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RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND MCLEAN VOYAGE 34.(U)

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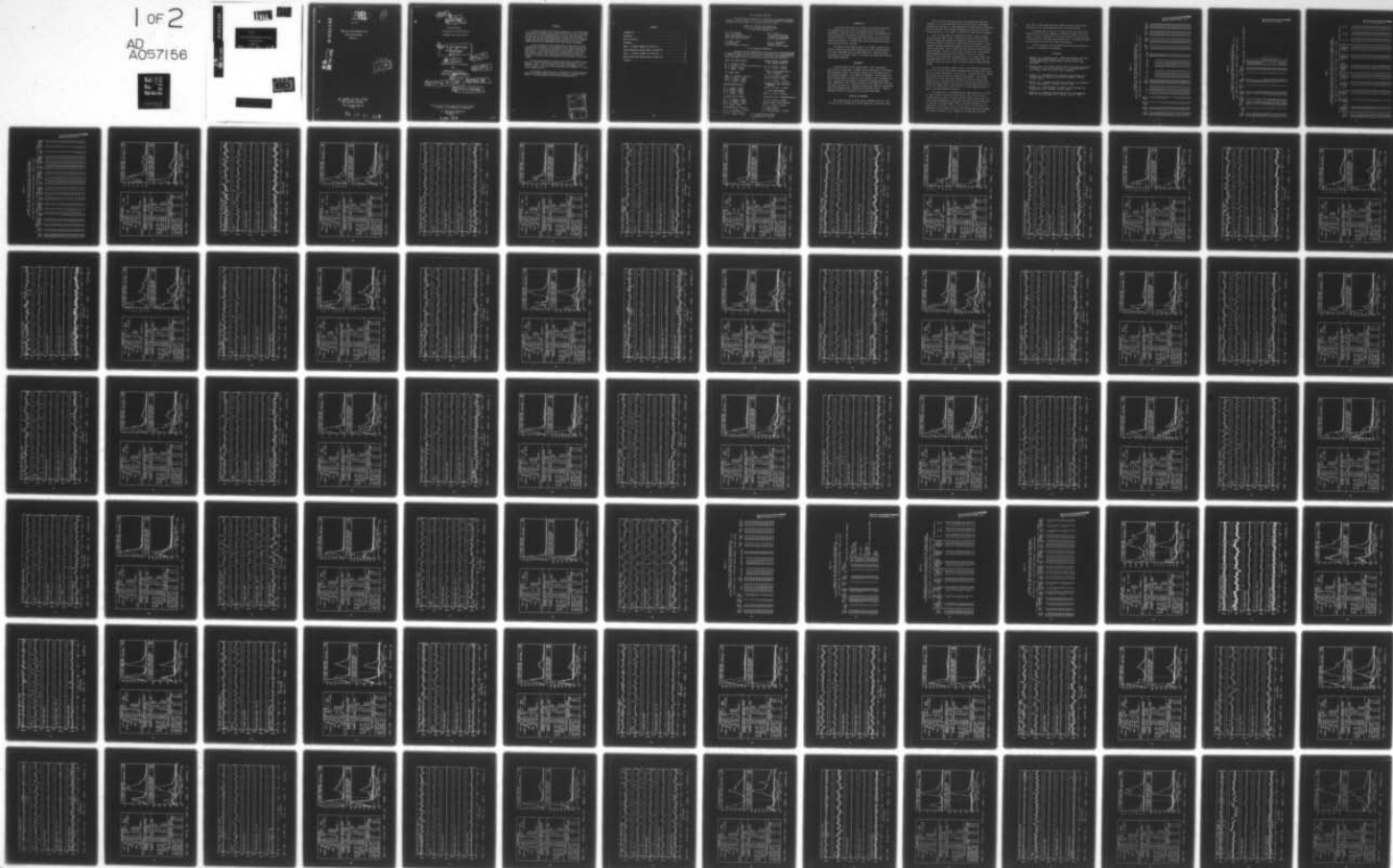
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RADAR AND TUCKER WAVEMETER DATA  
FROM SEA-LAND McLEAN  
VOYAGE 34

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18 SSC

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9 TECHNICAL REPORT  
on

Project SR-1221

"Correlation and Verification of  
Wavemeter Data from the SL-7"

6 RADAR AND TUCKER WAVEMETER DATA  
FROM SEA-LAND MCLEAN  
VOYAGE 34

by

10 J. F. Dalzell

Stevens Institute of Technology

under

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

11 Aug 78

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## 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 Second Season Voyage 34.

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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 Second Season Voyage 34.

## 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  $4.0 \times$  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.
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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.

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TABLE 1a

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

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 EAST

| D.L.<br>RUN<br>NO. | TMR<br>TAPE<br>NO. | TMR<br>INDX<br>NO. | TMR<br>INTV<br>NO. | DATE     | TIME<br>(GMT) | LATITUDE | LONGITUDE | COURSE | SPEED<br>KT. | PROP<br>RPM | DRAFT<br>FT. | SEA/AIR<br>TEMP |
|--------------------|--------------------|--------------------|--------------------|----------|---------------|----------|-----------|--------|--------------|-------------|--------------|-----------------|
| 1009               | 157                | 3                  | 9                  | 01-29-74 | 2400          |          |           | 082    | 32.3         | 132.0       | 29.80        | 45/45           |
| 1013               | 157                | 4                  | 13                 | 01-30-74 | 0400          |          |           | 089    | 32.2         | 131.7       | 30.10        | 45/45           |
| 1017               | 157                | 5                  | 17                 | 01-30-74 | 0800          |          |           | 087    | 32.3         | 132.0       | 30.06        | 64/49           |
| 1021               | 157                | 6                  | 21                 | 01-30-74 | 1200          | 40-31 N  | 59-02 W   | 090    | 32.3         | 131.8       | 30.11        | 65/52           |
| 1026               | 157                | 7                  | 26                 | 01-30-74 | 1600          | 40-31 N  | 59-02 W   | 090    | 32.1         | 131.3       | 30.08        | 59/55           |
| 1029               | 157                | 8                  | 29                 | 01-30-74 | 2000          | 40-31 N  | 59-02 W   | 090    | 32.2         | 131.8       | 30.02        | 58/52           |
| 1033               | 157                | 9                  | 33                 | 01-30-74 | 2400          | 40-31 N  | 59-02 W   | 090    | 32.1         | 131.5       | 30.00        | 66/60           |
| 1037               | 157                | 10                 | 37                 | 01-31-74 | 0400          | 40-31 N  | 59-02 W   | 090    | 31.9         | 130.1       | 30.00        | 65/55           |
| 1041               | 157                | 11                 | 41                 | 01-31-74 | 0800          | 40-31 N  | 59-02 W   | 090    | 32.2         | 131.7       | 30.00        | 34/44           |
| 1045               | 157                | 12                 | 45                 | 01-31-74 | 1200          | 40-59 N  | 43-08 W   | 090    | 32.6         | 133.1       | 30.05        | 57/52           |
| 1049               | 157                | 13                 | 49                 | 01-31-74 | 1600          | 40-59 N  | 43-08 W   | 073    | 32.3         | 132.2       | 30.06        | 60/55           |
| 1101               | 159                | 14                 | 1                  | 01-31-74 | 2000          | 40-59 N  | 43-08 W   | 073    | 32.1         | 131.0       | 30.10        | 57/48           |
| 1105               | 159                | 15                 | 5                  | 01-31-74 | 2400          | 40-59 N  | 43-08 W   | 073    | 32.3         | 132.2       | 30.10        | 56/46           |
| 1109               | 159                | 16                 | 9                  | 02-01-74 | 0400          | 40-59 N  | 43-08 W   | 073    | 31.8         | 130.0       | 30.09        | 55/45           |
| 1113               | 159                | 17                 | 13                 | 02-01-74 | 0800          | 40-59 N  | 43-08 W   | 073    | 32.3         | 132.0       | 30.05        | 54/47           |
| 1117               | 159                | 18                 | 17                 | 02-01-74 | 1200          | 44-27 N  | 27-18 W   | 072    | 32.3         | 132.0       | 30.09        | 53/60           |
| 1122               | 159                | 19                 | 22                 | 02-01-74 | 1600          | 44-27 N  | 27-18 W   | 072    | 32.4         | 132.6       | 30.00        | 53/50           |
| 1125               | 159                | 20                 | 25                 | 02-01-74 | 2000          | 44-27 N  | 27-18 W   | 072    | 32.3         | 132.0       | 29.89        | 52/54           |
| 1129               | 159                | 21                 | 29                 | 02-01-74 | 2400          | 44-27 N  | 27-18 W   | 072    | 32.6         | 133.0       | 29.75        | 52/50           |
| 1134               | 159                | 22                 | 34                 | 02-02-74 | 0400          | 44-27 N  | 27-18 W   | 071    | 32.4         | 132.5       | 29.62        | 52/45           |
| 1137               | 159                | 23                 | 37                 | 02-02-74 | 0800          | 44-27 N  | 27-18 W   | 071    | 32.6         | 133.0       | 29.57        | 51/47           |
| 1141               | 159                | 24                 | 41                 | 02-02-74 | 1200          | 48-10 N  | 10-20 W   | 071    | 32.3         | 132.0       | 29.61        | 51/48           |
| 1145               | 159                | 25                 | 45                 | 02-02-74 | 1600          | 48-10 N  | 10-20 W   | 071    | 32.1         | 131.2       | 29.75        | 53/44           |
| 1149               | 159                | 26                 | 49                 | 02-02-74 | 2000          | 48-10 N  | 10-20 W   | 071    | 32.2         | 131.6       | 29.80        | 50/47           |



TABLE 1b

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

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 EAST

| D.L.<br>RUN<br>NO. | SEA<br>STATE | <REL WIND>  |             | REL<br>WAVE<br>HT.<br>FT. | REL<br>SWELL<br>DIR | <-SWELL-> |           | VISUAL WEATHER / TMR LOG-BOOK COMMENTS |
|--------------------|--------------|-------------|-------------|---------------------------|---------------------|-----------|-----------|----------------------------------------|
|                    |              | DIR<br>(KT) | WAVE<br>DIR |                           |                     | HT<br>FT. | HT<br>FT. |                                        |
| 1009               | 2            | 172P/ 5     | 172P        | 1                         | 172P                | 2         | 150       | CLEAR /                                |
| 1013               | 2            | 179P/ 5     | 179P        | 1                         | 179P                | 3         | 150       | CLEAR /                                |
| 1017               | 2            | 19P/ 5      | 19P         | 1                         | 177P                | 4         | 150       | OCAST /                                |
| 1021               | 2            | 0 / 5       | 0           | 2                         | 180                 | 4         | 150       | OCAST /                                |
| 1026               | 3            | 11S/ 8      | 11S         | 2                         | 180                 | 5         | 150       | OCAST /                                |
| 1029               | 3            | 11S/ 8      | 11S         | 2                         | 180                 | 5         | 150       | OCAST /                                |
| 1033               | 4            | 45S/12      | 45S         | 2                         | 180                 | 5         | 150       | OCAST /                                |
| 1037               | 4            | 22S/12      | 22S         | 2                         | 180                 | 5         | 150       | OCAST /                                |
| 1041               | 3            | 11S/10      | 11S         | 2                         | 180                 | 5         | 150       | OCAST /                                |
| 1045               | 2            | 11S/ 5      | 11S         | 3                         | 180                 | 8         | 150       | PT CLDY /                              |
| 1049               | 2            | 95P/ 5      | 95P         | 2                         | 152S                | 8         | 150       | PT CLDY /                              |
| 1101               | 2            | 50P/ 5      | 50P         | 2                         | 152S                | 8         | 150       | PT CLDY /                              |
| 1105               | 4            | 95P/12      | 95P         | 2                         | 152S                | 8         | 150       | PT CLDY /                              |
| 1109               | 4            | 95P/15      | 95P         | 2                         | 107S                | 8         | 150       | PT CLDY /                              |
| 1113               | 4            | 118P/15     | 118P        | 2                         | 107S                | 8         | 150       | PT CLDY /                              |
| 1117               | 5            | 117P/20     | 117P        | 3                         | 63S                 | 8         | 150       | PT CLDY /                              |
| 1122               | 7            | 151P/30     | 151P        | 4                         | 63S                 | 8         | 150       | PT CLDY /                              |
| 1125               | 7            | 117P/30     | 117P        | 4                         | 63S                 | 6         | 150       | PT CLDY /                              |
| 1129               | 7            | 175S/30     | 175S        | 4                         | 63S                 | 6         | 150       | PT CLDY /                              |
| 1134               | 5            | 161P/20     | 161P        | 4                         | 64S                 | 8         | 150       | OCAST /                                |
| 1137               | 3            | 161P/10     | 161P        | 4                         | 64S                 | 8         | 150       | OCAST /                                |
| 1141               | 5            | 64S/20      | 64S         | 3                         | 64S                 | 6         | 150       | OCAST /                                |
| 1145               | 5            | 154S/20     | 154S        | 3                         | 64S                 | 8         | 150       | OCAST /                                |
| 1149               | 3            | 154S/10     | 154S        | 1                         | 64S                 | 1         | 300       | PT CLDY /                              |



TABLE 1c

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

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 EAST

| *<-----TMR RESULTS----->*<-----D.L. DIGITIZATION----->*<-----COLUMN RATIOS-----> |                         |                     |                        |                        |                          |                                 |                         |                      |           |
|----------------------------------------------------------------------------------|-------------------------|---------------------|------------------------|------------------------|--------------------------|---------------------------------|-------------------------|----------------------|-----------|
| D.L. RUN NO.                                                                     | NO. WAVE INDUCED CYCLES | NO. 1ST MODE BURSTS | MAX P-TO-T STRESS KPSI | RMS P-TO-T STRESS KPSI | MAX 1ST MODE STRESS KPSI | RANGE OF RECORDED EXTREMES KPSI | 2.83X (SAMPLE RMS) KPSI | REL MEAN STRESS KPSI | (6) / (3) |
| 1009                                                                             | 109                     | 0                   | 2.79                   | 1.15                   | 0.00                     | 3.18                            | 1.40                    | -1.93                | 1.21      |
| 1013                                                                             | 86                      | 0                   | 3.74                   | 1.54                   | 0.00                     | 4.21                            | 1.85                    | -1.83                | 1.20      |
| 1017                                                                             | 95                      | 0                   | 3.74                   | 1.61                   | 0.00                     | 5.33                            | 2.27                    | -2.22                | 1.41      |
| 1021                                                                             | 109                     | 0                   | 2.15                   | 1.12                   | 0.00                     | 4.26                            | 1.69                    | 1.53                 | 1.51      |
| 1026                                                                             | 93                      | 0                   | 2.77                   | 1.43                   | 0.00                     | 5.05                            | 2.12                    | 1.39                 | 1.48      |
| 1029                                                                             | 108                     | 0                   | 3.40                   | 1.47                   | 0.00                     | 4.95                            | 1.96                    | 1.40                 | 1.33      |
| 1033                                                                             | 127                     | 19                  | 4.25                   | 1.67                   | 1.05                     | 4.70                            | 2.04                    | 0.33                 | 1.22      |
| 1037                                                                             | 128                     | 13                  | 3.73                   | 1.86                   | 0.97                     | 5.44                            | 2.24                    | 0.68                 | 1.21      |
| 1041                                                                             | 128                     | 2                   | 4.52                   | 2.27                   | 0.67                     | 5.88                            | 2.61                    | 0.59                 | 1.15      |
| 1045                                                                             | 142                     | 21                  | 7.44                   | 3.53                   | 1.91                     | 8.90                            | 3.78                    | 0.74                 | 1.07      |
| 1049                                                                             | 108                     | 0                   | 4.84                   | 2.41                   | 0.00                     | 8.37                            | 3.15                    | 0.96                 | 1.30      |
| 1101                                                                             | 108                     | 8                   | 7.71                   | 2.75                   | 1.14                     | 7.72                            | 3.28                    | 0.91                 | 1.19      |
| 1105                                                                             | 105                     | 12                  | 5.34                   | 2.71                   | 1.20                     | 9.37                            | 3.67                    | 0.69                 | 1.35      |
| 1109                                                                             | 106                     | 15                  | 6.36                   | 2.92                   | 1.42                     | 8.80                            | 3.92                    | 0.87                 | 1.34      |
| 1113                                                                             | 109                     | 11                  | 6.58                   | 2.84                   | 1.02                     | 8.04                            | 3.48                    | 0.82                 | 1.23      |
| 1117                                                                             | 93                      | 10                  | 8.77                   | 2.77                   | 1.58                     | 8.31                            | 3.32                    | 1.50                 | 1.20      |
| 1122                                                                             | 94                      | 3                   | 7.28                   | 2.94                   | 1.43                     | 9.37                            | 3.94                    | 1.64                 | 1.34      |
| 1125                                                                             | 69                      | 1                   | 6.41                   | 3.26                   | 0.75                     | 9.83                            | 4.00                    | 1.78                 | 1.23      |
| 1129                                                                             | 90                      | 0                   | 6.92                   | 2.84                   | 0.00                     | 9.35                            | 3.80                    | 2.04                 | 1.34      |
| 1134                                                                             | 79                      | 4                   | 8.04                   | 3.38                   | 0.89                     | 7.64                            | 3.85                    | 1.73                 | 1.14      |
| 1137                                                                             | 64                      | 1                   | 6.50                   | 2.98                   | 8.74                     | 9.20                            | 3.65                    | 1.80                 | 1.22      |
| 1141                                                                             | 48                      | 0                   | 6.92                   | 3.54                   | 0.00                     | 7.88                            | 4.30                    | 1.90                 | 1.22      |
| 1145                                                                             | 49                      | 0                   | 7.71                   | 3.90                   | 0.00                     | 9.47                            | 4.43                    | 1.86                 | 1.14      |
| 1149                                                                             | 24                      | 0                   | 4.32                   | 2.86                   | 0.00                     | 5.46                            | 3.39                    | 1.89                 | 1.19      |

TABLE 1d

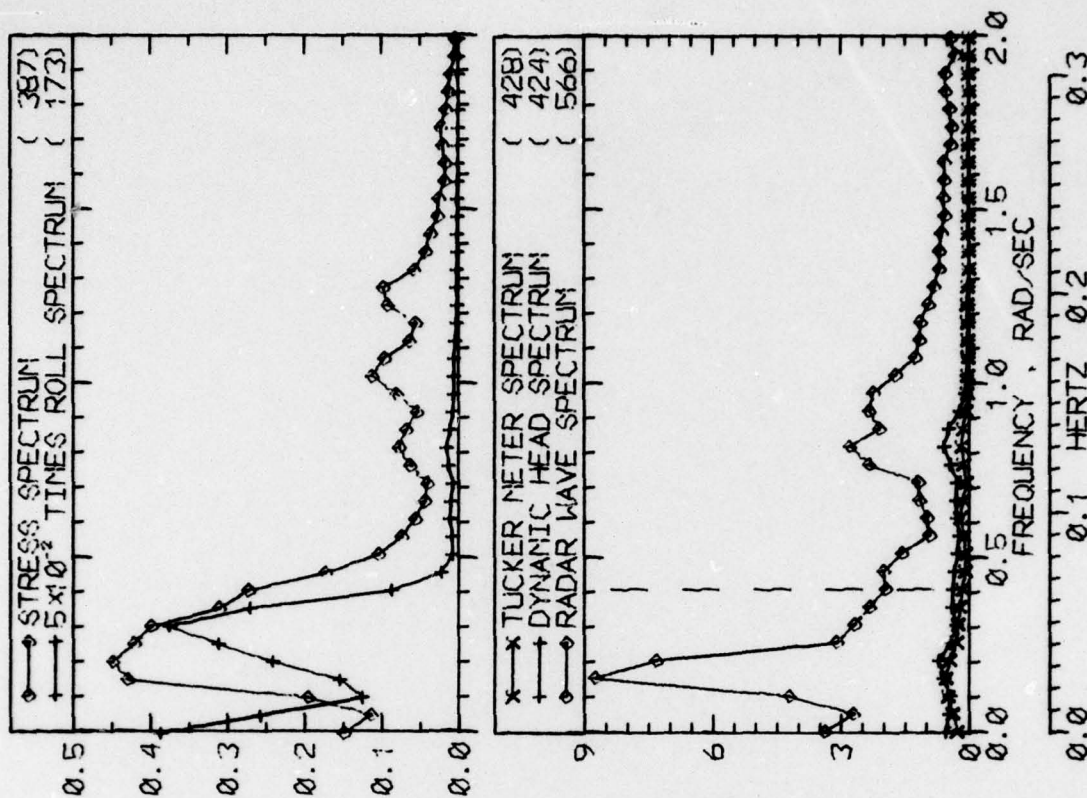
SUMMARY OF RAW DIGITIZATION RESULTS FOR RADAR RANGE  
ROLL, PITCH, DECK HOUSE ACCELERATIONS, AND TUCKER METER

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 EAST

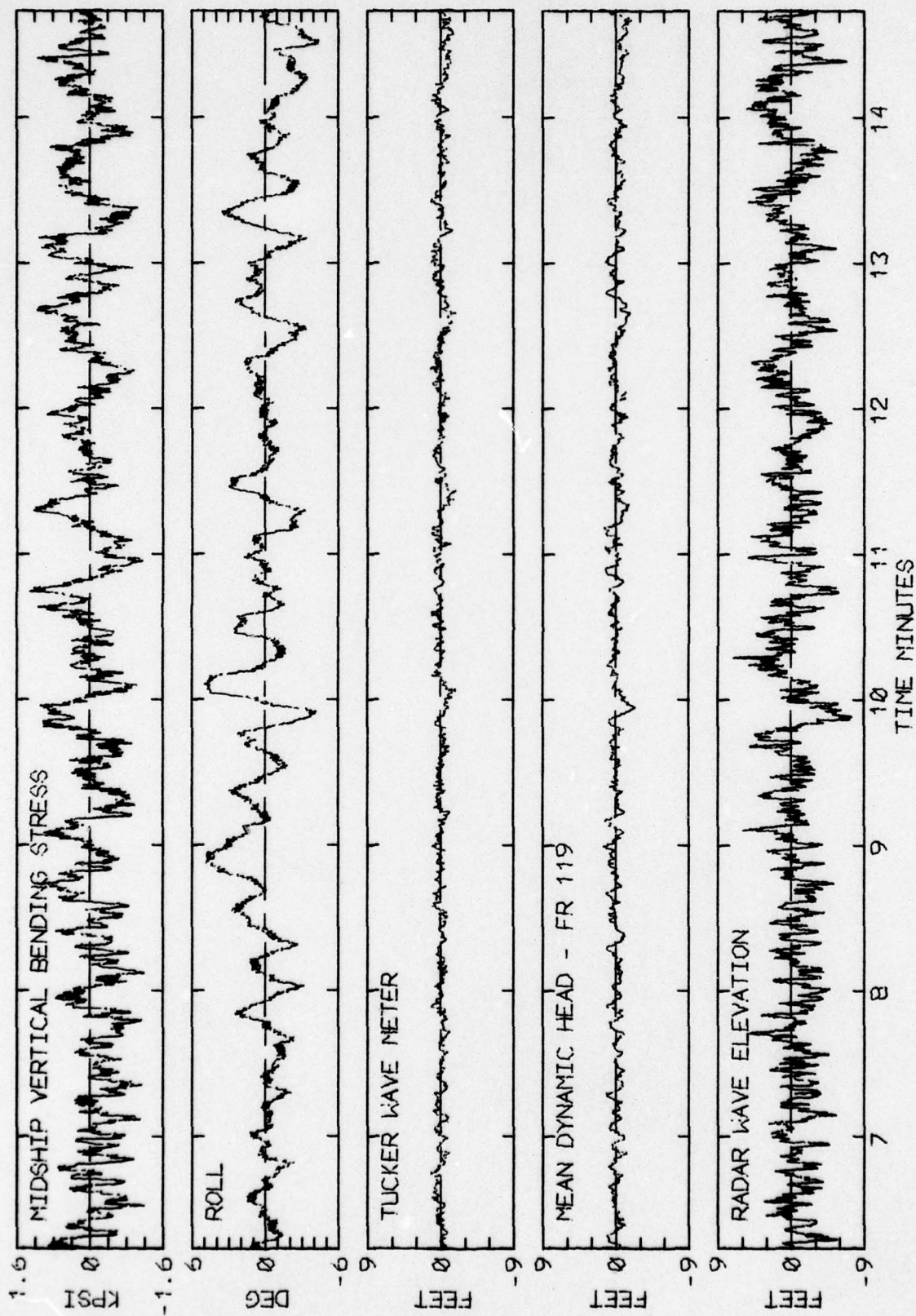
| D.L.<br>RUN<br>NO. | RADAR                          |                         | ROLL                            |                          | PITCH                           |                          | VERT ACCEL                    |                        | LAT ACCEL                     |                        | TUCKER                         |                         |
|--------------------|--------------------------------|-------------------------|---------------------------------|--------------------------|---------------------------------|--------------------------|-------------------------------|------------------------|-------------------------------|------------------------|--------------------------------|-------------------------|
|                    | 4.0<br>RECORDED<br>(RMS)<br>FT | EXTREMES<br>(RMS)<br>FT | 4.0<br>RECORDED<br>(RMS)<br>DEG | EXTREMES<br>(RMS)<br>DEG | 4.0<br>RECORDED<br>(RMS)<br>DEG | EXTREMES<br>(RMS)<br>DEG | 4.0<br>RECORDED<br>(RMS)<br>G | EXTREMES<br>(RMS)<br>G | 4.0<br>RECORDED<br>(RMS)<br>G | EXTREMES<br>(RMS)<br>G | 4.0<br>RECORDED<br>(RMS)<br>FT | EXTREMES<br>(RMS)<br>FT |
| 1009               | 14.                            | 13.                     | 5.9                             | 5.                       | 0.5                             | -0.0                     | 0.1                           | 0.1                    | 0.14                          | 0.1                    | 2.                             | -2.                     |
| 1013               | 21.                            | 21.                     | 9.9                             | 5.                       | 0.5                             | -0.1                     | 0.1                           | 0.1                    | 0.22                          | 0.2                    | 6.                             | 7.                      |
| 1017               | 21.                            | 16.                     | 9.1                             | 5.                       | 0.5                             | 0.0                      | 0.1                           | 0.1                    | 0.21                          | 0.2                    | 4.                             | 5.                      |
| 1021               | 14.                            | 16.                     | 6.0                             | 2.                       | 0.4                             | -0.1                     | 0.1                           | 0.1                    | 0.13                          | 0.1                    | 3.                             | 3.                      |
| 1026               | 19.                            | 24.                     | 8.9                             | 5.                       | 0.5                             | 0.1                      | 0.1                           | 0.1                    | 0.19                          | 0.2                    | 4.                             | 4.                      |
| 1029               | 18.                            | 14.                     | 8.2                             | 4.                       | 0.5                             | 0.1                      | 0.1                           | 0.1                    | 0.18                          | 0.2                    | 4.                             | 4.                      |
| 1033               | 18.                            | 16.                     | 7.2                             | 3.                       | 0.7                             | 0.1                      | 0.1                           | 0.1                    | 0.16                          | 0.2                    | 4.                             | 4.                      |
| 1037               | 21.                            | 19.                     | 9.1                             | 6.                       | 0.8                             | 0.3                      | 0.2                           | 0.2                    | 0.20                          | 0.2                    | 4.                             | 4.                      |
| 1041               | 22.                            | 18.                     | 8.0                             | 5.                       | 1.0                             | 0.5                      | 0.2                           | 0.2                    | 0.18                          | 0.1                    | 5.                             | 4.                      |
| 1045               | 30.                            | 27.                     | 9.4                             | 8.                       | 1.6                             | 1.1                      | 0.3                           | 0.3                    | 0.22                          | 0.2                    | 6.                             | 4.                      |
| 1049               | 25.                            | 21.                     | 12.1                            | 8.                       | 1.1                             | 0.6                      | 0.2                           | 0.2                    | 0.27                          | 0.2                    | 5.                             | 5.                      |
| 1101               | 25.                            | 21.                     | 12.9                            | 9.                       | 1.1                             | 0.6                      | 0.2                           | 0.2                    | 0.28                          | 0.3                    | 6.                             | 6.                      |
| 1105               | 26.                            | 22.                     | 13.7                            | 11.                      | 1.1                             | 0.6                      | 0.2                           | 0.2                    | 0.30                          | 0.3                    | 6.                             | 7.                      |
| 1109               | 26.                            | 22.                     | 13.8                            | 11.                      | 1.0                             | 0.4                      | 0.2                           | 0.2                    | 0.30                          | 0.2                    | 6.                             | 5.                      |
| 1113               | 26.                            | 21.                     | 14.9                            | 12.                      | 1.1                             | 0.4                      | 0.2                           | 0.2                    | 0.33                          | 0.3                    | 6.                             | 8.                      |
| 1117               | 27.                            | 22.                     | 16.0                            | 13.                      | 1.0                             | 0.4                      | 0.2                           | 0.2                    | 0.35                          | 0.3                    | 9.                             | 9.                      |
| 1122               | 27.                            | 20.                     | 16.2                            | 16.                      | 0.9                             | 0.5                      | 0.2                           | 0.2                    | 0.34                          | 0.2                    | 8.                             | 7.                      |
| 1125               | 29.                            | 24.                     | 17.9                            | 15.                      | 1.0                             | 0.4                      | 0.2                           | 0.2                    | 0.39                          | 0.3                    | 8.                             | 7.                      |
| 1129               | 33.                            | 30.                     | 18.7                            | 12.                      | 1.0                             | 0.8                      | 0.3                           | 0.2                    | 0.41                          | 0.3                    | 12.                            | 10.                     |
| 1134               | 30.                            | 23.                     | 19.8                            | 17.                      | 1.1                             | 0.6                      | 0.2                           | 0.2                    | 0.42                          | 0.3                    | 14.                            | 10.                     |
| 1137               | 31.                            | 35.                     | 19.6                            | 17.                      | 0.8                             | 0.4                      | 0.2                           | 0.2                    | 0.43                          | 0.3                    | 15.                            | 11.                     |
| 1141               | 30.                            | 23.                     | 21.3                            | 18.                      | 0.7                             | 0.2                      | 0.1                           | 0.1                    | 0.46                          | 0.3                    | 17.                            | 11.                     |
| 1145               | 34.                            | 34.                     | 23.1                            | 17.                      | 0.8                             | 0.2                      | 0.1                           | 0.1                    | 0.51                          | 0.4                    | 16.                            | 11.                     |
| 1149               | 24.                            | 21.                     | 13.1                            | 8.                       | 0.8                             | 0.1                      | 0.0                           | 0.0                    | 0.27                          | 0.2                    | 18.                            | 11.                     |



| LOG BOOK DATA                         |                   |
|---------------------------------------|-------------------|
| DATE AND TIME                         | 01-29-74 2400     |
| POSITION                              |                   |
| COURSE AND SPEED                      | 0082 , 32.3 KNOTS |
| SEA STATE                             | 2                 |
| WAVE HEIGHT                           | 1 FEET            |
| " REL DIR                             | 172 PORT          |
| SWELL HEIGHT                          | 2 FEET            |
| " REL DIR                             | 172 PORT          |
| ----- VISUAL WEATHER / COMMENTS ----- |                   |
| CLEAR /                               |                   |
| MIDSHIP VERTICAL BENDING STRESS       |                   |
| MAXIMUM PK-TR                         | 2.8 KPSI          |
| 4.0 X RMS                             | 1.9 KPSI          |
| SUMMARY OF NOTIONS (4.0 X RMS)        |                   |
| ROLL                                  | 6.0 DEG           |
| PITCH                                 | 0.48 DEG          |
| DK HSE VERT ACCEL                     | 0.10 G            |
| DK HSE LAT ACCEL                      | 0.14 G            |
| RADAR SLANT RANGE                     | 13.9 FEET         |
| VERTICAL RANGE                        | 10.0 FEET         |
| DISPL AT RADAR                        | 4.6 FEET          |
| WAVE HEIGHT STATISTICS (FEET)         |                   |
| TUCKER/DYN. HEAD/RADAR                |                   |
| P-T SAMPLE SIZE                       | 362 229 352       |
| MAXIMUM HEIGHT                        | 2.5 3.3 9.7       |
| 10TH HIGHEST HTS                      | 1.7 2.4 7.3       |
| 3RD HIGHEST HTS                       | 1.3 1.8 5.8       |
| 4.0 RMS(SPECTRA)                      | 2.1 2.6 8.2       |



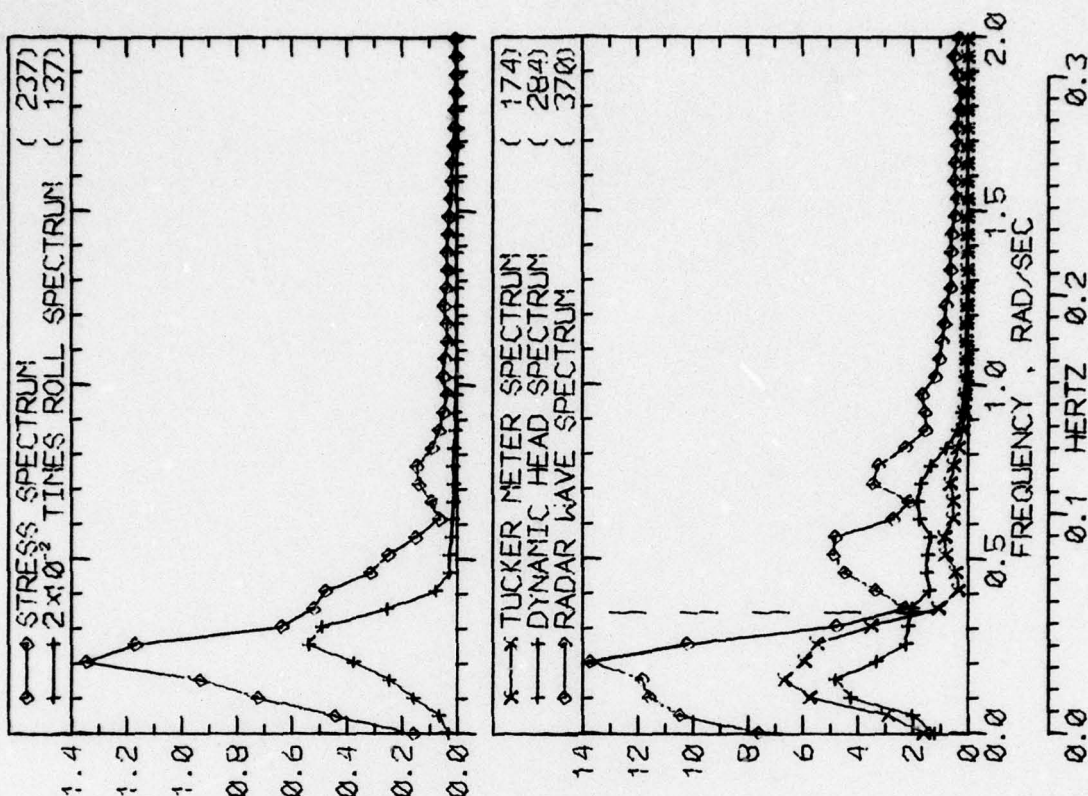
RUN 1009 -- VOYAGE 34E -- TAPE 157 -- INDEX 3 -- INTERVAL 9



