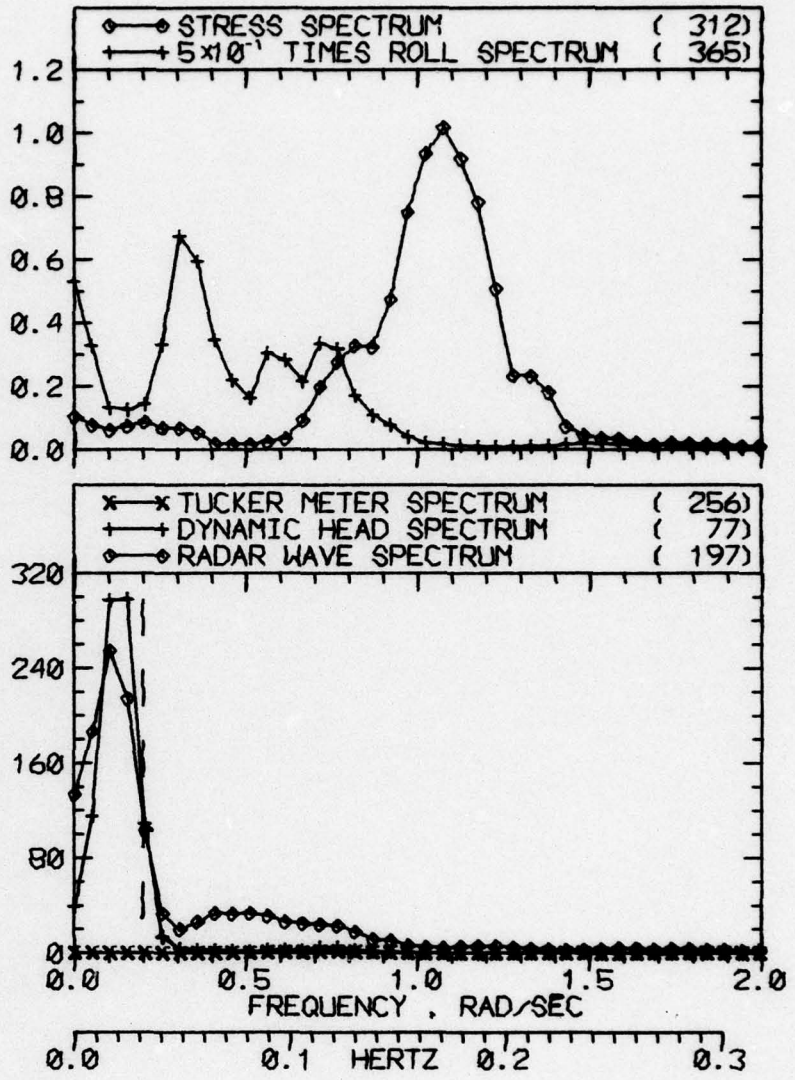
MAXIMUM PK-TR	3.9 KPSI
4.0 X RMS	2.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

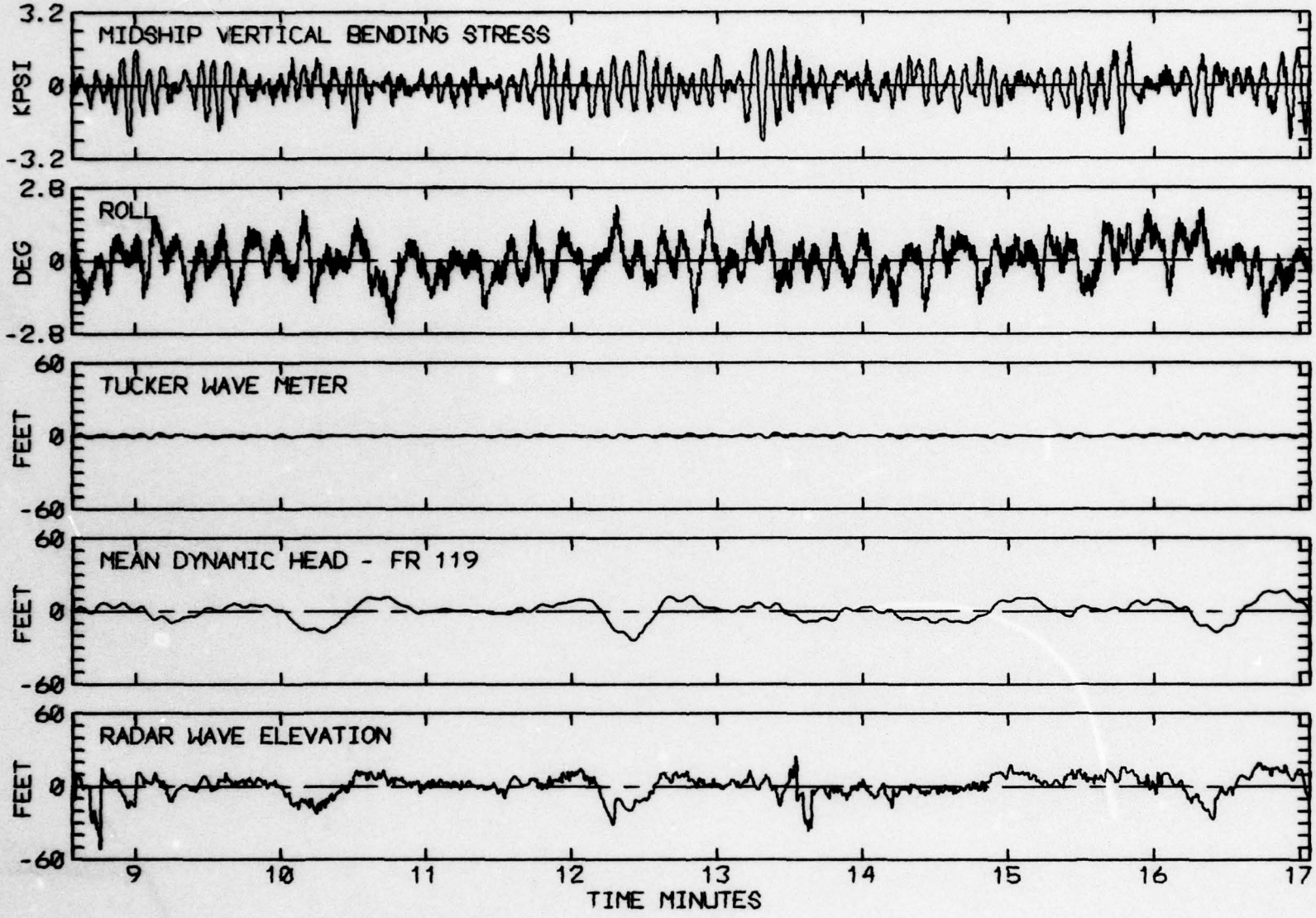
ROLL	3.1 DEG
PITCH	1.20 DEG
DK HSE VERT ACCEL	0.30 G
DK HSE LAT ACCEL	0.10 G
RADAR SLANT RANGE	25.0 FEET
VERTICAL RANGE	23.9 FEET
DISPL AT RADAR	27.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	264	43	140
MAXIMUM HEIGHT	3.8	33.2	62.6
10TH HIGHEST HTS	3.0	28.8	33.3
3RD HIGHEST HTS	2.1	19.7	21.1
4.0 RMS(SPECTRA)	2.9	26.9	32.8



RUN 2348 -- VOYAGE 60W -- TAPE 217 -- INDEX 12 -- INTERVAL 48



RUN 2348 -- VOYAGE 60W -- TAPE 217 -- INDEX 12 -- INTERVAL 48

LOG BOOK DATA

DATE AND TIME	02-20-75 1600
POSITION	39-52 N 31-00 W
COURSE AND SPEED	270 . 31.4 KNOTS
SEA STATE	5
WAVE HEIGHT	3 FEET
" REL DIR	68 PORT
SWELL HEIGHT	3 FEET
" REL DIR	22 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

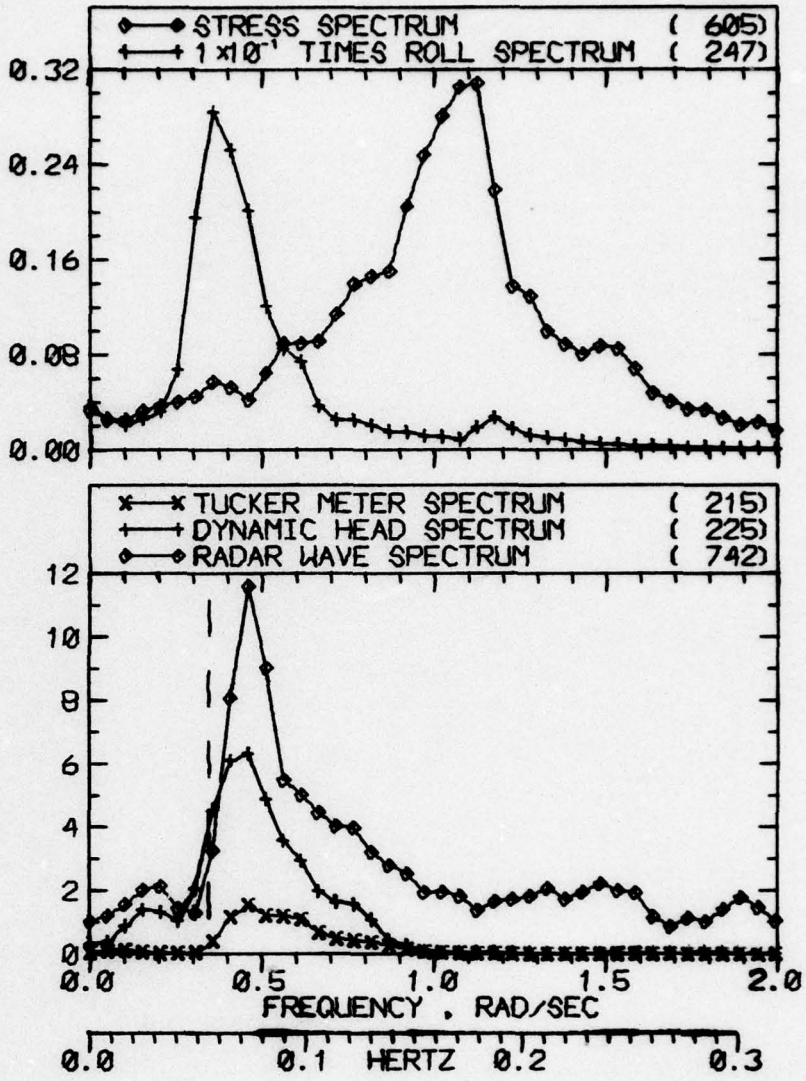
MAXIMUM PK-TR	3.0 KPSI
4.0 X RMS	1.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

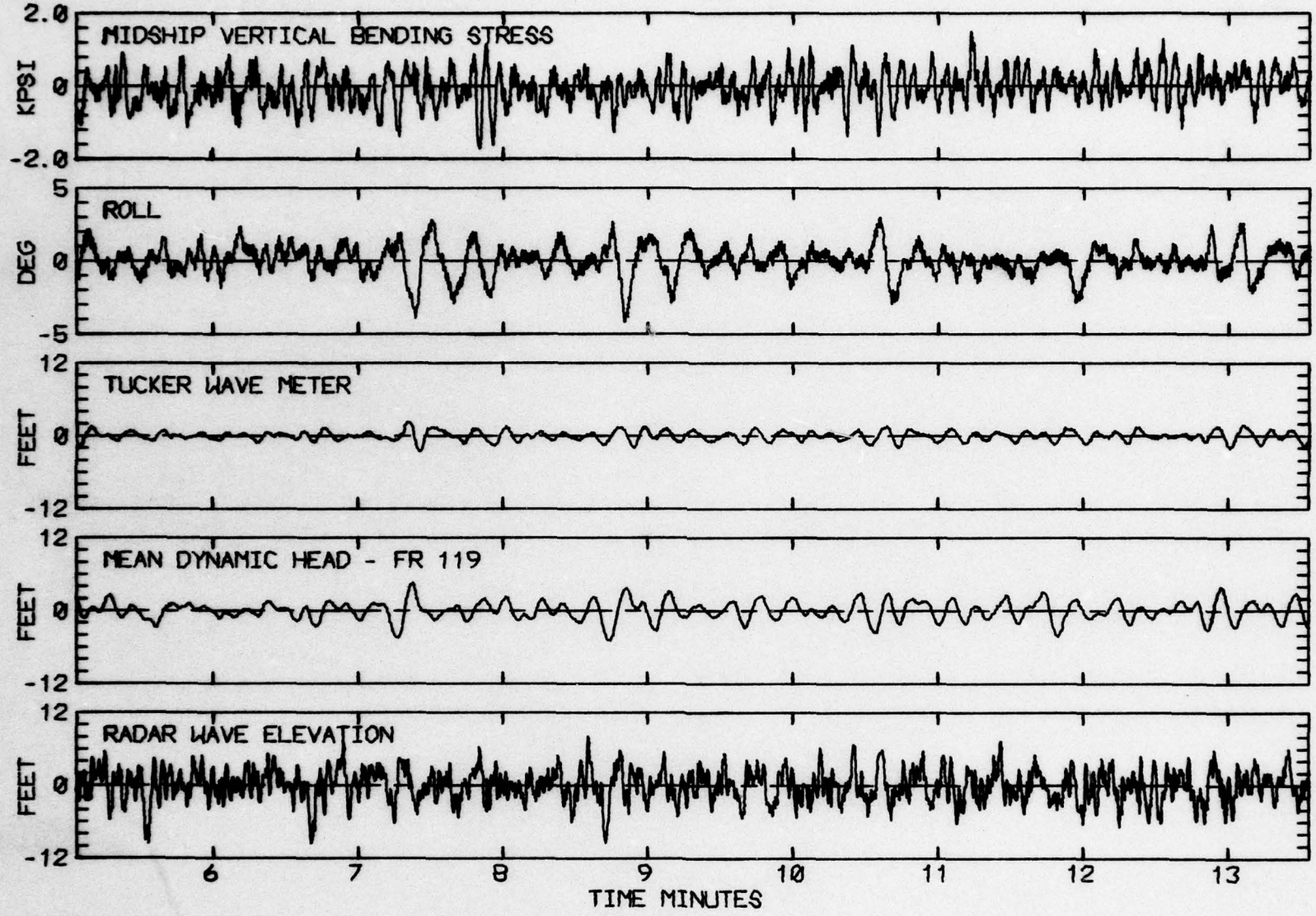
ROLL	3.9 DEG
PITCH	0.85 DEG
DK HSE VERT ACCEL	0.21 G
DK HSE LAT ACCEL	0.10 G
RADAR SLANT RANGE	14.1 FEET
VERTICAL RANGE	13.2 FEET
DISPL AT RADAR	11.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	284	117	459
MAXIMUM HEIGHT	5.0	7.5	14.3
10TH HIGHEST HTS	2.7	6.3	10.3
3RD HIGHEST HTS	1.7	5.1	7.6
4.0 RMS(SPECTRA)	2.7	5.9	10.6