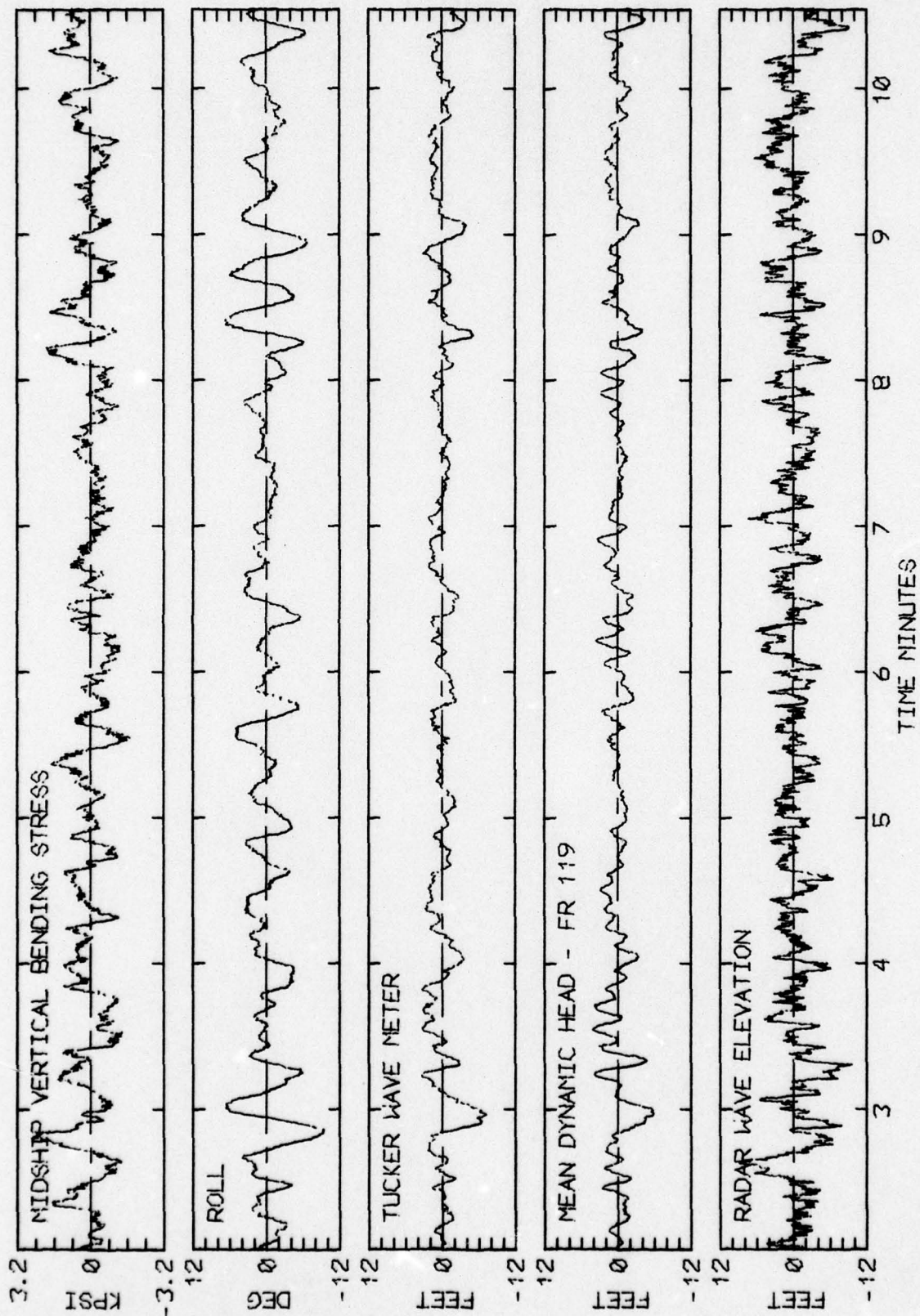
RUN 1009 -- VOYAGE 34E -- TAPE 157 -- INDEX 3 -- INTERVAL 9



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 01-30-74  | 0400       |      |
| POSITION                              |           |            |      |
| COURSE AND SPEED                      | 089       | 32.2 KNOTS |      |
| SEA STATE                             | 2         |            |      |
| WAVE HEIGHT                           | 1 FEET    |            |      |
| " REL DIR                             | 179 PORT  |            |      |
| SWELL HEIGHT                          | 3 FEET    |            |      |
| " REL DIR                             | 179 PORT  |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| CLEAR /                               |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 3.7 KPSI  |            |      |
| 4.0 X RMS                             | 2.6 KPSI  |            |      |
| SUMMARY OF NOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 9.9 DEG   |            |      |
| PITCH                                 | 0.46 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.10 G    |            |      |
| DK HSE LAT ACCEL                      | 0.22 G    |            |      |
| RADAR SLANT RANGE                     | 20.6 FEET |            |      |
| VERTICAL RANGE                        | 12.1 FEET |            |      |
| DISPL AT RADAR                        | 6.9 FEET  |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| TUCKER/DYN. HEAD/RADAR                |           |            |      |
| P-T SAMPLE SIZE                       | 123       | 112        | 229  |
| MAXIMUM HEIGHT                        | 9.6       | 8.6        | 15.5 |
| 10TH HIGHEST HTS                      | 5.6       | 5.9        | 9.0  |
| 3RD HIGHEST HTS                       | 3.6       | 4.3        | 6.6  |
| 4.0 RMS(SPECTRA)                      | 5.6       | 5.4        | 10.2 |



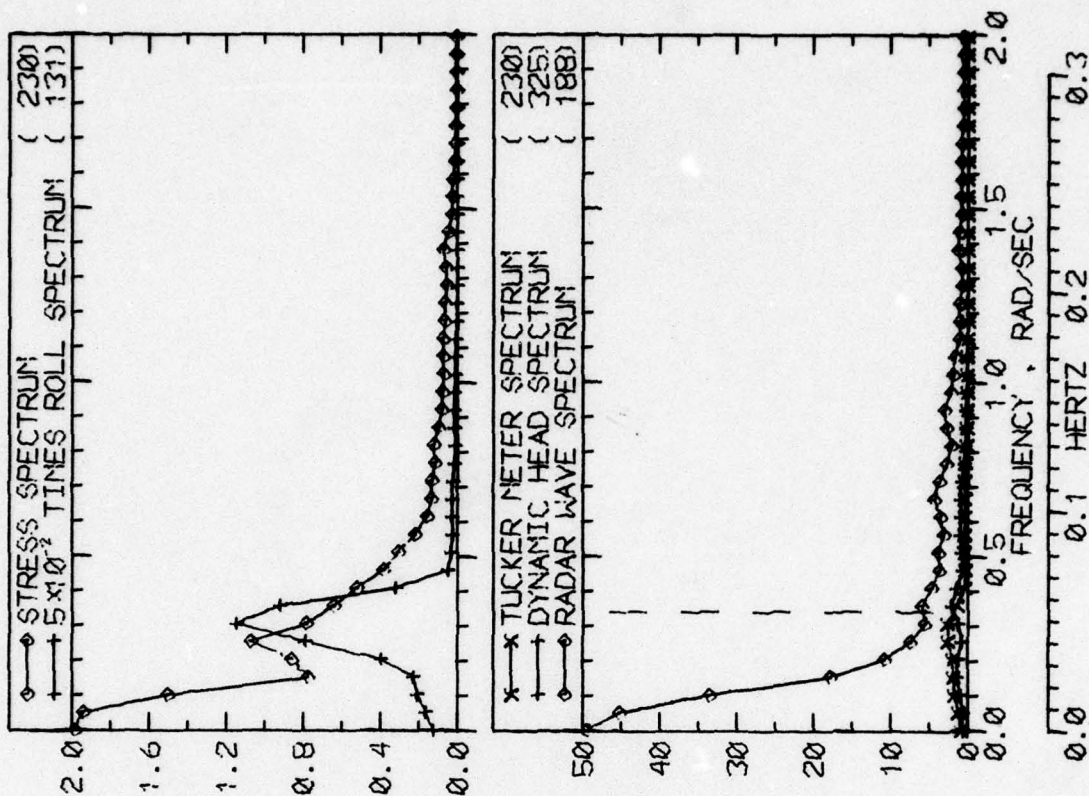
RUN 1013 -- VOYAGE 34E -- TAPE 157 -- INDEX 4 -- INTERVAL 13



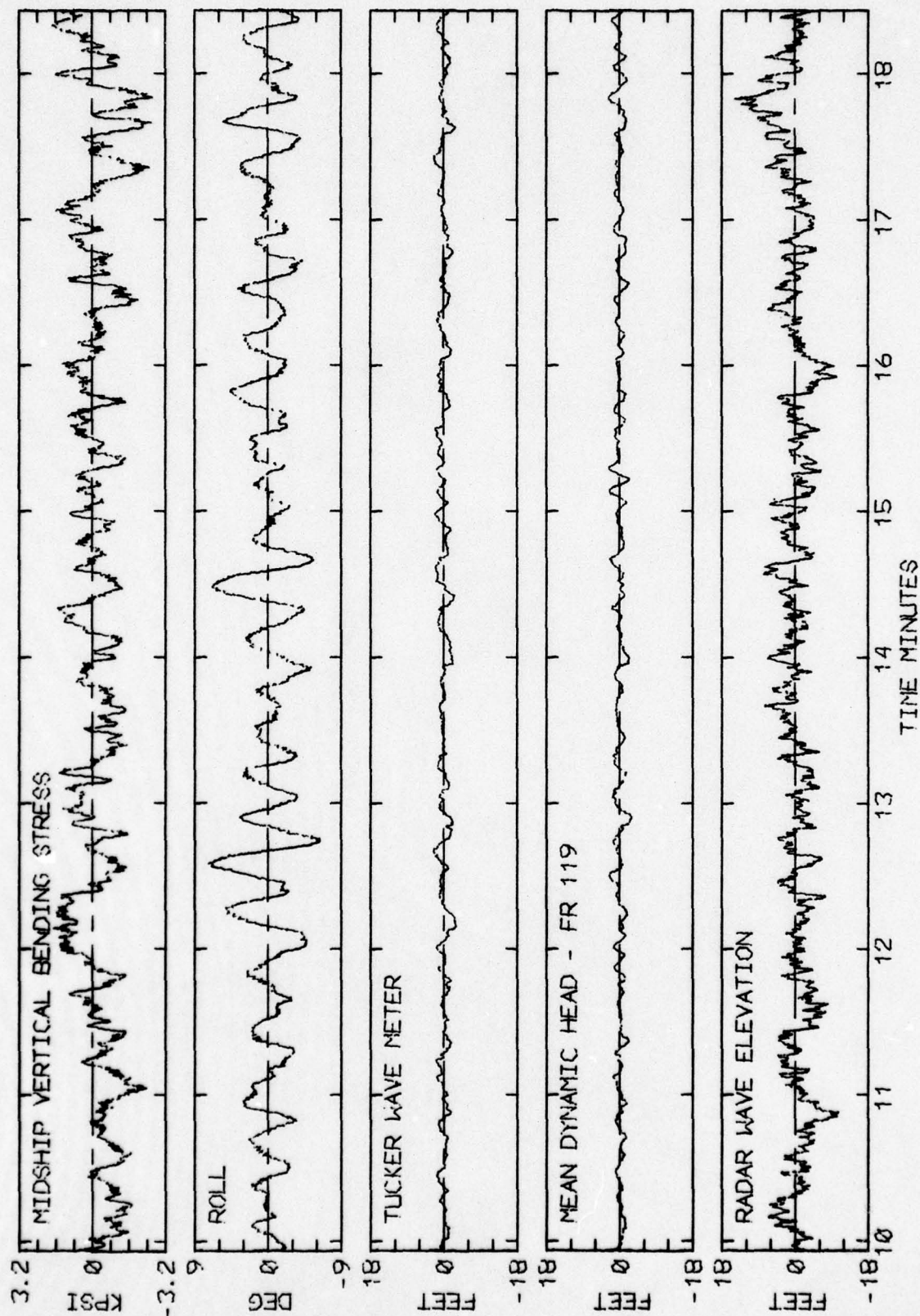
RUN 1013 -- VOYAGE 34E -- TAPE 157 -- INDEX 4 -- INTERVAL 13



| LOG BOOK DATA                         |                  |
|---------------------------------------|------------------|
| DATE AND TIME                         | 01-30-74 0800    |
| POSITION                              |                  |
| COURSE AND SPEED                      | 087 , 32.3 KNOTS |
| SEA STATE                             | 2                |
| WAVE HEIGHT                           | 1 FEET           |
| " REL DIR                             | 19 PORT          |
| SWELL HEIGHT                          | 4 FEET           |
| " REL DIR                             | 177 PORT         |
| ----- VISUAL WEATHER / COMMENTS ----- |                  |
| OCAST /                               |                  |
| MIDSHIP VERTICAL BENDING STRESS       |                  |
| MAXIMUM PK-TR                         | 3.7 KPSI         |
| 4.0 X RMS                             | 3.1 KPSI         |
| SUMMARY OF MOTIONS (4.0 X RMS)        |                  |
| ROLL                                  | 8.6 DEG          |
| PITCH                                 | 0.50 DEG         |
| DK HSE VERT ACCEL                     | 0.10 G           |
| DK HSE LAT ACCEL                      | 0.21 G           |
| RADAR SLANT RANGE                     | 21.4 FEET        |
| VERTICAL RANGE                        | 14.9 FEET        |
| DISPL AT RADAR                        | 6.4 FEET         |
| WAVE HEIGHT STATISTICS (FEET)         |                  |
| P-T SAMPLE SIZE                       | 168 136 181      |
| MAXIMUM HEIGHT                        | 5.0 4.8 16.2     |
| 10TH HIGHEST HTS                      | 3.1 3.7 11.2     |
| 3RD HIGHEST HTS                       | 2.2 2.9 8.2      |
| 4.0 RMS(SPECTRA)                      | 3.9 3.8 13.4     |



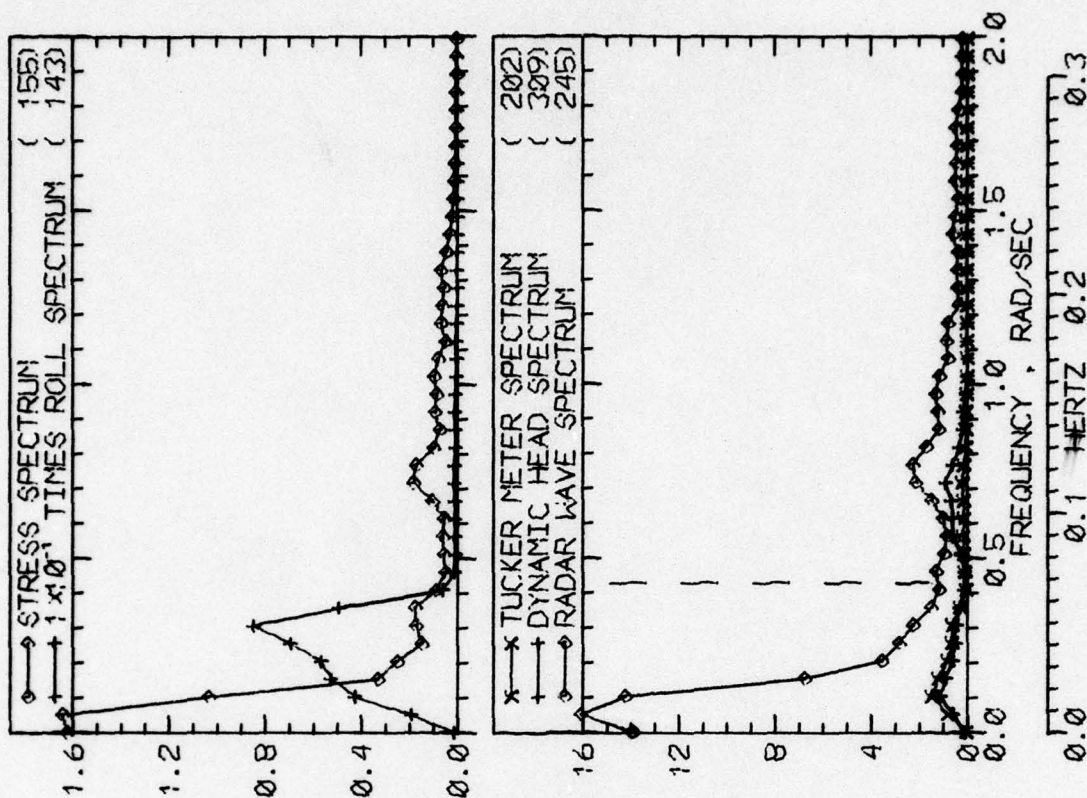
RUN 1017 -- VOYAGE 34E -- TAPE 157 -- INDEX 5 -- INTERVAL 17



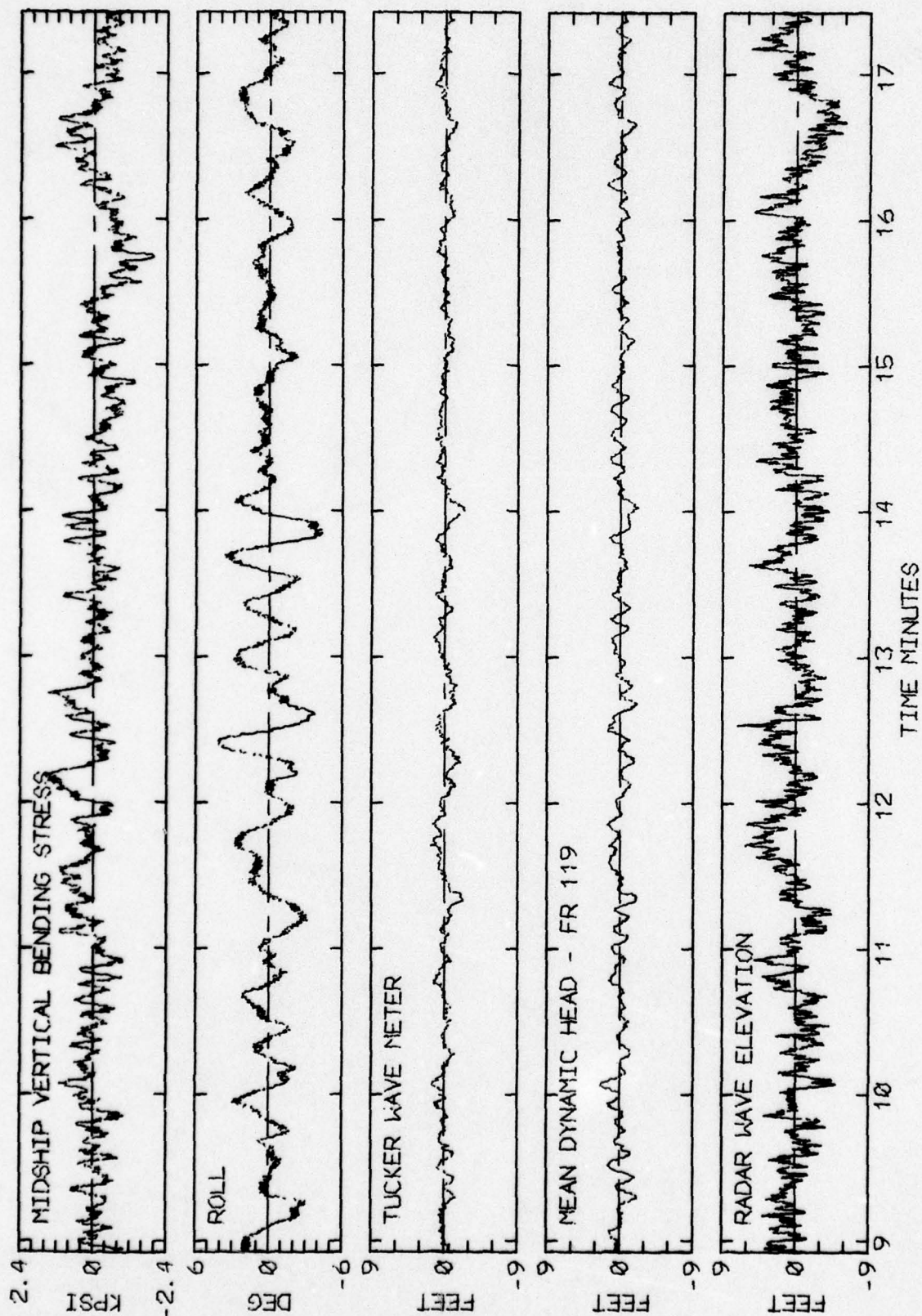
RUN 1017 -- VOYAGE 34E -- TAPE 157 -- INDEX 5 -- INTERVAL 17



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 01-30-74  | 1200       |      |
| POSITION                              | 40-31 N   | 59-02 W    |      |
| COURSE AND SPEED                      | 090       | 32.3 KNOTS |      |
| SEA STATE                             | 2         |            |      |
| WAVE HEIGHT                           | 2 FEET    |            |      |
| " REL DIR                             | 0         |            |      |
| SWELL HEIGHT                          | 4 FEET    |            |      |
| " REL DIR                             | 180       |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST /                               |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 2.1 KPSI  |            |      |
| 4.0 X RMS                             | 2.3 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 5.8 DEG   |            |      |
| PITCH                                 | 0.42 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.08 G    |            |      |
| DK HSE LAT ACCEL                      | 0.13 G    |            |      |
| RADAR SLANT RANGE                     | 14.4 FEET |            |      |
| VERTICAL RANGE                        | 10.0 FEET |            |      |
| DISPL AT RADAR                        | 4.2 FEET  |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| TUCKER/DYN. HEAD/RADAR                |           |            |      |
| P-T SAMPLE SIZE                       | 194       | 171        | 271  |
| MAXIMUM HEIGHT                        | 2.7       | 3.5        | 10.4 |
| 10TH HIGHEST HTS                      | 2.0       | 2.6        | 6.7  |
| 3RD HIGHEST HTS                       | 1.4       | 2.0        | 5.3  |
| 4.0 RMS(SPECTRA)                      | 2.5       | 2.8        | 8.6  |



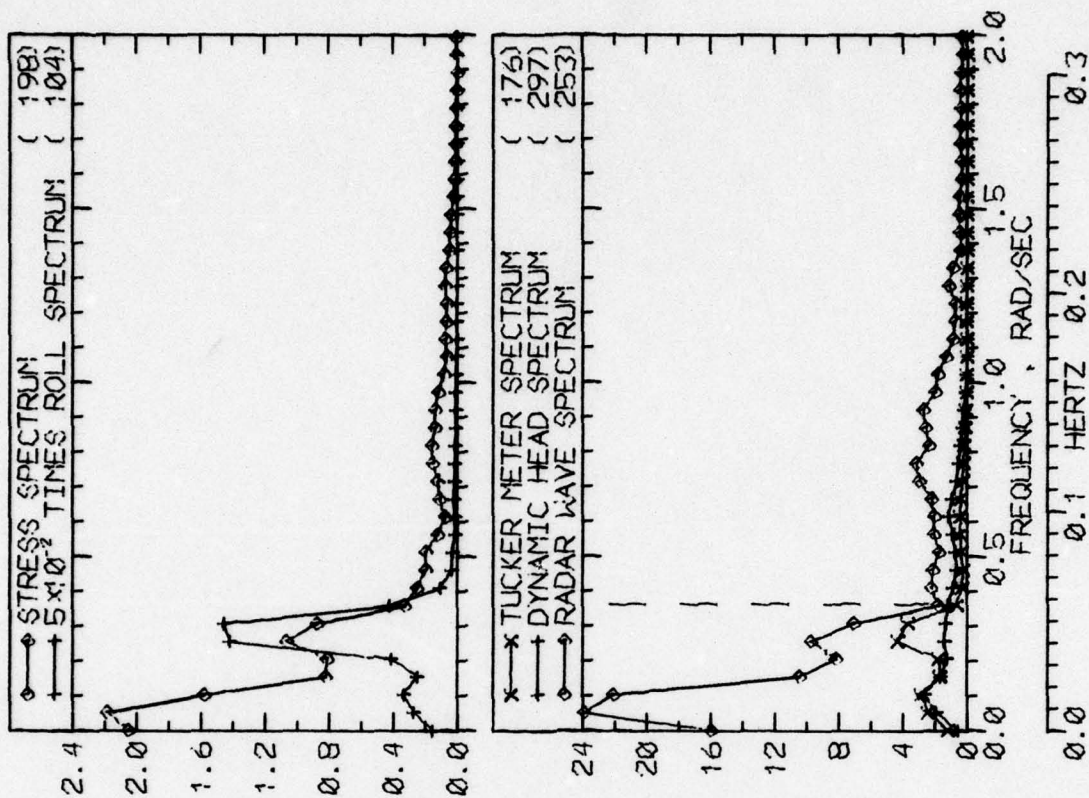
RUN 1021 -- VOYAGE 34E -- TAPE 157 -- INDEX 6 -- INTERVAL 21



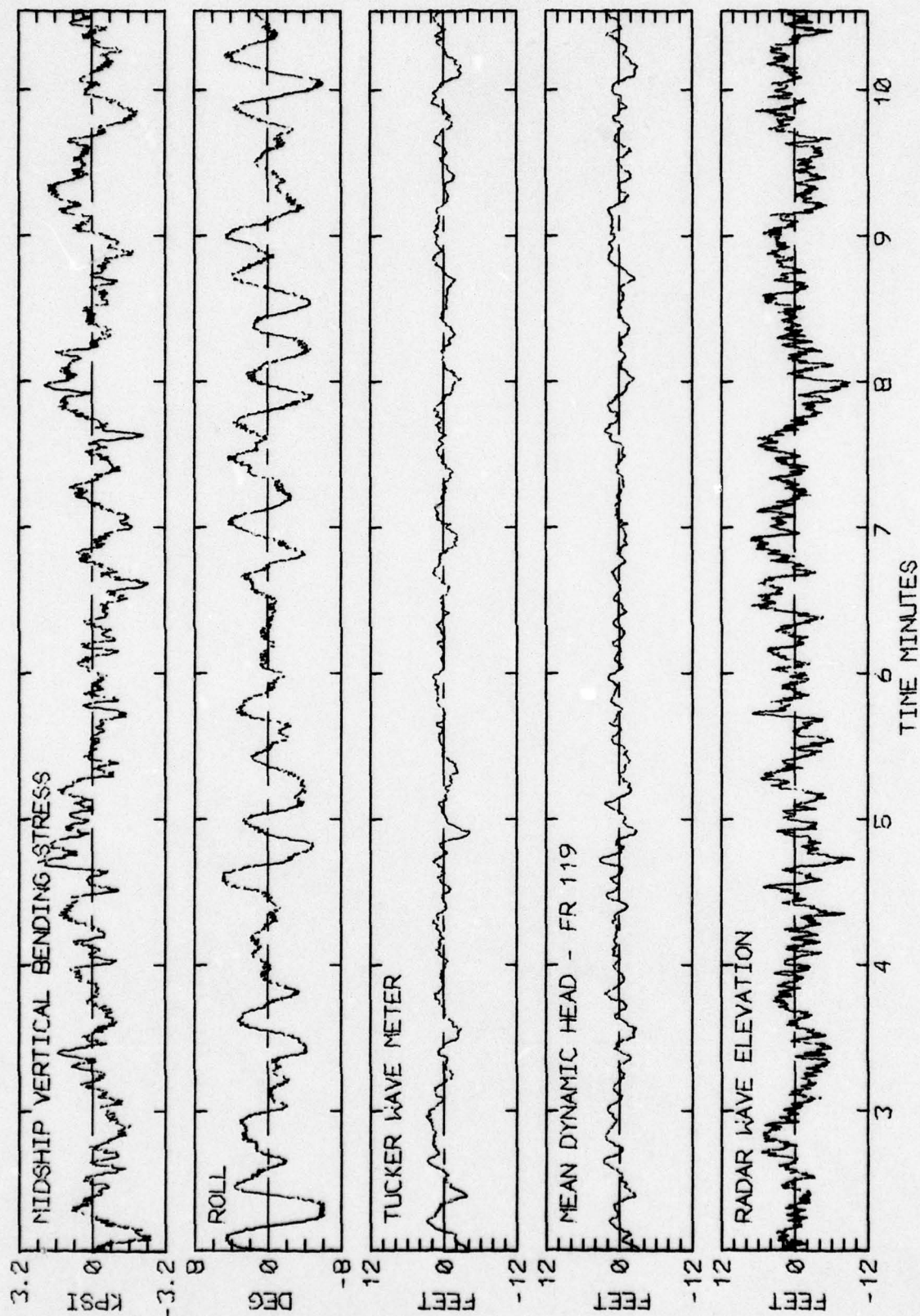
RUN 1021 -- VOYAGE 34E -- TAPE 157 -- INDEX 6 -- INTERVAL 21



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 01-30-74  | 1600       |      |
| POSITION                              | 40-31 N   | 59-02 W    |      |
| COURSE AND SPEED                      | 090       | 32.1 KNOTS |      |
| SEA STATE                             | 3         |            |      |
| WAVE HEIGHT                           | 2 FEET    |            |      |
| " REL DIR                             | 11 STBD   |            |      |
| SWELL HEIGHT                          | 5 FEET    |            |      |
| " REL DIR                             | 180       |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST /                               |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 2.8 KPSI  |            |      |
| 4.0 X RMS                             | 3.0 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 9.0 DEG   |            |      |
| PITCH                                 | 0.50 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.10 G    |            |      |
| DK HSE LAT ACCEL                      | 0.19 G    |            |      |
| RADAR SLANT RANGE                     | 19.1 FEET |            |      |
| VERTICAL RANGE                        | 12.3 FEET |            |      |
| DISPL AT RADAR                        | 5.8 FEET  |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| TUCKER/DYN. HEAD/RADAR                |           |            |      |
| P-T SAMPLE SIZE                       | 173       | 135        | 245  |
| MAXIMUM HEIGHT                        | 6.4       | 4.8        | 10.6 |
| 10TH HIGHEST HTS                      | 3.1       | 3.8        | 8.4  |
| 3RD HIGHEST HTS                       | 2.1       | 2.7        | 6.4  |
| 4.0 RMS(SPECTRA)                      | 4.3       | 4.0        | 10.8 |



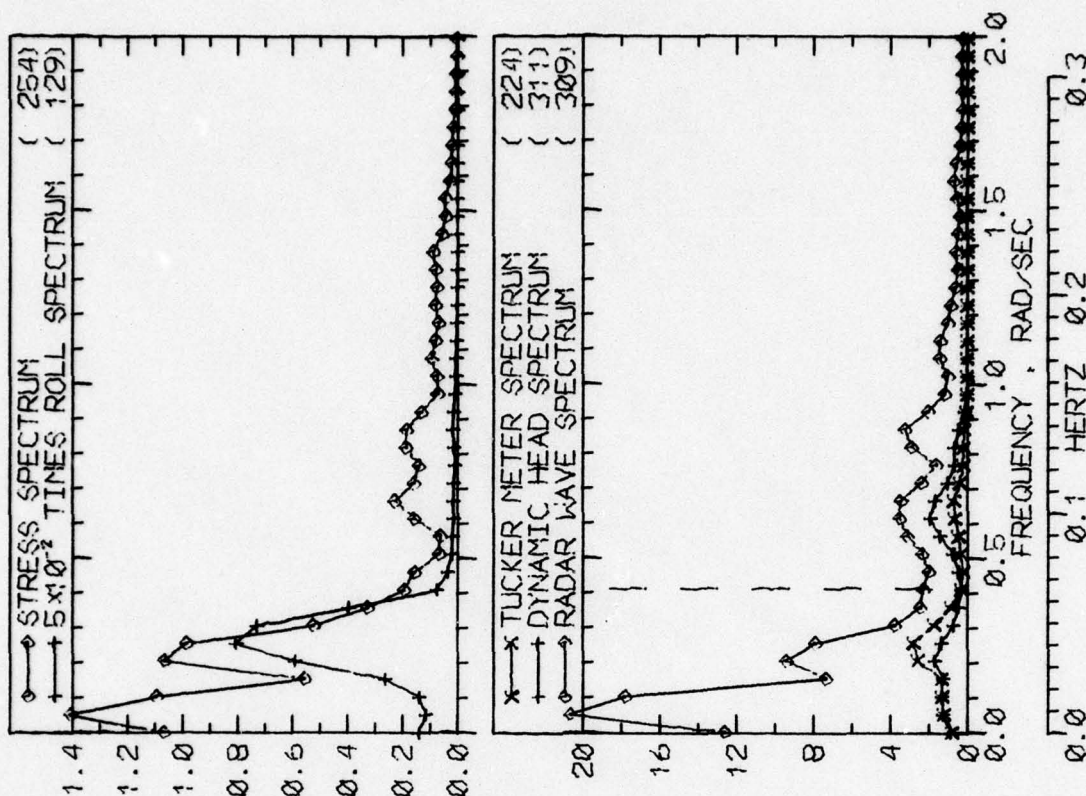
RUN 1026 -- VOYAGE 34E -- TAPE 157 -- INDEX 7 -- INTERVAL 26



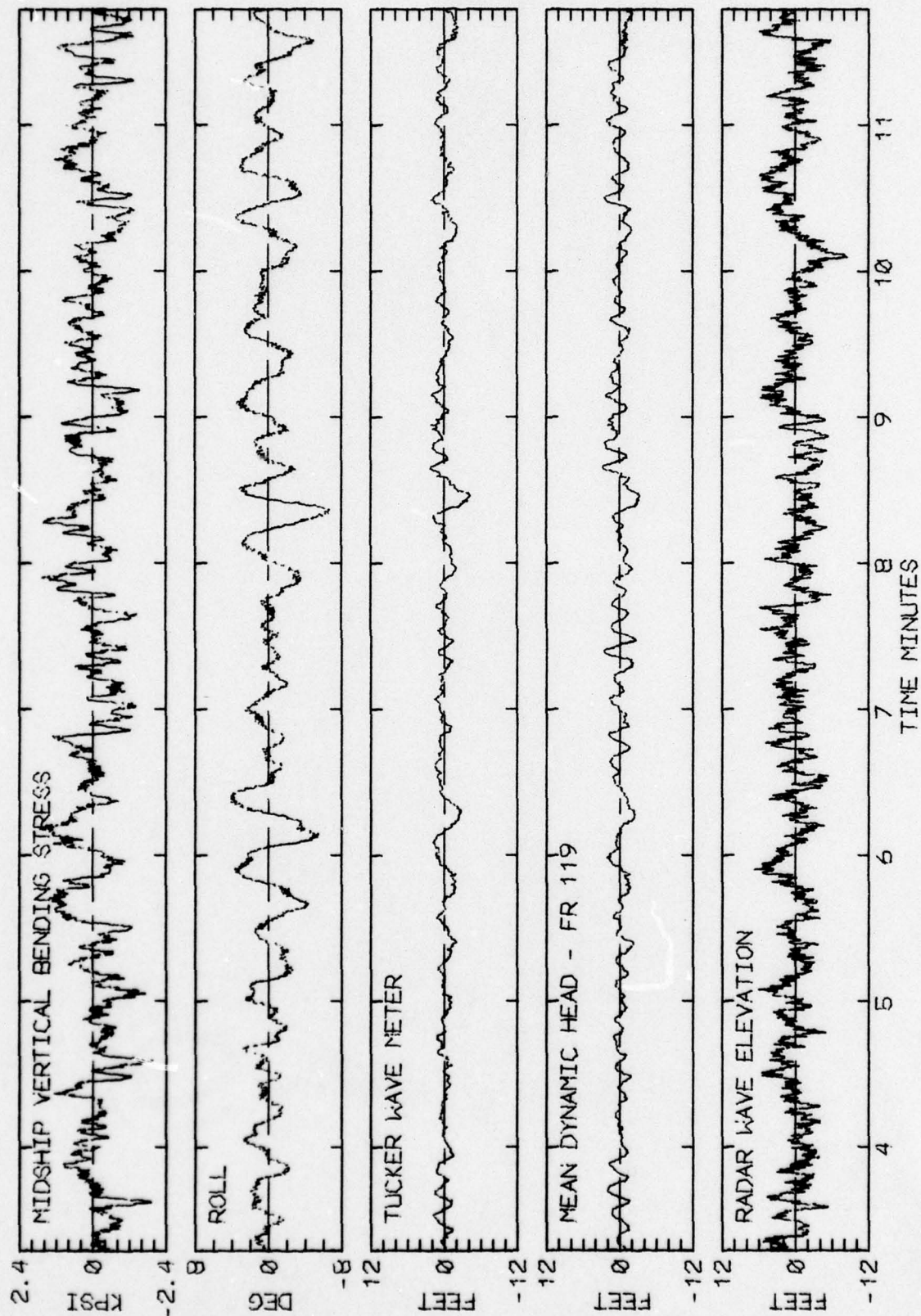
RUN 1026 -- VOYAGE 34E -- TAPE 157 -- INDEX 7 -- INTERVAL 26



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 01-30-74  | 2000       |      |
| POSITION                              | 40-31 N   | 59-02 W    |      |
| COURSE AND SPEED                      | 090       | 32.2 KNOTS |      |
| SEA STATE                             | 3         |            |      |
| WAVE HEIGHT                           | 2 FEET    |            |      |
| " REL DIR                             | 11 STBD   |            |      |
| SWELL HEIGHT                          | 5 FEET    |            |      |
| " REL DIR                             | 180       |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST /                               |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 3.4 KPSI  |            |      |
| 4.0 X RMS                             | 2.8 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 7.5 DEG   |            |      |
| PITCH                                 | 0.53 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.12 G    |            |      |
| DK HSE LAT ACCEL                      | 0.18 G    |            |      |
| RADAR SLANT RANGE                     | 17.9 FEET |            |      |
| VERTICAL RANGE                        | 12.2 FEET |            |      |
| DISPL AT RADAR                        | 6.4 FEET  |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| P-T SAMPLE SIZE                       | 164       | 135        | 310  |
| MAXIMUM HEIGHT                        | 6.1       | 5.2        | 11.6 |
| 10TH HIGHEST HTS                      | 3.3       | 3.7        | 7.8  |
| 3RD HIGHEST HTS                       | 2.2       | 2.9        | 6.0  |
| 4.0 RMS(SPECTRA)                      | 3.7       | 3.9        | 10.4 |