RUN 2350 -- VOYAGE 60W -- TAPE 217 -- INDEX 13 -- INTERVAL 50



RUN 2350 -- VOYAGE 60W -- TAPE 217 -- INDEX 13 -- INTERVAL 50

LOG BOOK DATA

DATE AND TIME	02-21-75 0400
POSITION	39-52 N 31-00 W
COURSE AND SPEED	270 . 27.7 KNOTS
SEA STATE	6
WAVE HEIGHT	5 FEET
" REL DIR	68 PORT
SWELL HEIGHT	12 FEET
" REL DIR	22 STBD

---- VISUAL WEATHER / COMMENTS ----

RAIN /

MIDSHIP VERTICAL BENDING STRESS

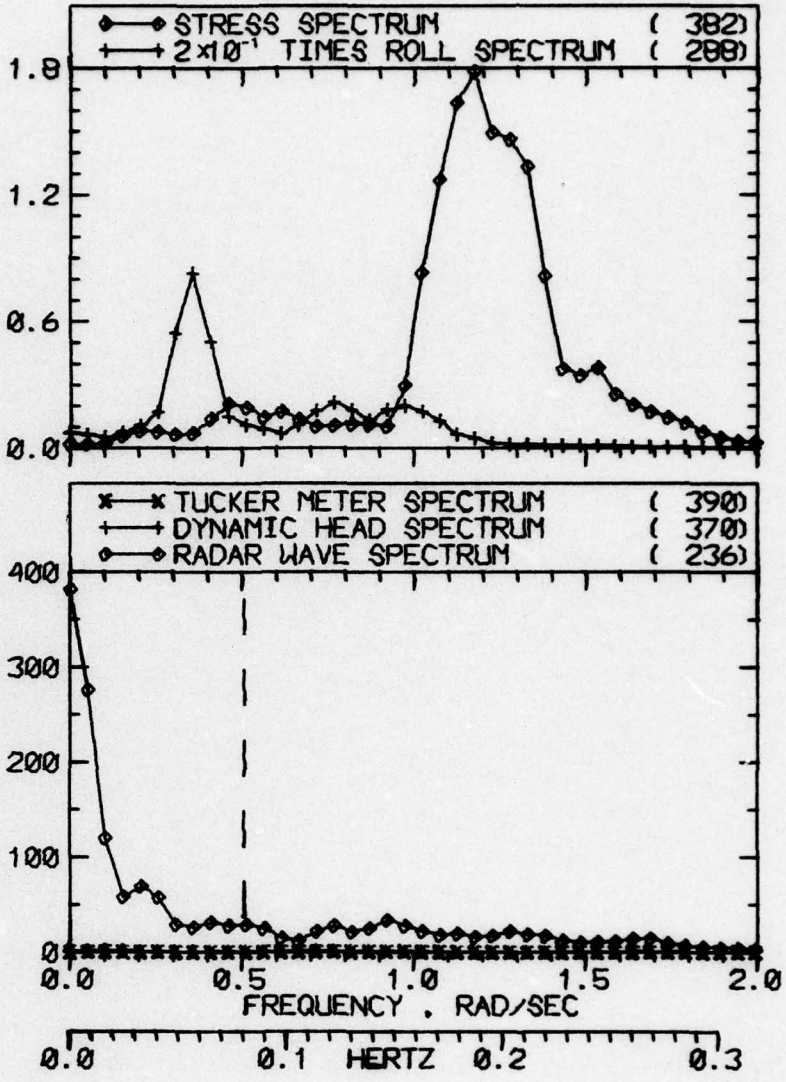
MAXIMUM PK-TR	4.3 KPSI
4.0 X RMS	3.8 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

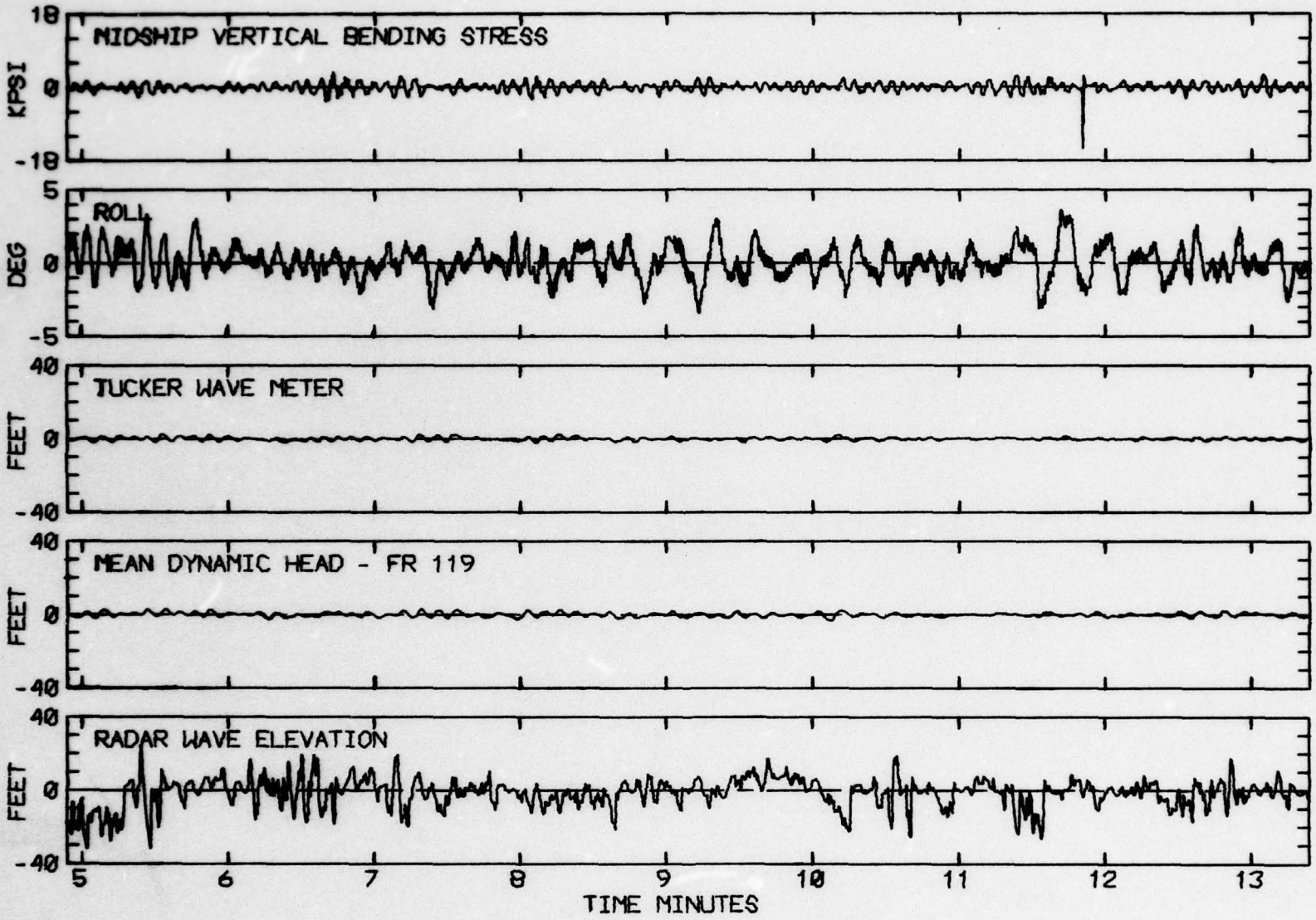
ROLL	4.5 DEG
PITCH	1.09 DEG
DK HSE VERT ACCEL	0.30 G
DK HSE LAT ACCEL	0.12 G
RADAR SLANT RANGE	38.5 FEET
VERTICAL RANGE	35.4 FEET
DISPL AT RADAR	11.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	318	183	240
MAXIMUM HEIGHT	3.6	5.8	60.6
10TH HIGHEST HTS	2.5	4.0	34.2
3RD HIGHEST HTS	1.7	3.1	22.5
4.0 RMS(SPECTRA)	2.7	3.8	34.9



RUN 2401 -- VOYAGE 60W -- TAPE 219 -- INDEX 16 -- INTERVAL 1



RUN 2401 -- VOYAGE 60W -- TAPE 219 -- INDEX 16 -- INTERVAL 1

LOG BOOK DATA

DATE AND TIME	02-21-75 1200
POSITION	39-53 N 45-20 W
COURSE AND SPEED	270 . 21.3 KNOTS
SEA STATE	7
WAVE HEIGHT	5 FEET
" REL DIR	22 STBD
SWELL HEIGHT	14 FEET
" REL DIR	22 STBD

---- VISUAL WEATHER / COMMENTS ----

RAIN /

MIDSHIP VERTICAL BENDING STRESS

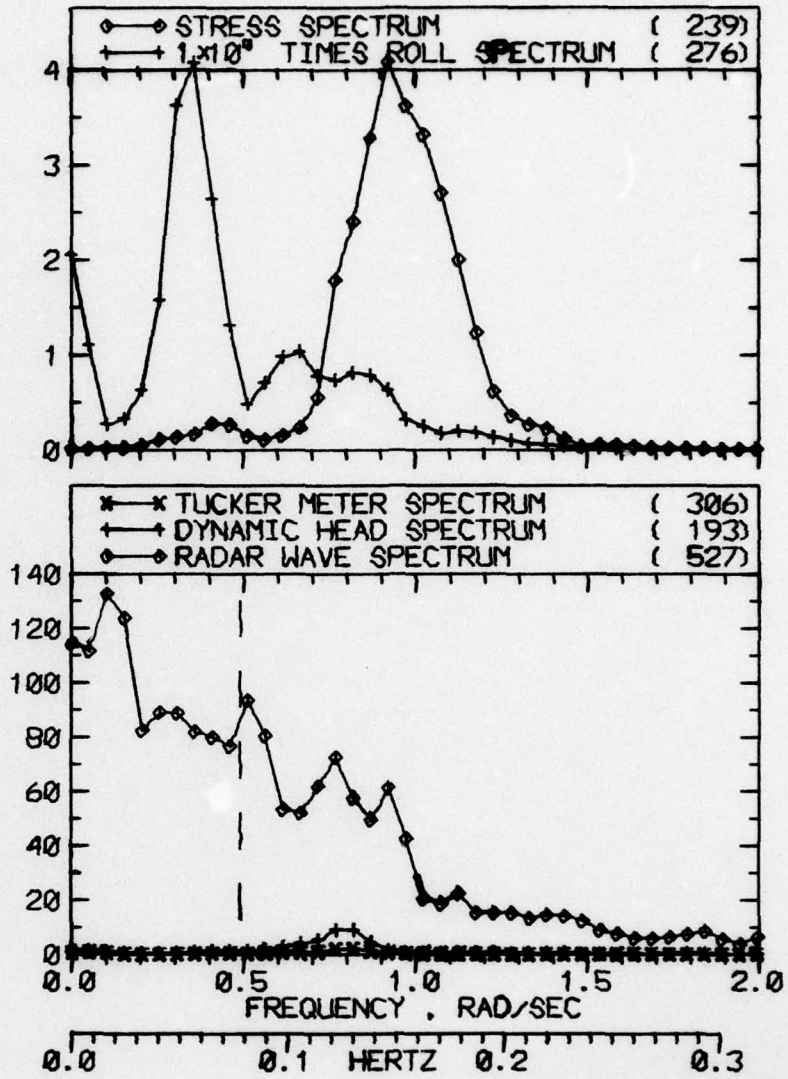
MAXIMUM PK-TR	8.5 KPSI
4.0 X RMS	4.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