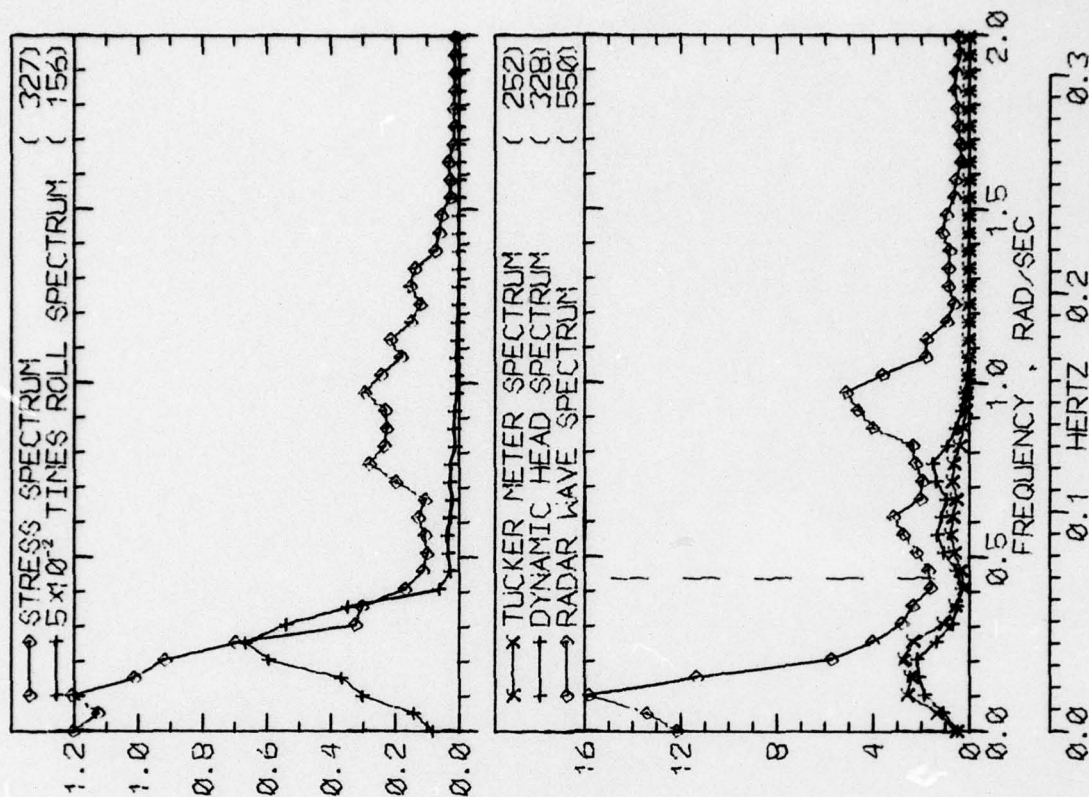
RUN 1029 -- VOYAGE 34E -- TAPE 157 -- INDEX 8 -- INTERVAL 29



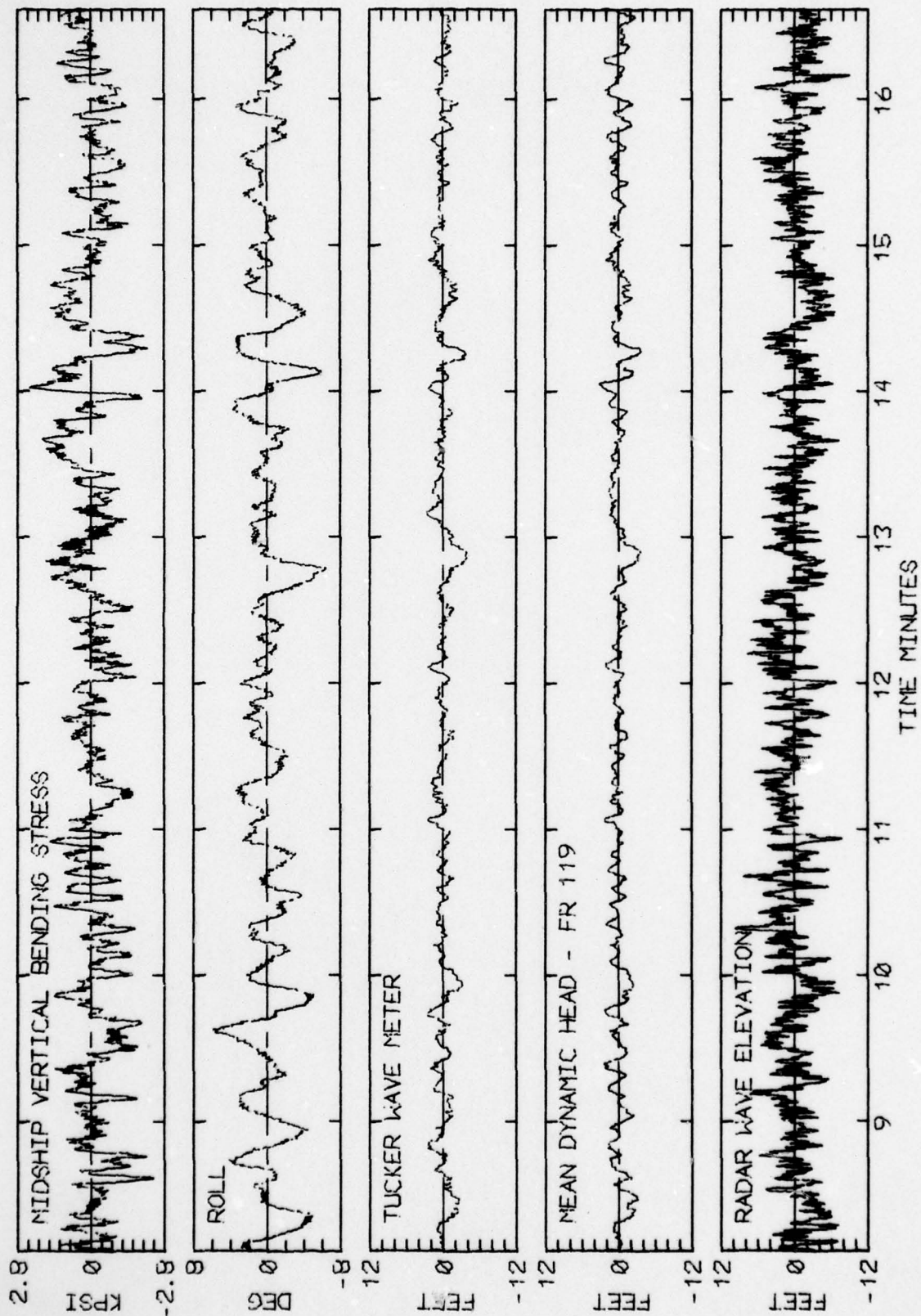
RUN 1029 -- VOYAGE 34E -- TAPE 157 -- INDEX 8 -- INTERVAL 29



| LOG BOOK DATA                         |           |                        |      |
|---------------------------------------|-----------|------------------------|------|
| DATE AND TIME                         | 01-30-74  | 2400                   |      |
| POSITION                              | 40-31 N   | 59-02 W                |      |
| COURSE AND SPEED                      | 090       | 32.1 KNOTS             |      |
| SEA STATE                             | 4         |                        |      |
| WAVE HEIGHT                           | 2 FEET    |                        |      |
| " REL DIR                             | 45 STBD   |                        |      |
| SKELL HEIGHT                          | 5 FEET    |                        |      |
| " REL DIR                             | 180       |                        |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |                        |      |
| OCAST /                               |           |                        |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |                        |      |
| MAXIMUM PK-TR                         | 4.2 KPSI  |                        |      |
| 4.0 X RMS                             | 2.9 KPSI  |                        |      |
| SUMMARY OF NOTIONS (4.0 X RMS)        |           |                        |      |
| ROLL                                  | 7.4 DEG   |                        |      |
| PITCH                                 | 0.66 DEG  |                        |      |
| DK HSE VERT ACCEL                     | 0.15 G    |                        |      |
| DK HSE LAT ACCEL                      | 0.16 G    |                        |      |
| RADAR SLANT RANGE                     | 18.1 FEET |                        |      |
| VERTICAL RANGE                        | 13.5 FEET |                        |      |
| DISPL AT RADAR                        | 7.1 FEET  |                        |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |                        |      |
|                                       |           | TUCKER/DYN. HEAD/RADAR |      |
| P-T SAMPLE SIZE                       | 185       | 138                    | 354  |
| MAXIMUM HEIGHT                        | 5.1       | 6.0                    | 14.3 |
| 10TH HIGHEST HTS                      | 3.4       | 4.2                    | 10.0 |
| 3RD HIGHEST HTS                       | 2.5       | 3.3                    | 8.0  |
| 4.0 RMS(SPECTRA)                      | 4.0       | 4.2                    | 11.2 |



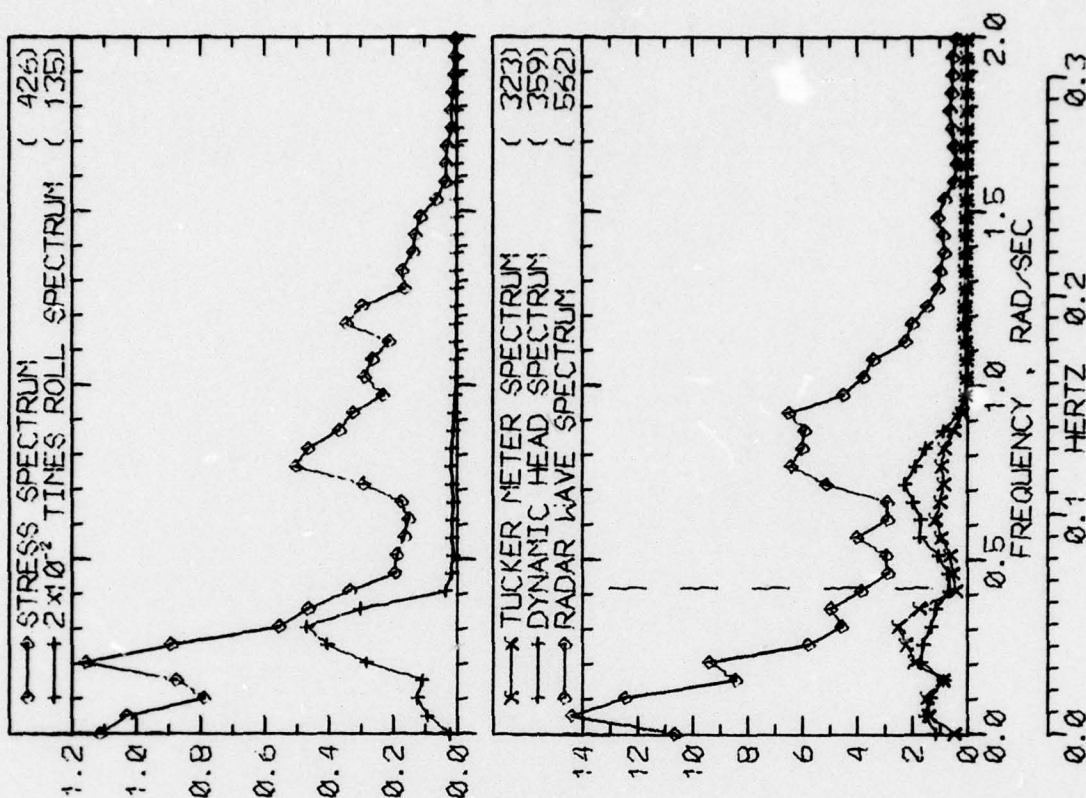
RUN 1033 -- VOYAGE 34E -- TAPE 157 -- INDEX 9 -- INTERVAL 33



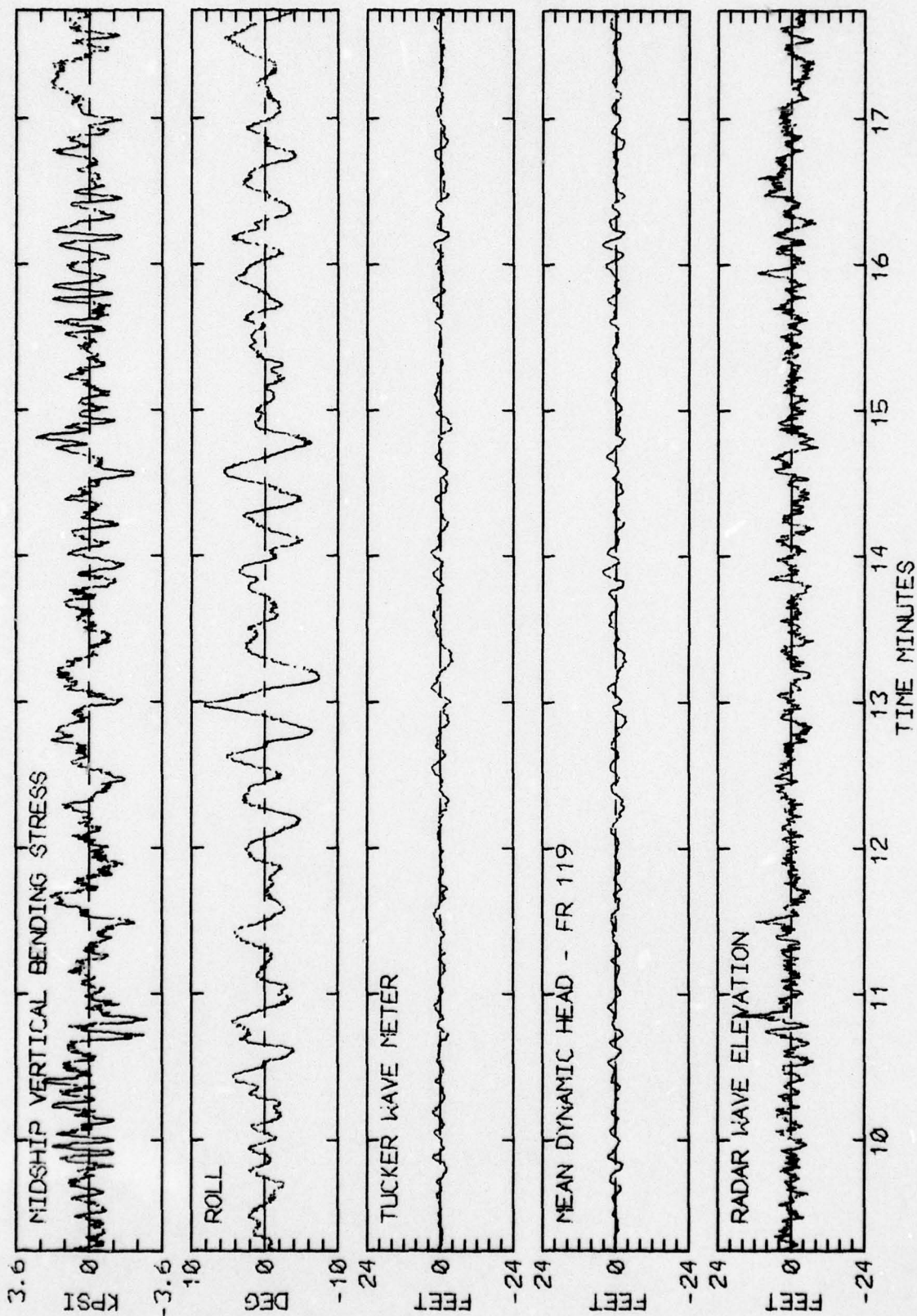
RUN 1033 -- VOYAGE 34E -- TAPE 157 -- INDEX 9 -- INTERVAL 33



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 01-31-74  | 0400       |      |
| POSITION                              | 40-31 N   | 59-02 W    |      |
| COURSE AND SPEED                      | 090       | 31.9 KNOTS |      |
| SEA STATE                             | 4         |            |      |
| WAVE HEIGHT                           | 2 FEET    |            |      |
| " REL DIR                             | 22 STBD   |            |      |
| SWELL HEIGHT                          | 5 FEET    |            |      |
| " REL DIR                             | 180       |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST /                               |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 3.7 KPSI  |            |      |
| 4.0 X RMS                             | 3.2 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 9.1 DEG   |            |      |
| PITCH                                 | 0.83 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.19 G    |            |      |
| DK HSE LAT ACCEL                      | 0.20 G    |            |      |
| RADAR SLANT RANGE                     | 20.6 FEET |            |      |
| VERTICAL RANGE                        | 15.3 FEET |            |      |
| DISPL AT RADAR                        | 9.7 FEET  |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| P-T SAMPLE SIZE                       | 193       | 156        | 301  |
| MAXIMUM HEIGHT                        | 5.1       | 7.0        | 17.8 |
| 10TH HIGHEST HTS                      | 3.9       | 4.5        | 11.1 |
| 3RD HIGHEST HTS                       | 2.8       | 3.4        | 8.0  |
| 4.0 RMS(SPECTRA)                      | 4.2       | 4.6        | 11.6 |



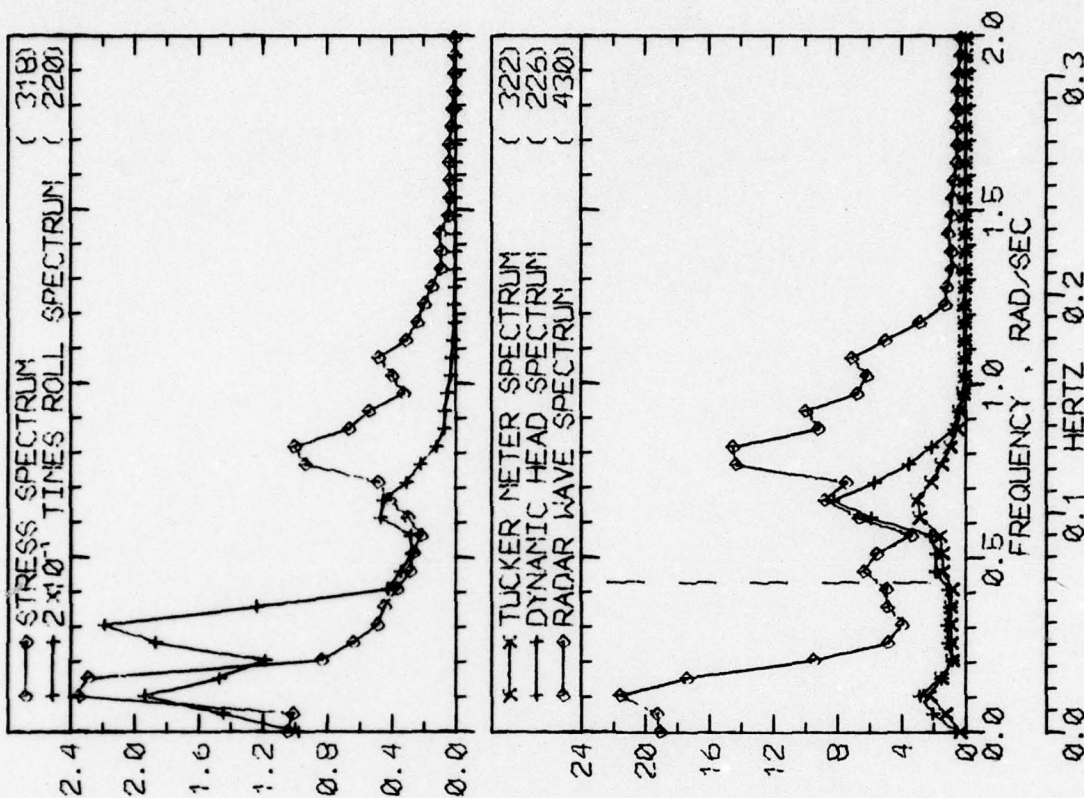
RUN 1037 -- VOYAGE 34E -- TAPE 157 -- INDEX 10 -- INTERVAL 37



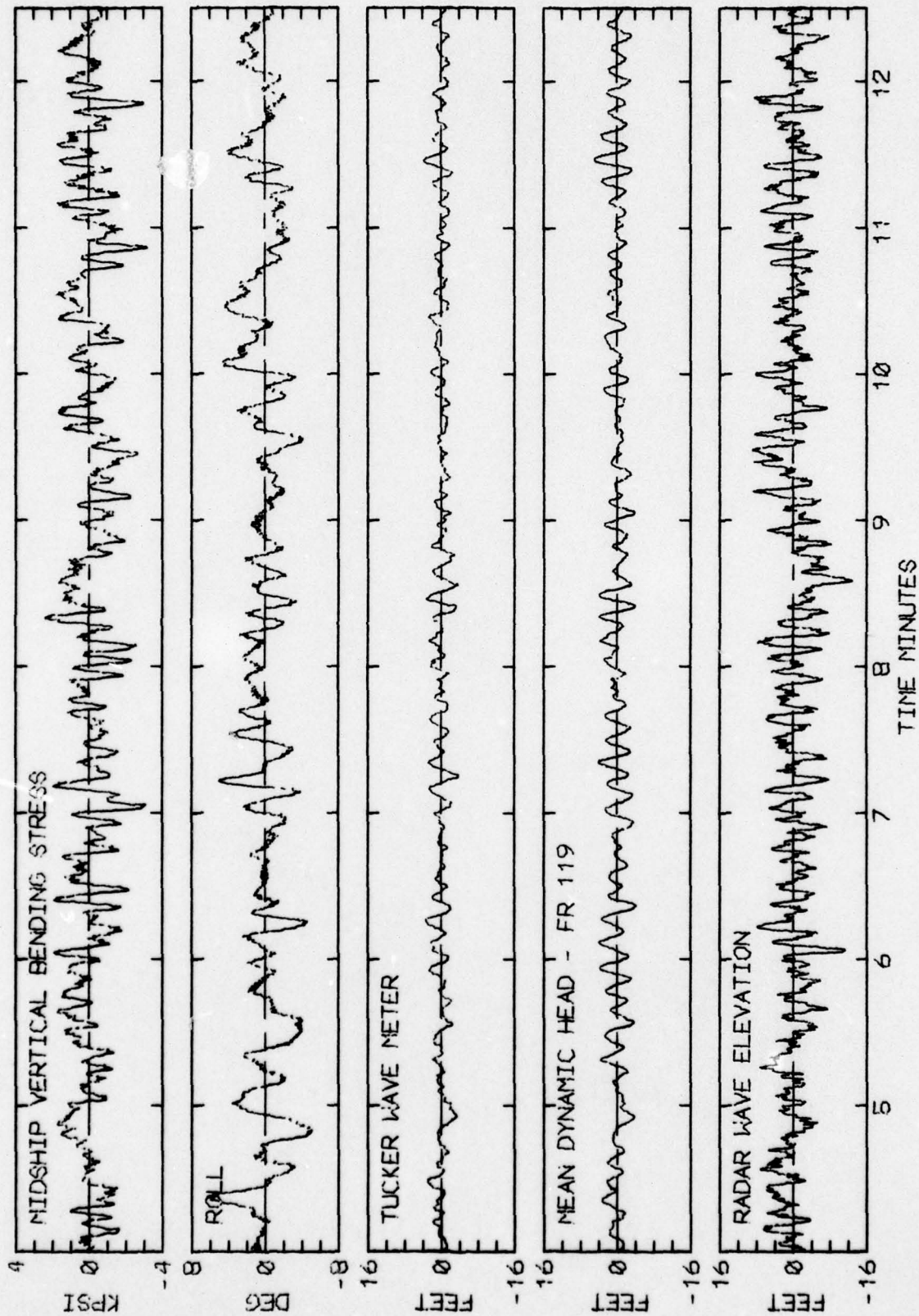
RUN 1037 -- VOYAGE 34E -- TAPE 157 -- INDEX 10 -- INTERVAL 37



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 01-31-74  | 0800       |      |
| POSITION                              | 40-31 N   | 59-02 W    |      |
| COURSE AND SPEED                      | 090       | 32.2 KNOTS |      |
| SEA STATE                             | 3         |            |      |
| WAVE HEIGHT                           | 2 FEET    |            |      |
| " REL DIR                             | 11 STBD   |            |      |
| SWELL HEIGHT                          | 5 FEET    |            |      |
| " REL DIR                             | 180       |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST /                               |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 4.5 KPSI  |            |      |
| 4.0 X RMS                             | 3.7 KPSI  |            |      |
| SUMMARY OF NOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 7.9 DEG   |            |      |
| PITCH                                 | 1.03 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.24 G    |            |      |
| DK HSE LAT ACCEL                      | 0.18 G    |            |      |
| RADAR SLANT RANGE                     | 21.7 FEET |            |      |
| VERTICAL RANGE                        | 18.3 FEET |            |      |
| DISPL AT RADAR                        | 13.3 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| P-T SAMPLE SIZE                       | 159       | 116        | 189  |
| MAXIMUM HEIGHT                        | 6.8       | 7.6        | 15.5 |
| 10TH HIGHEST HTS                      | 4.9       | 6.6        | 12.7 |
| 3RD HIGHEST HTS                       | 3.7       | 5.5        | 10.6 |
| 4.0 RMS(SPECTRA)                      | 4.7       | 6.1        | 13.8 |



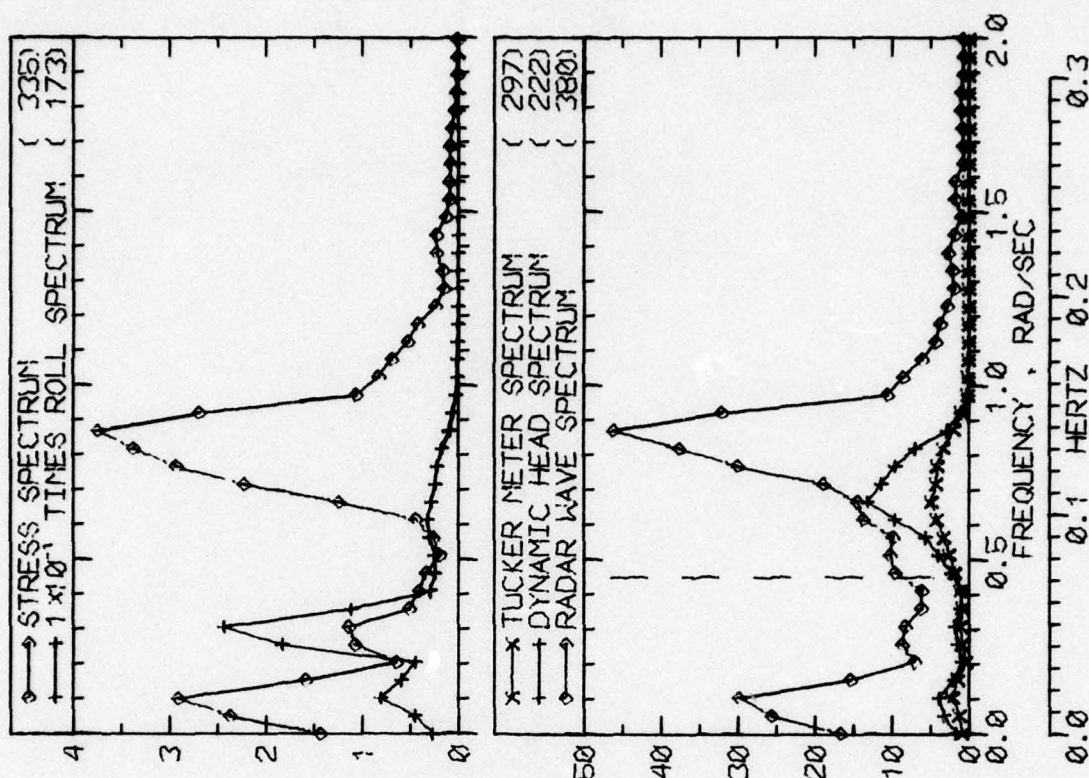
RUN 1041 -- VOYAGE 34E -- TAPE 157 -- INDEX 11 -- INTERVAL 41



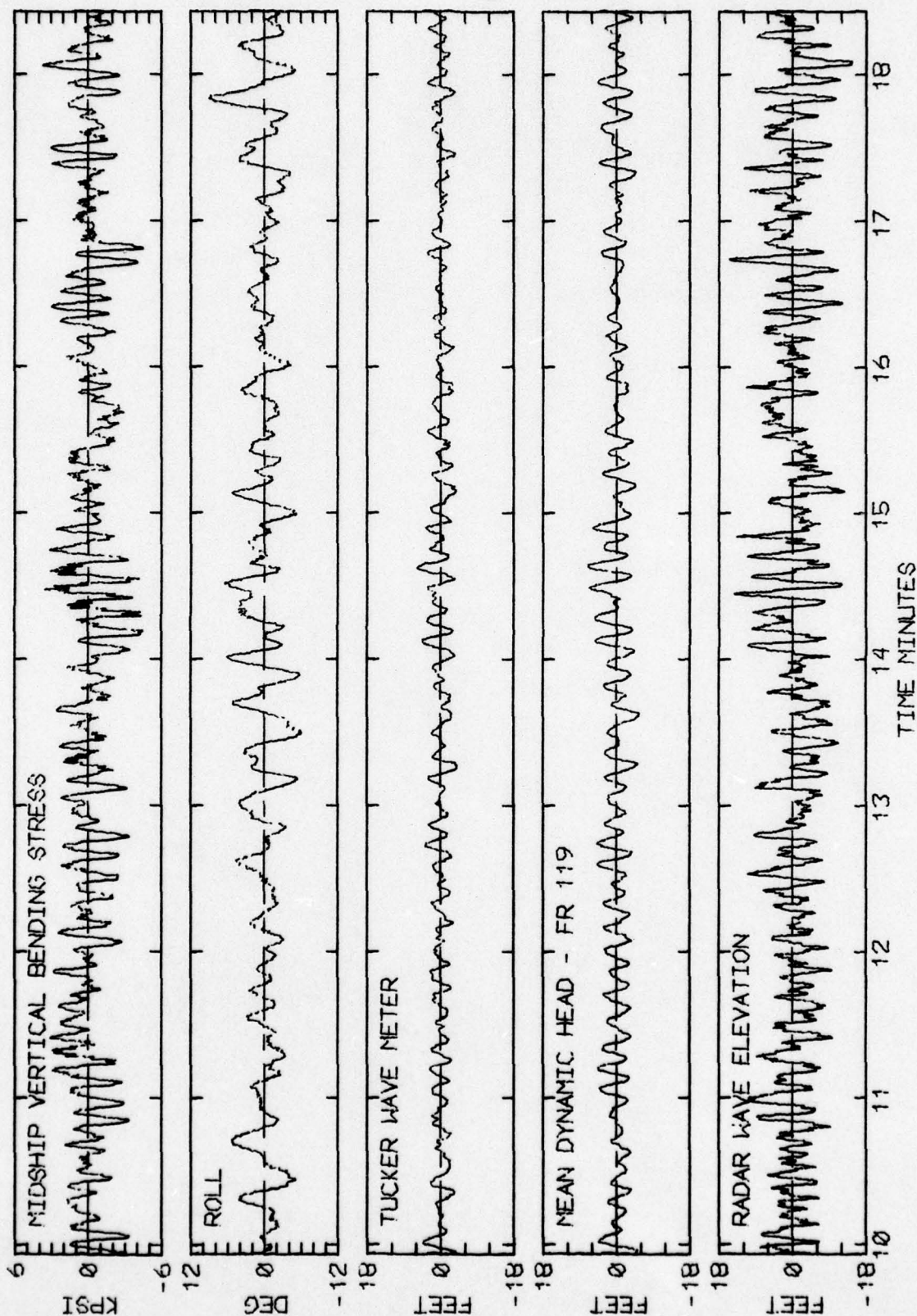
RUN 1041 -- VOYAGE 34E -- TAPE 157 -- INDEX 11 -- INTERVAL 41



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 01-31-74  | 1200       |      |
| POSITION                              | 40-59 N   | 43-08 W    |      |
| COURSE AND SPEED                      | 090       | 32.6 KNOTS |      |
| SEA STATE                             | 2         |            |      |
| WAVE HEIGHT                           | 3 FEET    |            |      |
| " REL DIR                             | 11 STBD   |            |      |
| SWELL HEIGHT                          | 8 FEET    |            |      |
| " REL DIR                             | 180       |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| PT CLDY /                             |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 7.4 KPSI  |            |      |
| 4.0 X RMS                             | 5.3 KPSI  |            |      |
| SUMMARY OF NOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 9.2 DEG   |            |      |
| PITCH                                 | 1.64 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.39 G    |            |      |
| DK HSE LAT ACCEL                      | 0.22 G    |            |      |
| RADAR SLANT RANGE                     | 30.2 FEET |            |      |
| VERTICAL RANGE                        | 28.3 FEET |            |      |
| DISPL AT RADAR                        | 21.0 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| P-T SAMPLE SIZE                       | 160       | 111        | 188  |
| MAXIMUM HEIGHT                        | 7.8       | 10.1       | 27.5 |
| 10TH HIGHEST HTS                      | 6.1       | 8.8        | 20.4 |
| 3RD HIGHEST HTS                       | 5.0       | 7.4        | 15.8 |
| 4.0 RMS(SPECTRA)                      | 6.0       | 8.3        | 18.4 |



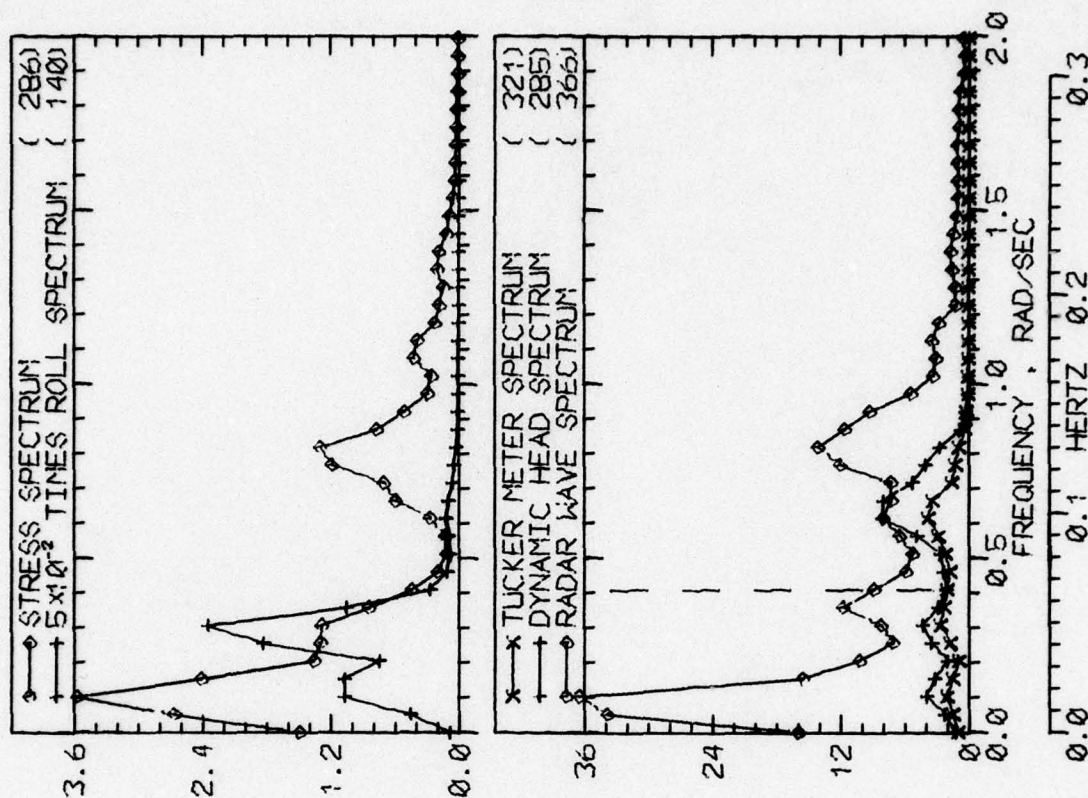
RUN 1045 -- VOYAGE 34E -- TAPE 157 -- INDEX 12 -- INTERVAL 45