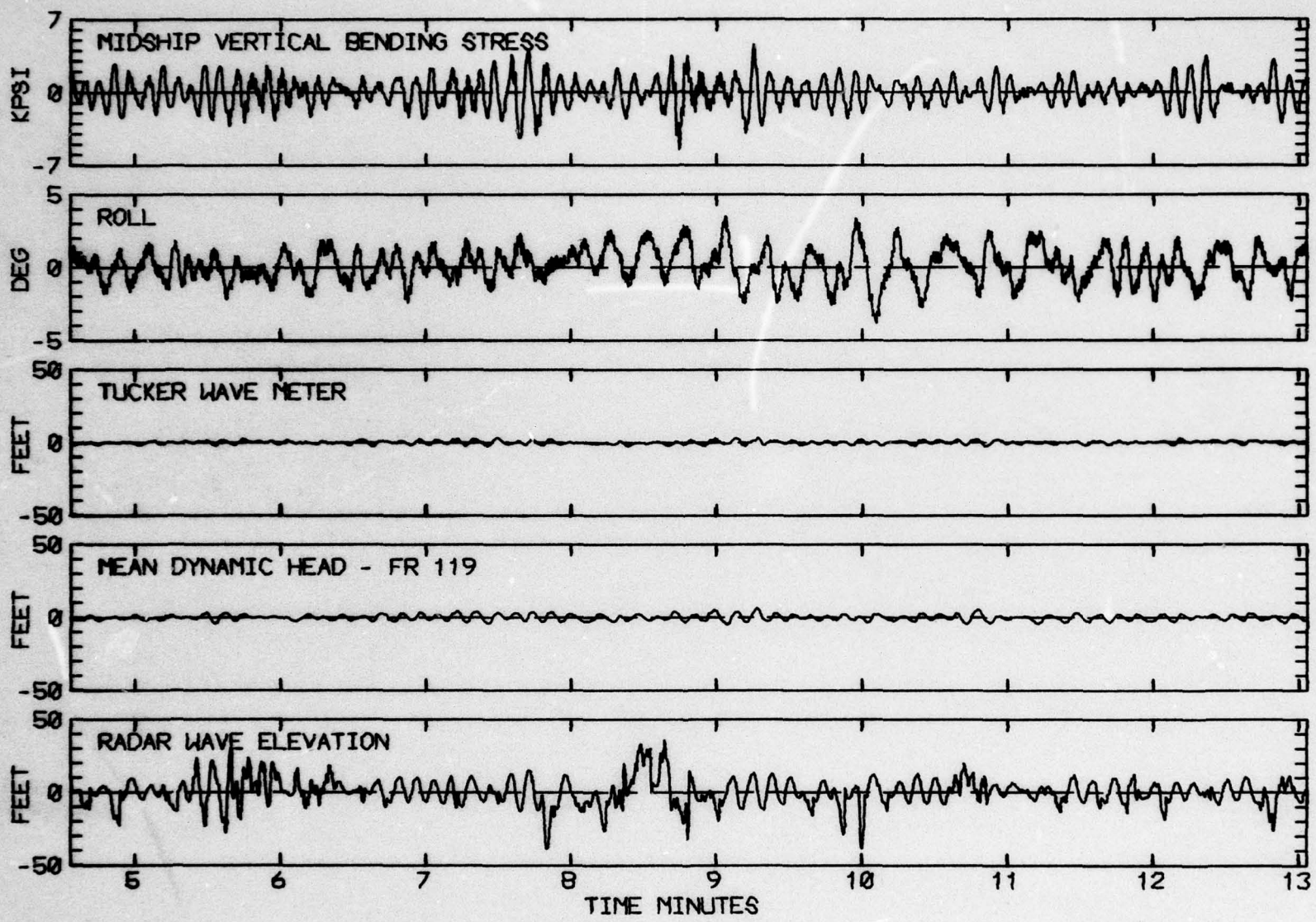
ROLL	4.7 DEG
PITCH	1.57 DEG
DK HSE VERT ACCEL	0.43 G
DK HSE LAT ACCEL	0.12 G
RADAR SLANT RANGE	41.8 FEET
VERTICAL RANGE	40.5 FEET
DISPL AT RADAR	20.5 FEET

WAVE HEIGHT STATISTICS (FEET)

		TUCKER/DYN.	HEAD/RADAR
P-T SAMPLE SIZE	263	150	201
MAXIMUM HEIGHT	4.6	10.0	67.6
10TH HIGHEST HTS	3.7	7.6	44.2
3RD HIGHEST HTS	2.7	5.8	29.1
4.0 RMS(SPECTRA)	3.5	6.4	39.5



RUN 2409 -- VOYAGE 60W -- TAPE 219 -- INDEX 18 -- INTERVAL 9



RUN 2409 -- VOYAGE 60W -- TAPE 219 -- INDEX 18 -- INTERVAL 9

LOG BOOK DATA

DATE AND TIME	02-21-75 1600
POSITION	39-53 N 45-20 W
COURSE AND SPEED	270 . 21.8 KNOTS
SEA STATE	1
WAVE HEIGHT	2 FEET
* REL DIR	67 STBD
SWELL HEIGHT	8 FEET
* REL DIR	67 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

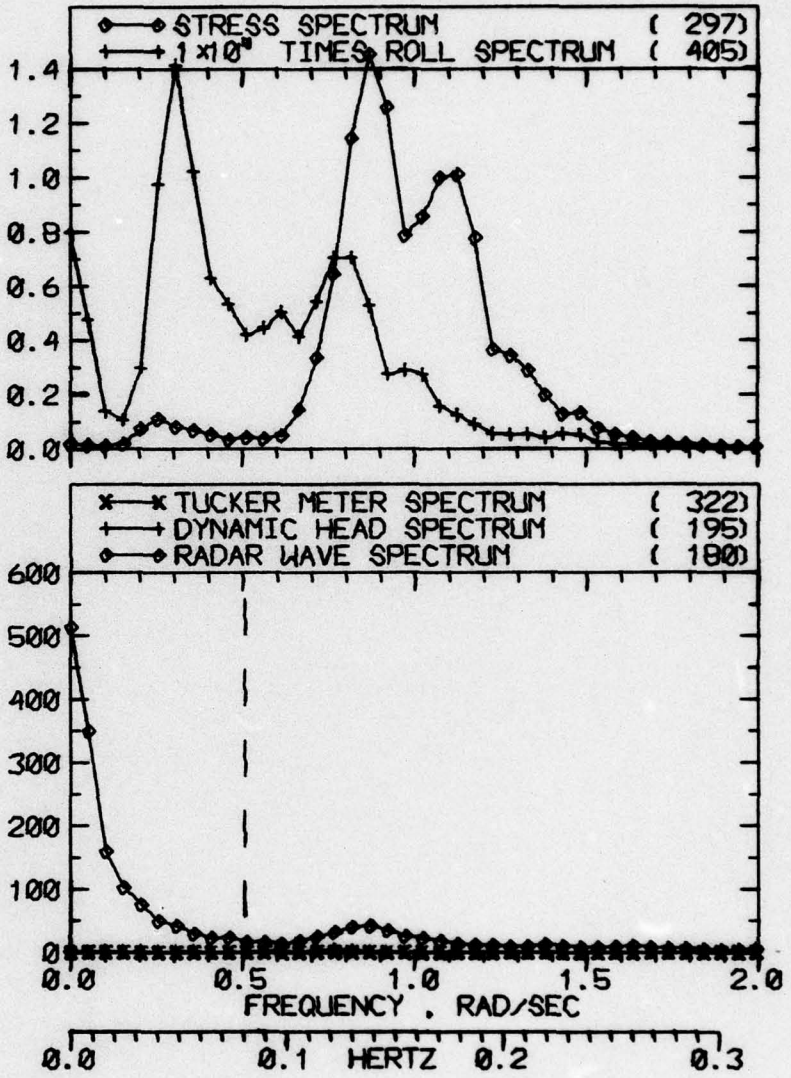
MAXIMUM PK-TR	4.8 KPSI
4.0 X RMS	3.2 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

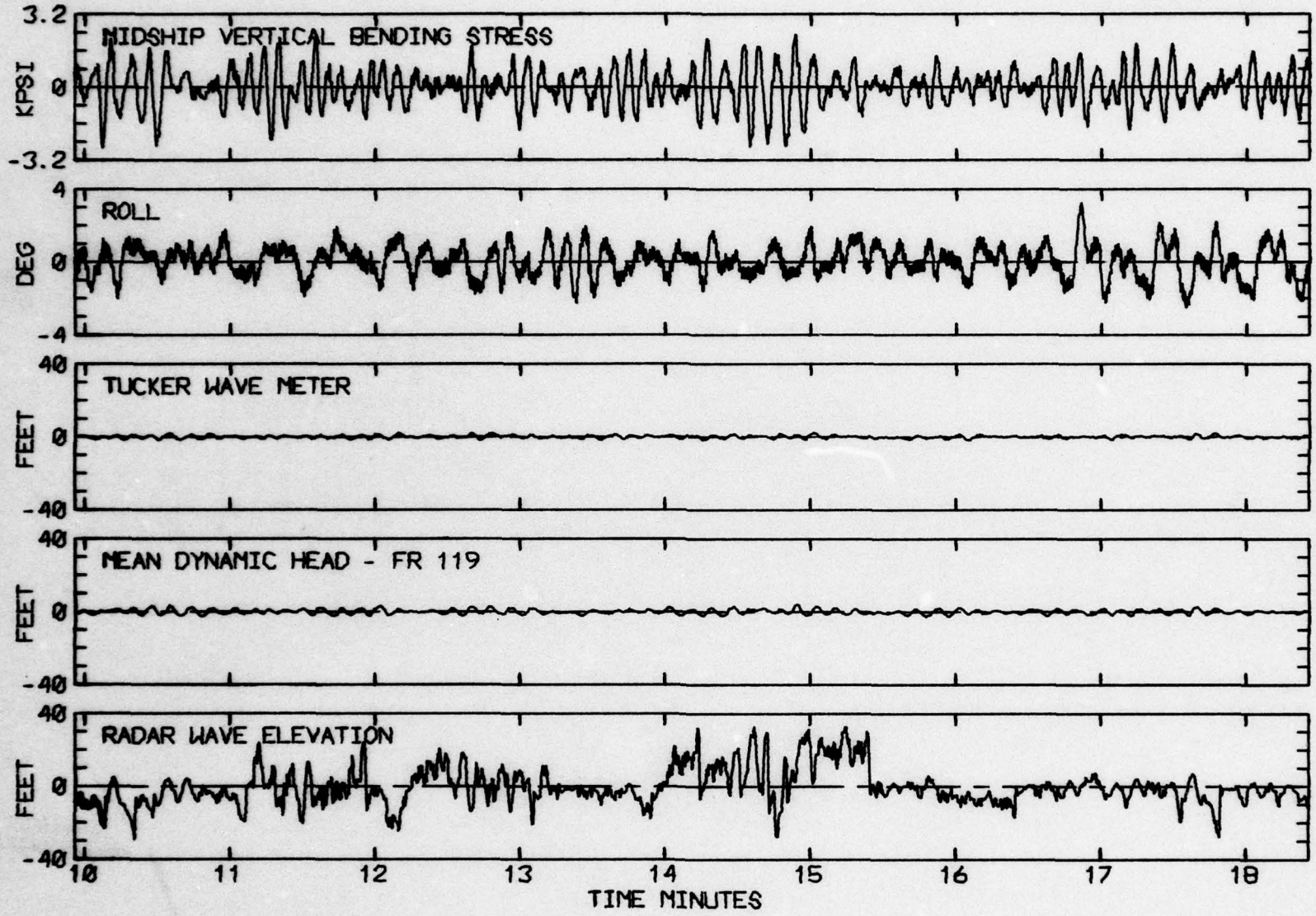
ROLL	3.3 DEG
PITCH	1.13 DEG
DK HSE VERT ACCEL	0.30 G
DK HSE LAT ACCEL	0.09 G
RADAR SLANT RANGE	41.5 FEET
VERTICAL RANGE	40.4 FEET
DISPL AT RADAR	12.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	342	165	198
MAXIMUM HEIGHT	3.5	5.9	59.2
10TH HIGHEST HTS	2.3	4.5	34.6
3RD HIGHEST HTS	1.7	3.6	24.8
4.0 RMS(SPECTRA)	2.5	4.1	37.1



RUN 2413 -- VOYAGE 60W -- TAPE 219 -- INDEX 19 -- INTERVAL 13



RUN 2413 -- VOYAGE 60W -- TAPE 219 -- INDEX 19 -- INTERVAL 13

LOG BOOK DATA

DATE AND TIME	02-21-75 2000
POSITION	39-53 N 45-20 W
COURSE AND SPEED	270 . 22.6 KNOTS
SEA STATE	1
WAVE HEIGHT	1 FEET
* REL DIR	90 PORT
SWELL HEIGHT	8 FEET
* REL DIR	22 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

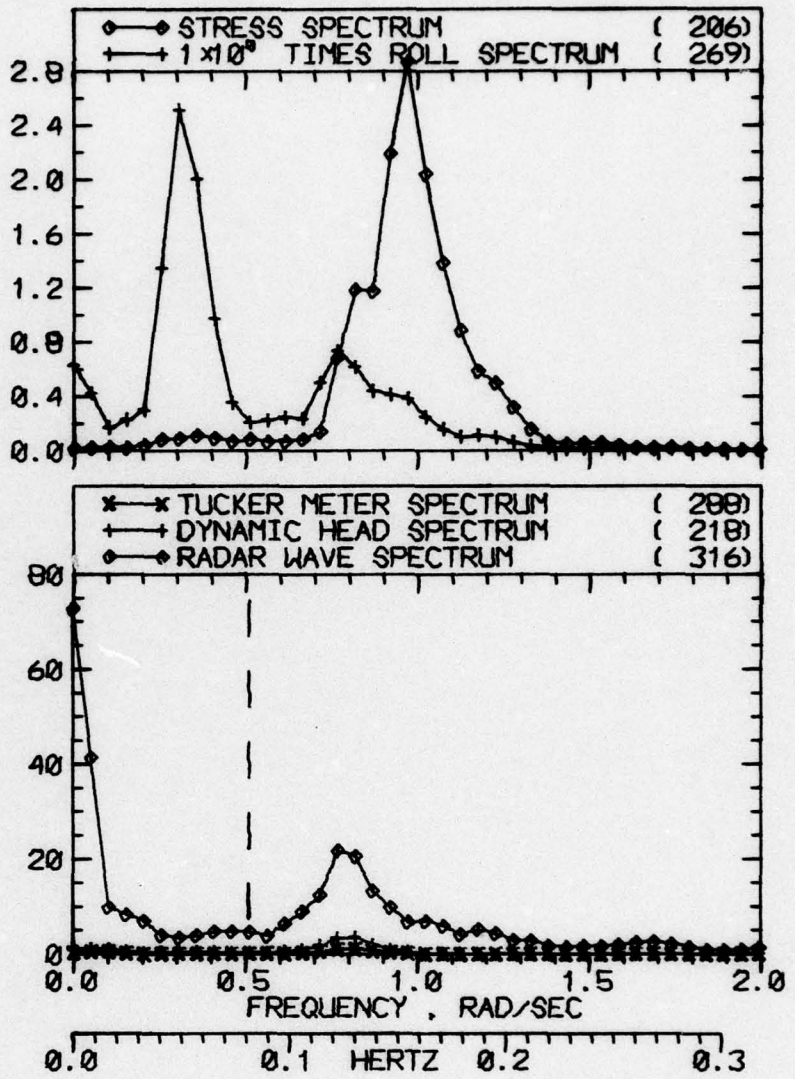
MAXIMUM PK-TR	4.9 KPSI
4.0 X RMS	3.6 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

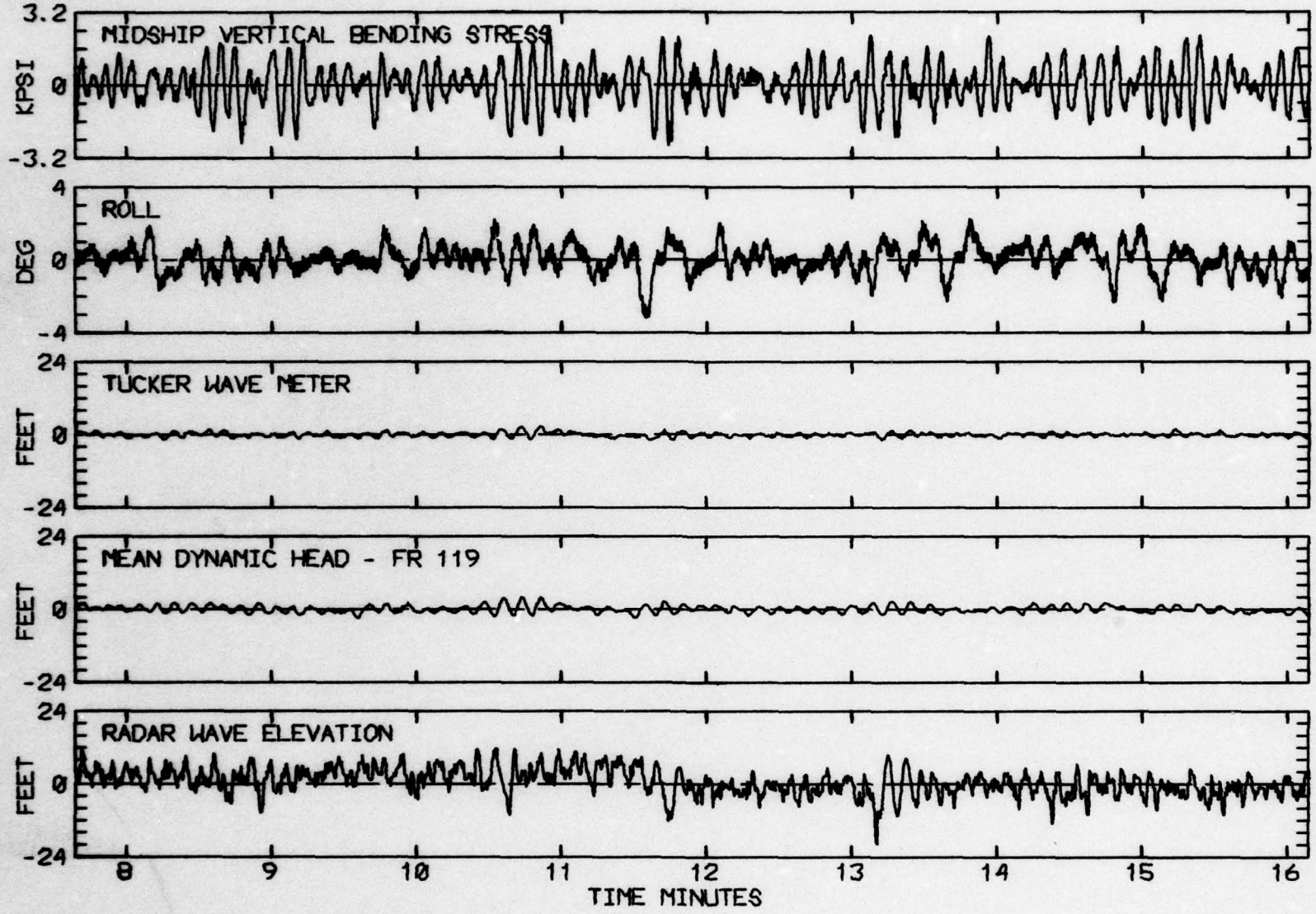
ROLL	3.5 DEG
PITCH	1.31 DEG
DK HSE VERT ACCEL	0.34 G
DK HSE LAT ACCEL	0.10 G
RADAR SLANT RANGE	24.1 FEET
VERTICAL RANGE	20.0 FEET
DISPL AT RADAR	13.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	369	163	303
MAXIMUM HEIGHT	4.5	5.8	23.2
10TH HIGHEST HTS	2.3	4.4	14.2
3RD HIGHEST HTS	1.6	3.5	11.2
4.0 RMS(SPECTRA)	2.5	4.0	16.1



RUN 2420 -- VOYAGE 60W -- TAPE 219 -- INDEX 20 -- INTERVAL 20



RUN 2420 -- VOYAGE 60W -- TAPE 219 -- INDEX 20 -- INTERVAL 20

LOG BOOK DATA

DATE AND TIME	02-21-75 2400
POSITION	39-53 N 45-20 W
COURSE AND SPEED	270 . 21.8 KNOTS
SEA STATE	3
WAVE HEIGHT	2 FEET
" REL DIR	0
SWELL HEIGHT	5 FEET
" REL DIR	67 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

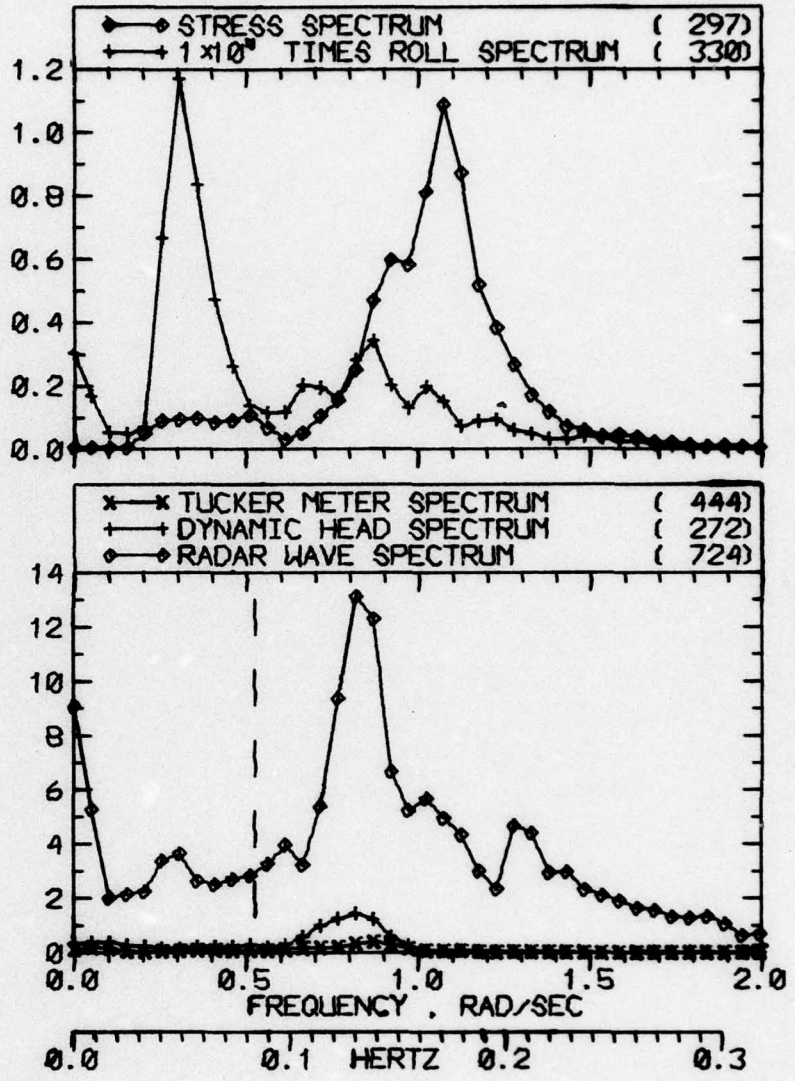
MAXIMUM PK-TR	4.1 KPSI
4.0 X RMS	2.5 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

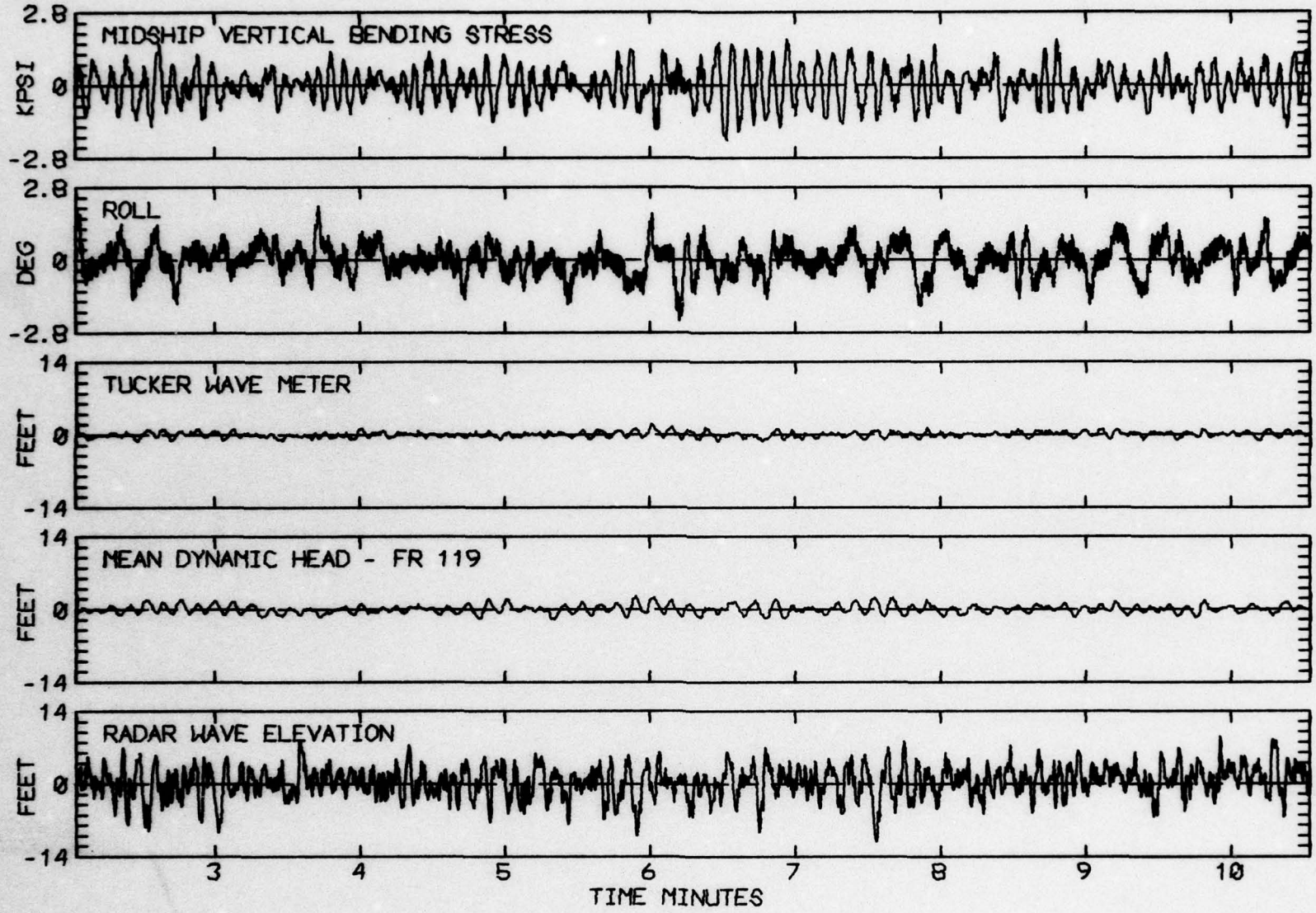
ROLL	2.6 DEG
PITCH	1.01 DEG
DK HSE VERT ACCEL	0.25 G
DK HSE LAT ACCEL	0.09 G
RADAR SLANT RANGE	16.3 FEET
VERTICAL RANGE	15.2 FEET
DISPL AT RADAR	10.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	476	210	438
MAXIMUM HEIGHT	2.6	3.9	16.6
10TH HIGHEST HTS	1.8	3.1	12.2
3RD HIGHEST HTS	1.2	2.3	8.8
4.0 RMS(SPECTRA)	1.8	2.9	12.1



RUN 2424 -- VOYAGE 60W -- TAPE 219 -- INDEX 21 -- INTERVAL 24



RUN 2424 -- VOYAGE 60W -- TAPE 219 -- INDEX 21 -- INTERVAL 24

LOG BOOK DATA

DATE AND TIME	02-22-75 0400
POSITION	39-53 N 45-20 W
COURSE AND SPEED	270 . 22.3 KNOTS
SEA STATE	2
WAVE HEIGHT	2 FEET
" REL DIR	67 STBD
SWELL HEIGHT	8 FEET
" REL DIR	45 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

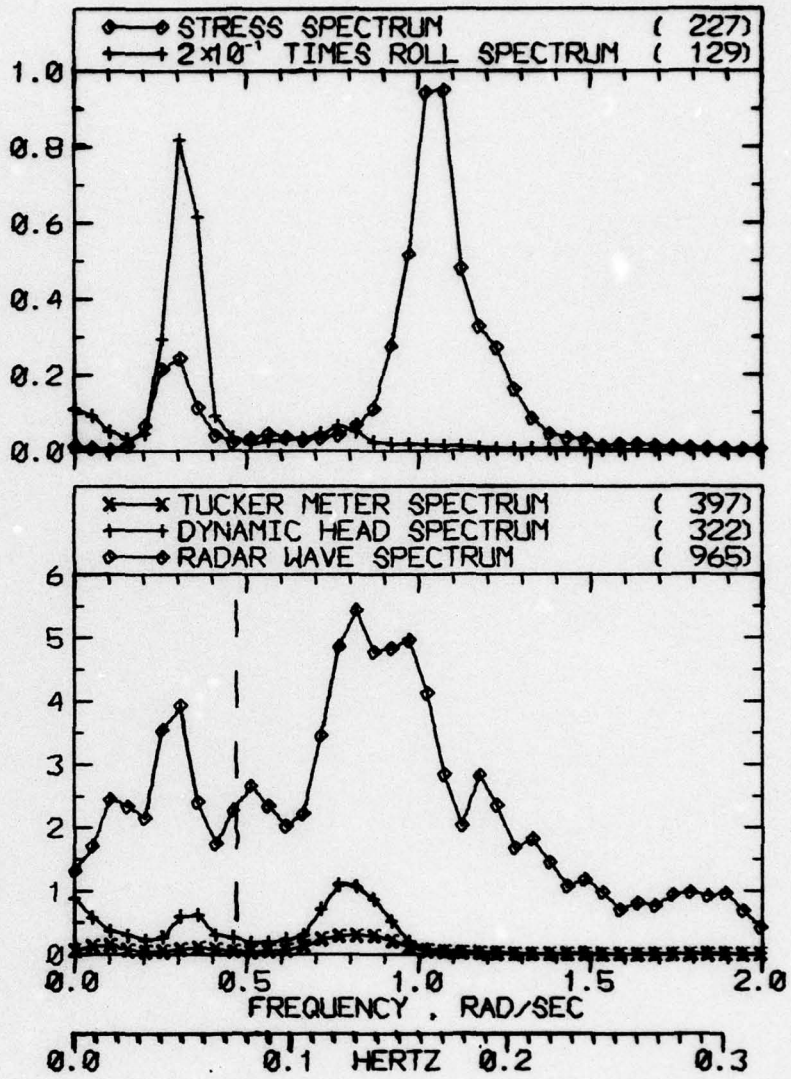
MAXIMUM PK-TR	2.8 KPSI
4.0 X RMS	2.1 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