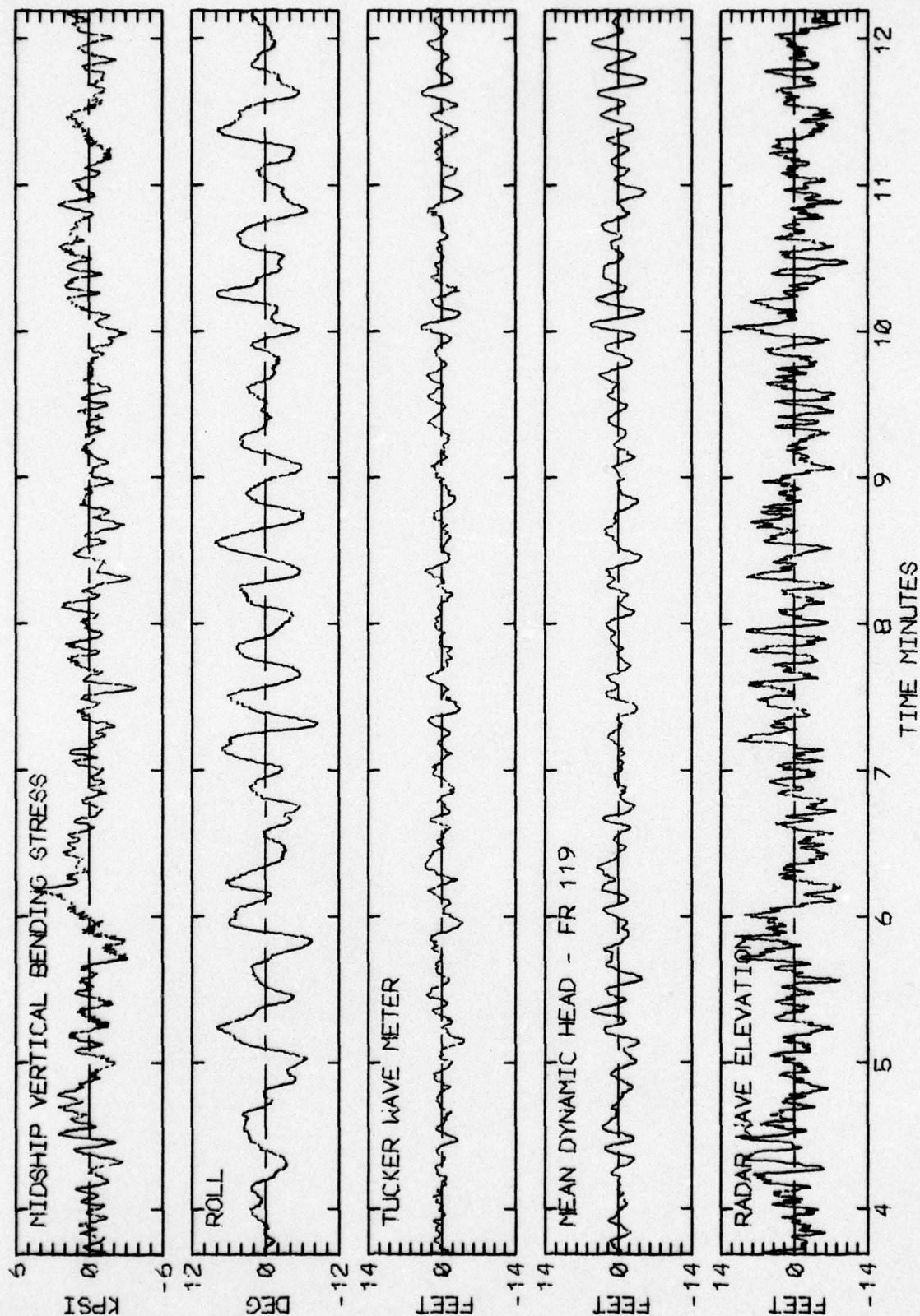
RUN 1045 -- VOYAGE 34E -- TAPE 157 -- INDEX 12 -- INTERVAL 45



| LOG BOOK DATA                   |                                       |      |            |
|---------------------------------|---------------------------------------|------|------------|
| DATE AND TIME                   | 01-31-74                              |      | 1600       |
| POSITION                        | 40-59 N                               |      | 43-08 W    |
| COURSE AND SPEED                | 073 ,                                 |      | 32.3 KNOTS |
| SEA STATE                       | 2                                     |      |            |
| WAVE HEIGHT                     | 2 FEET                                |      |            |
| " REL DIR                       | 95 PORT                               |      |            |
| SWELL HEIGHT                    | 8 FEET                                |      |            |
| " REL DIR                       | 152 STBD                              |      |            |
| PT CLDY /                       | ----- VISUAL WEATHER / COMMENTS ----- |      |            |
| MIDSHIP VERTICAL BENDING STRESS |                                       |      |            |
| MAXIMUM PK-TR                   | 4.8 KPSI                              |      |            |
| 4.0 X RMS                       | 4.4 KPSI                              |      |            |
| SUMMARY OF NOTIONS (4.0 X RMS)  |                                       |      |            |
| ROLL                            | 12.6 DEG                              |      |            |
| PITCH                           | 1.09 DEG                              |      |            |
| DK HSE VERT ACCEL               | 0.26 G                                |      |            |
| DK HSE LAT ACCEL                | 0.27 G                                |      |            |
| RADAR SLANT RANGE               | 25.0 FEET                             |      |            |
| VERTICAL RANGE                  | 19.8 FEET                             |      |            |
| DISPL AT RADAR                  | 14.7 FEET                             |      |            |
| WAVE HEIGHT STATISTICS (FEET)   |                                       |      |            |
| P-T SAMPLE SIZE                 | 135                                   | 105  | 193        |
| MAXIMUM HEIGHT                  | 7.4                                   | 10.5 | 18.2       |
| 10TH HIGHEST HTS                | 5.8                                   | 8.0  | 13.8       |
| 3RD HIGHEST HTS                 | 4.4                                   | 6.4  | 11.1       |
| 4.0 RMS(SPECTRA)                | 5.4                                   | 7.3  | 15.1       |



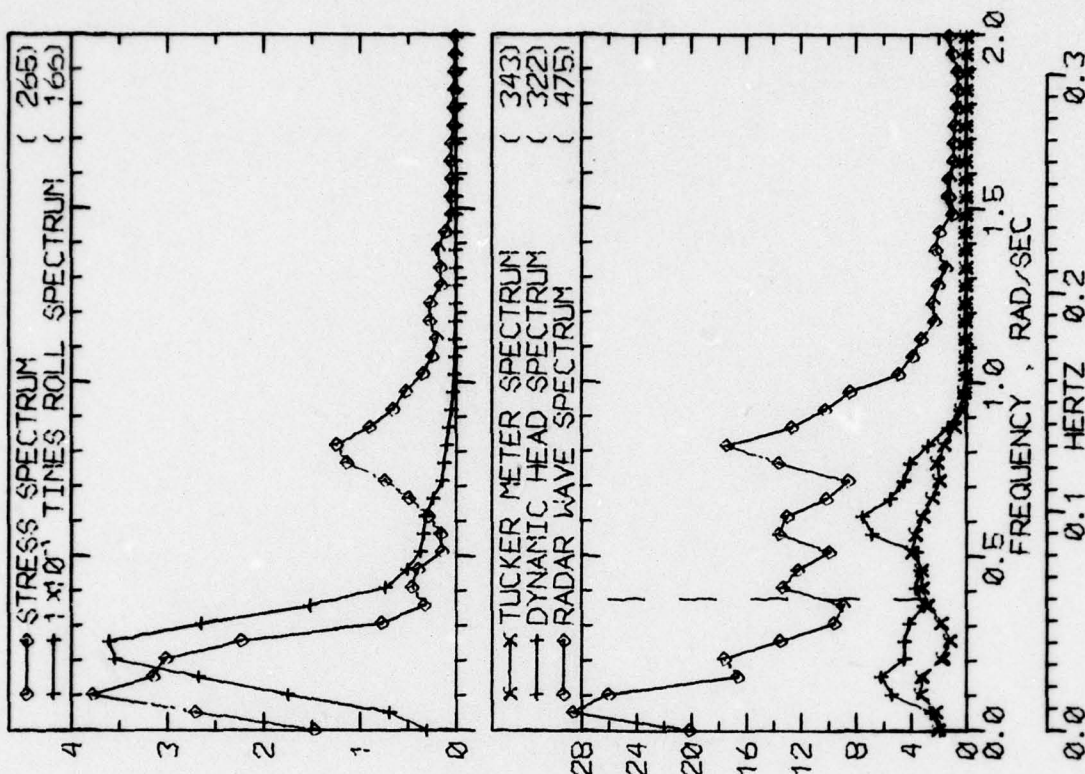
RUN 1049 -- VOYAGE 34E -- TAPE 157 -- INDEX 13 -- INTERVAL 49



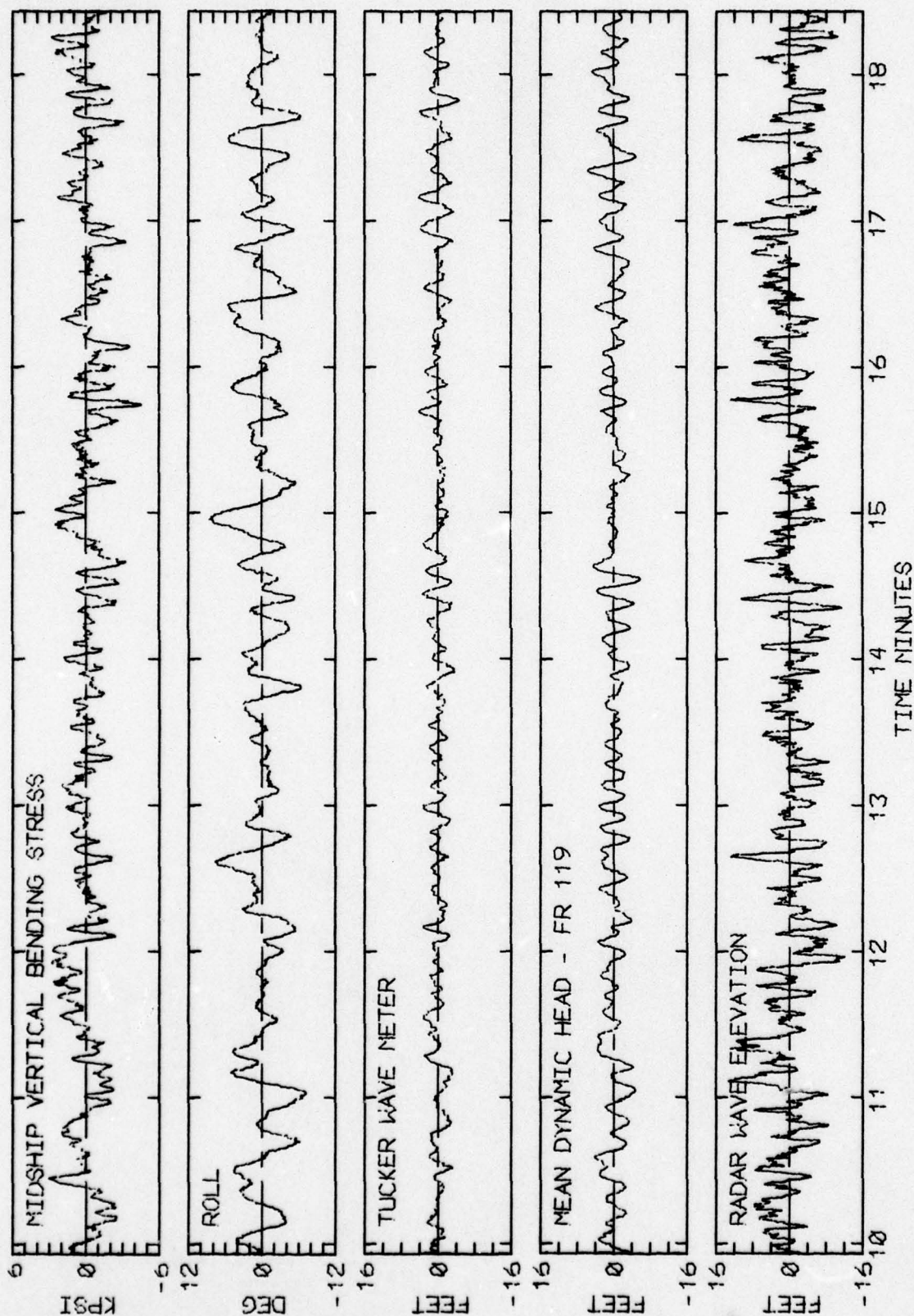
RUN 1049 -- VOYAGE 34E -- TAPE 157 -- INDEX 13 -- INTERVAL 49



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 01-31-74  | 2000       |      |
| POSITION                              | 40-59 N   | 43-08 W    |      |
| COURSE AND SPEED                      | 073       | 32.1 KNOTS |      |
| SEA STATE                             | 2         |            |      |
| WAVE HEIGHT                           | 2 FEET    |            |      |
| " REL DIR                             | 50 PORT   |            |      |
| SWELL HEIGHT                          | 8 FEET    |            |      |
| " REL DIR                             | 152 STBD  |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| PT CLDY /                             |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 7.7 KPSI  |            |      |
| 4.0 X RMS                             | 4.7 KPSI  |            |      |
| SUMMARY OF MOTIONS ( 4.0 X RMS)       |           |            |      |
| ROLL                                  | 12.7 DEG  |            |      |
| PITCH                                 | 1.13 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.26 G    |            |      |
| DK HSE LAT ACCEL                      | 0.20 G    |            |      |
| RADAR SLANT RANGE                     | 25.0 FEET |            |      |
| VERTICAL RANGE                        | 20.7 FEET |            |      |
| DISPL AT RADAR                        | 15.7 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| P-T SAMPLE SIZE                       | 154       | 98         | 193  |
| MAXIMUM HEIGHT                        | 8.6       | 10.5       | 21.0 |
| 10TH HIGHEST HTS                      | 6.1       | 8.4        | 16.7 |
| 3RD HIGHEST HTS                       | 4.6       | 6.9        | 12.5 |
| 4.0 RMS(SPECTRA)                      | 6.1       | 7.9        | 16.4 |



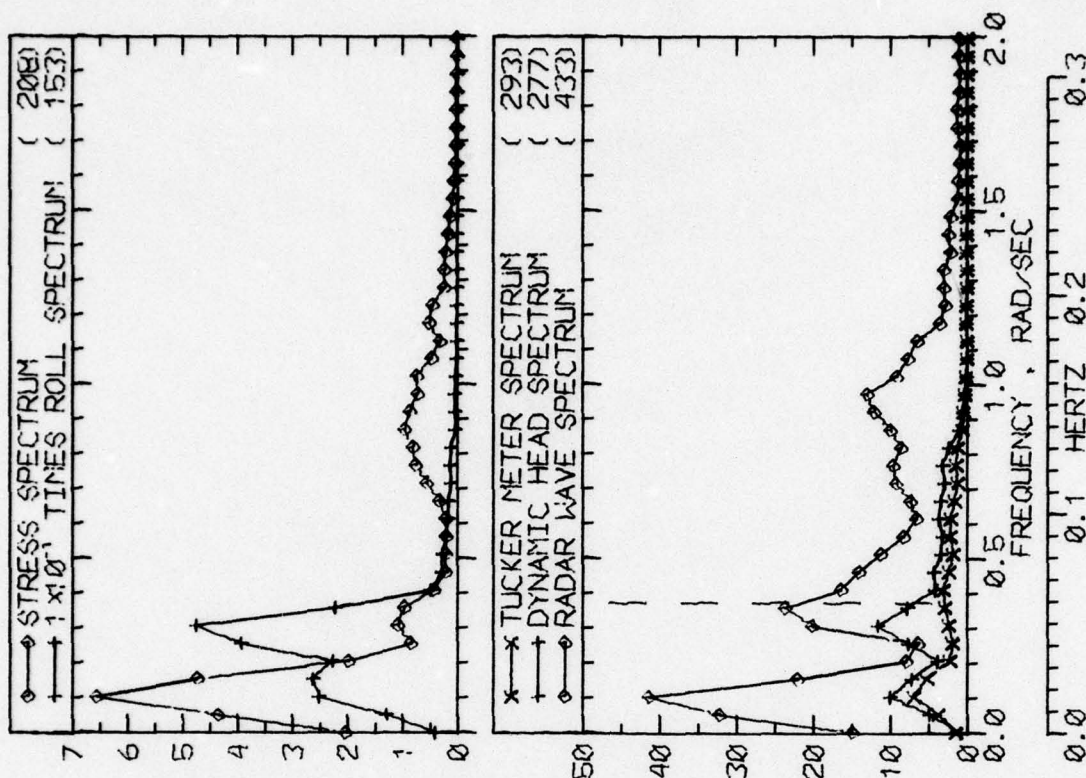
RUN 1101 -- VOYAGE 34E -- TAPE 159 -- INDEX 14 -- INTERVAL 1



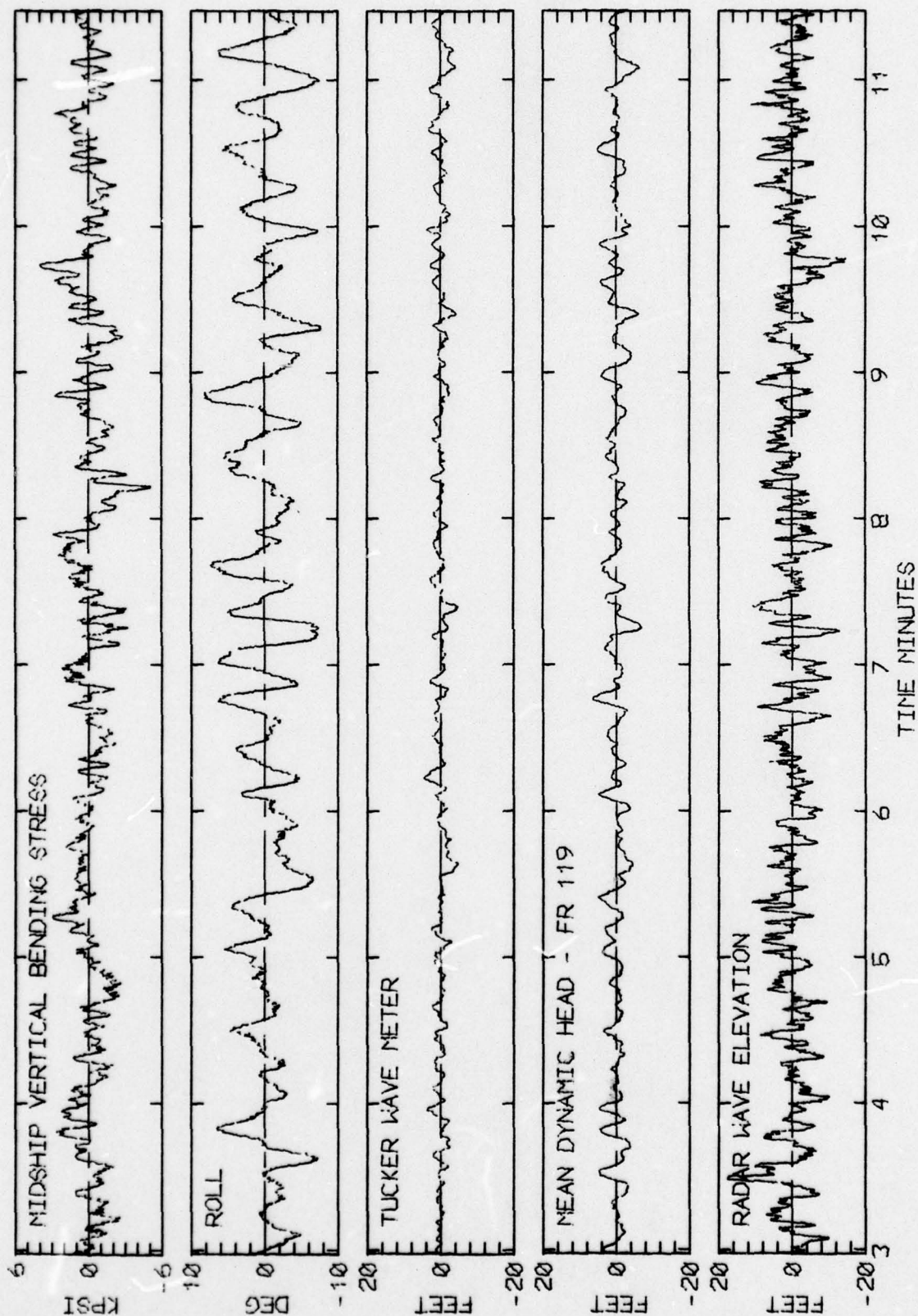
RUN 1101 -- VOYAGE 34E -- TAPE 159 -- INDEX 14 -- INTERVAL 1



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 01-31-74  | 2400       |      |
| POSITION                              | 40-59 N   | 43-08 W    |      |
| COURSE AND SPEED                      | 073       | 32.3 KNOTS |      |
| SEA STATE                             | 4         |            |      |
| WAVE HEIGHT                           | 2 FEET    |            |      |
| " REL DIR                             | 95 PORT   |            |      |
| SWELL HEIGHT                          | 8 FEET    |            |      |
| " REL DIR                             | 152 STBD  |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| PT CLDY /                             |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 5.3 KPSI  |            |      |
| 4.0 X RMS                             | 5.1 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 13.4 DEG  |            |      |
| PITCH                                 | 1.11 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.25 G    |            |      |
| DK HSE LAT ACCEL                      | 0.30 G    |            |      |
| RADAR SLANT RANGE                     | 25.7 FEET |            |      |
| VERTICAL RANGE                        | 20.9 FEET |            |      |
| DISPL AT RADAR                        | 14.1 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| TUCKER/DYN. HEAD/RADAR                |           |            |      |
| P-T SAMPLE SIZE                       | 158       | 104        | 195  |
| MAXIMUM HEIGHT                        | 7.9       | 11.6       | 23.6 |
| 10TH HIGHEST HTS                      | 5.8       | 8.9        | 16.7 |
| 3RD HIGHEST HTS                       | 4.0       | 6.9        | 12.9 |
| 4.0 RMS(SPECTRA)                      | 6.2       | 8.5        | 17.3 |



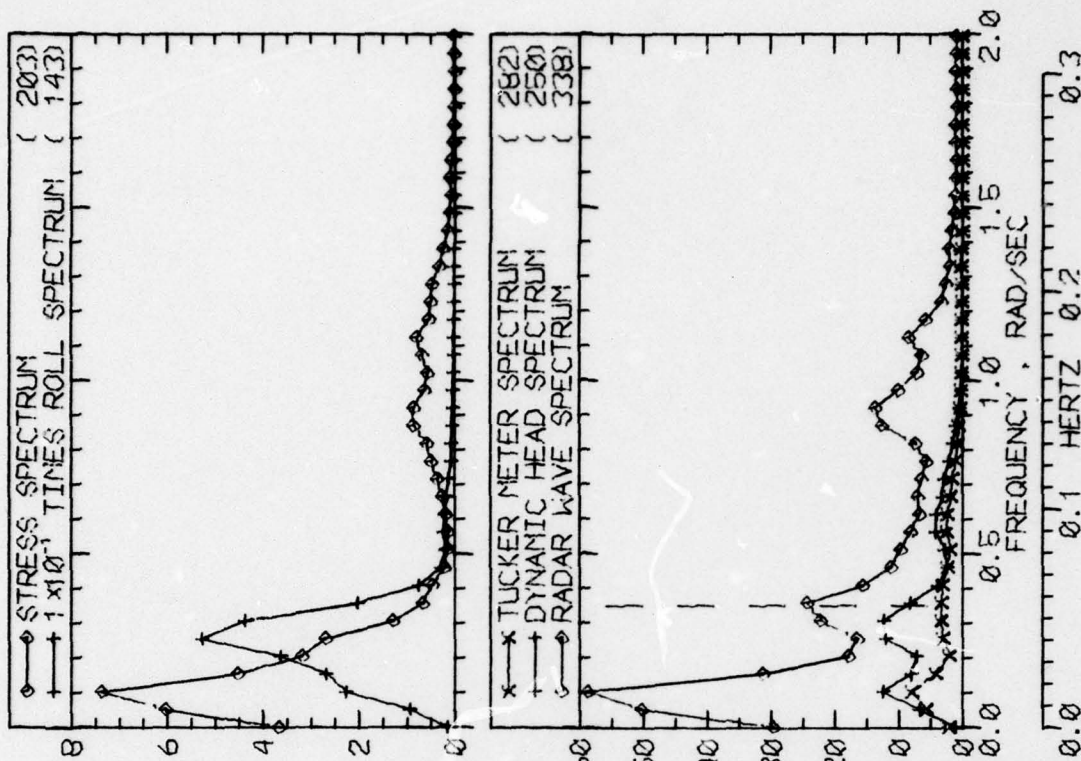
RUN 1105 -- VOYAGE 34E -- TAPE 159 -- INDEX 15 -- INTERVAL 5



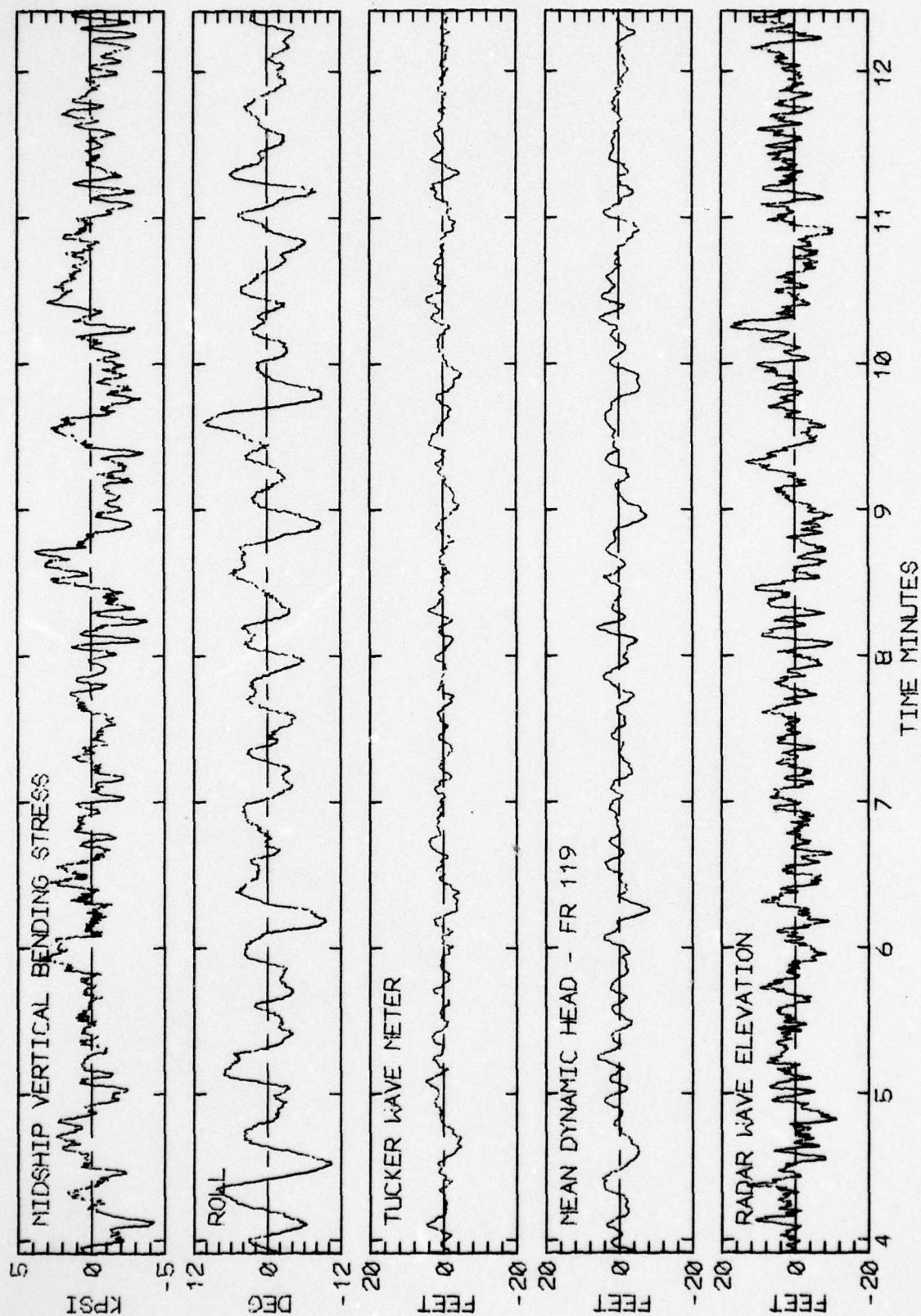
RUN 1105 -- VOYAGE 34E -- TAPE 159 -- INDEX 15 -- INTERVAL 5



| LOG BOOK DATA                   |                                       |
|---------------------------------|---------------------------------------|
| DATE AND TIME                   | 02-01-74 0400                         |
| POSITION                        | 40-59 N 43-08 W                       |
| COURSE AND SPEED                | 073 , 31.8 KNOTS                      |
| SEA STATE                       | 4                                     |
| WAVE HEIGHT                     | 2 FEET                                |
| " REL DIR                       | 95 PORT                               |
| SWELL HEIGHT                    | 8 FEET                                |
| " REL DIR                       | 107 STBD                              |
| PT CLDY /                       | ----- VISUAL WEATHER / COMMENTS ----- |
| MIDSHIP VERTICAL BENDING STRESS |                                       |
| MAXIMUM PK-TR                   | 6.4 KPSI                              |
| 4.0 X RMS                       | 5.6 KPSI                              |
| SUMMARY OF MOTIONS (4.0 X RMS)  |                                       |
| ROLL                            | 13.9 DEG                              |
| PITCH                           | 1.04 DEG                              |
| DK HSE VERT ACCEL               | 0.23 G                                |
| DK HSE LAT ACCEL                | 0.30 G                                |
| RADAR SLANT RANGE               | 26.2 FEET                             |
| VERTICAL RANGE                  | 21.4 FEET                             |
| DISPL AT RADAR                  | 13.0 FEET                             |
| WAVE HEIGHT STATISTICS (FEET)   |                                       |
| P-T SAMPLE SIZE                 | 156 93 177                            |
| MAXIMUM HEIGHT                  | 8.4 12.4 22.0                         |
| 10TH HIGHEST HTS                | 6.2 9.3 16.9                          |
| 3RD HIGHEST HTS                 | 4.3 7.2 13.1                          |
| 4.0 RMS(SPECTRA)                | 6.5 9.0 18.6                          |



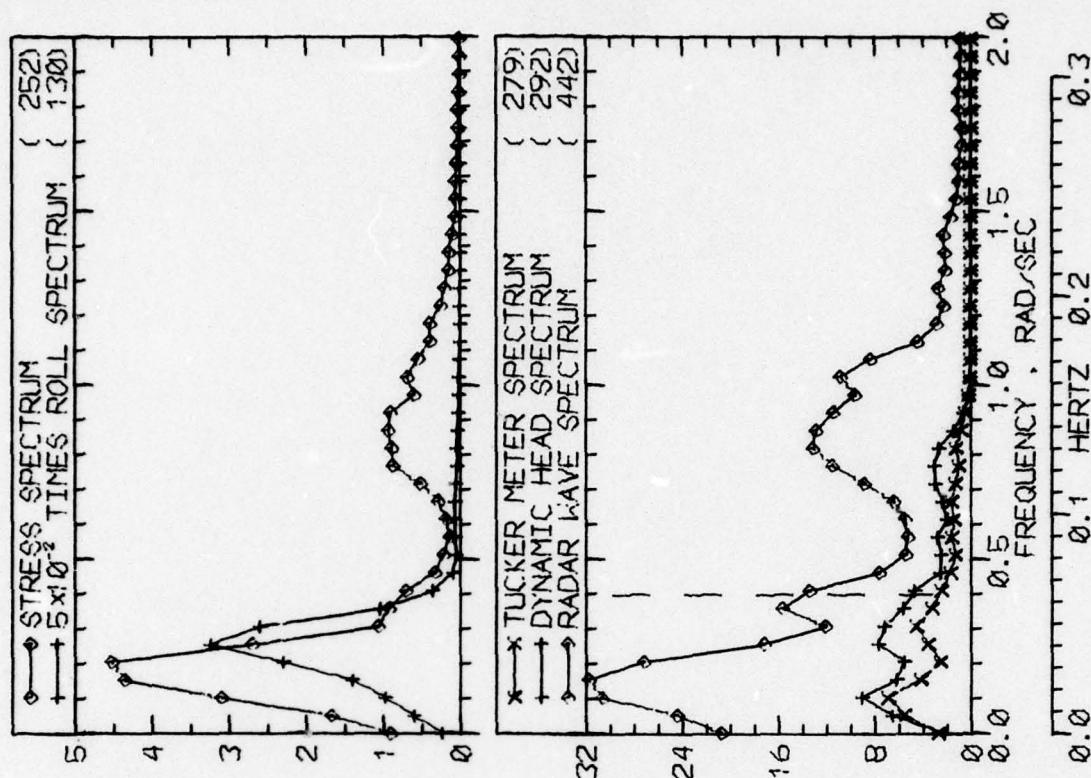
RUN 1109 -- VOYAGE 34E -- TAPE 159 -- INDEX 16 -- INTERVAL 9



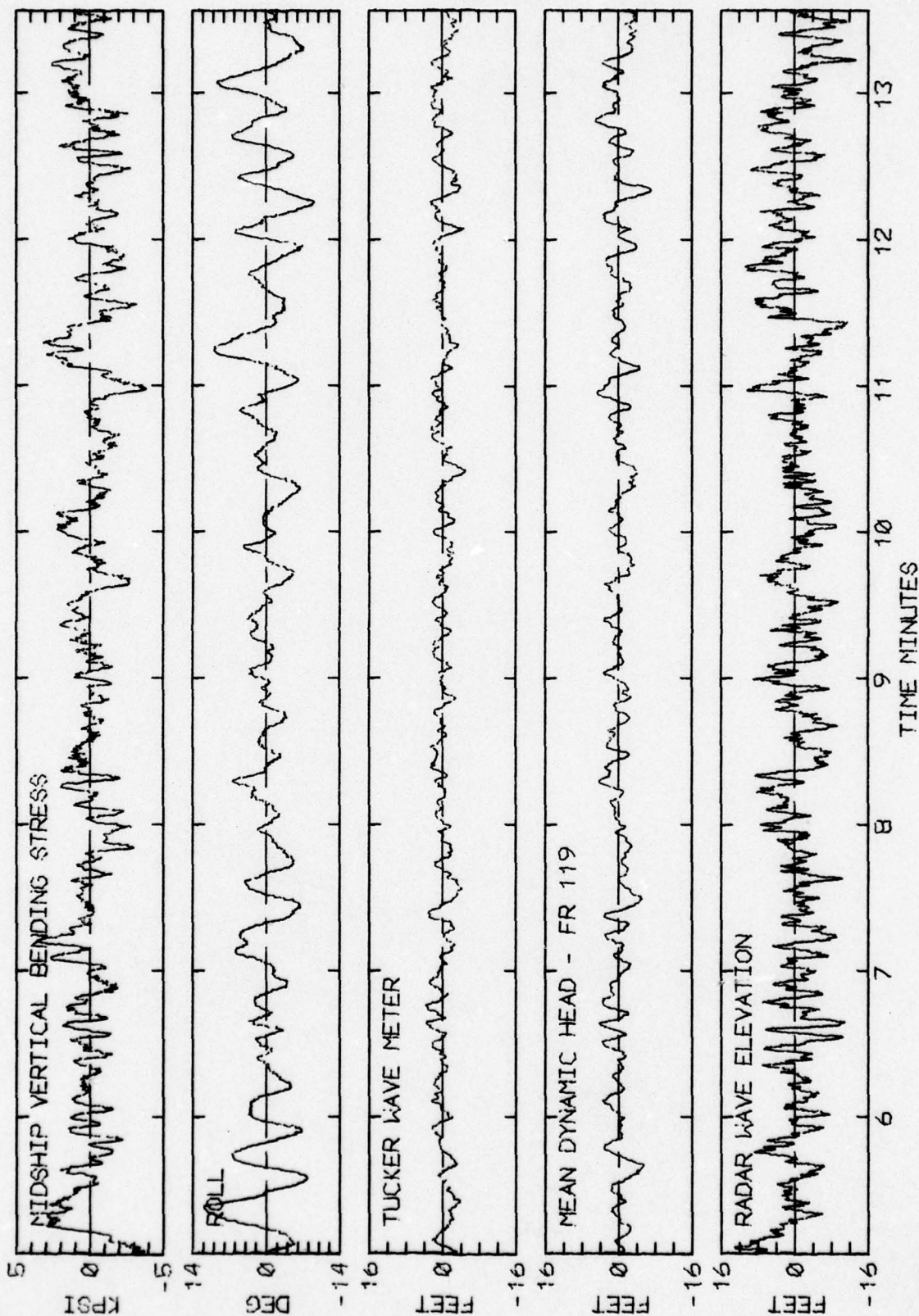
RUN 1109 -- VOYAGE 34E -- TAPE 159 -- INDEX 16 -- INTERVAL 9



| LOG BOOK DATA                   |                                       |
|---------------------------------|---------------------------------------|
| DATE AND TIME                   | 02-01-74 0600                         |
| POSITION                        | 40-59 N 43-08 W                       |
| COURSE AND SPEED                | 073 , 32.3 KNOTS                      |
| SEA STATE                       | 4                                     |
| WAVE HEIGHT                     | 2 FEET                                |
| " REL DIR                       | 118 PORT                              |
| SWELL HEIGHT                    | 8 FEET                                |
| " REL DIR                       | 107 STBD                              |
| PT CLDY /                       | ----- VISUAL WEATHER / COMMENTS ----- |
| MIDSHIP VERTICAL BENDING STRESS |                                       |
| MAXIMUM PK-TR                   | 6.6 KPSI                              |
| 4.0 X RMS                       | 4.9 KPSI                              |
| SUMMARY OF MOTIONS (4.0 X RMS)  |                                       |
| ROLL                            | 14.8 DEG                              |
| PITCH                           | 1.13 DEG                              |
| DK HSE VERT ACCEL               | 0.26 G                                |
| DK HSE LAT ACCEL                | 0.33 G                                |
| RADAR SLANT RANGE               | 26.3 FEET                             |
| VERTICAL RANGE                  | 21.8 FEET                             |
| DISPL AT RADAR                  | 13.7 FEET                             |
| WAVE HEIGHT STATISTICS (FEET)   |                                       |
| P-T SAMPLE SIZE                 | TUCKER/DYN. HEAD/RADAR                |
| MAXIMUM HEIGHT                  | 134 110 192                           |
| 10TH HIGHEST HTS                | 8.1 10.3 17.3                         |
| 3RD HIGHEST HTS                 | 5.8 8.0 15.4                          |
| 4.0 RMS(SPECTRA)                | 4.3 6.0 12.5                          |
|                                 | 6.3 8.0 17.0                          |



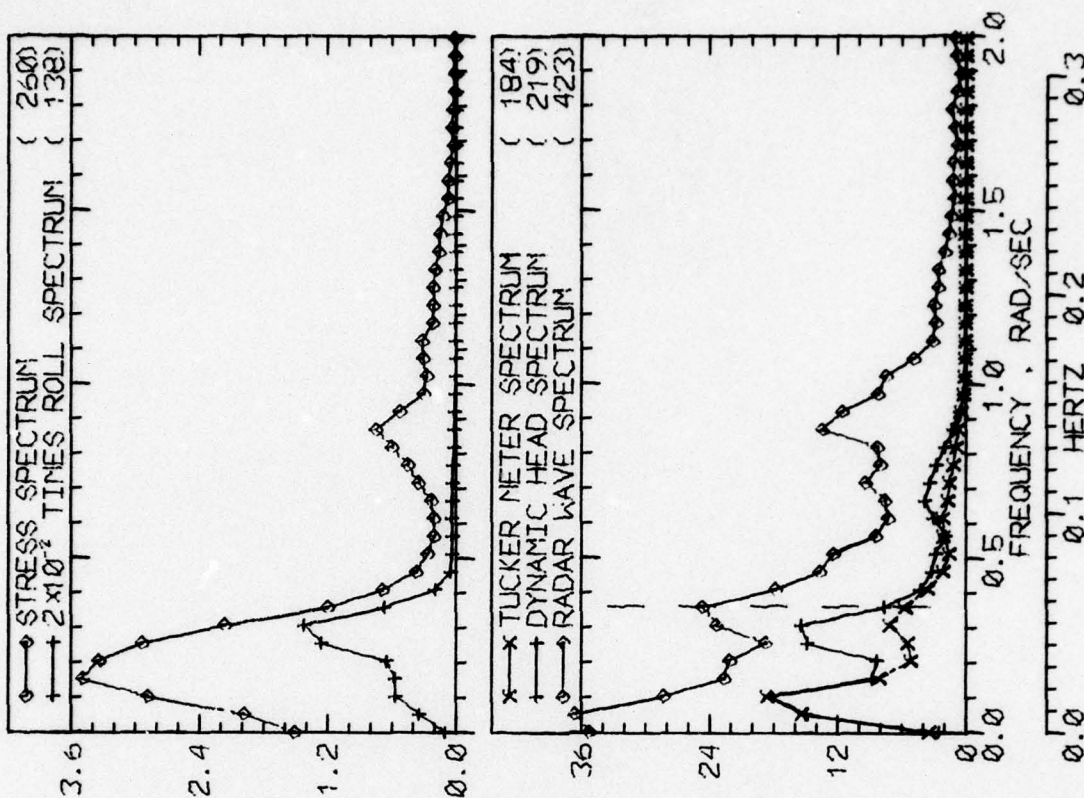
RUN 1113 -- VOYAGE 34E -- TAPE 159 -- INDEX 17 -- INTERVAL 13



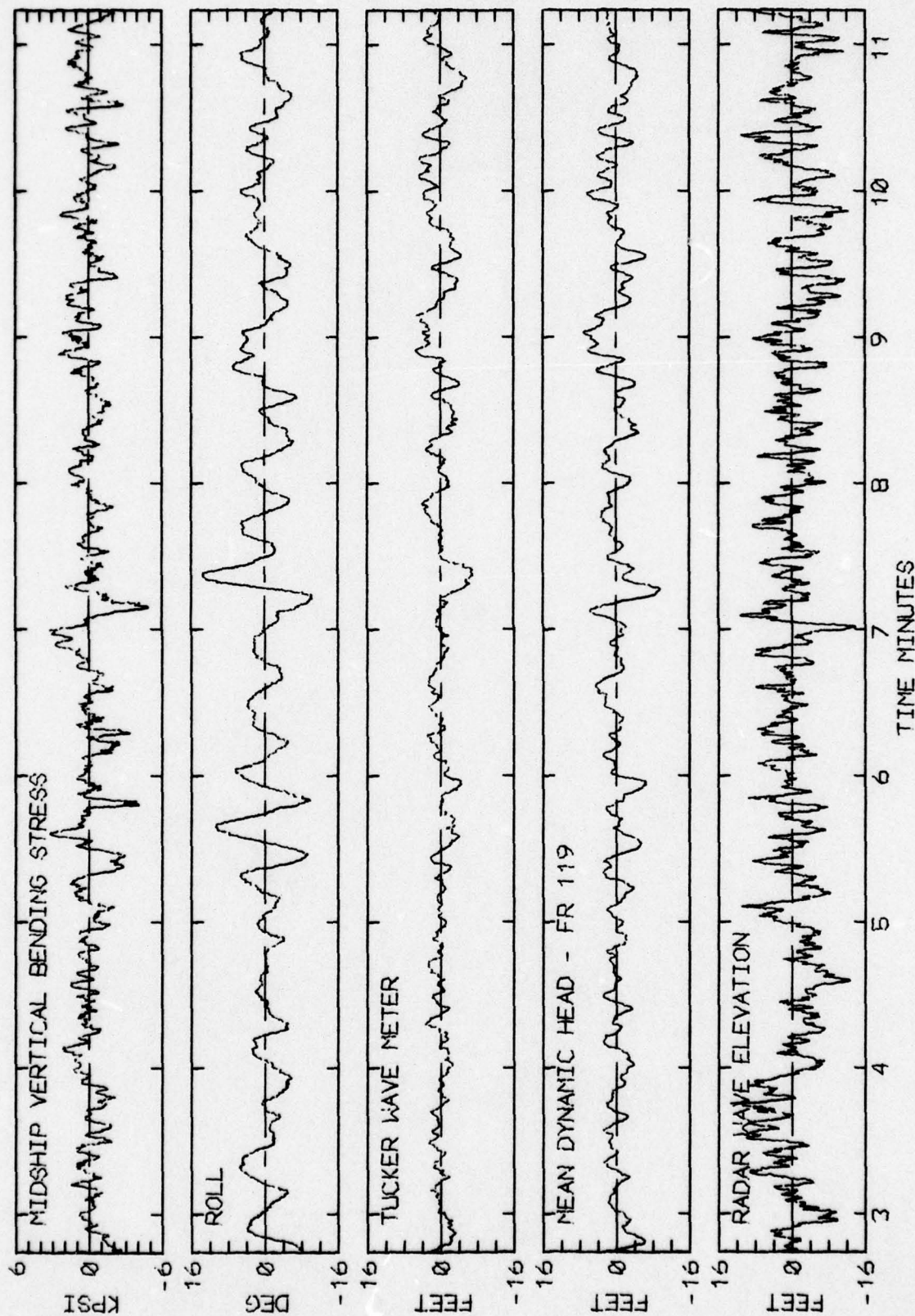
RUN 1113 -- VOYAGE 34E -- TAPE 159 -- INDEX 17 -- INTERVAL 13



| LOG BOOK DATA                          |           |      |            |
|----------------------------------------|-----------|------|------------|
| DATE AND TIME                          | 02-01-74  |      | 1200       |
| POSITION                               | 44-27 N   |      | 27-18 W    |
| COURSE AND SPEED                       | 072 ,     |      | 32.3 KNOTS |
| SEA STATE                              | 5         |      |            |
| WAVE HEIGHT                            | 3 FEET    |      |            |
| " REL DIR                              | 117 PORT  |      |            |
| SWELL HEIGHT                           | 8 FEET    |      |            |
| " REL DIR                              | 63 STBD   |      |            |
| ----- VISUAL WEATHER / COMMENTS -----  |           |      |            |
| PT CLDY /                              |           |      |            |
| <u>NIDSHIP VERTICAL BENDING STRESS</u> |           |      |            |
| MAXIMUM PK-TR                          | 8.8 KPSI  |      |            |
| 4.0 X RMS                              | 4.7 KPSI  |      |            |
| <u>SUMMARY OF MOTIONS (4.0 X RMS)</u>  |           |      |            |
| ROLL                                   | 15.7 DEG  |      |            |
| PITCH                                  | 0.98 DEG  |      |            |
| DK HSE VERT ACCEL                      | 0.24 G    |      |            |
| DK HSE LAT ACCEL                       | 0.35 G    |      |            |
| RADAR SLANT RANGE                      | 26.9 FEET |      |            |
| VERTICAL RANGE                         | 20.7 FEET |      |            |
| DISPL AT RADAR                         | 13.2 FEET |      |            |
| <u>WAVE HEIGHT STATISTICS (FEET)</u>   |           |      |            |
| <u>TUCKER/DYN. HEAD/RADAR</u>          |           |      |            |
| P-T SAMPLE SIZE                        | 116       | 73   | 173        |
| MAXIMUM HEIGHT                         | 9.3       | 15.2 | 22.1       |
| 10TH HIGHEST HTS                       | 7.5       | 10.7 | 17.6       |
| 3RD HIGHEST HTS                        | 5.3       | 8.2  | 13.4       |
| 4.0 RMS(SPECTRA)                       | 8.5       | 9.9  | 17.7       |



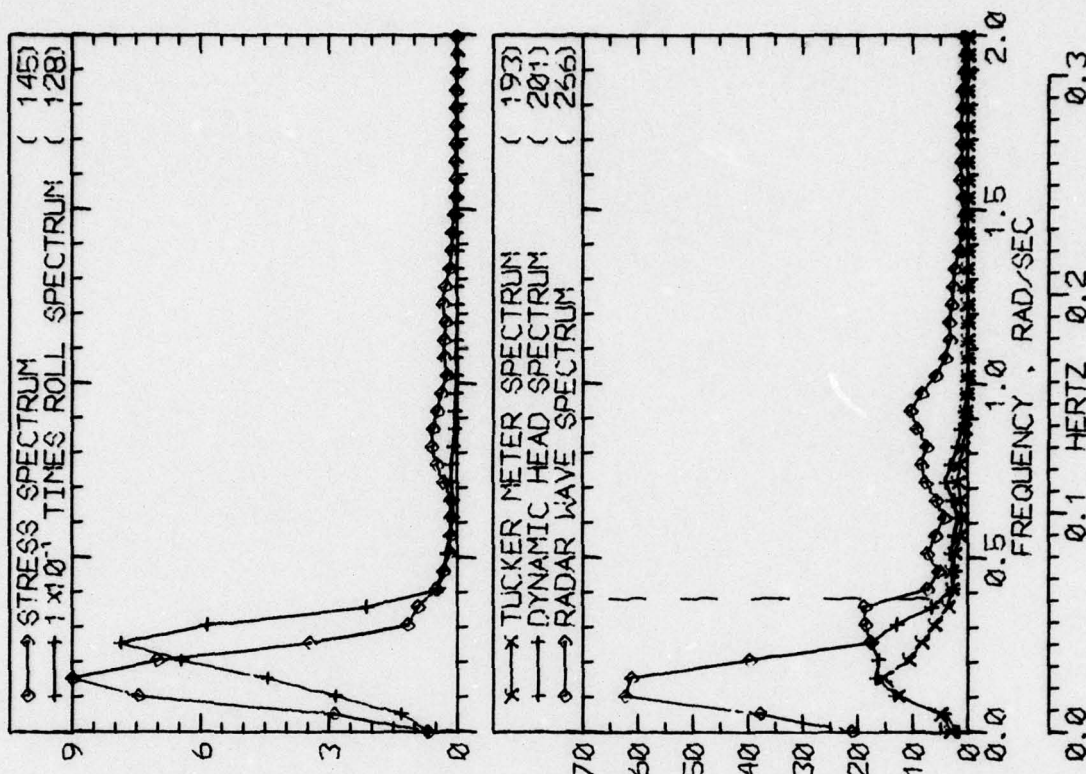
RUN 1117 -- VOYAGE 34E -- TAPE 159 -- INDEX 18 -- INTERVAL 17



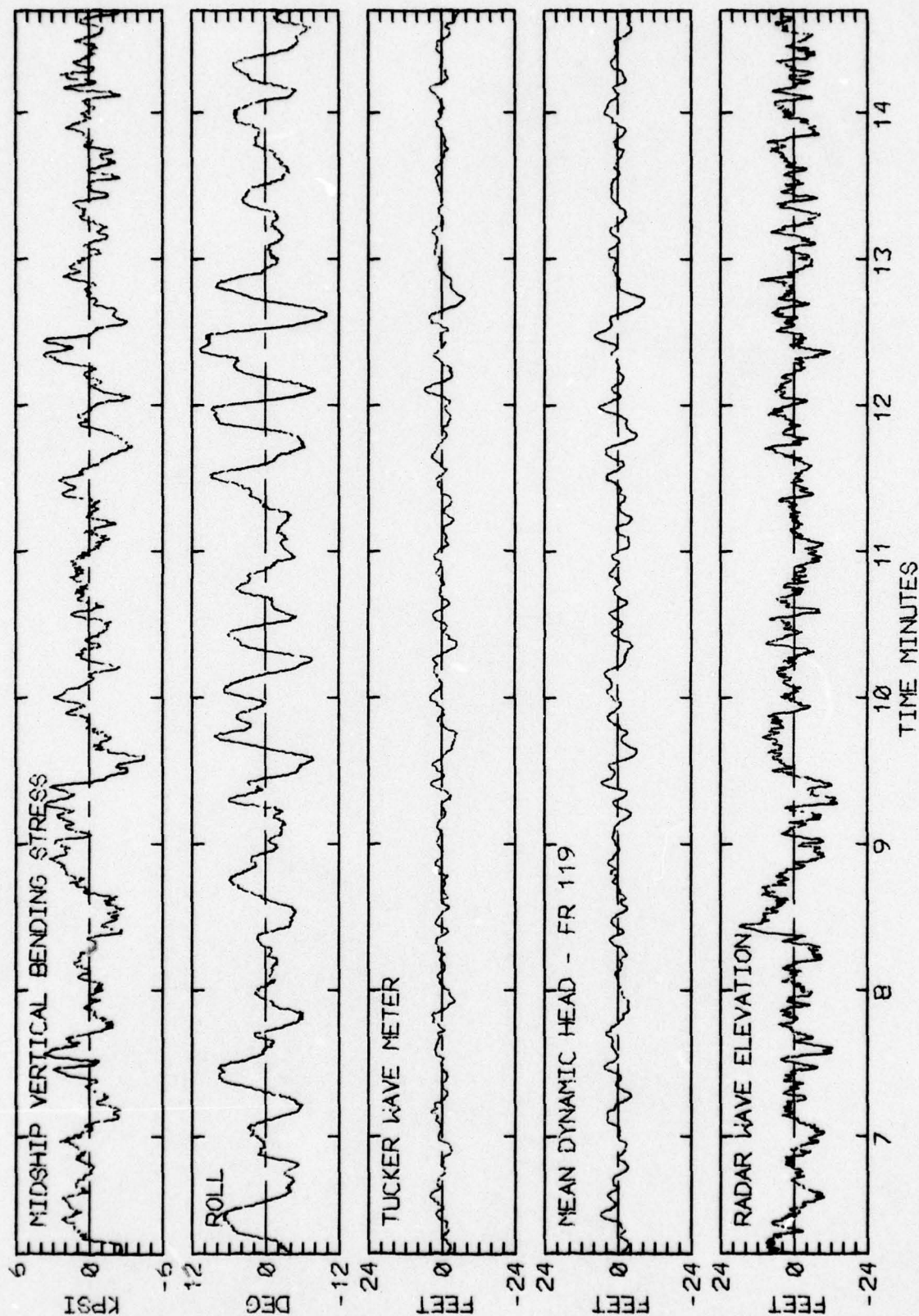
RUN 1117 -- VOYAGE 34E -- TAPE 159 -- INDEX 18 -- INTERVAL 17



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-01-74  | 1600       |      |
| POSITION                              | 44-27 N   | 27-18 W    |      |
| COURSE AND SPEED                      | 072       | 32.4 KNOTS |      |
| SEA STATE                             | 7         |            |      |
| WAVE HEIGHT                           | 4 FEET    |            |      |
| " REL DIR                             | 151 PORT  |            |      |
| SWELL HEIGHT                          | 8 FEET    |            |      |
| " REL DIR                             | 63 STBD   |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| PT CLDY /                             |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 7.3 KPSI  |            |      |
| 4.0 X RMS                             | 5.7 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 16.5 DEG  |            |      |
| PITCH                                 | 0.95 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.23 G    |            |      |
| DK HSE LAT ACCEL                      | 0.34 G    |            |      |
| RADAR SLANT RANGE                     | 27.0 FEET |            |      |
| VERTICAL RANGE                        | 22.0 FEET |            |      |
| DISPL AT RADAR                        | 12.6 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| P-T SAMPLE SIZE                       | 105       | 77         | 178  |
| MAXIMUM HEIGHT                        | 11.6      | 16.3       | 21.2 |
| 10TH HIGHEST HTS                      | 8.5       | 11.3       | 16.1 |
| 3RD HIGHEST HTS                       | 5.7       | 7.9        | 12.0 |
| 4.0 RMS(SPECTRA)                      | 8.2       | 9.7        | 18.3 |



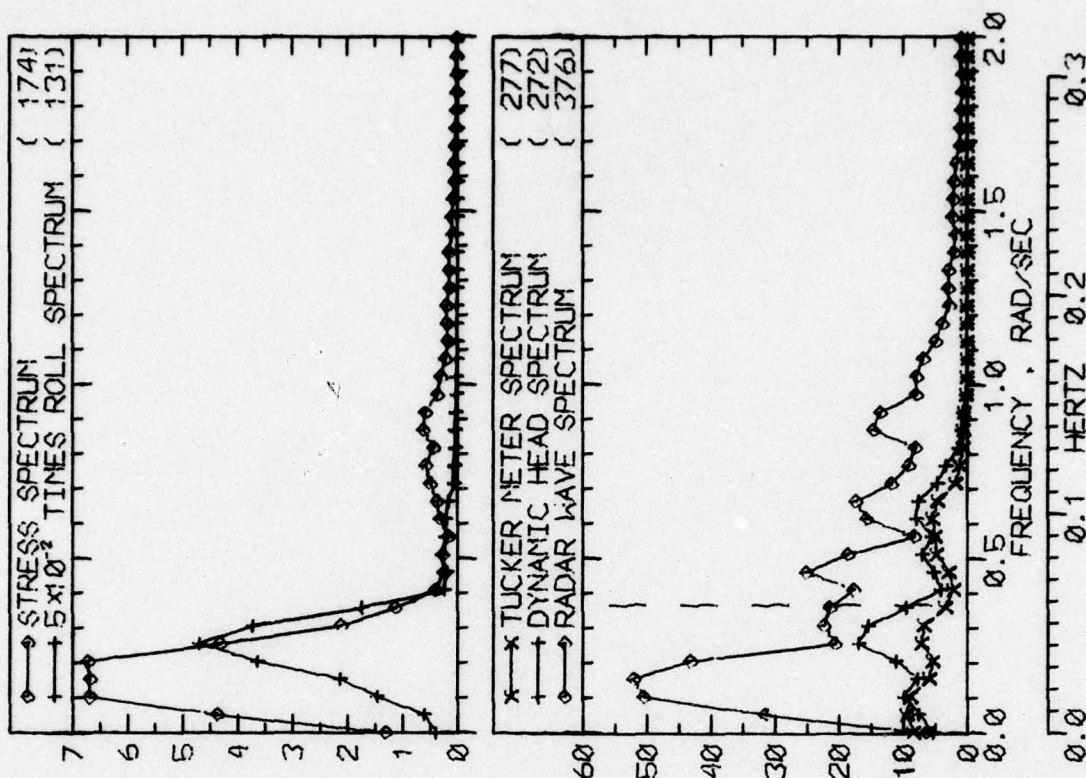
RUN 1122 -- VOYAGE 34E -- TAPE 159 -- INDEX 19 -- INTERVAL 22



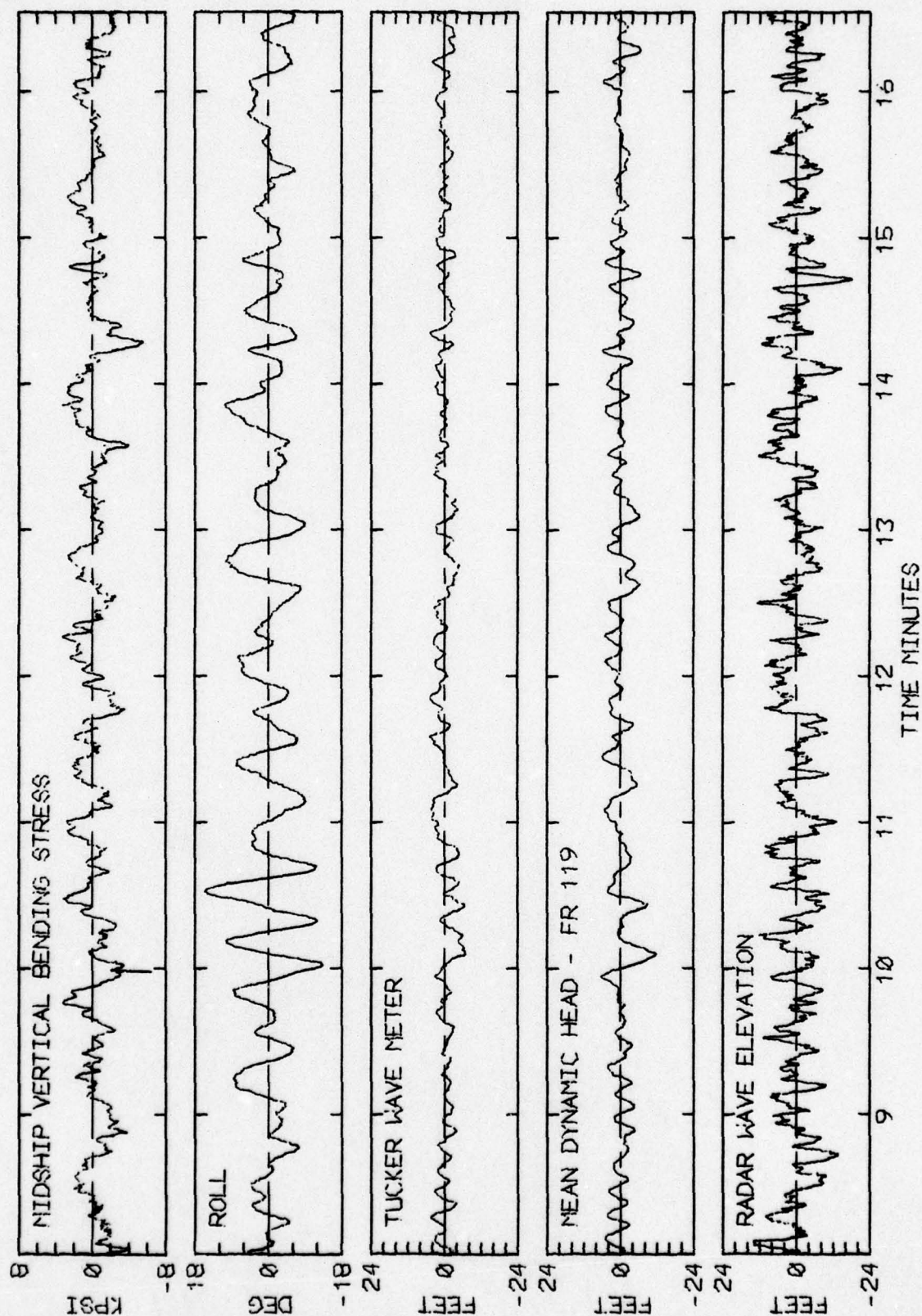
RUN 1122 -- VOYAGE 34E -- TAPE 159 -- INDEX 19 -- INTERVAL 22



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-01-74  | 2000       |      |
| POSITION                              | 44-27 N   | 27-18 W    |      |
| COURSE AND SPEED                      | 072       | 32.3 KNOTS |      |
| SEA STATE                             | 7         |            |      |
| WAVE HEIGHT                           | 4 FEET    |            |      |
| " REL DIR                             | 117 PORT  |            |      |
| SWELL HEIGHT                          | 6 FEET    |            |      |
| " REL DIR                             | 63 STBD   |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| PT CLDY /                             |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 6.4 KPSI  |            |      |
| 4.0 X RMS                             | 5.7 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 18.0 DEG  |            |      |
| PITCH                                 | 1.04 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.24 G    |            |      |
| DK HSE LAT ACCEL                      | 0.39 G    |            |      |
| RADAR SLANT RANGE                     | 29.3 FEET |            |      |
| VERTICAL RANGE                        | 22.6 FEET |            |      |
| DISPL AT RADAR                        | 15.0 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| TUCKER/DYN. HEAD/RADAR                |           |            |      |
| P-T SAMPLE SIZE                       | 116       | 94         | 176  |
| MAXIMUM HEIGHT                        | 8.8       | 17.6       | 25.7 |
| 10TH HIGHEST HTS                      | 7.7       | 11.1       | 18.1 |
| 3RD HIGHEST HTS                       | 6.2       | 8.6        | 14.7 |
| 4.0 RMS(SPECTRA)                      | 8.2       | 10.3       | 19.9 |



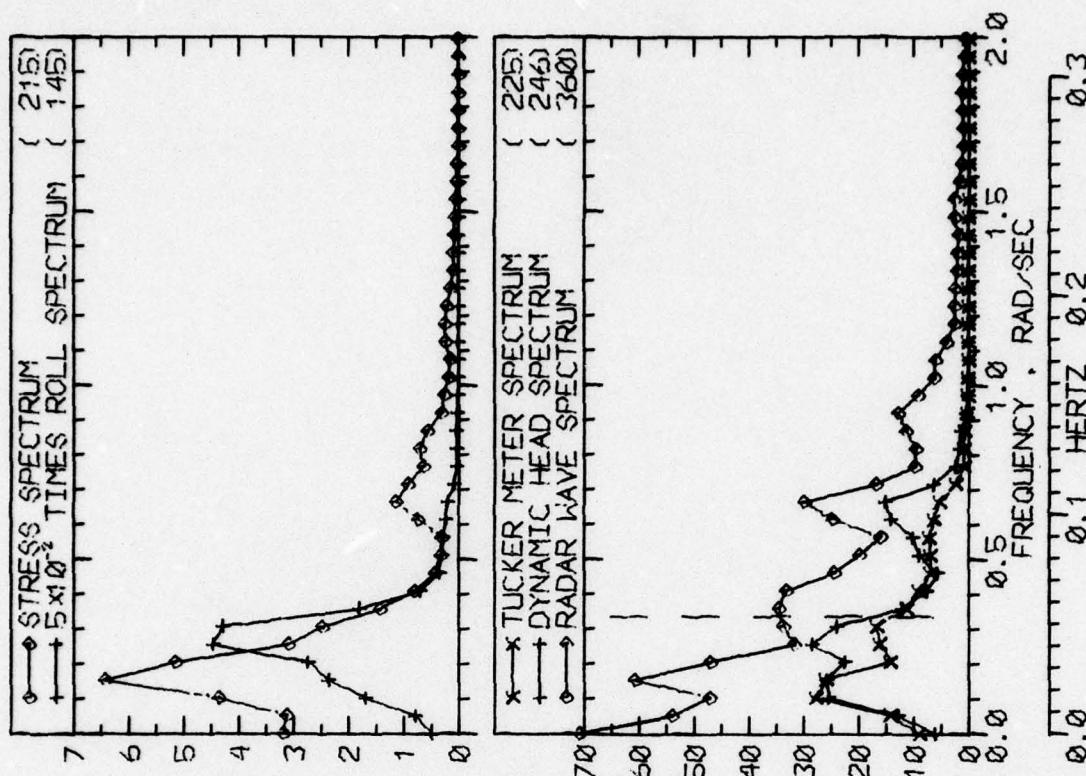
RUN 1125 -- VOYAGE 34E -- TAPE 159 -- INDEX 20 -- INTERVAL 25



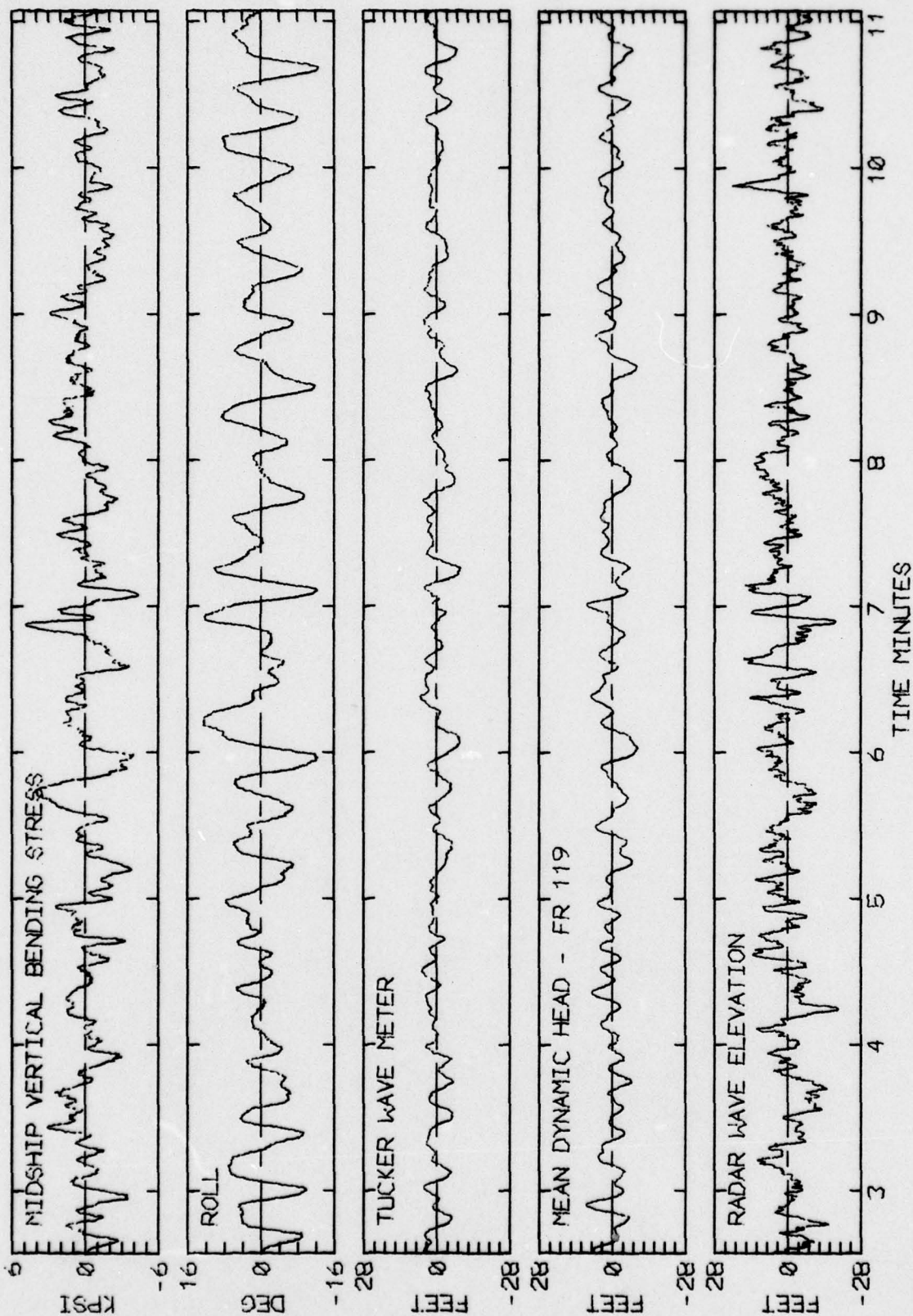
RUN 1125 -- VOYAGE 34E -- TAPE 159 -- INDEX 20 -- INTERVAL 25



| LOG BOOK DATA                   |                                       |      |            |
|---------------------------------|---------------------------------------|------|------------|
| DATE AND TIME                   | 02-01-74                              |      | 2400       |
| POSITION                        | 44-27 N                               |      | 27-18 W    |
| COURSE AND SPEED                | 072 ,                                 |      | 32.6 KNOTS |
| SEA STATE                       | 7                                     |      |            |
| WAVE HEIGHT                     | 4 FEET                                |      |            |
| " REL DIR                       | 175 STBD                              |      |            |
| SWELL HEIGHT                    | 6 FEET                                |      |            |
| " REL DIR                       | 63 STBD                               |      |            |
| PT CLDY /                       | ----- VISUAL WEATHER / COMMENTS ----- |      |            |
| MIDSHIP VERTICAL BENDING STRESS |                                       |      |            |
| MAXIMUM PK-TR                   | 6.9 KPSI                              |      |            |
| 4.0 X RMS                       | 5.5 KPSI                              |      |            |
| SUMMARY OF NOTIONS (4.0 X RMS)  |                                       |      |            |
| ROLL                            | 18.4 DEG                              |      |            |
| PITCH                           | 1.04 DEG                              |      |            |
| DK HSE VERT ACCEL               | 0.26 G                                |      |            |
| DK HSE LAT ACCEL                | 0.41 G                                |      |            |
| RADAR SLANT RANGE               | 33.2 FEET                             |      |            |
| VERTICAL RANGE                  | 24.9 FEET                             |      |            |
| DISPL AT RADAR                  | 18.8 FEET                             |      |            |
| WAVE HEIGHT STATISTICS (FEET)   |                                       |      |            |
| TUCKER/DYN. HEAD/RADAR          |                                       | 78   | 79         |
| P-T SAMPLE SIZE                 | 78                                    | 79   | 140        |
| MAXIMUM HEIGHT                  | 13.5                                  | 16.0 | 35.1       |
| 10TH HIGHEST HTS                | 12.3                                  | 13.9 | 22.6       |
| 3RD HIGHEST HTS                 | 9.8                                   | 11.4 | 17.1       |
| 4.0 RMS(SPECTRA)                | 12.1                                  | 13.7 | 22.6       |



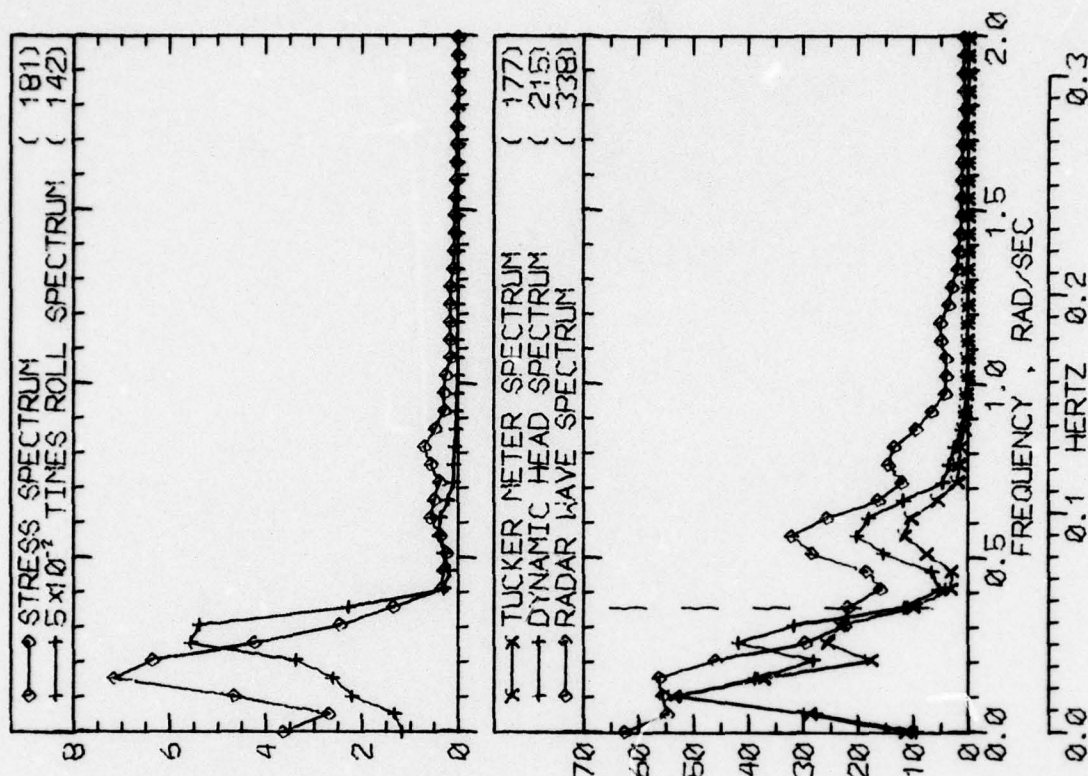
RUN 1129 -- VOYAGE 34E -- TAPE 159 -- INDEX 21 -- INTERVAL 29