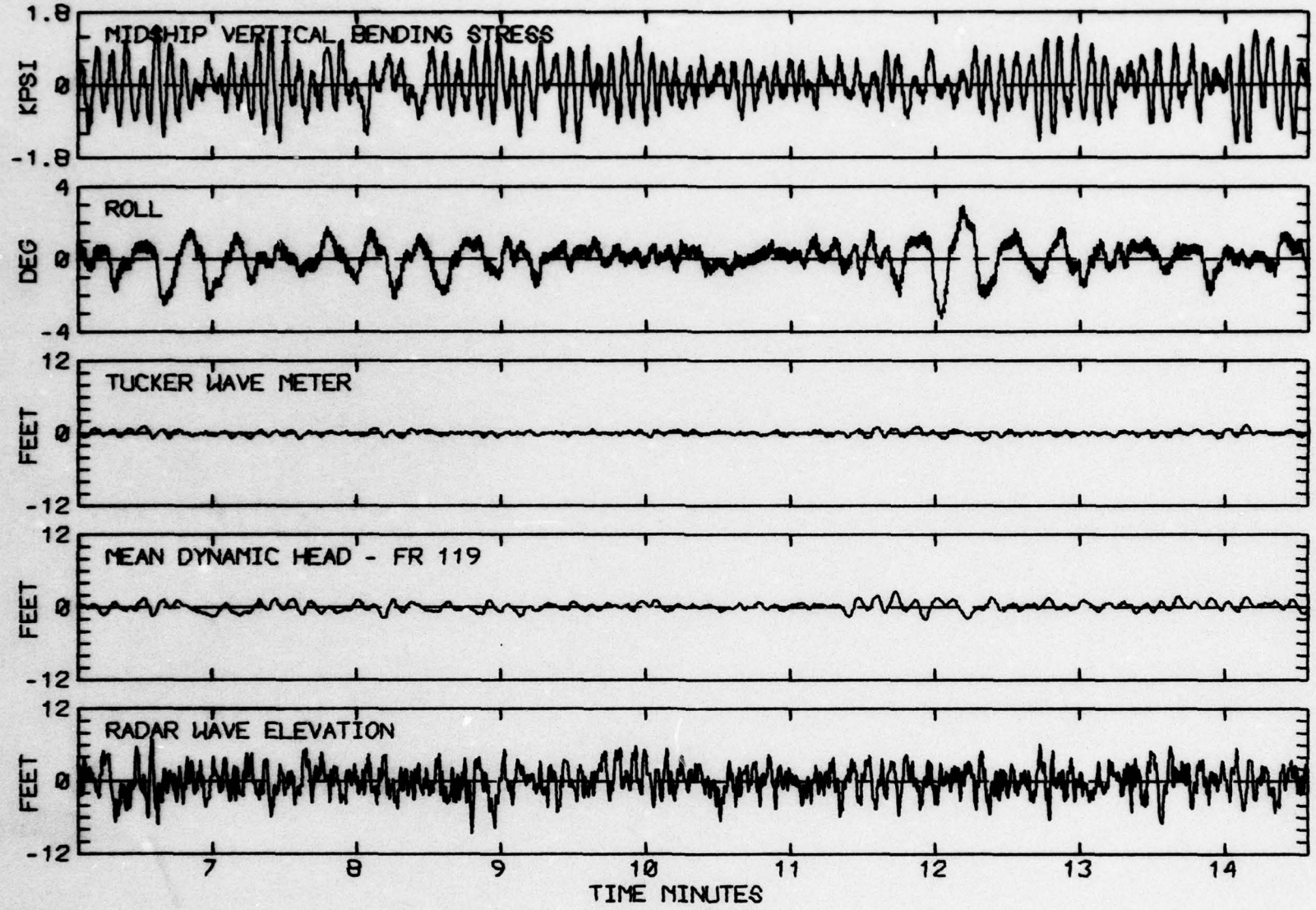
ROLL	3.4 DEG
PITCH	0.81 DEG
DK HSE VERT ACCEL	0.20 G
DK HSE LAT ACCEL	0.09 G
RADAR SLANT RANGE	13.6 FEET
VERTICAL RANGE	12.8 FEET
DISPL AT RADAR	7.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	569	230	453
MAXIMUM HEIGHT	2.1	4.3	15.2
10TH HIGHEST HTS	1.2	2.9	9.9
3RD HIGHEST HTS	0.9	2.0	7.5
4.0 RMS(SPECTRA)	1.6	2.8	9.9



RUN 2426 -- VOYAGE 60W -- TAPE 219 -- INDEX 22 -- INTERVAL 26



RUN 2426 -- VOYAGE 60W -- TAPE 219 -- INDEX 22 -- INTERVAL 26

LOG BOOK DATA

DATE AND TIME	02-22-75 0800
POSITION	39-53 N 45-20 W
COURSE AND SPEED	270 . 22.3 KNOTS
SEA STATE	2
WAVE HEIGHT	2 FEET
" REL DIR	67 STBD
SWELL HEIGHT	10 FEET
" REL DIR	45 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

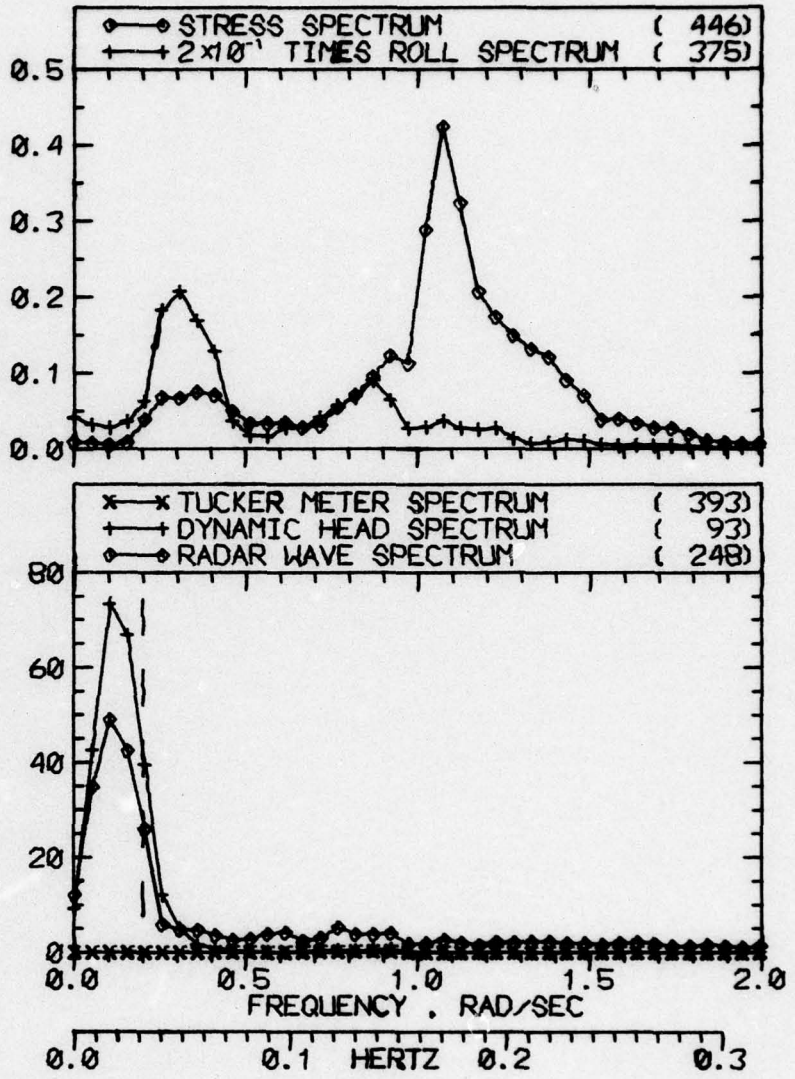
MAXIMUM PK-TR	2.2 KPSI
4.0 X RMS	1.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

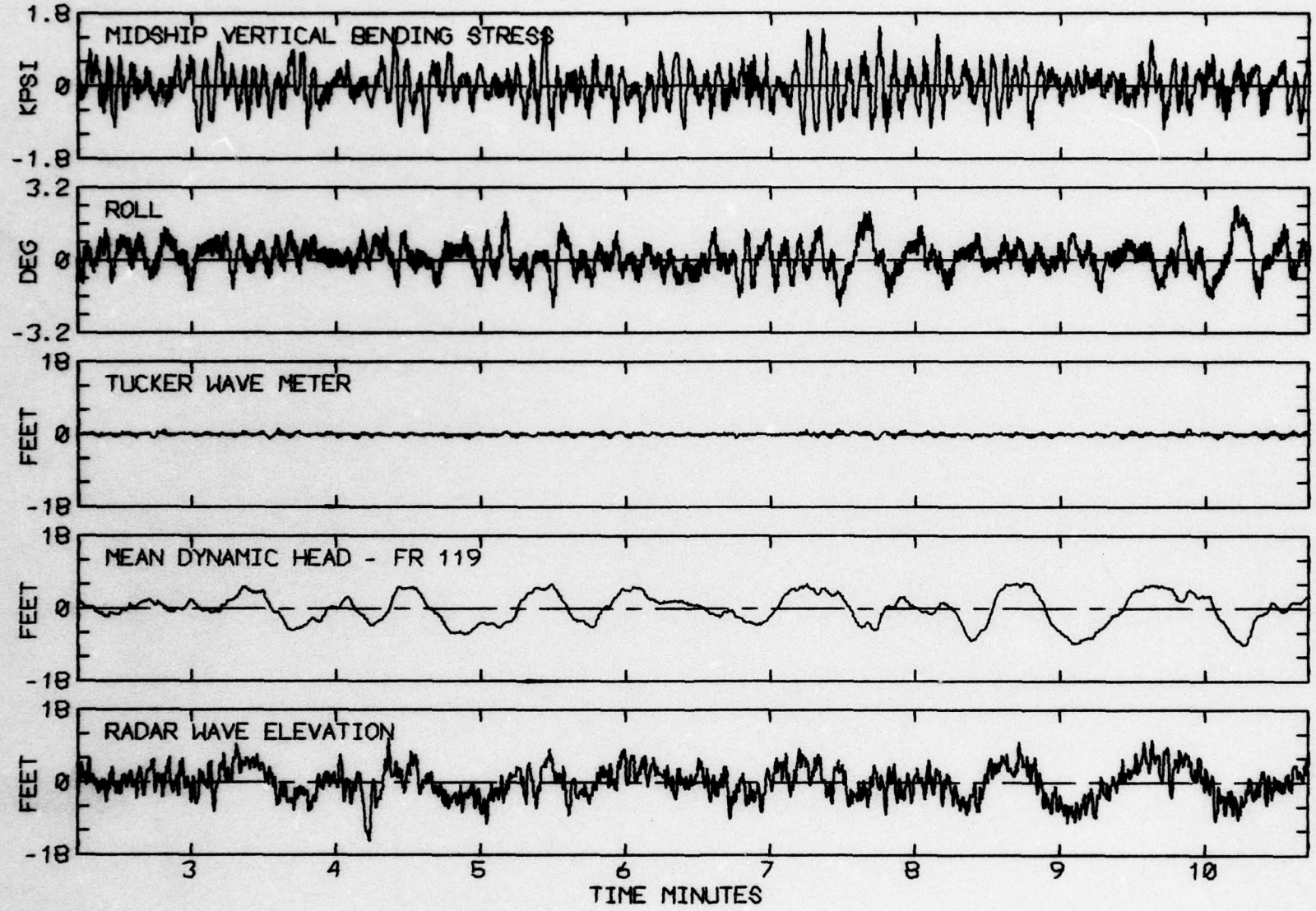
ROLL	2.7 DEG
PITCH	0.68 DEG
DK HSE VERT ACCEL	0.17 G
DK HSE LAT ACCEL	0.09 G
RADAR SLANT RANGE	12.4 FEET
VERTICAL RANGE	11.8 FEET
DISPL AT RADAR	14.0 FEET

WAVE HEIGHT STATISTICS (FEET)

		TUCKER/DYN. HEAD/RADAR	
P-T SAMPLE SIZE	617	51	287
MAXIMUM HEIGHT	2.0	15.3	17.1
10TH HIGHEST HTS	1.3	12.7	12.4
3RD HIGHEST HTS	0.9	8.8	9.6
4.0 RMS(SPECTRA)	1.5	14.3	15.2



RUN 2430 -- VOYAGE 60W -- TAPE 219 -- INDEX 23 -- INTERVAL 30



RUN 2430 -- VOYAGE 60W -- TAPE 219 -- INDEX 23 -- INTERVAL 30

LOG BOOK DATA

DATE AND TIME	02-22-75 1200
POSITION	39-53 N 45-20 W
COURSE AND SPEED	270 . 22.4 KNOTS
SEA STATE	7
WAVE HEIGHT	5 FEET
" REL DIR	45 STBD
SWELL HEIGHT	10 FEET
" REL DIR	45 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