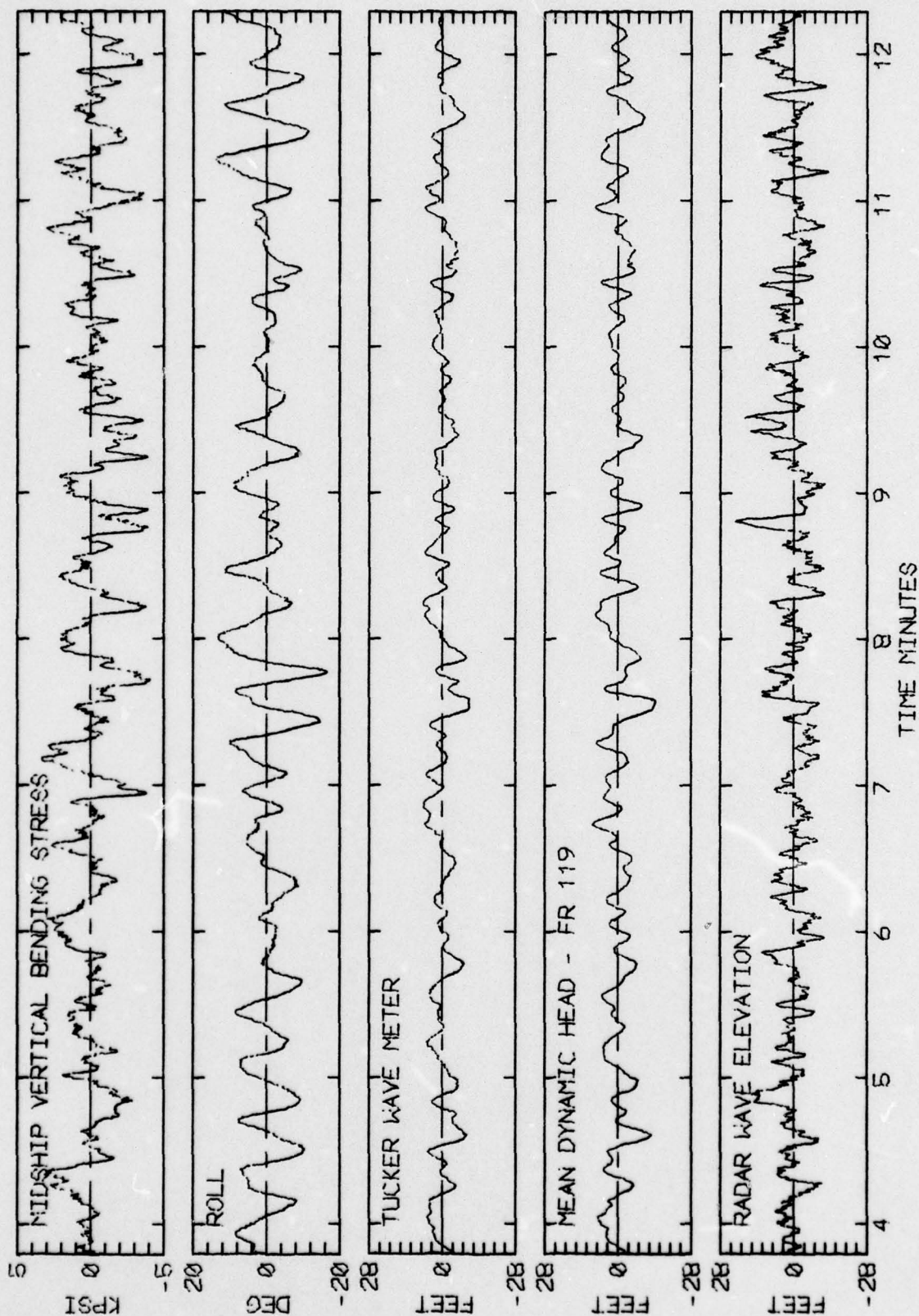
RUN 1129 -- VOYAGE 34E -- TAPE 159 -- INDEX 21 -- INTERVAL 29



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-02-74  | 0400       |      |
| POSITION                              | 44-27 N   | 27-18 W    |      |
| COURSE AND SPEED                      | 071       | 32.4 KNOTS |      |
| SEA STATE                             | 5         |            |      |
| WAVE HEIGHT                           | 4 FEET    |            |      |
| " REL DIR                             | 161 PORT  |            |      |
| SWELL HEIGHT                          | 8 FEET    |            |      |
| " REL DIR                             | 64 STBD   |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST /                               |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 8.0 KPSI  |            |      |
| 4.0 X RMS                             | 5.5 KPSI  |            |      |
| SUMMARY OF NOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 20.4 DEG  |            |      |
| PITCH                                 | 1.08 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.26 G    |            |      |
| DK HSE LAT ACCEL                      | 0.42 G    |            |      |
| RADAR SLANT RANGE                     | 29.7 FEET |            |      |
| VERTICAL RANGE                        | 22.6 FEET |            |      |
| DISPL AT RADAR                        | 17.5 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| P-T SAMPLE SIZE                       | 65        | 59         | 150  |
| MAXIMUM HEIGHT                        | 15.3      | 22.5       | 34.0 |
| 10TH HIGHEST HTS                      | 14.2      | 17.8       | 21.3 |
| 3RD HIGHEST HTS                       | 11.1      | 14.8       | 15.6 |
| 4.0 RMS(SPECTRA)                      | 14.3      | 16.4       | 21.6 |



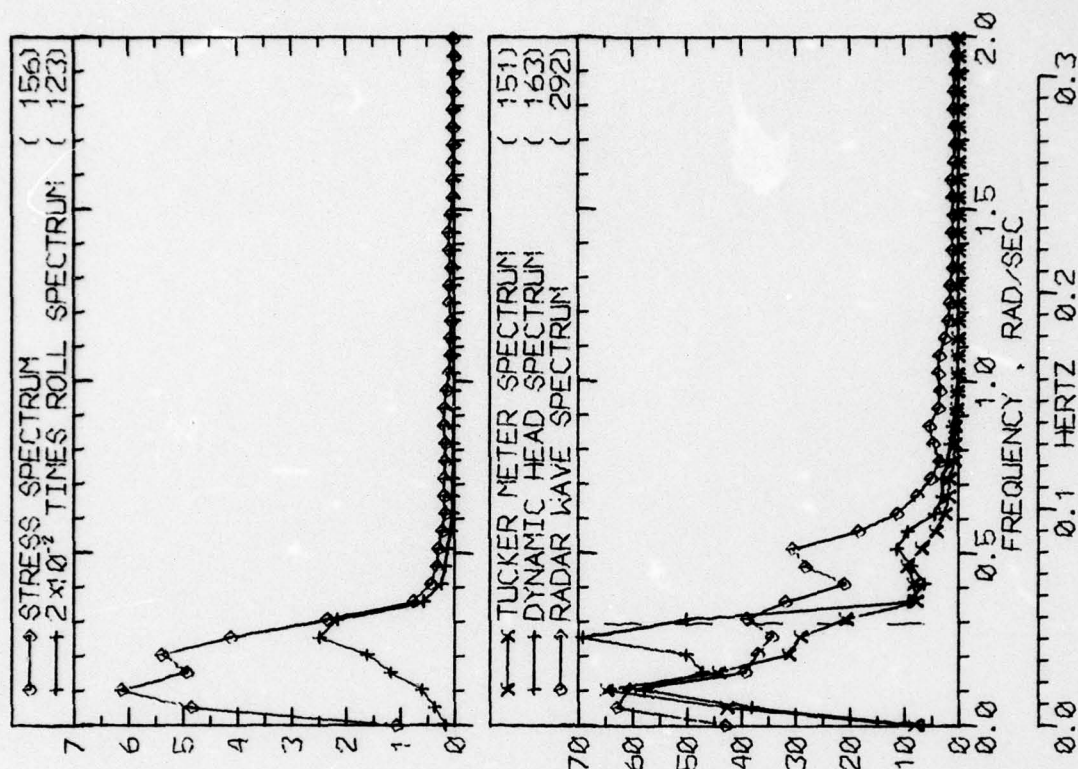
RUN 1134 -- VOYAGE 34E -- TAPE 159 -- INDEX 22 -- INTERVAL 34



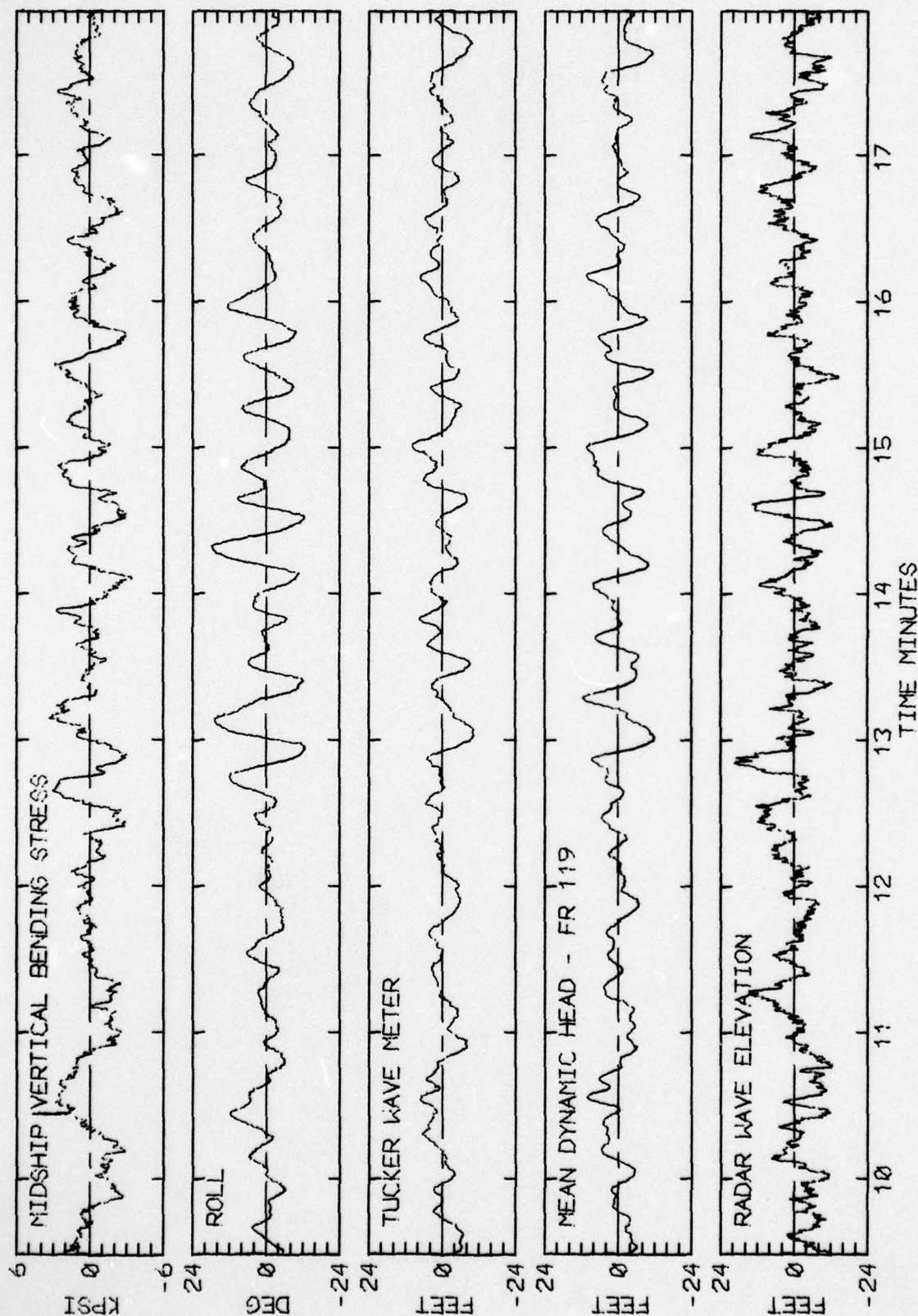
RUN 1134 -- VOYAGE 34E -- TAPE 159 -- INDEX 22 -- INTERVAL 34



| LOG BOOK DATA                          |           |            |      |
|----------------------------------------|-----------|------------|------|
| DATE AND TIME                          | 02-02-74  | 0800       |      |
| POSITION                               | 44-27 N   | 27-18 W    |      |
| COURSE AND SPEED                       | 071       | 32.6 KNOTS |      |
| SEA STATE                              | 3         |            |      |
| WAVE HEIGHT                            | 4 FEET    |            |      |
| " REL DIR                              | 161 PORT  |            |      |
| SWELL HEIGHT                           | 8 FEET    |            |      |
| " REL DIR                              | 64 STBD   |            |      |
| ----- VISUAL WEATHER / COMMENTS -----  |           |            |      |
| OCAST /                                |           |            |      |
| <u>MIDSHIP VERTICAL BENDING STRESS</u> |           |            |      |
| MAXIMUM PK-TR                          | 6.5 KPSI  |            |      |
| 4.0 X RMS                              | 5.2 KPSI  |            |      |
| <u>SUMMARY OF NOTIONS (4.0 X RMS)</u>  |           |            |      |
| ROLL                                   | 20.1 DEG  |            |      |
| PITCH                                  | 0.83 DEG  |            |      |
| DK HSE VERT ACCEL                      | 0.18 G    |            |      |
| DK HSE LAT ACCEL                       | 0.43 G    |            |      |
| RADAR SLANT RANGE                      | 30.8 FEET |            |      |
| VERTICAL RANGE                         | 20.7 FEET |            |      |
| DISPL AT RADAR                         | 15.3 FEET |            |      |
| <u>WAVE HEIGHT STATISTICS (FEET)</u>   |           |            |      |
| P-T SAMPLE SIZE                        | 57        | 51         | 152  |
| MAXIMUM HEIGHT                         | 16.4      | 20.4       | 24.1 |
| 10TH HIGHEST HTS                       | 14.9      | 18.5       | 18.5 |
| 3RD HIGHEST HTS                        | 12.1      | 15.2       | 13.9 |
| 4.0 RMS(SPECTRA)                       | 15.2      | 17.6       | 20.5 |



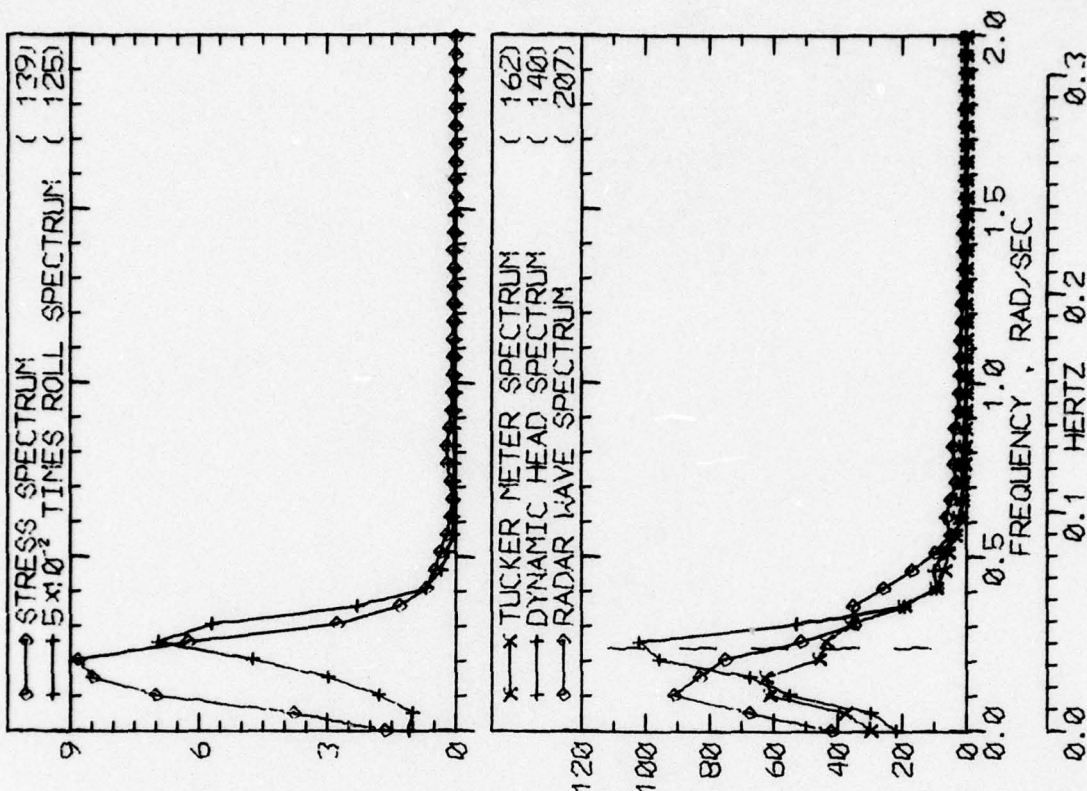
RUN 1137 -- VOYAGE 34E -- TAPE 159 -- INDEX 23 -- INTERVAL 37



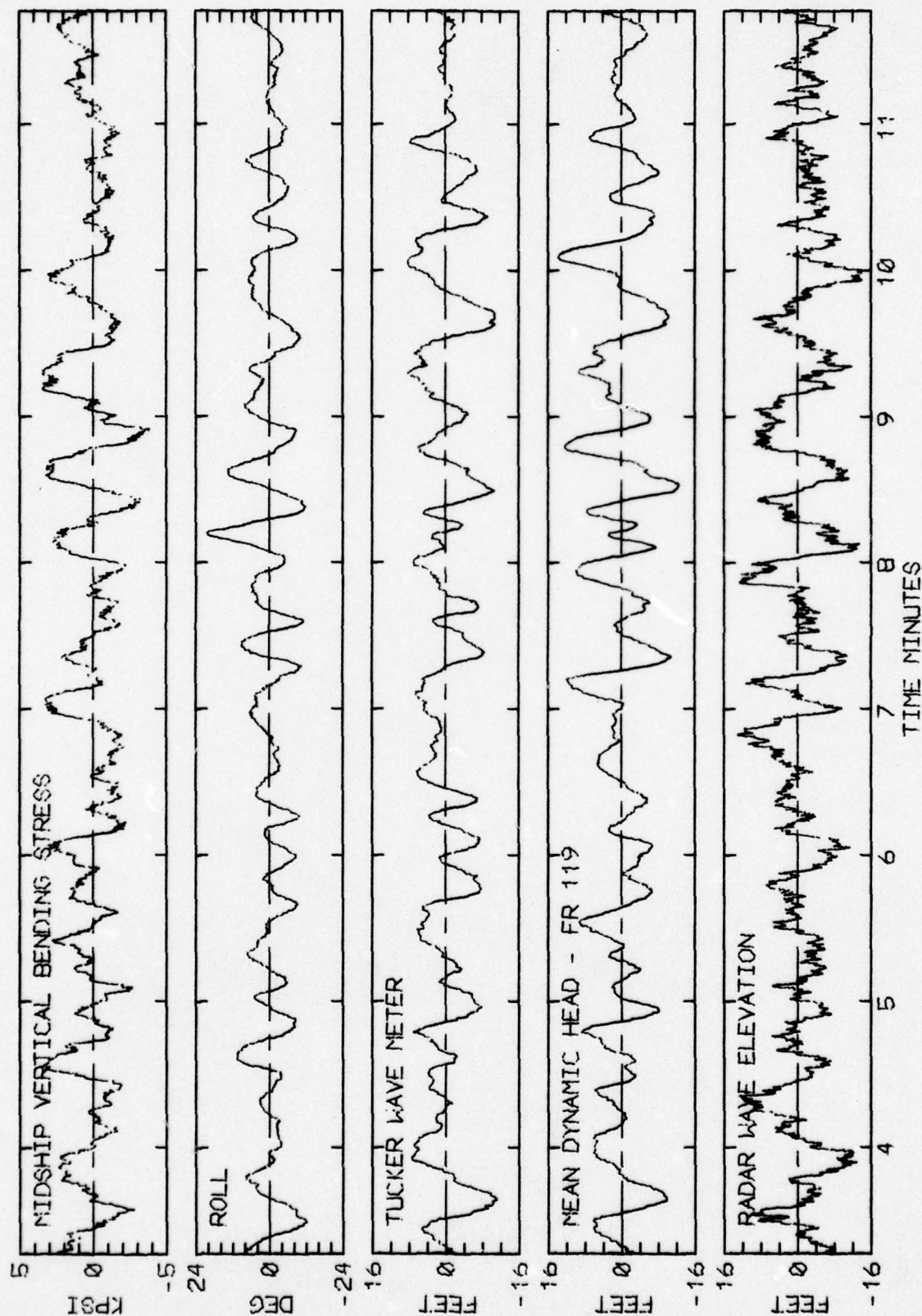
RUN 1137 -- VOYAGE 34E -- TAPE 159 -- INDEX 23 -- INTERVAL 37



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-02-74  | 1200       |      |
| POSITION                              | 48-10 N   | 10-20 W    |      |
| COURSE AND SPEED                      | 071       | 32.3 KNOTS |      |
| SEA STATE                             | 5         |            |      |
| WAVE HEIGHT                           | 3 FEET    |            |      |
| " REL DIR                             | 64 STBD   |            |      |
| SWELL HEIGHT                          | 6 FEET    |            |      |
| " REL DIR                             | 64 STBD   |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST /                               |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 6.9 KPSI  |            |      |
| 4.0 X RMS                             | 5.9 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 21.3 DEG  |            |      |
| PITCH                                 | 0.72 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.14 G    |            |      |
| DK HSE LAT ACCEL                      | 0.46 G    |            |      |
| RADAR SLANT RANGE                     | 30.5 FEET |            |      |
| VERTICAL RANGE                        | 21.5 FEET |            |      |
| DISPL AT RADAR                        | 14.7 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| P-T SAMPLE SIZE                       | 67        | 45         | 132  |
| MAXIMUM HEIGHT                        | 19.4      | 22.6       | 26.5 |
| 10TH HIGHEST HTS                      | 15.0      | 20.7       | 21.8 |
| 3RD HIGHEST HTS                       | 12.8      | 18.2       | 14.1 |
| 4.0 RMS(SPECTRA)                      | 17.0      | 19.6       | 21.8 |



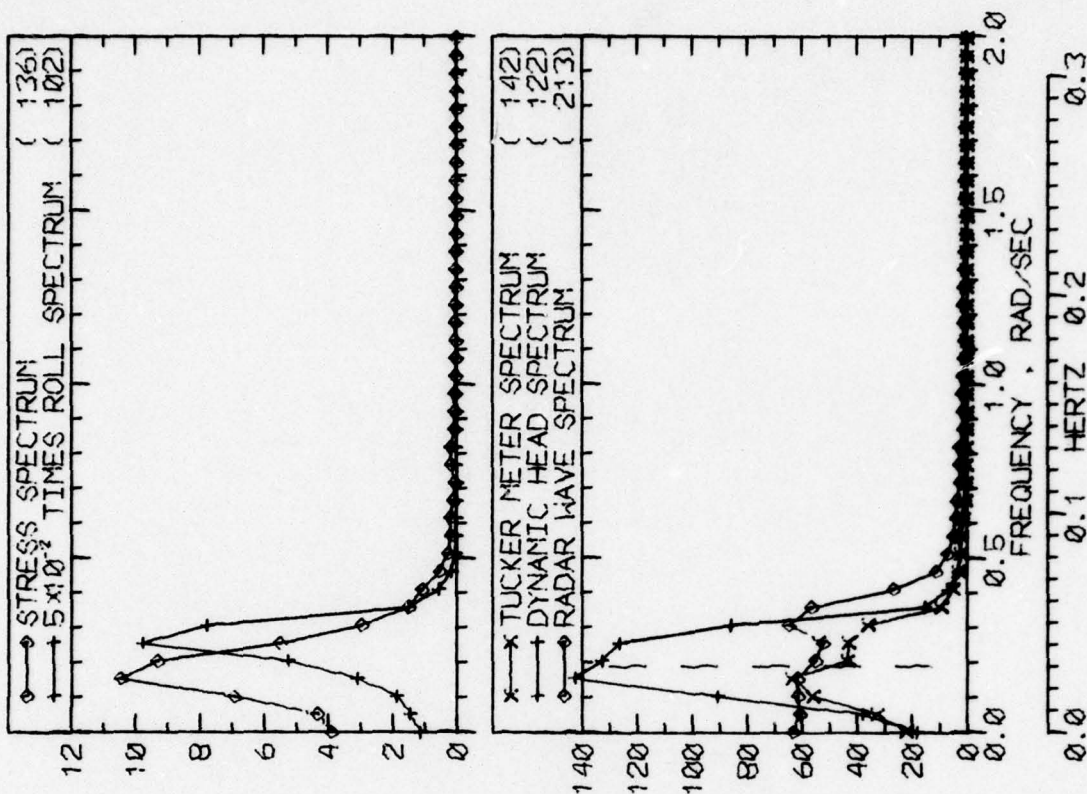
RUN 1141 -- VOYAGE 34E -- TAPE 159 -- INDEX 24 -- INTERVAL 41



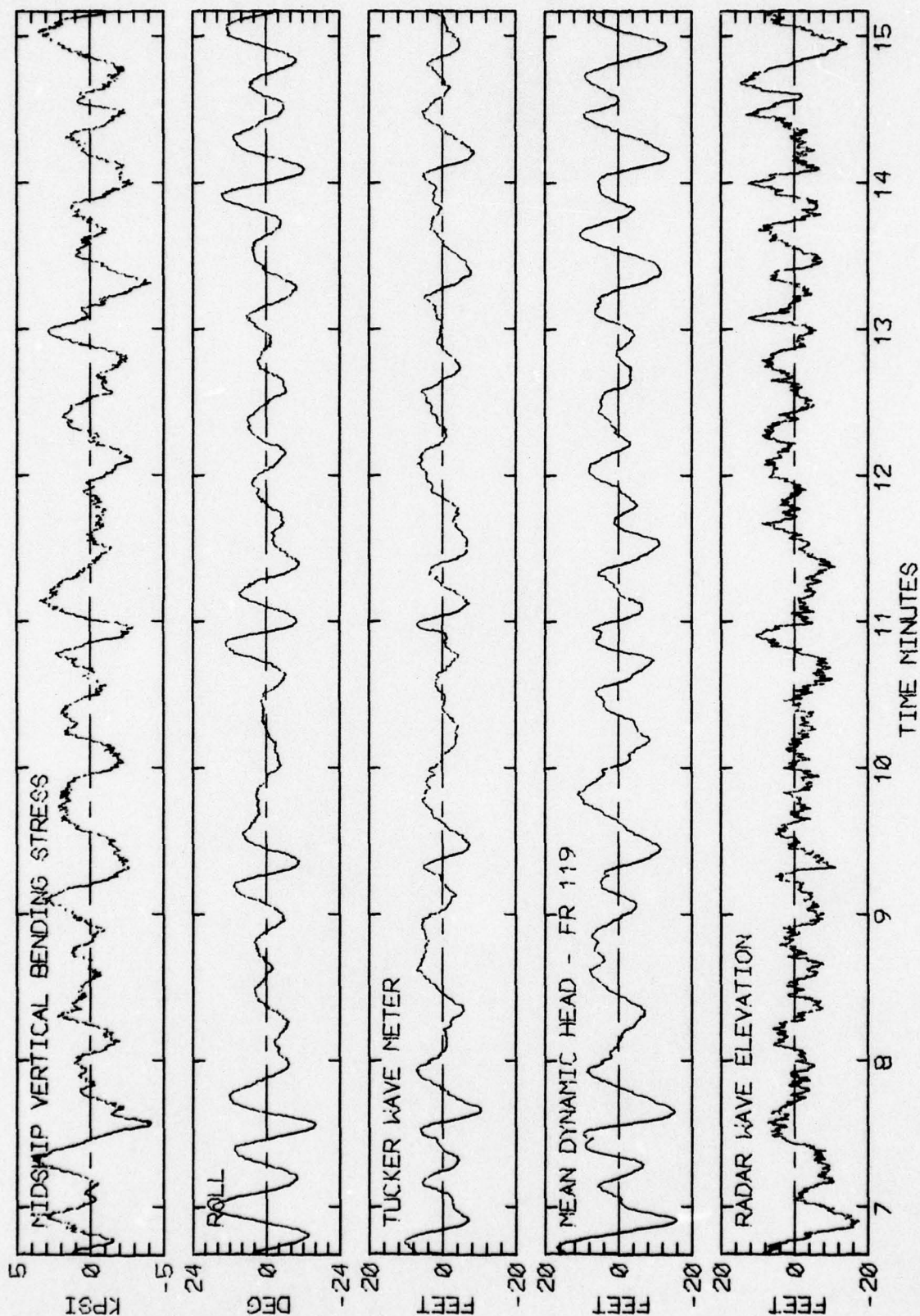
RUN 1141 -- VOYAGE 34E -- TAPE 159 -- INDEX 24 -- INTERVAL 41



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-02-74  | 1600       |      |
| POSITION                              | 48-10 N   | 10-20 W    |      |
| COURSE AND SPEED                      | 071       | 32.1 KNOTS |      |
| SEA STATE                             | 5         |            |      |
| WAVE HEIGHT                           | 3 FEET    |            |      |
| " REL DIR                             | 154 STBD  |            |      |
| SWELL HEIGHT                          | 8 FEET    |            |      |
| " REL DIR                             | 64 STBD   |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST /                               |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 7.7 KPSI  |            |      |
| 4.0 X RMS                             | 6.2 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 23.0 DEG  |            |      |
| PITCH                                 | 0.76 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.10 G    |            |      |
| DK HSE LAT ACCEL                      | 0.51 G    |            |      |
| RADAR SLANT RANGE                     | 33.6 FEET |            |      |
| VERTICAL RANGE                        | 20.8 FEET |            |      |
| DISPL AT RADAR                        | 13.8 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| P-T SAMPLE SIZE                       | 43        | 48         | 136  |
| MAXIMUM HEIGHT                        | 17.6      | 32.5       | 29.0 |
| 10TH HIGHEST HTS                      | 16.0      | 24.5       | 19.1 |
| 3RD HIGHEST HTS                       | 14.0      | 19.5       | 13.1 |
| 4.0 RMS(SPECTRA)                      | 16.0      | 23.3       | 21.1 |



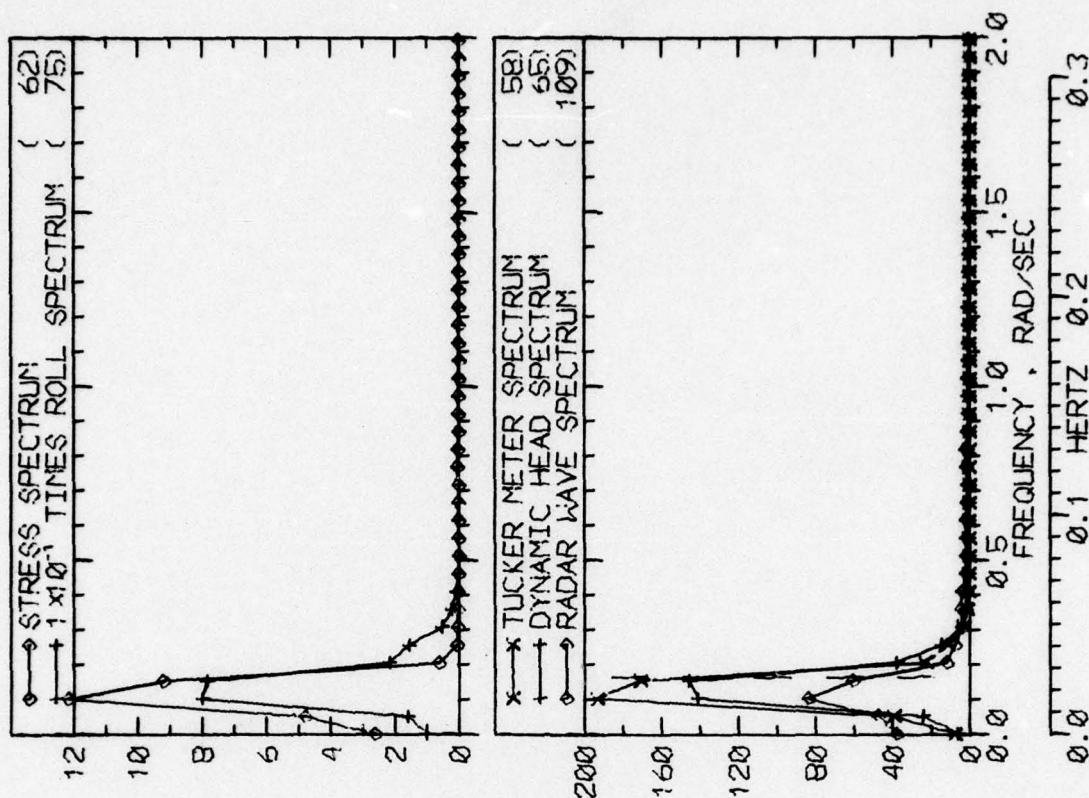
RUN 1145 -- VOYAGE 34E -- TAPE 159 -- INDEX 25 -- INTERVAL 45



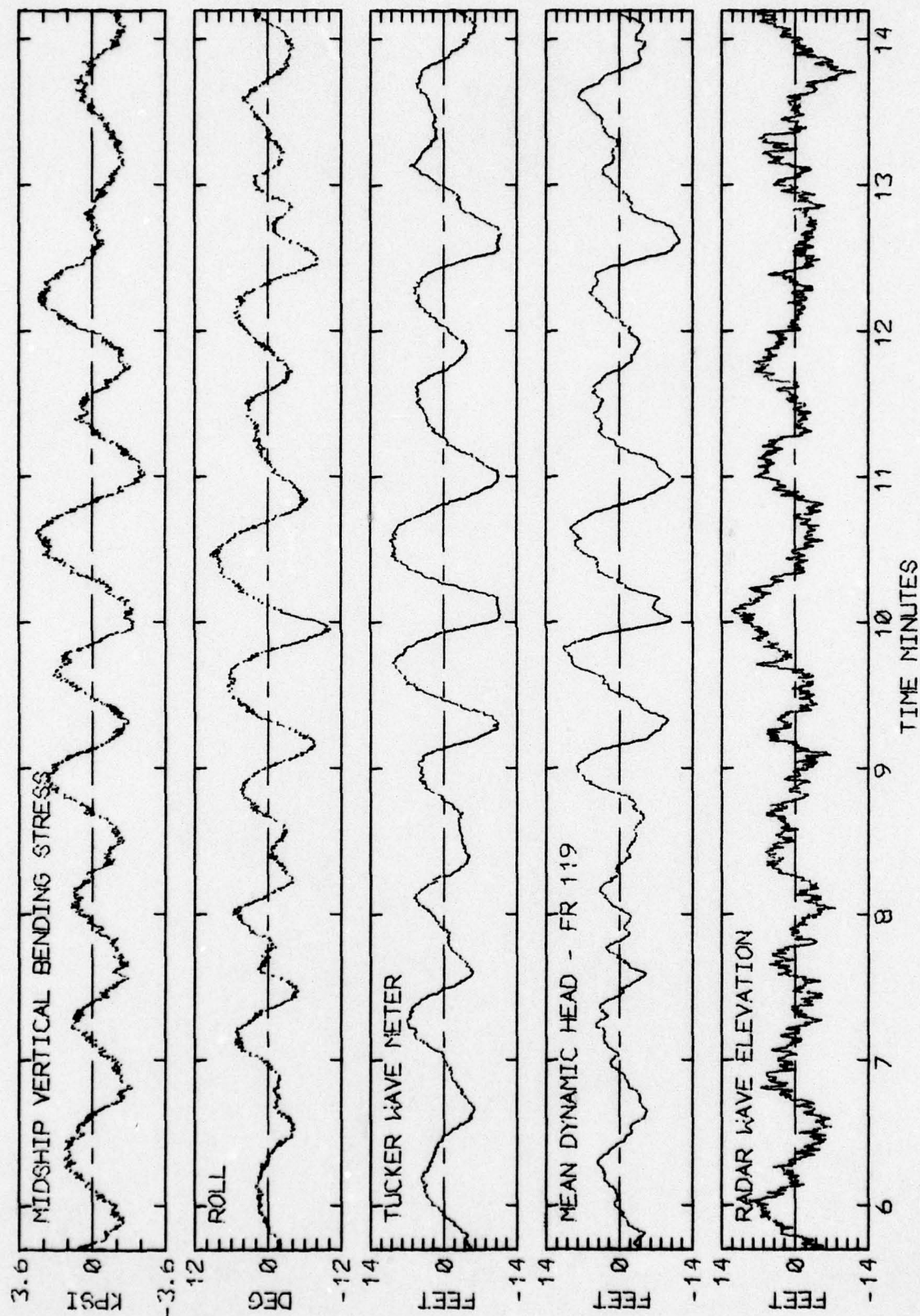
RUN 1145 -- VOYAGE 34E -- TAPE 159 -- INDEX 25 -- INTERVAL 45



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-02-74  | 2000       |      |
| POSITION                              | 48-10 N   | 10-20 W    |      |
| COURSE AND SPEED                      | 071       | 32.2 KNOTS |      |
| SEA STATE                             | 3         |            |      |
| WAVE HEIGHT                           | 1 FEET    |            |      |
| " REL DIR                             | 154 STBD  |            |      |
| SWELL HEIGHT                          | 1 FEET    |            |      |
| " REL DIR                             | 64 STBD   |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| PT CLDY /                             |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 4.3 KPSI  |            |      |
| 4.0 X RMS                             | 4.8 KPSI  |            |      |
| SUMMARY OF NOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 13.6 DEG  |            |      |
| PITCH                                 | 0.77 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.04 G    |            |      |
| DK HSE LAT ACCEL                      | 0.27 G    |            |      |
| RADAR SLANT RANGE                     | 24.5 FEET |            |      |
| VERTICAL RANGE                        | 15.2 FEET |            |      |
| DISPL AT RADAR                        | 6.4 FEET  |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| TUCKER/DYN. HEAD/RADAR                |           |            |      |
| P-T SAMPLE SIZE                       | 23        | 31         | 158  |
| MAXIMUM HEIGHT                        | 21.0      | 21.0       | 14.3 |
| 10TH HIGHEST HTS                      | 20.4      | 19.5       | 10.9 |
| 3RD HIGHEST HTS                       | 18.0      | 16.7       | 7.6  |
| 4.0 RMS(SPECTRA)                      | 19.2      | 17.6       | 15.0 |



RUN 1149 -- VOYAGE 34E -- TAPE 159 -- INDEX 26 -- INTERVAL 49



RUN 1149 -- VOYAGE 34E -- TAPE 159 -- INDEX 26 -- INTERVAL 49



TABLE 11a

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

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 WEST

| D.L.<br>RUN<br>NO. | TMR<br>TAPE<br>NO. | TMR<br>INDEX<br>NO. | TMR<br>INTV<br>NO. | DATE     | TIME<br>(GMT) | LATITUDE | LONGITUDE | COURSE | SPEED<br>KT. | PROP<br>RPM | DRAFT<br>FT. | SEA/AIR<br>TEMP |
|--------------------|--------------------|---------------------|--------------------|----------|---------------|----------|-----------|--------|--------------|-------------|--------------|-----------------|
| 1209               | 161                | 3                   | 9                  | 02-06-74 | 0400          |          |           | 308    | 32.3         | 132.0       | 28.82        | 43/40           |
| 1217               | 161                | 5                   | 17                 | 02-06-74 | 1200          | 58-27 N  | 08-51 W   | 267    | 31.9         | 130.0       | 29.09        | 46/42           |
| 1228               | 161                | 7                   | 28                 | 02-06-74 | 2000          | 58-27 N  | 08-51 W   | 246    | 30.8         | 127.0       | 29.74        | 47/41           |
| 1230               | 161                | 8                   | 30                 | 02-06-74 | 2400          | 58-27 N  | 08-51 W   | 246    | 31.3         | 128.0       | 29.83        | 47/45           |
| 1233               | 161                | 9                   | 33                 | 02-07-74 | 0400          | 58-27 N  | 08-51 W   | 246    | 31.6         | 129.0       | 29.65        | 47/46           |
| 1237               | 161                | 10                  | 37                 | 02-07-74 | 0800          | 58-27 N  | 08-51 W   | 242    | 31.6         | 129.0       | 29.34        | 47/48           |
| 1241               | 161                | 11                  | 41                 | 02-07-74 | 1200          | 54-00 N  | 30-00 W   | 241    | 31.6         | 129.2       | 29.15        | 44/50           |
| 1245               | 161                | 12                  | 45                 | 02-07-74 | 1600          | 54-00 N  | 30-00 W   | 238    | 31.7         | 129.5       | 29.04        | 42/44           |
| 1305               | 163                | 14                  | 5                  | 02-07-74 | 2400          | 54-00 N  | 30-00 W   | 243    | 31.3         | 128.0       | 28.93        | 45/42           |
| 1309               | 163                | 15                  | 9                  | 02-08-74 | 0400          | 54-00 N  | 30-00 W   | 243    | 31.4         | 128.5       | 28.97        | 54/44           |
| 1317               | 163                | 17                  | 17                 | 02-08-74 | 1200          | 48-09 N  | 47-18 W   | 243    | 31.4         | 128.5       | 29.22        | 34/31           |
| 1321               | 163                | 18                  | 21                 | 02-08-74 | 1600          | 48-09 N  | 47-18 W   | 245    | 31.8         | 130.0       | 29.14        | 28/27           |
| 1329               | 163                | 20                  | 29                 | 02-08-74 | 2400          | 48-09 N  | 47-18 W   | 245    | 31.3         | 128.0       | 29.62        | 28/24           |
| 1333               | 163                | 21                  | 33                 | 02-09-74 | 0400          | 48-09 N  | 47-18 W   | 240    | 31.4         | 128.5       | 29.60        | 33/26           |
| 1337               | 163                | 22                  | 37                 | 02-09-74 | 0800          | 48-09 N  | 47-18 W   | 246    | 31.8         | 130.0       | 29.42        | 34/28           |
| 1341               | 163                | 23                  | 41                 | 02-09-74 | 1200          | 42-32 N  | 63-16 W   | 245    | 32.1         | 131.0       | 29.52        | 37/33           |
| 1345               | 163                | 24                  | 45                 | 02-09-74 | 1600          | 42-32 N  | 63-16 W   | 245    | 32.1         | 131.0       | 29.62        | 39/34           |

TABLE 11b

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

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 WEST

| D.L.<br>RUN<br>NO. | SEA<br>STATE | <REL WIND><br>DIR/SPEED<br>(KT) | REL<br>WAVE<br>DIR | WAVE<br>HT.<br>FT. | REL<br>SWELL<br>DIR | <-SWELL-><br>HT LENGTH<br>FT. | VISUAL WEATHER /TMR LOG-BOOK COMMENTS    |
|--------------------|--------------|---------------------------------|--------------------|--------------------|---------------------|-------------------------------|------------------------------------------|
| 1209               | 4            | 83P/15                          | 83P                | 1                  |                     |                               | PT CLDY /                                |
| 1217               | 6            | 138S/25                         | 138S               | 5                  | 115S                | 8 150                         | OCAST /HEAVY ROLL                        |
| 1228               | 8            | 136S/35                         | 136S               | 5                  | 136S                | 8 150                         | PT CLDY /HEAVY ROLL                      |
| 1230               | 3            | 156P/10                         | 156P               | 4                  | 136S                | 6 150                         | PT CLDY /RIDING EASY                     |
| 1233               | 5            | 100P/20                         | 100P               | 2                  | 114S                | 6 150                         | OCAST /                                  |
| 1237               | 6            | 118P/25                         | 118P               | 2                  | 118S                | 6 150                         | OCAST /                                  |
| 1241               | 3            | 106P/10                         | 106P               | 3                  | 119S                | 6 150                         | OCAST FOG RAIN /                         |
| 1245               | 3            | 103P/10                         | 103P               | 2                  | 122S                | 6 200                         | OCAST /                                  |
| 1305               | 3            | 18P/10                          | 18P                | 2                  | 18P                 | 6 200                         | PT CLDY /                                |
| 1309               | 6            | 49S/25                          | 49S                | 5                  | 18P                 | 8 150                         | HAIL RAIN SQUALLS /                      |
| 1317               | 2            | 49S/ 5                          | 49S                | 5                  | 27S                 | 8 150                         | CLEAR FOG SNOW /                         |
| 1321               | 4            | 47S/15                          | 47S                | 0                  | 25S                 | 15 200                        | OCAST SNOW /ICE FIELD ROLLING HIGH SWELL |
| 1329               | 6            | 92S/25                          | 92S                | 2                  | 25S                 | 5 150                         | OCAST /                                  |
| 1333               | 5            | 75S/20                          | 75S                | 2                  | 30S                 | 5 150                         | OCAST /                                  |
| 1337               | 5            | 159S/20                         | 159S               | 2                  | 24S                 | 5 150                         | OCAST SNOW /                             |
| 1341               | 4            | 137S/15                         | 137S               | 2                  | 25S                 | 3 200                         | OCAST SNOW /                             |
| 1345               | 4            | 137S/15                         | 137S               | 2                  | 160S                | 2 300                         | PT CLDY /                                |



TABLE 11c

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

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 WEST

| * <-----TMR RESULTS-----* <-----D.L. DIGITIZATION-----* <-----COLUMN RATIOS-----* |                                                              |                               |                                                 |                                                 |                                                   |                                                          |                                                  |                                               |                             |                               |                             |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------------------|-------------------------------------------------|-------------------------------------------------|---------------------------------------------------|----------------------------------------------------------|--------------------------------------------------|-----------------------------------------------|-----------------------------|-------------------------------|-----------------------------|
| D.L. RUN NO.                                                                      | * NO. *<br>* WAVE *<br>* INDUCED MODE *<br>* CYCLES BURSTS * | * NO. *<br>* 1ST *<br>* 2ND * | * MAX *<br>* P-TO-T *<br>* STRESS *<br>* KPSI * | * RMS *<br>* P-TO-T *<br>* STRESS *<br>* KPSI * | * MAX 1ST *<br>* MODE *<br>* STRESS *<br>* KPSI * | * RANGE OF *<br>* RECORDED *<br>* EXTREMES *<br>* KPSI * | * 2.83X *<br>* (SAMPLE *<br>* RMS) *<br>* KPSI * | * REL *<br>* MEAN *<br>* STRESS *<br>* KPSI * | * (7) *<br>* / *<br>* (4) * | * (6) *<br>* / *<br>* (3+5) * | * (6) *<br>* / *<br>* (3) * |
| 1209                                                                              | * 177 *                                                      | 0                             | 1.32                                            | 0.55                                            | 0.00                                              | 1.83                                                     | 0.73                                             | 3.53                                          | 1.35                        | 1.38                          | 1.38                        |
| 1217                                                                              | * 142 *                                                      | 44                            | 10.16                                           | 4.85                                            | 3.30                                              | 14.62                                                    | 5.21                                             | 0.01                                          | 1.07                        | 1.09                          | 1.44                        |
| 1228                                                                              | * 140 *                                                      | 23                            | 11.02                                           | 5.29                                            | 1.53                                              | 15.15                                                    | 5.95                                             | 0.28                                          | 1.13                        | 1.21                          | 1.37                        |
| 1230                                                                              | * 145 *                                                      | 19                            | 9.21                                            | 4.81                                            | 2.34                                              | 12.58                                                    | 5.49                                             | 1.96                                          | 1.14                        | 1.09                          | 1.37                        |
| 1233                                                                              | * 125 *                                                      | 5                             | 8.66                                            | 3.64                                            | 1.02                                              | 11.69                                                    | 4.73                                             | 1.55                                          | 1.30                        | 1.21                          | 1.35                        |
| 1237                                                                              | * 85 *                                                       | 34                            | 8.34                                            | 3.83                                            | 1.33                                              | 11.69                                                    | 5.19                                             | 2.05                                          | 1.36                        | 1.21                          | 1.40                        |
| 1241                                                                              | * 91 *                                                       | 5                             | 6.72                                            | 3.01                                            | 1.17                                              | 8.76                                                     | 4.16                                             | 0.28                                          | 1.38                        | 1.11                          | 1.30                        |
| 1245                                                                              | * 137 *                                                      | 8                             | 8.97                                            | 4.12                                            | 1.81                                              | 12.34                                                    | 4.98                                             | 1.89                                          | 1.21                        | 1.14                          | 1.38                        |
| 1305                                                                              | * 157 *                                                      | 60                            | 14.77                                           | 5.80                                            | 4.03                                              | 17.51                                                    | 6.15                                             | -0.06                                         | 1.06                        | 0.93                          | 1.19                        |
| 1309                                                                              | * 154 *                                                      | 57                            | 14.43                                           | 5.68                                            | 5.62                                              | 18.31                                                    | 5.99                                             | 0.02                                          | 1.06                        | 0.91                          | 1.27                        |
| 1317                                                                              | * 138 *                                                      | 43                            | 9.26                                            | 3.87                                            | 2.10                                              | 12.14                                                    | 4.70                                             | 0.06                                          | 1.21                        | 1.07                          | 1.31                        |
| 1321                                                                              | * 117 *                                                      | 0                             | 8.34                                            | 3.00                                            | 0.00                                              | 8.49                                                     | 3.53                                             | -0.04                                         | 1.17                        | 1.02                          | 1.02                        |
| 1329                                                                              | * 198 *                                                      | 45                            | 8.31                                            | 3.47                                            | 1.77                                              | 9.39                                                     | 3.68                                             | 0.18                                          | 1.06                        | 0.93                          | 1.13                        |
| 1333                                                                              | * 181 *                                                      | 44                            | 10.46                                           | 4.39                                            | 3.63                                              | 13.32                                                    | 4.54                                             | 0.21                                          | 1.03                        | 0.95                          | 1.27                        |
| 1337                                                                              | * 197 *                                                      | 2                             | 5.41                                            | 2.36                                            | 0.92                                              | 6.66                                                     | 2.66                                             | 0.18                                          | 1.12                        | 1.05                          | 1.23                        |
| 1341                                                                              | * 192 *                                                      | 0                             | 2.87                                            | 1.10                                            | 0.00                                              | 3.20                                                     | 1.22                                             | -0.04                                         | 1.11                        | 1.12                          | 1.12                        |
| 1345                                                                              | * 139 *                                                      | 2                             | 1.84                                            | 0.86                                            | 0.81                                              | 2.99                                                     | 1.22                                             | 0.10                                          | 1.42                        | 1.13                          | 1.62                        |

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TABLE 11d

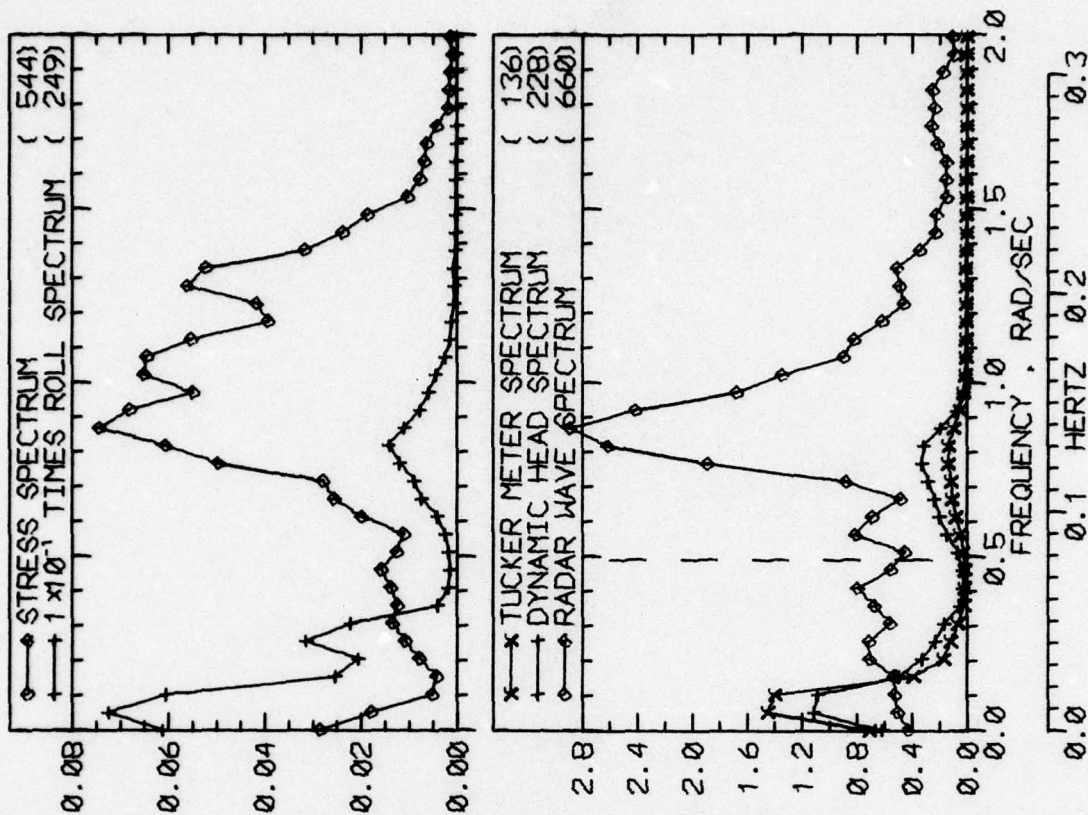
SUMMARY OF RAW DIGITIZATION RESULTS FOR RADAR RANGE  
ROLL, PITCH, DECKHOUSE ACCELERATIONS, AND TUCKER METER

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 WEST

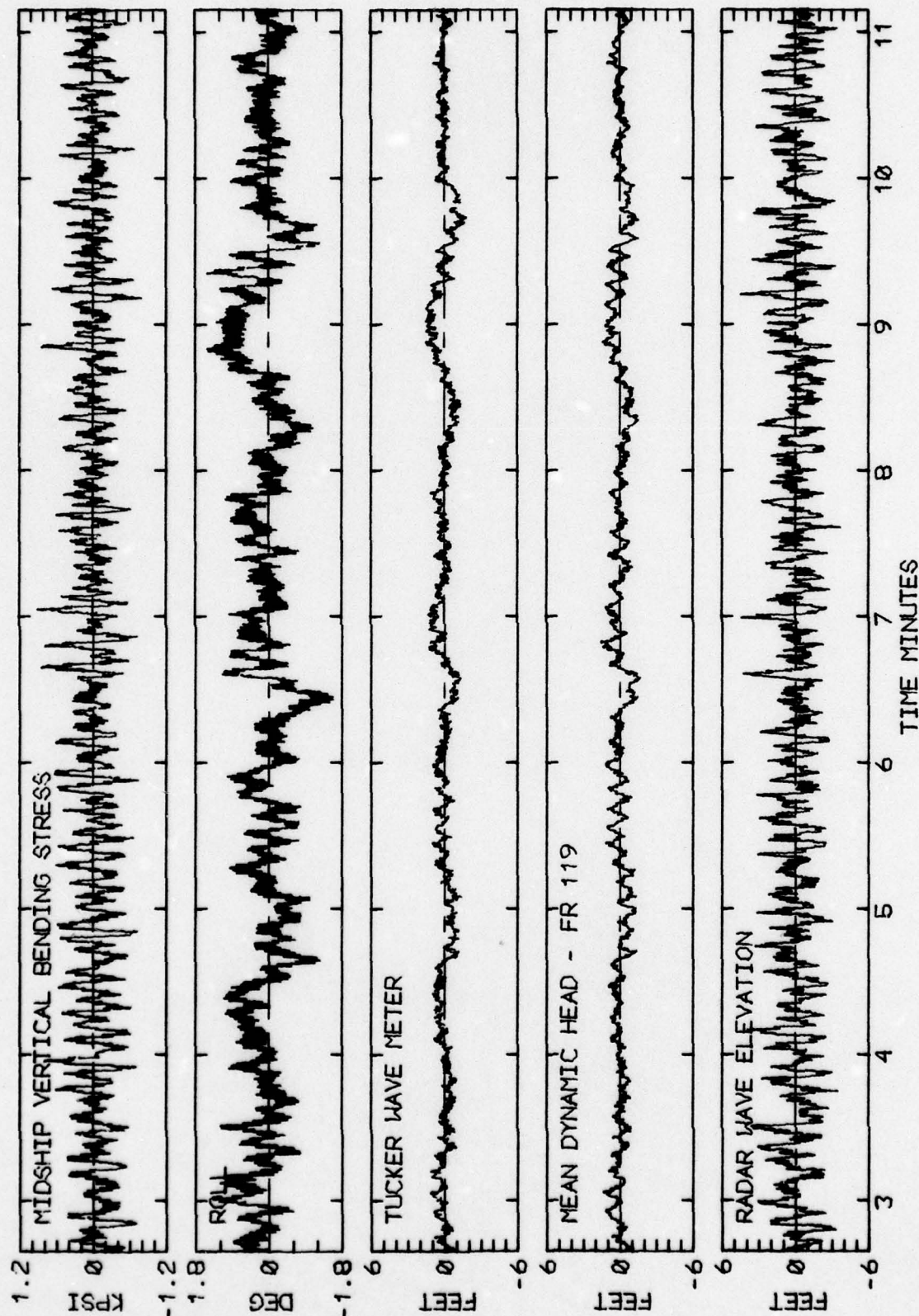
| D.L.<br>RUN<br>NO. | RADAR        |          | ROLL         |          | PITCH        |          | VERT ACCEL   |          | LAT ACCEL    |          | TUCKER       |          |      |     |      |     |     |      |
|--------------------|--------------|----------|--------------|----------|--------------|----------|--------------|----------|--------------|----------|--------------|----------|------|-----|------|-----|-----|------|
|                    | 4.0<br>(RMS) | RECORDED | 4.0<br>(RMS) | RECORDED | 4.0<br>(RMS) | RECORDED | 4.0<br>(RMS) | RECORDED | 4.0<br>(RMS) | RECORDED | 4.0<br>(RMS) | RECORDED |      |     |      |     |     |      |
|                    | FT           | FT       | DEG          | DEG      | DEG          | DEG      | DEG          | DEG      | DEG          | DEG      | DEG          | DEG      |      |     |      |     |     |      |
| 1209               | 9.           | 7.       | -9.          | 2.0      | 1.           | -3.      | 0.6          | -0.0     | -0.9         | 0.09     | 0.1          | -0.1     | 0.06 | 0.1 | -0.0 | 2.  | 2.  | -2.  |
| 1217               | 50.          | 59.      | -52.         | 17.6     | 7.           | -19.     | 1.8          | 1.2      | -2.3         | 0.42     | 0.4          | -0.4     | 0.39 | 0.4 | -0.3 | 15. | 10. | -10. |
| 1228               | 56.          | 46.      | -52.         | 18.0     | 10.          | -16.     | 1.9          | 1.0      | -2.1         | 0.43     | 0.3          | -0.3     | 0.39 | 0.3 | -0.3 | 19. | 11. | -11. |
| 1230               | 43.          | 32.      | -46.         | 15.7     | 9.           | -14.     | 1.6          | 0.9      | -1.9         | 0.35     | 0.3          | -0.3     | 0.34 | 0.3 | -0.2 | 14. | 11. | -8.  |
| 1233               | 36.          | 30.      | -40.         | 14.5     | 8.           | -15.     | 1.0          | 0.4      | -1.7         | 0.23     | 0.2          | -0.2     | 0.30 | 0.3 | -0.2 | 15. | 11. | -9.  |
| 1237               | 30.          | 25.      | -23.         | 9.8      | 10.          | -8.      | 0.9          | 0.3      | -1.4         | 0.19     | 0.2          | -0.2     | 0.22 | 0.2 | -0.2 | 9.  | 8.  | -5.  |
| 1241               | 25.          | 22.      | -19.         | 8.9      | 5.           | -8.      | 0.9          | 0.3      | -1.4         | 0.18     | 0.1          | -0.2     | 0.20 | 0.2 | -0.2 | 8.  | 8.  | -7.  |
| 1245               | 31.          | 26.      | -25.         | 8.3      | 5.           | -7.      | 1.3          | 0.5      | -2.0         | 0.27     | 0.2          | -0.3     | 0.18 | 0.1 | -0.1 | 9.  | 7.  | -6.  |
| 1305               | 44.          | 33.      | -44.         | 8.0      | 5.           | -7.      | 2.2          | 1.7      | -2.4         | 0.50     | 0.4          | -0.4     | 0.19 | 0.2 | -0.2 | 9.  | 7.  | -7.  |
| 1309               | 43.          | 40.      | -43.         | 10.1     | 8.           | -9.      | 2.1          | 1.7      | -2.3         | 0.47     | 0.5          | -0.4     | 0.23 | 0.2 | -0.2 | 9.  | 9.  | -8.  |
| 1317               | 40.          | 33.      | -47.         | 16.2     | 9.           | -16.     | 1.3          | 0.6      | -1.9         | 0.30     | 0.3          | -0.3     | 0.35 | 0.3 | -0.3 | 14. | 10. | -9.  |
| 1321               | 33.          | 31.      | -20.         | 16.5     | 7.           | -16.     | 0.7          | 0.0      | -1.3         | 0.15     | 0.1          | -0.1     | 0.36 | 0.3 | -0.2 | 13. | 11. | -7.  |
| 1329               | 25.          | 26.      | -25.         | 4.0      | -1.          | -8.      | 1.2          | 0.5      | -2.1         | 0.28     | 0.3          | -0.2     | 0.11 | 0.1 | -0.1 | 5.  | 4.  | -3.  |
| 1333               | 35.          | 31.      | -47.         | 4.6      | 2.           | -6.      | 1.8          | 1.2      | -2.2         | 0.41     | 0.4          | -0.4     | 0.12 | 0.1 | -0.1 | 4.  | 4.  | -4.  |
| 1337               | 19.          | 15.      | -16.         | 3.9      | 2.           | -6.      | 1.0          | 0.4      | -1.8         | 0.23     | 0.2          | -0.2     | 0.09 | 0.1 | -0.1 | 4.  | 3.  | -4.  |
| 1341               | 11.          | 13.      | -10.         | 2.8      | -0.          | -5.      | 0.7          | -0.0     | -1.3         | 0.12     | 0.1          | -0.1     | 0.07 | 0.1 | -0.1 | 3.  | 2.  | -2.  |
| 1345               | 12.          | 15.      | -11.         | 5.3      | 1.           | -8.      | 0.6          | -0.0     | -1.1         | 0.07     | 0.1          | -0.1     | 0.12 | 0.1 | -0.1 | 6.  | 5.  | -4.  |



| LOG BOOK DATA                         |                  |
|---------------------------------------|------------------|
| DATE AND TIME                         | 02-06-74 0400    |
| COURSE AND SPEED                      | 308 , 32.3 KNOTS |
| SEA STATE                             | 4                |
| WAVE HEIGHT                           | 1 FEET           |
| " REL DIR                             | 83 PORT          |
| SWELL HEIGHT                          | FEET             |
| " REL DIR                             |                  |
| ----- VISUAL WEATHER / COMMENTS ----- |                  |
| PT CLDY /                             |                  |
| MIDSHIP VERTICAL BENDING STRESS       |                  |
| MAXIMUM PK-TR                         | 1.3 KPSI         |
| 4.0 X RMS                             | 1.0 KPSI         |
| SUMMARY OF MOTIONS (4.0 X RMS)        |                  |
| ROLL                                  | 1.9 DEG          |
| PITCH                                 | 0.59 DEG         |
| DK HSE VERT ACCEL                     | 0.09 G           |
| DK HSE LAT ACCEL                      | 0.06 G           |
| RADAR SLANT RANGE                     | 8.7 FEET         |
| VERTICAL RANGE                        | 7.7 FEET         |
| DISPL AT RADAR                        | 3.6 FEET         |
| WAVE HEIGHT STATISTICS (FEET)         |                  |
| TUCKER/DYN. HEAD/RADAR                |                  |
| P-T SAMPLE SIZE                       | 507 355 428      |
| MAXIMUM HEIGHT                        | 2.1 2.1 7.1      |
| 10TH HIGHEST HTS                      | 1.3 1.6 5.5      |
| 3RD HIGHEST HTS                       | 0.9 1.1 4.2      |
| 4.0 RMS(SPECTRA)                      | 2.1 2.3 5.4      |



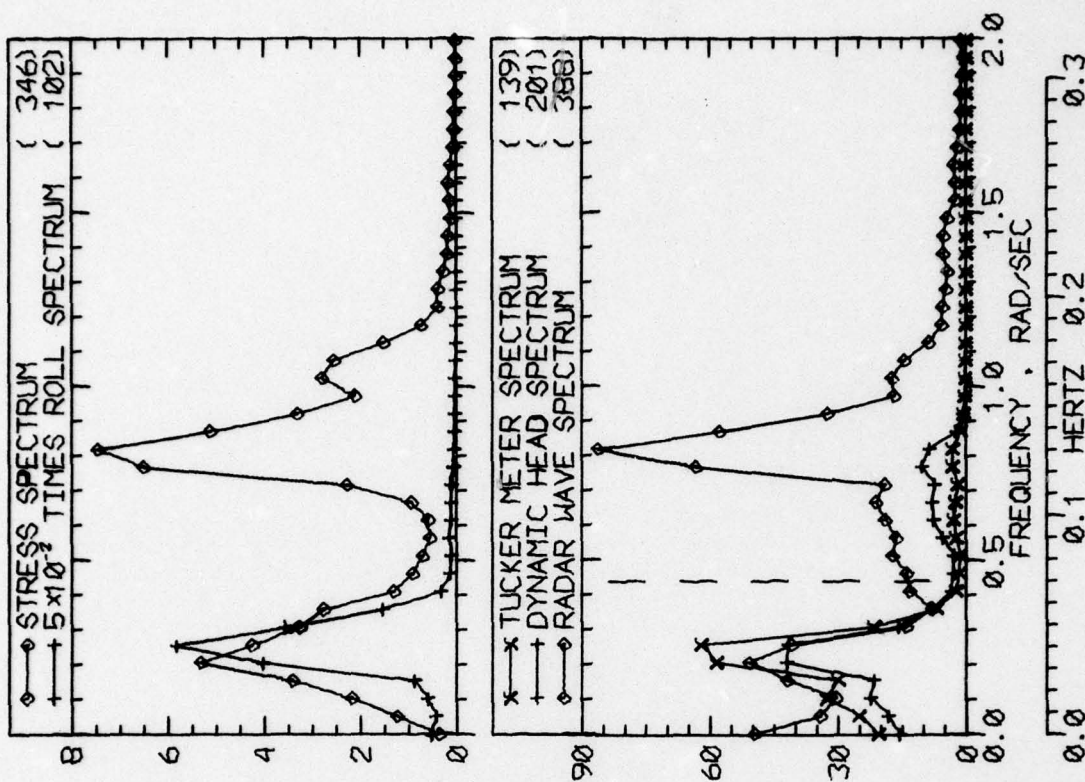
RUN 1209 -- VOYAGE 34W -- TAPE 161 -- INDEX 3 -- INTERVAL 9



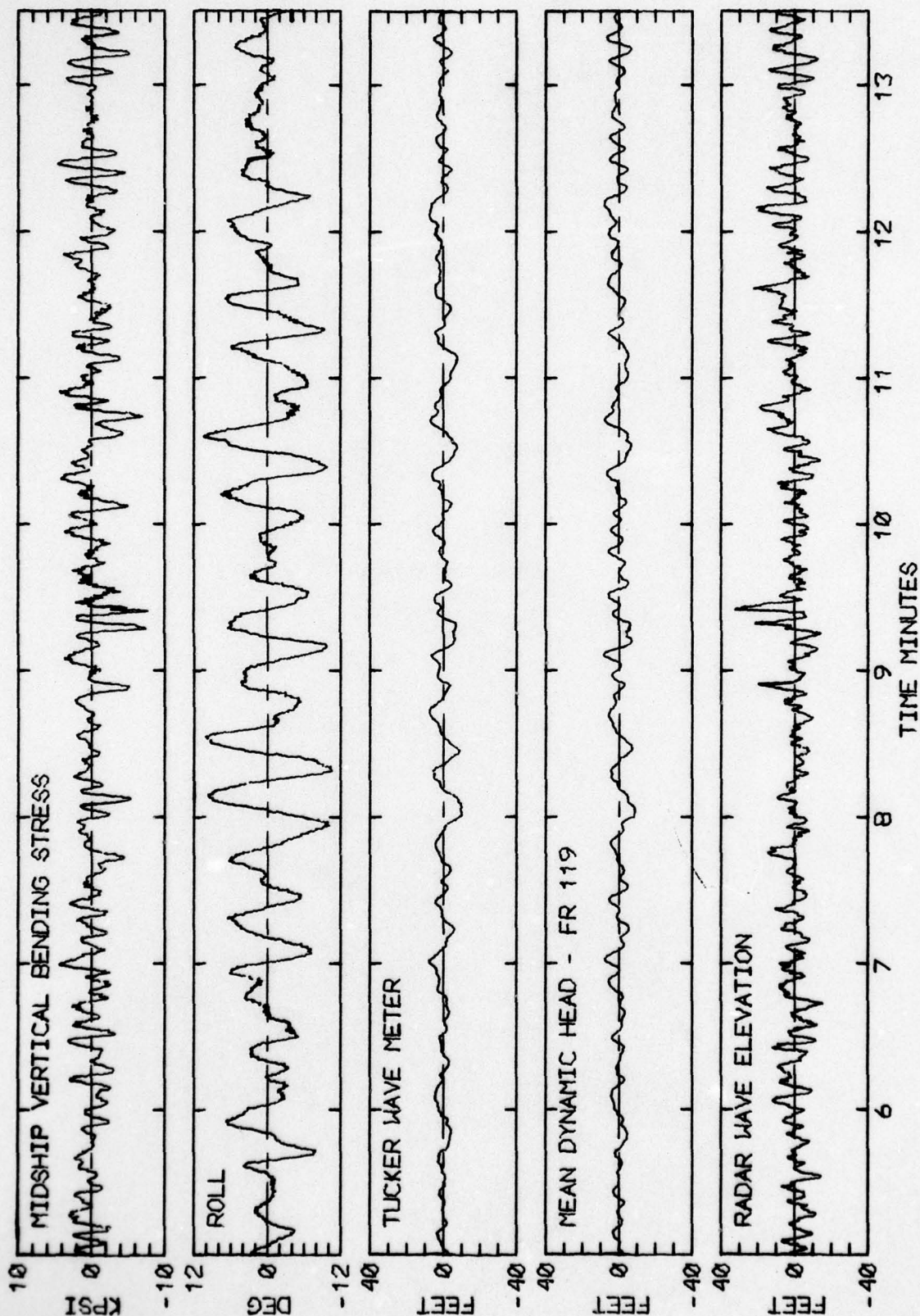
RUN 1209 -- VOYAGE 34W -- TAPE 161 -- INDEX 3 -- INTERVAL 9



| LOG BOOK DATA                          |                        |            |      |
|----------------------------------------|------------------------|------------|------|
| DATE AND TIME                          | 02-06-74               | 1200       |      |
| POSITION                               | 58-27 N                | 08-51 W    |      |
| COURSE AND SPEED                       | 267                    | 31.9 KNOTS |      |
| SEA STATE                              | 6                      |            |      |
| WAVE HEIGHT                            | 5 FEET                 |            |      |
| " REL DIR                              | 138 STBD               |            |      |
| SWELL HEIGHT                           | 8 FEET                 |            |      |
| " REL DIR                              | 115 STBD               |            |      |
| ----- VISUAL WEATHER / COMMENTS -----  |                        |            |      |
| OCAST / HEAVY ROLL                     |                        |            |      |
| <u>MIDSHIP VERTICAL BENDING STRESS</u> |                        |            |      |
| MAXIMUM PK-TR                          | 10.2 KPSI              |            |      |
| 4.0 X RMS                              | 7.3 KPSI               |            |      |
| <u>SUMMARY OF MOTIONS (4.0 X RMS)</u>  |                        |            |      |
| ROLL                                   | 17.4 DEG               |            |      |
| PITCH                                  | 1.81 DEG               |            |      |
| DK HSE VERT ACCEL                      | 0.42 G                 |            |      |
| DK HSE LAT ACCEL                       | 0.39 G                 |            |      |
| RADAR SLANT RANGE                      | 49.6 FEET              |            |      |
| VERTICAL RANGE                         | 36.9 FEET              |            |      |
| DISPL AT RADAR                         | 22.0 FEET              |            |      |
| <u>WAVE HEIGHT STATISTICS (FEET)</u>   |                        |            |      |
|                                        | TUCKER/DYN. HEAD/RADAR |            |      |
| P-T SAMPLE SIZE                        | 74                     | 76         | 174  |
| MAXIMUM HEIGHT                         | 14.7                   | 14.9       | 37.5 |
| 10TH HIGHEST HTS                       | 13.9                   | 13.5       | 26.7 |
| 3RD HIGHEST HTS                        | 10.3                   | 10.6       | 20.1 |
| 4.0 RMS(SPECTRA)                       | 14.9                   | 14.0       | 24.7 |