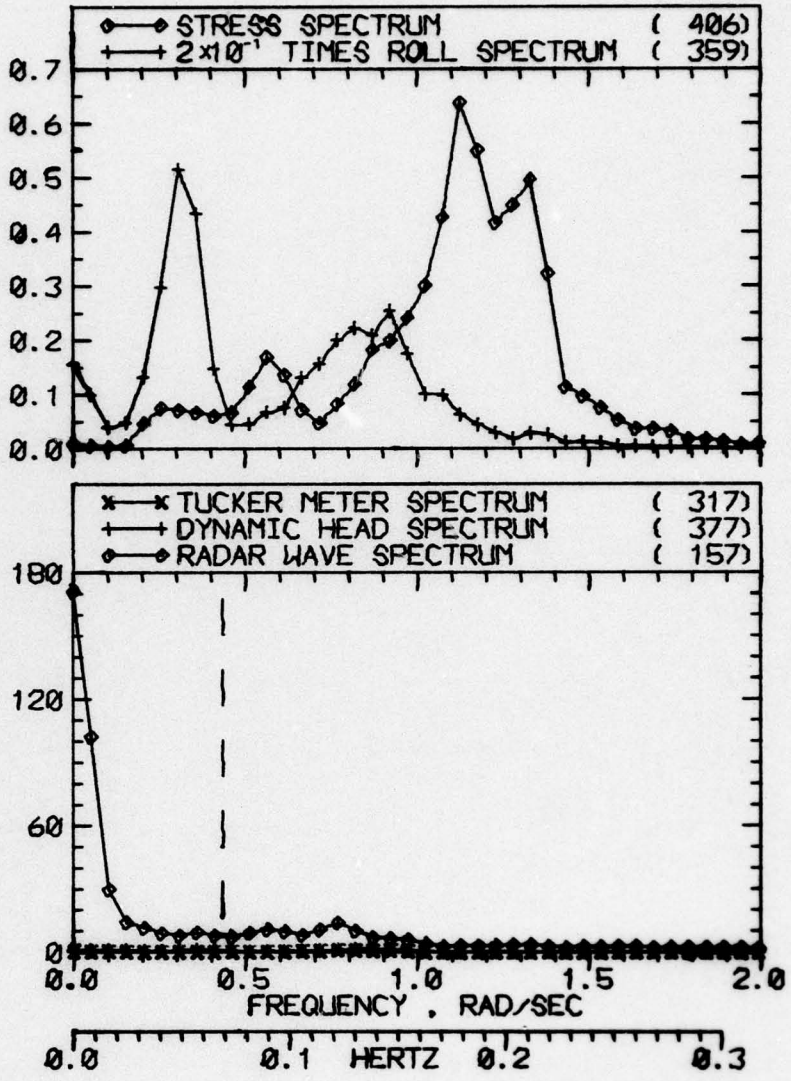
MAXIMUM PK-TR	2.5 KPSI
4.0 X RMS	2.3 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

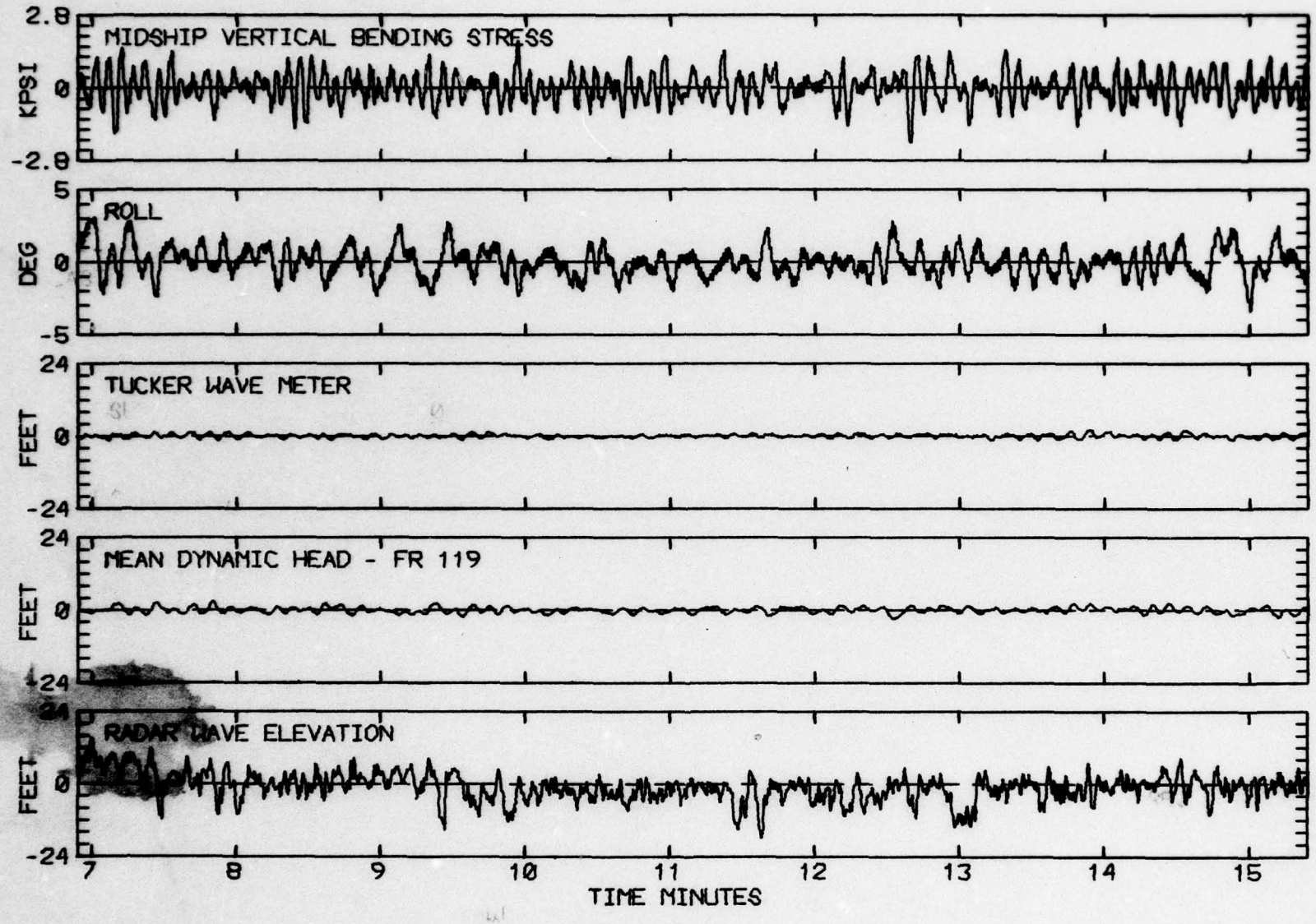
ROLL	4.1 DEG
PITCH	0.77 DEG
DK HSE VERT ACCEL	0.22 G
DK HSE LAT ACCEL	0.11 G
RADAR SLANT RANGE	25.3 FEET
VERTICAL RANGE	19.8 FEET
DISPL AT RADAR	8.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	375	206	270
MAXIMUM HEIGHT	3.2	4.3	23.8
10TH HIGHEST HTS	2.3	3.5	16.8
3RD HIGHEST HTS	1.5	2.6	11.8
4.0 RMS(SPECTRA)	2.4	3.6	19.5



RUN 2433 -- VOYAGE 60W -- TAPE 219 -- INDEX 24 -- INTERVAL 33



RUN 2433 -- VOYAGE 60W -- TAPE 219 -- INDEX 24 -- INTERVAL 33

LOG BOOK DATA

DATE AND TIME	02-22-75 1600
POSITION	39-44 N 57-05 W
COURSE AND SPEED	270 . 21.8 KNOTS
SEA STATE	8
WAVE HEIGHT	7 FEET
° REL DIR	67 STBD
SWELL HEIGHT	10 FEET
° REL DIR	45 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

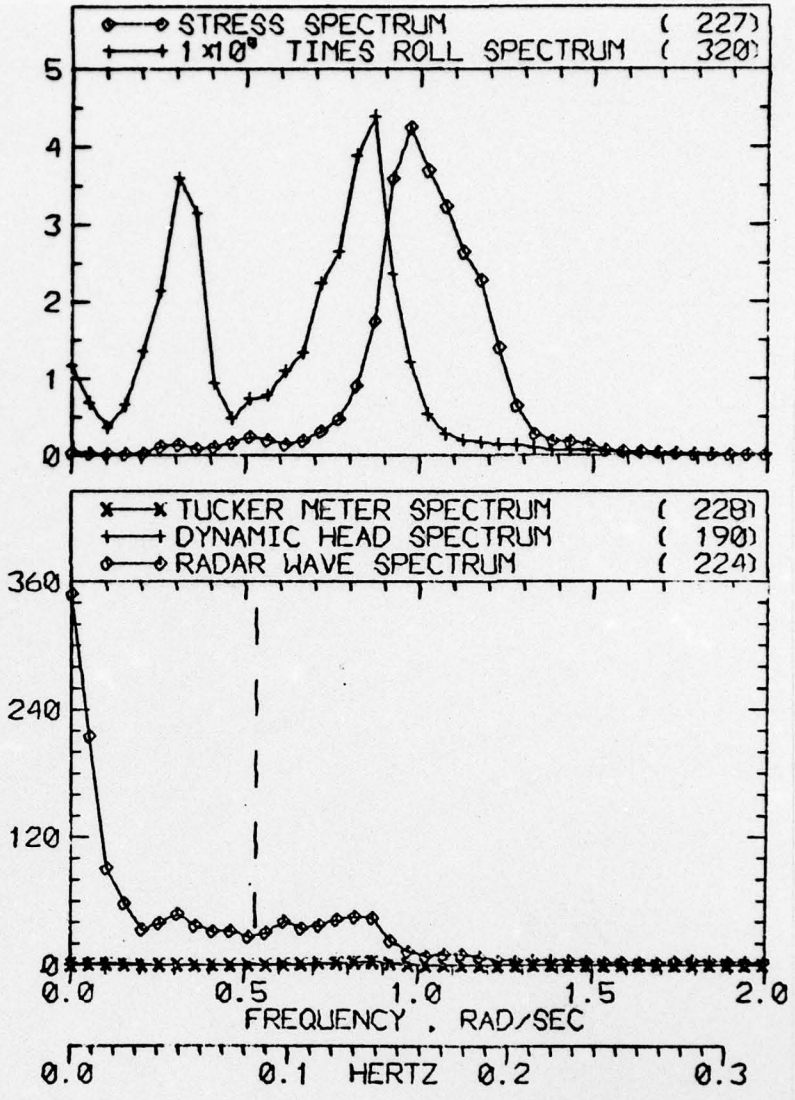
MAXIMUM PK-TR	7.5 KPSI
4.0 X RMS	4.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

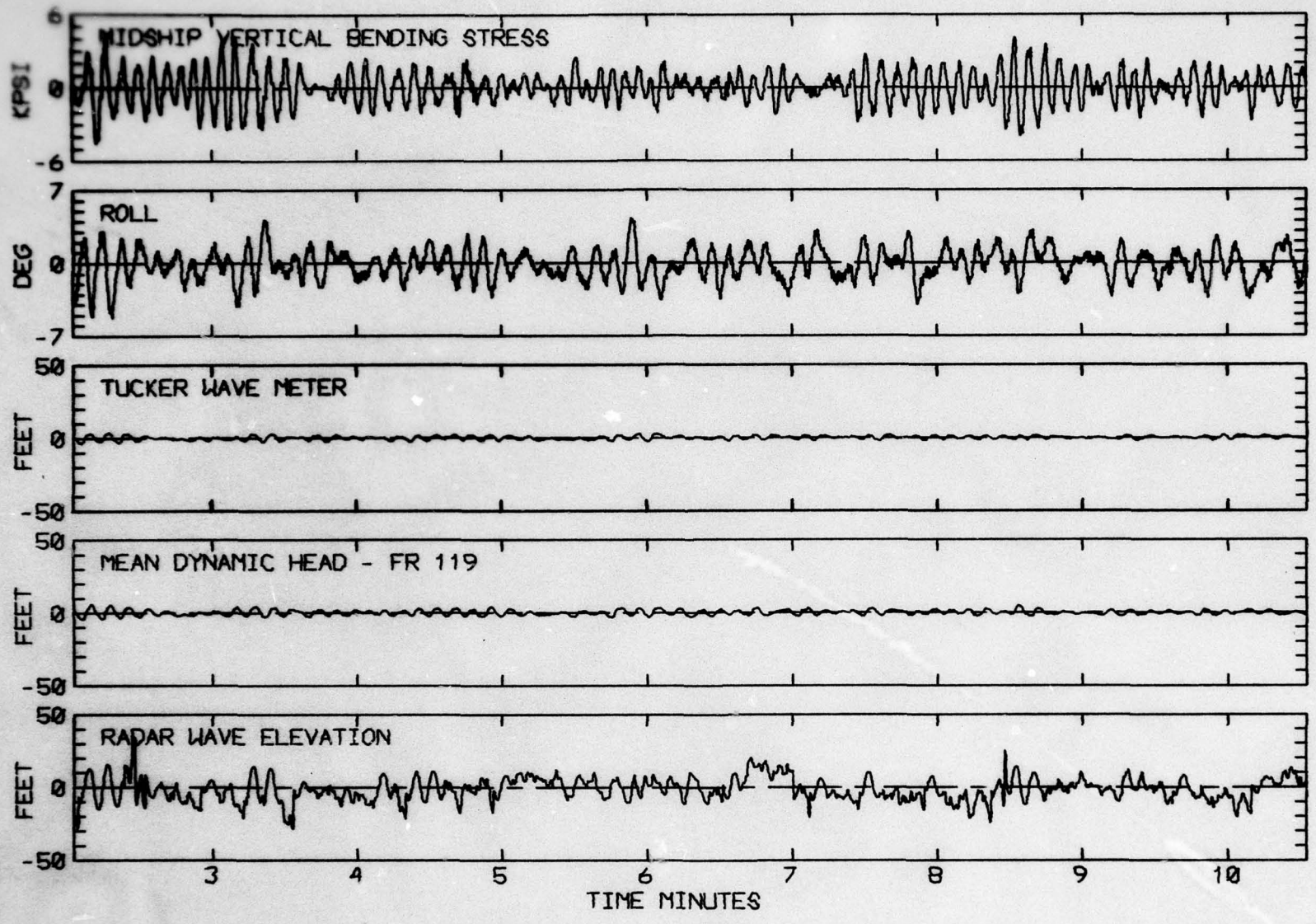
ROLL	5.6 DEG
PITCH	1.65 DEG
DK HSE VERT ACCEL	0.45 G
DK HSE LAT ACCEL	0.14 G
RADAR SLANT RANGE	32.0 FEET
VERTICAL RANGE	31.2 FEET
DISPL AT RADAR	18.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	266	143	147
MAXIMUM HEIGHT	6.5	10.3	54.1
10TH HIGHEST HTS	4.1	6.6	31.1
3RD HIGHEST HTS	2.9	5.2	23.6
4.0 RMS(SPECTRA)	4.0	5.7	32.0



RUN 2437 -- VOYAGE 60W -- TAPE 219 -- INDEX 25 -- INTERVAL 37



RUN 2437 -- VOYAGE 60W -- TAPE 219 -- INDEX 25 -- INTERVAL 37

LOG BOOK DATA

DATE AND TIME	02-22-75 2000
POSITION	39-44 N 57-05 W
COURSE AND SPEED	272 . 21.6 KNOTS
SEA STATE	8
WAVE HEIGHT	7 FEET
" REL DIR	43 STBD
SWELL HEIGHT	6 FEET
" REL DIR	43 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

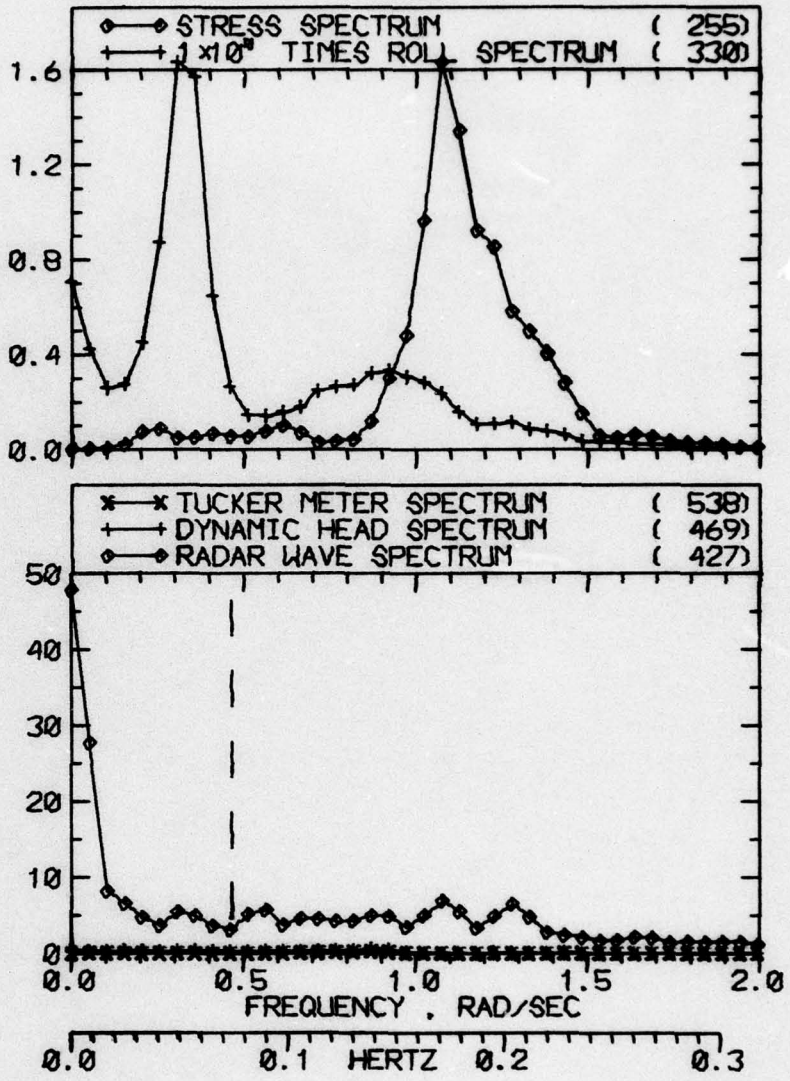
MAXIMUM PK-TR	3.7 KPSI
4.0 X RMS	2.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

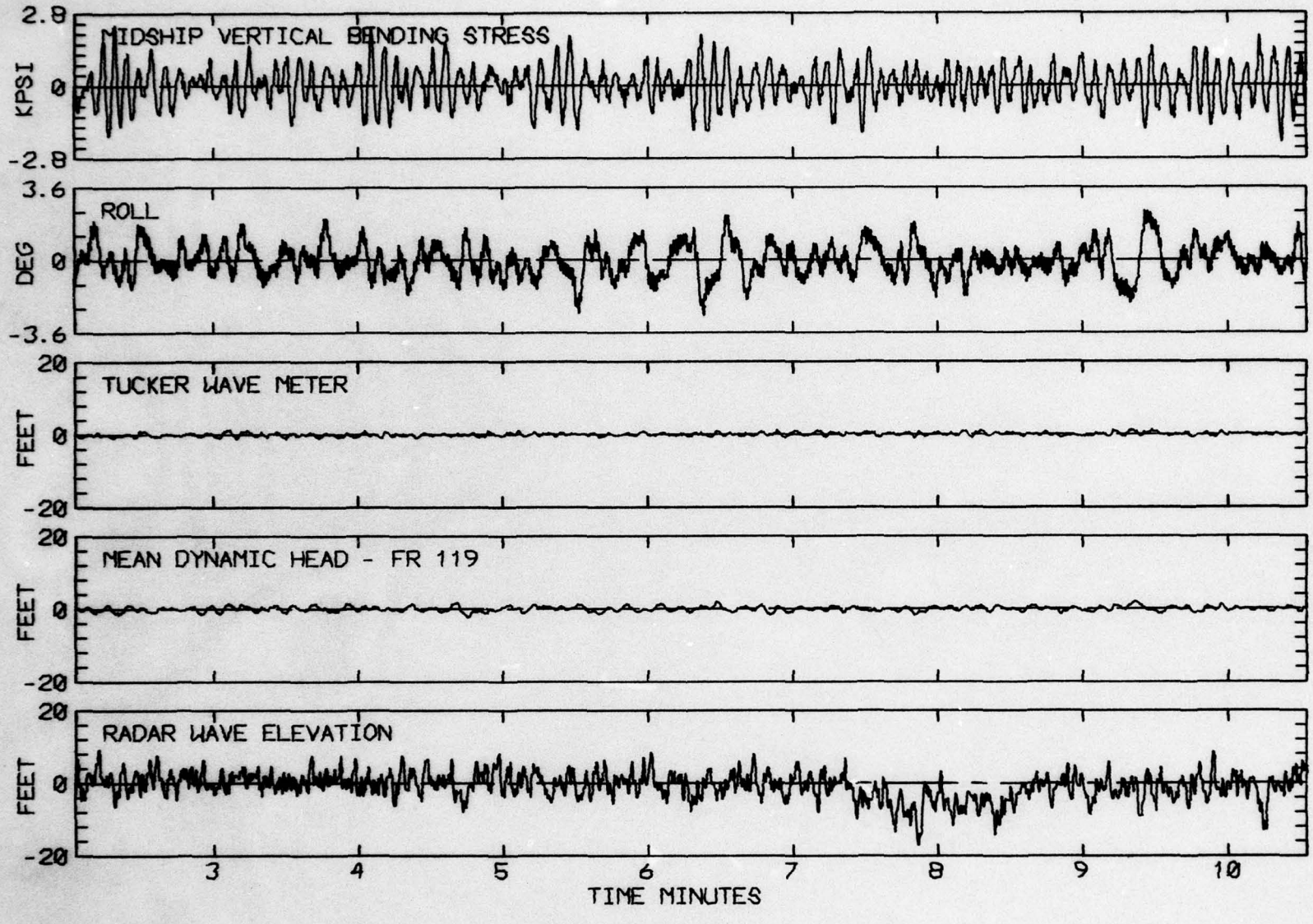
ROLL	3.1 DEG
PITCH	0.79 DEG
DK HSE VERT ACCEL	0.20 G
DK HSE LAT ACCEL	0.09 G
RADAR SLANT RANGE	16.2 FEET
VERTICAL RANGE	15.3 FEET
DISPL AT RADAR	6.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	539	266	364
MAXIMUM HEIGHT	2.9	4.3	18.8
10TH HIGHEST HTS	1.6	2.5	12.7
3RD HIGHEST HTS	1.1	1.7	9.5
4.0 RMS(SPECTRA)	1.7	2.5	13.9



RUN 2442 -- VOYAGE 60W -- TAPE 219 -- INDEX 26 -- INTERVAL 42



RUN 2442 -- VOYAGE 60W -- TAPE 219 -- INDEX 26 -- INTERVAL 42

LOG BOOK DATA

DATE AND TIME	02-22-75 2400
POSITION	39-44 N 57-05 W
COURSE AND SPEED	272 . 22.2 KNOTS
SEA STATE	4
WAVE HEIGHT	4 FEET
" REL DIR	43 STBD
SWELL HEIGHT	6 FEET
" REL DIR	43 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

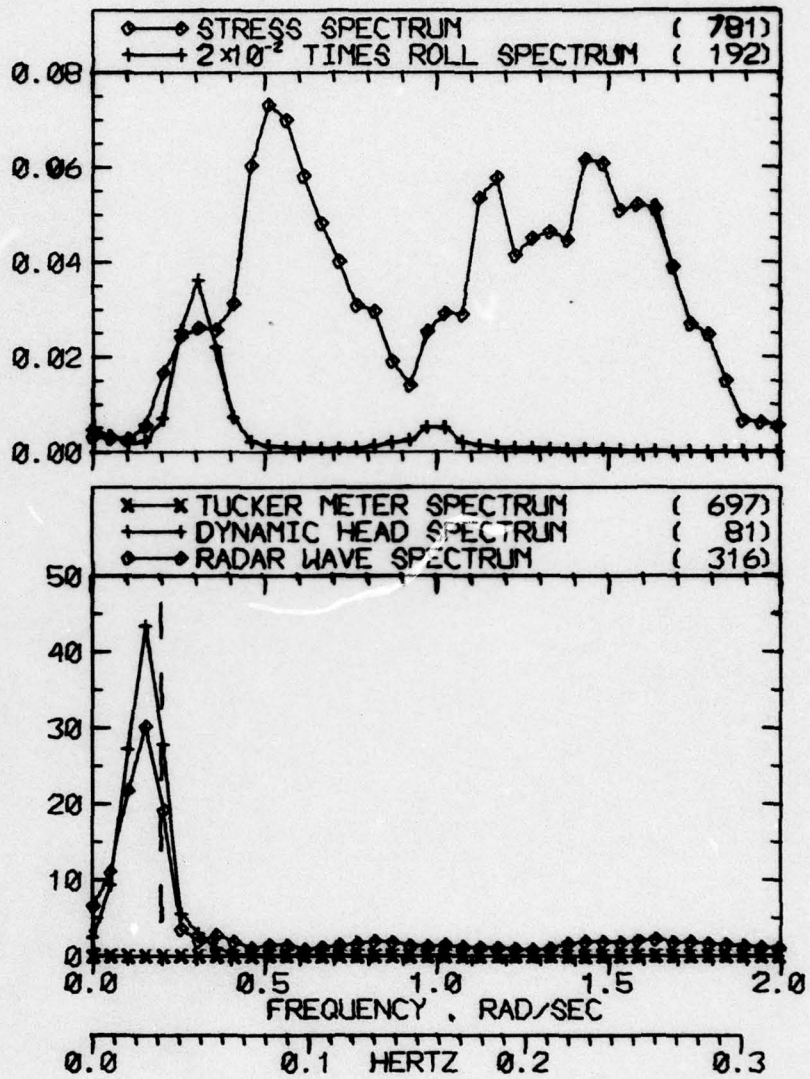
MAXIMUM PK-TR	1.2 KPSI
4.0 X RMS	1.2 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

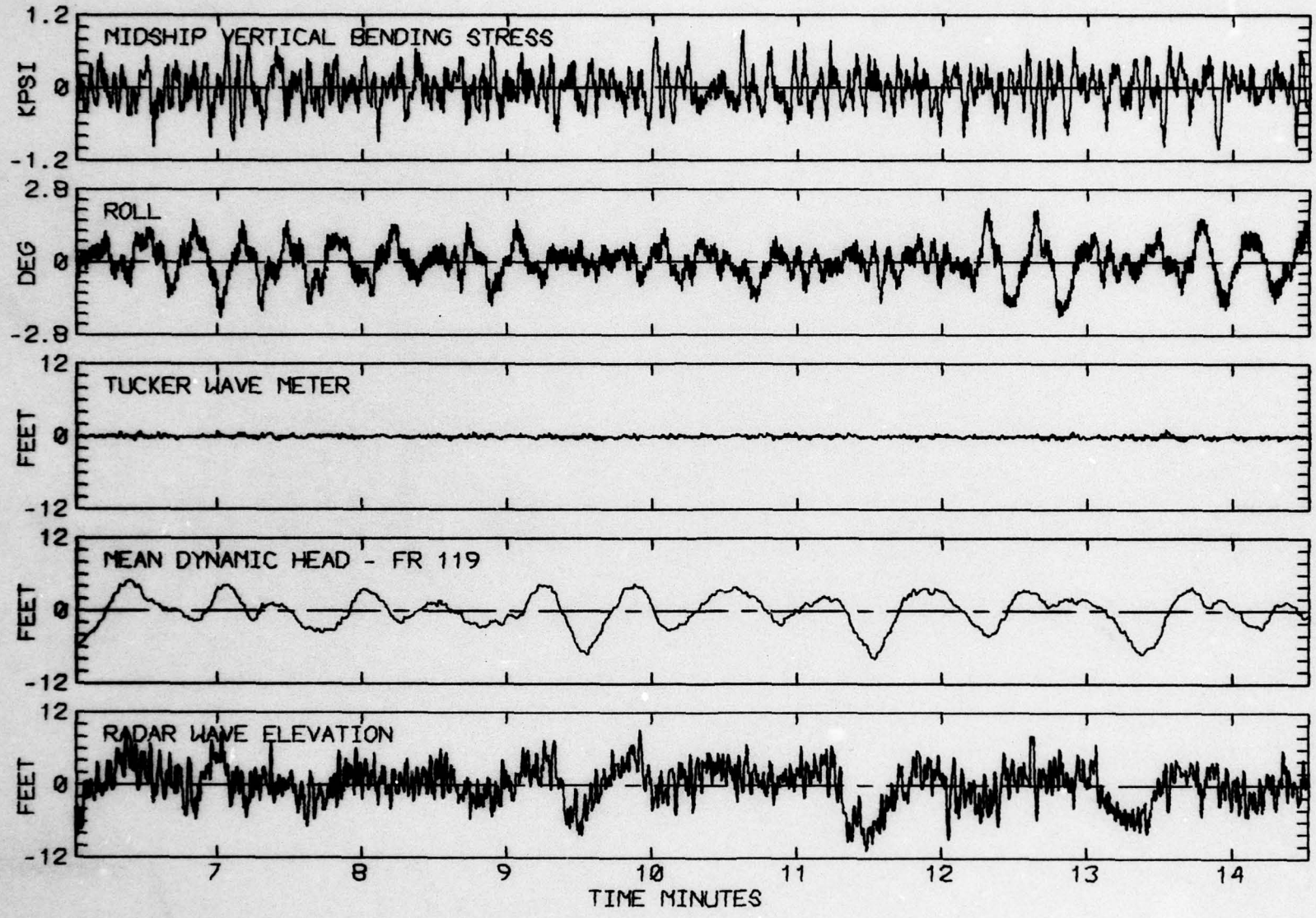
ROLL	2.6 DEG
PITCH	0.63 DEG
DK HSE VERT ACCEL	0.12 G
DK HSE LAT ACCEL	0.08 G
RADAR SLANT RANGE	10.3 FEET
VERTICAL RANGE	9.4 FEET
DISPL AT RADAR	9.4 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	969	84	419
MAXIMUM HEIGHT	1.2	11.7	14.4
10TH HIGHEST HTS	0.8	7.6	10.2
3RD HIGHEST HTS	0.7	5.1	7.9
4.0 RMS(SPECTRA)	1.0	9.9	12.1



RUN 2448 -- VOYAGE 60W -- TAPE 219 -- INDEX 27 -- INTERVAL 48



RUN 2448 -- VOYAGE 60W -- TAPE 219 -- INDEX 27 -- INTERVAL 48

APPENDIX

THE DATA REDUCTION AND PRESENTATION PROCEDURE ACCORDING TO THE DEVELOPMENT IN REFERENCE 4

The data reduction procedure for each interval involved:

a. Four main computation programs, the last one of which produced a complete file of results for each interval.

b. Two lister programs to supply immediate indications of some of the results.

c. One file consolidation program which produced one file for each voyage leg containing everything but the time histories of radar wave and mean dynamic head.

d. Two programs to generate the final graphical presentations for each interval.

Items b through d amount to bookkeeping operations. The work was done in the four main computation programs.

The first computation program carried out the procedure described in Reference 4 for the radar. At its conclusion the radar wave spectrum and the computed time history were written in temporary files as was the time history of vertical displacement at the radar.

The second program involved reduction of the Tucker data. Both the original data and the displacement file produced by the first program were accessed. The procedure was carried out so that time histories of mean dynamic head and the Tucker Meter signal were available. These were spectrum analyzed, and all results written in a temporary file.

The third computation program accessed the various wave-related time histories (radar, Tucker, and mean dynamic head) and performed a peak-trough analysis on the middle 16-1/2 minutes of each. (Because of the tapering described in Reference 4 both the radar and mean dynamic head data are not valid for the first and last two minutes of sample.) The object of the peak-trough analysis was to produce double amplitude statistics. The zero crossing convention was used; that is, a crest was defined as the largest instantaneous value in an excursion <u>above</u> the sample mean, a trough was the smallest instantaneous value in an excursion <u>below</u> the sample mean. The double amplitude is the difference in elevation between crest and succeeding trough. In this approach small fluctuations are more or less ignored if they are riding on top of large ones. The results resemble the double amplitudes which would be estimated by hand from an oscillograph record except that the hand analyst would probably visually fair through superimposed noise whereas the computer does not. The effect is that while the computer gets about the same number of double amplitudes as the human analyst, the computer's answers tend to be higher if the records are noisy. From the double amplitudes found, the average of 1/3 and 1/10 highest were computed, and the position in the sample of the largest double amplitude was noted. All results, including the actual double amplitudes were written in a temporary file.

The fourth computation program accessed the original data and performed spectrum analyses upon the midship vertical bending stress and roll. It then accessed all previously written temporary files and produced a new file containing all of the results for the interval. These results included log-book data, results of the first analysis of raw data (Ref.3,5), five spectra along with all analysis parameters, all results from the peak-trough analysis, and the two new time histories, the radar wave and the mean dynamic head. These files were meant to be stored on magnetic tape for possible future reference.

The final presentation of results for each interval is contained on two charts. The first type of chart (which appears on the even numbered pages of this report) contains the scalar spectra and a tabulation of results. The second type of chart (odd numbered pages) involves sample time histories. Both are identified at the bottom with the DL run number, the voyage number, the analog tape and interval numbers, and the index number assigned by Teledyne.

Referring to any even page, the tabulation at the left is intended as a summary of the most significant numbers pertaining to the interval. At the top is as much of the original log-book data as it seemed reasonable to squeeze in. This includes date, time, position, and ship speed, as well as the visual estimates of wave and swell heights and directions. Directions are counted from the bow to port or starboard in degrees. The "sea state" is apparently the Beaufort wind. The final line in the first section of the tabulation includes comments on visual weather and, after the slash, any other comment appearing in the log.

The second box in the tabulation involves midship longitudinal stress results. Only two of the many numbers which are available could be included as indices. The first is the maximum peak to trough stress excursion as obtained in Reference 1 or 2. The second index is the significant stress (4 times rms) as derived from the area of the stress spectrum obtained in the present reduction.

The third box in the tabulation is a summary of motions. Again the "significant" motions (4 rms) are indicated. The value for roll was derived from spectrum area, that for pitch and accelerations from the rms of the basic data. (Unless there are significant linear trends in the data the differences are slight between "raw" and "spectrum" rms.) The last three items in the list involve various stages in the radar data reduction. The first is the slant range as recorded. The "vertical range is $R_c(t)$ of the radar analysis. This entry is essentially the vertical component of the range relative to the position of the accelerometer package. The number was derived from the spectrum. The last entry is the significant displacement at the radar (significant doubly integrated acceleration). It too was derived from spectrum analyses.

In a sense, the table at the bottom of the tabulation contains the final numerical answers. Items in the first column pertain to the uncorrected Tucker Meter signal. The second column pertains to the mean dynamic

head developed in conjunction with the analysis of the Tucker meter, and the third column pertains to wave elevations derived from the radar system. The first row in the table is the number of double amplitudes found in the middle 16-1/2 minutes of the sample. Below this are noted the maximum height found and the averages of the 1/10 and 1/3 highest double amplitudes. The final line in the table is the significant (4 rms) height derived from the spectral analyses. Ordinarily it is expected that the last two lines of the table will be about the same.

At the right of any even page are plots of the five computed spectra. It was decided to standardize the frequency scale from 0 to 2 rad/sec. In the great majority of intervals everything of interest is contained in this range. In some intervals one spectrum or another is non-negligible beyond 2 rad/sec but nothing much has been seen beyond 2.5 rad/sec for any of the quantities analyzed except in the stress spectrum where something may often be noticed around the frequency of the first mode of vertical vibration. The folding frequency of the analyses is above 20 rad/sec; no aliasing is expected, Reference 3.

The stress and roll spectra are plotted together. The vertical scale is for the stress spectrum. The roll spectrum has been multiplied by the factor noted in the legend before plotting. Dimensions of the stress spectral density are ($kpsi^2$/rad/sec) and those of the roll spectral density are (deg^2/rad/sec).

All three wave related spectra (Tucker, mean dynamic head, and radar) are plotted together to the same scale. The dimension of the wave spectral density is ($feet^2$/rad/sec). In the wave spectrum plot there is a vertical (slightly joggled) dashed line. This line marks the position of the low frequency cutoff, ω_o, discussed in Reference 4 in conjunction with double integration of the vertical accelerations. It is correct to interpret the position of this line as meaning that the double integration has been done correctly for higher frequencies, and incorrectly for lower frequencies.

There are several details about the spectrum analyses which are not documented in the plots because they are constant throughout the data reduction. First, the normalization of the spectra is such that the spectrum area equals variance. All spectra are derived from a Fast Fourier Transform analysis of an 8192 point sample. The fundamental results is 4096 spectral estimates of 2 degrees of freedom each. These estimates are uniformly spaced in frequency at a delta-frequency of 0.00511 rad/sec. In order to improve statistical reliability, the basic spectral estimates were averaged in blocks of 20 estimates at intervals of 10 estimates. The resulting averages are thus equi-speced on the frequency scale at intervals of $\Delta\omega = 0.0511$ rad/sec. This also means that adjacent spectral estimates as shown in the plot are not quite independent -- to about the same degree as spectral estimates from the older autocorrelation methods are not independent.

As a result of the averaging, each spectral estimate has 40 degrees of freedom associated with it. Accordingly, the 90% confidence bounds on the spectra shown in the charts may be formed by multiplying the values given by 0.72 and 1.51. Had the process sampled continued indefinitely and a large number of 20.5 minute samples been obtained and analyzed, nine out of ten of these new estimates of spectral density would be expected to lie within the bounds so constructed. The practical implication is simply that the influence of sampling variability upon the given numerical results is roughly the same as that associated with the result of most other full scale wave measurement exercises.

The last detail of the spectrum analysis is the "total degrees of freedom." This number is included in parentheses at the end of each line of legend because it depends upon the shape of each individual spectrum. It is an estimate of the proper number of degrees of freedom to use in constructing confidence bounds on the sample variance. If each of the numbers in the present 8192 point time histories had been picked randomly the "total degrees of freedom" would be 8191. This is not the case -- adjacent members of all the present time series are highly correlated so that the equivalent "random" sample size is much smaller. In the present data set the "total degrees of freedom" (TDF) is expected to vary between 60 and 600. Approximate 90% confidence bounds on the variances assuming a Normal zero mean process, may be constructed by multiplying the estimate by two factors derived from the percentage points of the Chi-square distribution. Examples of the values of these factors are given as follows:

TDF	Factor for Lower Bound	Factor for High Bound
60	.72	1.32
120	.80	1.27
200	.84	1.17
400	.89	1.12
600	.91	1.10

These are factors for the variances. The square root applies to the rms values so that very roughly the 90% confidence bounds on rms range from the sample rms ± 15% for TDF = 60 to the sample rms ± 5% for TDF = 600. The practical implications of these results are quite similar to those mentioned in connection with the confidence bounds on the spectra. There is only so much "precision" obtainable from one 20 minute sample of wave elevation -- that which was attacined in the present work appears comparable to that achieved in the past in similar studies. With respect to comparisons between wave meters or between data and predictions of rms ship responses there can be little justification to a concern about differences of 5 to 15% magnitude.

The sample time histories on the odd numbered pages need little explanation, except perhaps to say that the duration of the sample shown (8-1/2 minutes) was a compromise between a desire to display as much of

the 16-1/2 minutes of derived wave time histories as was possible in one page; and the desire to spread the time scale out so that individual fluctuations were visible for intervals involving high ship speed in head seas. To produce the charts an 8-1/2 minute portion of the available 16-1/2 minutes of sample was chosen such that the largest radar wave double amplitude is shown -- as well as (if possible) the largest mean dynamic head double amplitude.

It may be fairly asked why the effort in producing plotted time histories for each interval was considered worthwhile. The answer to the question is fairly simple. While the present data in its original analog form has been scanned systematically by eye, the process involved oscillograph records with a time scale of about 15 minutes to the inch. At this time compression only a gross idea of what was happening can be formed, no detailed assessment of the believability of the data can be made, and, most importantly, the odd malfunction which is enough to upset the spectrum estimates or the statistics may often go unnoticed. This last is considered most important in the radar data. It was pointed out in References 3 and 5 that an attempt was made to weed out intervals where the radar had evidently lost signal and re-established a new reference range. In this process only the most obvious instances could be identified; no guarantees could be made that all instances of moderate or small magnitude had been eliminated.

METRIC CONVERSION FACTORS

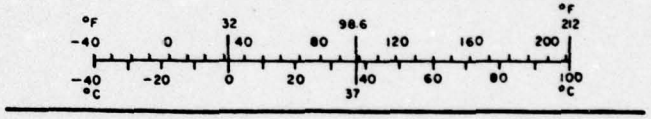
Approximate Conversions to Metric Measures

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). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

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	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



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19. KEY WORDS (Continue on reverse side if necessary and identify by block number):
20. ABSTRACT (Continue on reverse side if necessary and identify by block number):

So that more precise correlations between full scale observations and analytical and model results could be carried out, one of the objectives of the instrumentation program for the SL-7 class container ships was the provision of instrumental measures of the wave environment. To this end, two wave meter systems were installed on the S.S. SEA-LAND McLEAN. Raw data was collected from both systems during the second (1973-1974) and third (1974-1975) winter data collecting seasons.

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It was the purpose of the present work to reduce this raw data, to develop and implement such corrections as were found necessary and feasible, and to correlate and evaluate the final results from the two wave meters. In carrying out this work it was necessary to at least partly reduce several other channels of recorded data, so that, as a by-product, reduced results were also obtained for midship bending stresses, roll, pitch, and two components of acceleration on the ship's bridge.

As the work progressed it became evident that the volume of documentation required would grow beyond the usual dimensions of a single technical report. For this reason the analyses, the methods, the detailed results, discussions, and conclusions are contained in a series of ten related reports.

This report is one of the six in the series in which the detailed results of the data reduction process are presented. Included in this report is the reduced data from the Third Season Voyage 60.

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