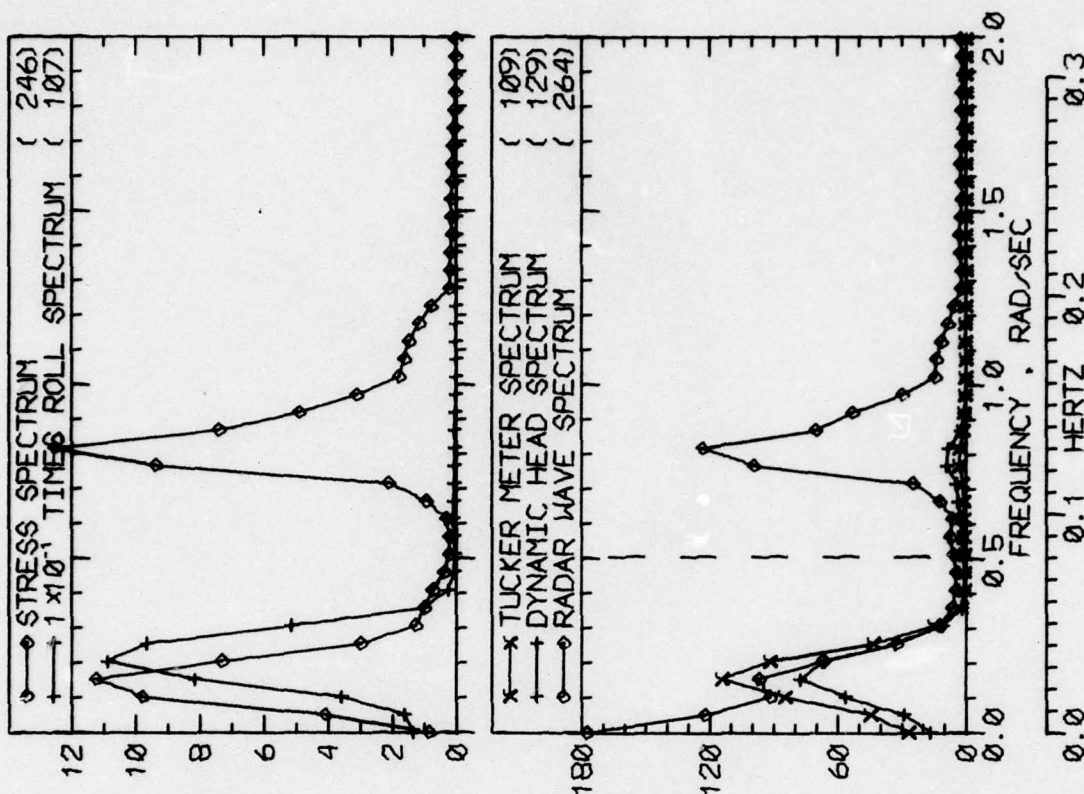
RUN 1217 -- VOYAGE 34W -- TAPE 161 -- INDEX 5 -- INTERVAL 17



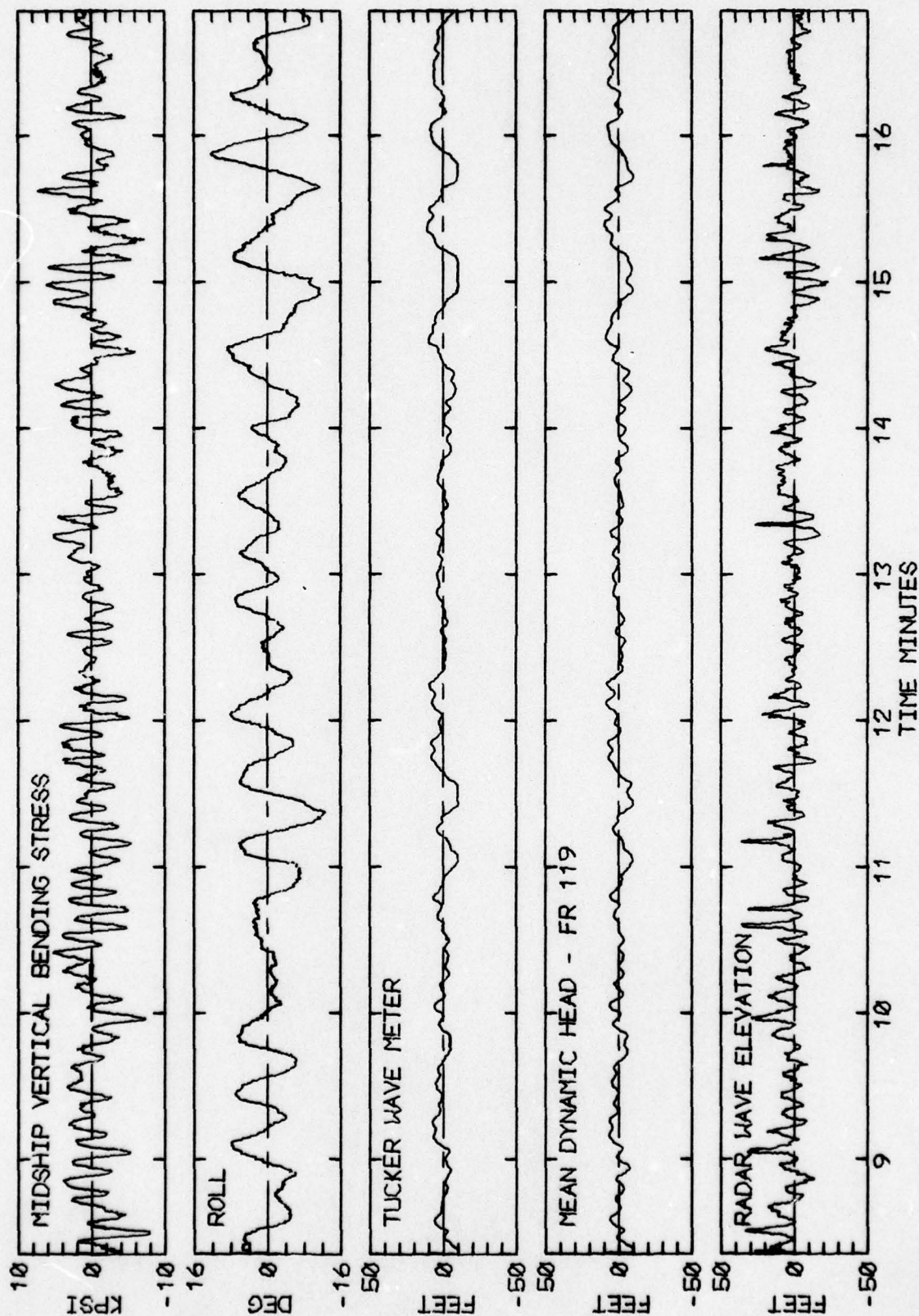
RUN 1217 -- VOYAGE 34W -- TAPE 161 -- INDEX 5 -- INTERVAL 17



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-06-74  | 2000       |      |
| POSITION                              | 58-27 N   | 08-51 W    |      |
| COURSE AND SPEED                      | 246       | 30.8 KNOTS |      |
| SEA STATE                             | 8         |            |      |
| WAVE HEIGHT                           | 5 FEET    |            |      |
| " REL DIR                             | 136 STBD  |            |      |
| SWELL HEIGHT                          | 8 FEET    |            |      |
| " REL DIR                             | 136 STBD  |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| PT CLDY / HEAVY ROLL                  |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 11.0 KPSI |            |      |
| 4.0 X RMS                             | 8.6 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 18.5 DEG  |            |      |
| PITCH                                 | 1.92 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.43 G    |            |      |
| DK HSE LAT ACCEL                      | 0.39 G    |            |      |
| RADAR SLANT RANGE                     | 55.7 FEET |            |      |
| VERTICAL RANGE                        | 43.5 FEET |            |      |
| DISPL AT RADAR                        | 21.2 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| P-T SAMPLE SIZE                       | 50        | 62         | 147  |
| MAXIMUM HEIGHT                        | 21.0      | 18.5       | 43.7 |
| 10TH HIGHEST HTS                      | 18.2      | 16.3       | 33.1 |
| 3RD HIGHEST HTS                       | 13.7      | 12.3       | 25.0 |
| 4.0 RMS(SPECTRA)                      | 18.6      | 16.2       | 29.8 |



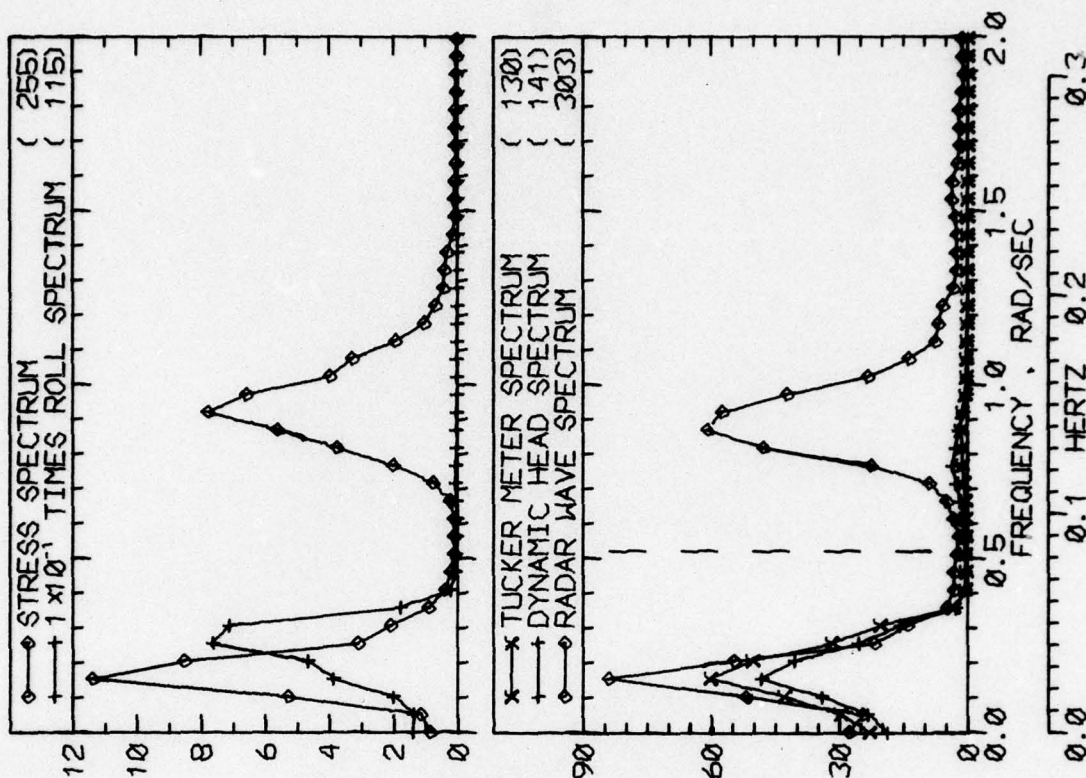
RUN 122B -- VOYAGE 34W -- TAPE 161 -- INDEX 7 -- INTERVAL 28



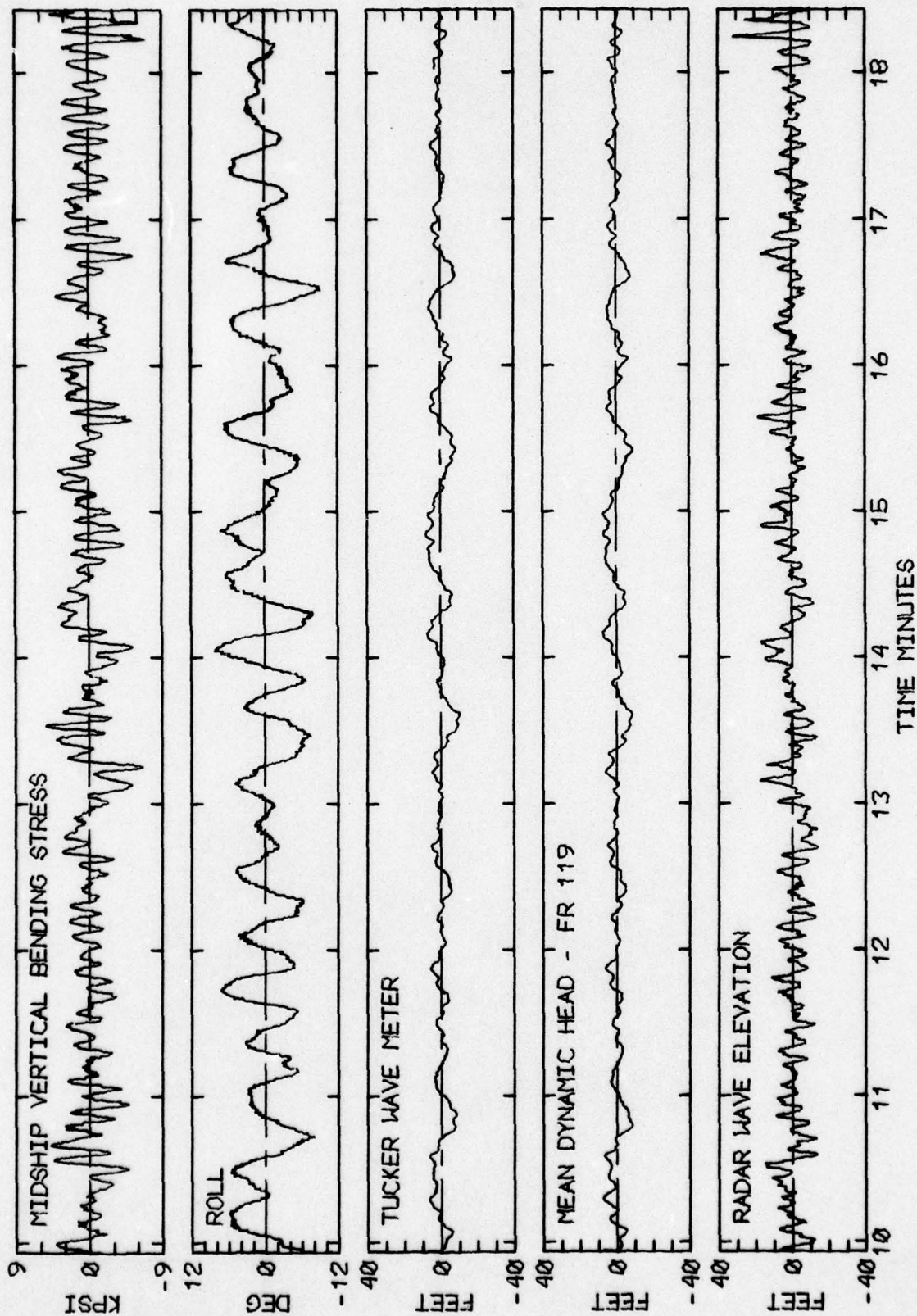
RUN 1228 -- VOYAGE 34W -- TAPE 161 -- INDEX 7 -- INTERVAL 28



| LOG BOOK DATA                         |              |            |      |
|---------------------------------------|--------------|------------|------|
| DATE AND TIME                         | 02-06-74     | 2400       |      |
| POSITION                              | 58-27 N      | 08-51 W    |      |
| COURSE AND SPEED                      | 246          | 31.3 KNOTS |      |
| SEA STATE                             | 3            |            |      |
| WAVE HEIGHT                           | 4 FEET       |            |      |
| " REL DIR                             | 156 PORT     |            |      |
| SWELL HEIGHT                          | 6 FEET       |            |      |
| " REL DIR                             | 136 STBD     |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |              |            |      |
| PT CLDY                               | ARIDING EASY |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |              |            |      |
| MAXIMUM PK-TR                         | 9.2 KPSI     |            |      |
| 4.0 X RMS                             | 7.8 KPSI     |            |      |
| SUMMARY OF NOTIONS (4.0 X RMS)        |              |            |      |
| ROLL                                  | 15.6 DEG     |            |      |
| PITCH                                 | 1.61 DEG     |            |      |
| DK HSE VERT ACCEL                     | 0.35 G       |            |      |
| DK HSE LAT ACCEL                      | 0.34 G       |            |      |
| RADAR SLANT RANGE                     | 43.2 FEET    |            |      |
| VERTICAL RANGE                        | 33.2 FEET    |            |      |
| DISPL AT RADAR                        | 15.6 FEET    |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |              |            |      |
| TUCKER/DYN. HEAD/RADAR                |              | 62         | 65   |
| P-T SAMPLE SIZE                       |              | 157        |      |
| MAXIMUM HEIGHT                        | 15.0         | 16.3       | 41.9 |
| 10TH HIGHEST HTS                      | 14.0         | 13.4       | 25.1 |
| 3RD HIGHEST HTS                       | 10.7         | 10.0       | 19.5 |
| 4.0 RMS(SPECTRA)                      | 14.6         | 13.4       | 22.9 |



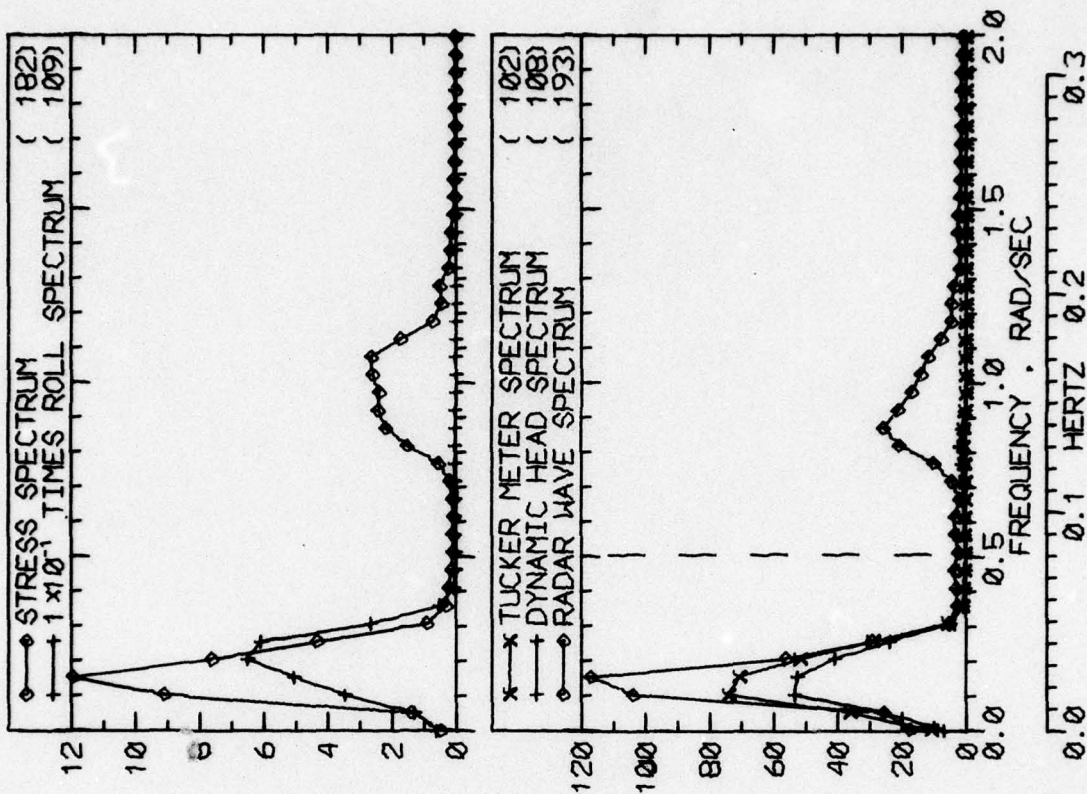
RUN 1230 -- VOYAGE 34W -- TAPE 161 -- INDEX 8 -- INTERVAL 30



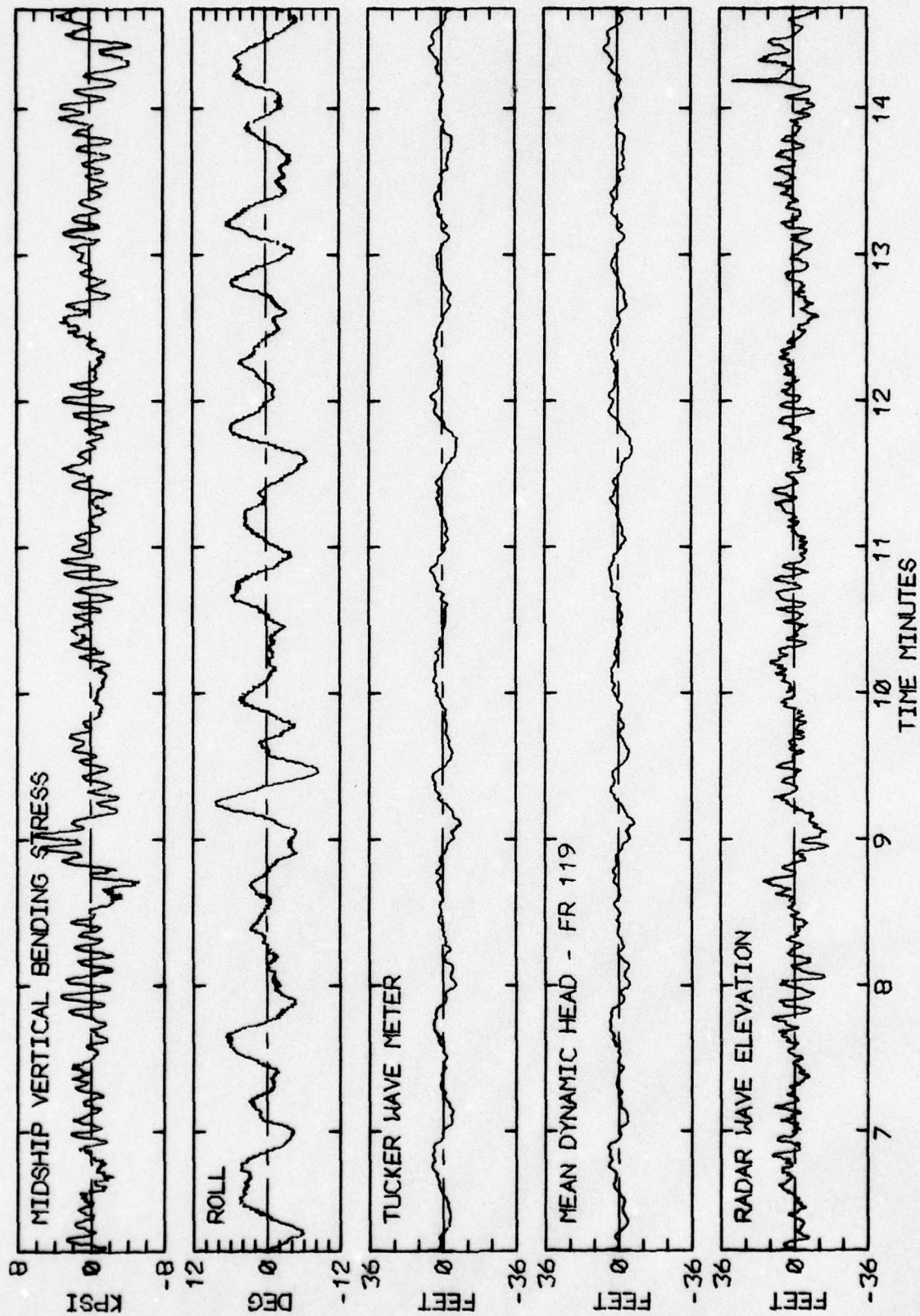
RUN 1230 -- VOYAGE 34W -- TAPE 161 -- INDEX 8 -- INTERVAL 30



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-07-74  | 0400       |      |
| POSITION                              | 58-27 N   | 08-51 W    |      |
| COURSE AND SPEED                      | 246       | 31.6 KNOTS |      |
| SEA STATE                             | 5         |            |      |
| WAVE HEIGHT                           | 2 FEET    |            |      |
| " REL DIR                             | 100 PORT  |            |      |
| SWELL HEIGHT                          | 6 FEET    |            |      |
| " REL DIR                             | 114 STBD  |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST /                               |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 8.7 KPSI  |            |      |
| 4.0 X RMS                             | 6.8 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 14.7 DEG  |            |      |
| PITCH                                 | 1.04 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.23 G    |            |      |
| DK HSE LAT ACCEL                      | 0.30 G    |            |      |
| RADAR SLANT RANGE                     | 36.1 FEET |            |      |
| VERTICAL RANGE                        | 26.1 FEET |            |      |
| DISPL AT RADAR                        | 9.9 FEET  |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| P-T SAMPLE SIZE                       | 80        | 68         | 148  |
| MAXIMUM HEIGHT                        | 13.5      | 14.3       | 30.1 |
| 10TH HIGHEST HTS                      | 11.9      | 11.8       | 20.3 |
| 3RD HIGHEST HTS                       | 7.7       | 8.2        | 15.5 |
| 4.0 RMS(SPECTRA)                      | 15.2      | 13.3       | 21.3 |



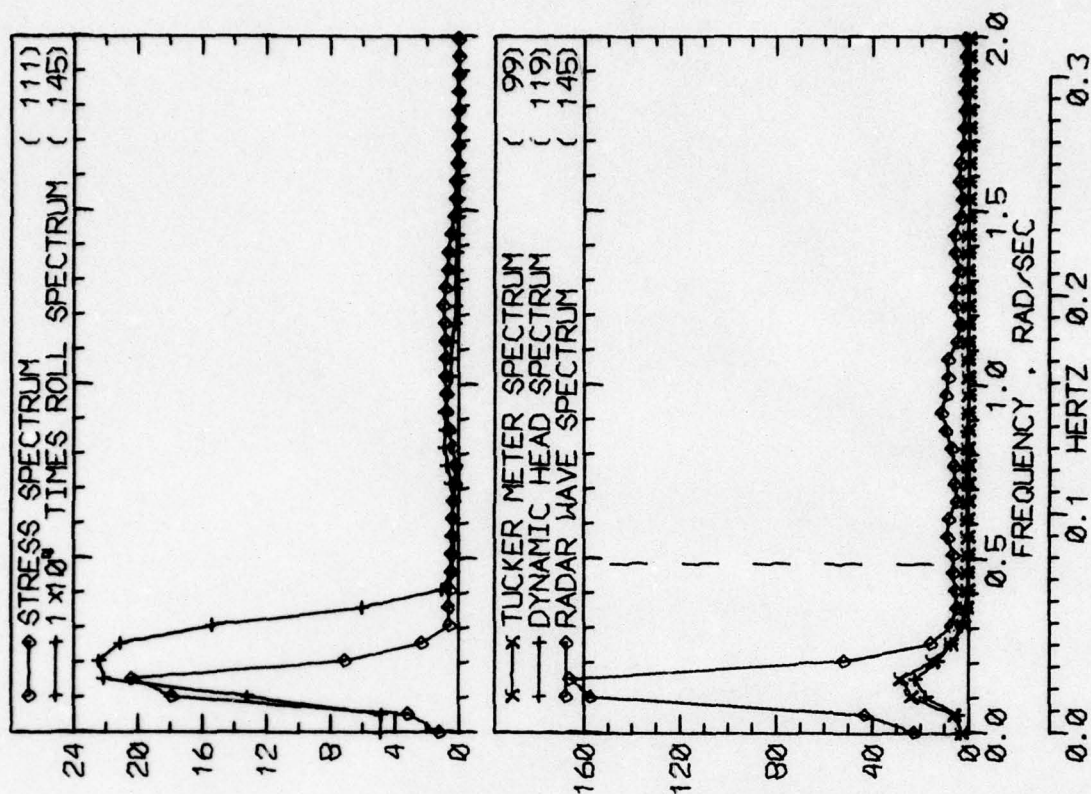
RUN 1233 -- VOYAGE 34W -- TAPE 161 -- INDEX 9 -- INTERVAL 33



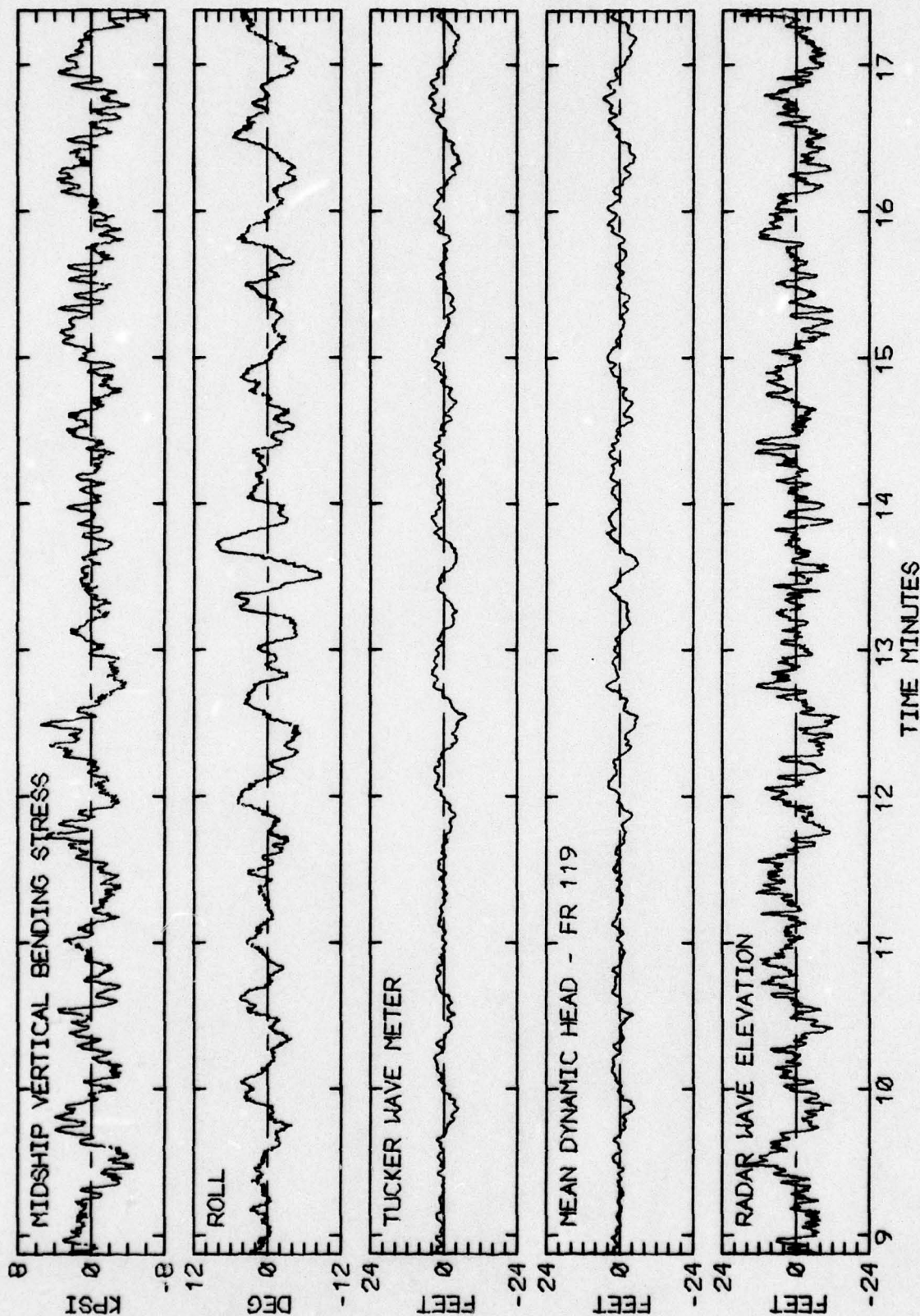
RUN 1233 -- VOYAGE 34W -- TAPE 161 -- INDEX 9 -- INTERVAL 33



| LOG BOOK DATA                         |                  |
|---------------------------------------|------------------|
| DATE AND TIME                         | 02-07-74 0800    |
| POSITION                              | 58-27 N 08-51 W  |
| COURSE AND SPEED                      | 242 . 31.6 KNOTS |
| SEA STATE                             | 6                |
| WAVE HEIGHT                           | 2 FEET           |
| " REL DIR                             | 118 PORT         |
| SWELL HEIGHT                          | 6 FEET           |
| " REL DIR                             | 118 STBD         |
| ----- VISUAL WEATHER / COMMENTS ----- |                  |
| OCAST /                               |                  |
| MIDSHIP VERTICAL BENDING STRESS       |                  |
| MAXIMUM PK-TR                         | 8.3 KPSI         |
| 4.0 X RMS                             | 7.4 KPSI         |
| SUMMARY OF MOTIONS (4.0 X RMS)        |                  |
| ROLL                                  | 9.8 DEG          |
| PITCH                                 | 0.94 DEG         |
| DK HSE VERT ACCEL                     | 0.19 G           |
| DK HSE LAT ACCEL                      | 0.22 G           |
| RADAR SLANT RANGE                     | 30.2 FEET        |
| VERTICAL RANGE                        | 25.6 FEET        |
| DISPL AT RADAR                        | 8.3 FEET         |
| WAVE HEIGHT STATISTICS (FEET)         |                  |
| TUCKER/DYN. HEAD/RADAR                |                  |
| P-T SAMPLE SIZE                       | 128 116 151      |
| MAXIMUM HEIGHT                        | 11.1 10.7 28.0   |
| 10TH HIGHEST HTS                      | 7.1 7.1 19.2     |
| 3RD HIGHEST HTS                       | 4.4 4.7 15.3     |
| 4.0 RMS(SPECTRA)                      | 8.7 8.1 23.1     |



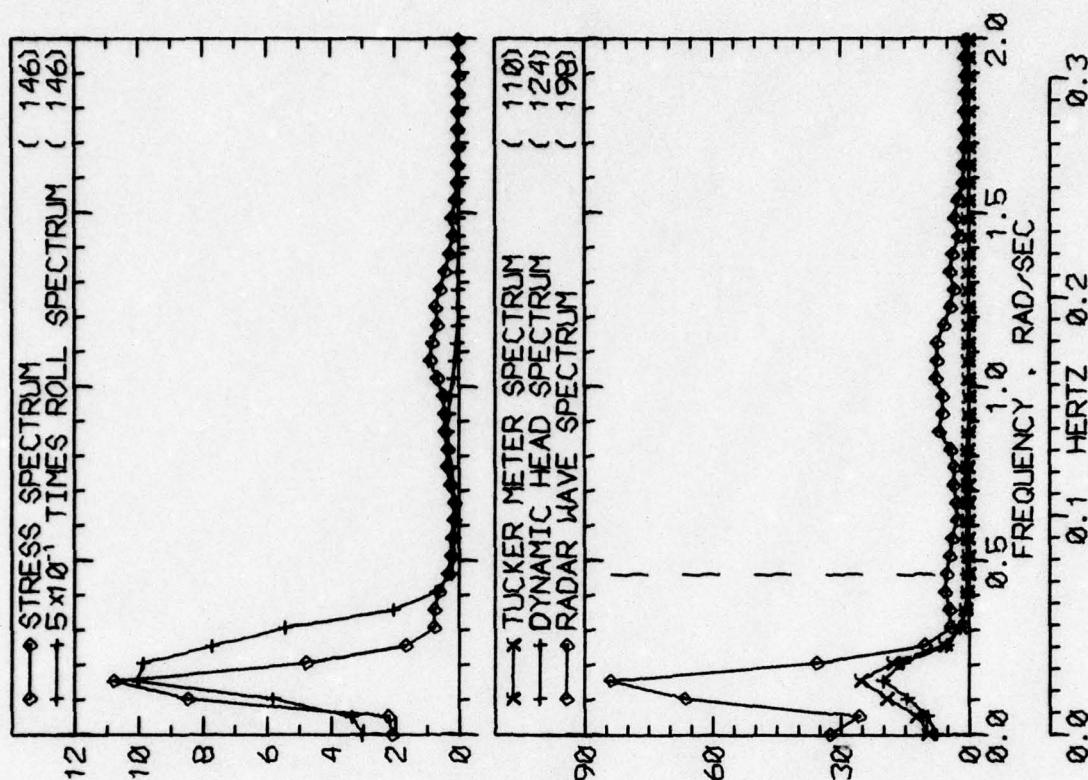
RUN 1237 -- VOYAGE 34W -- TAPE 161 -- INDEX 10 -- INTERVAL 37



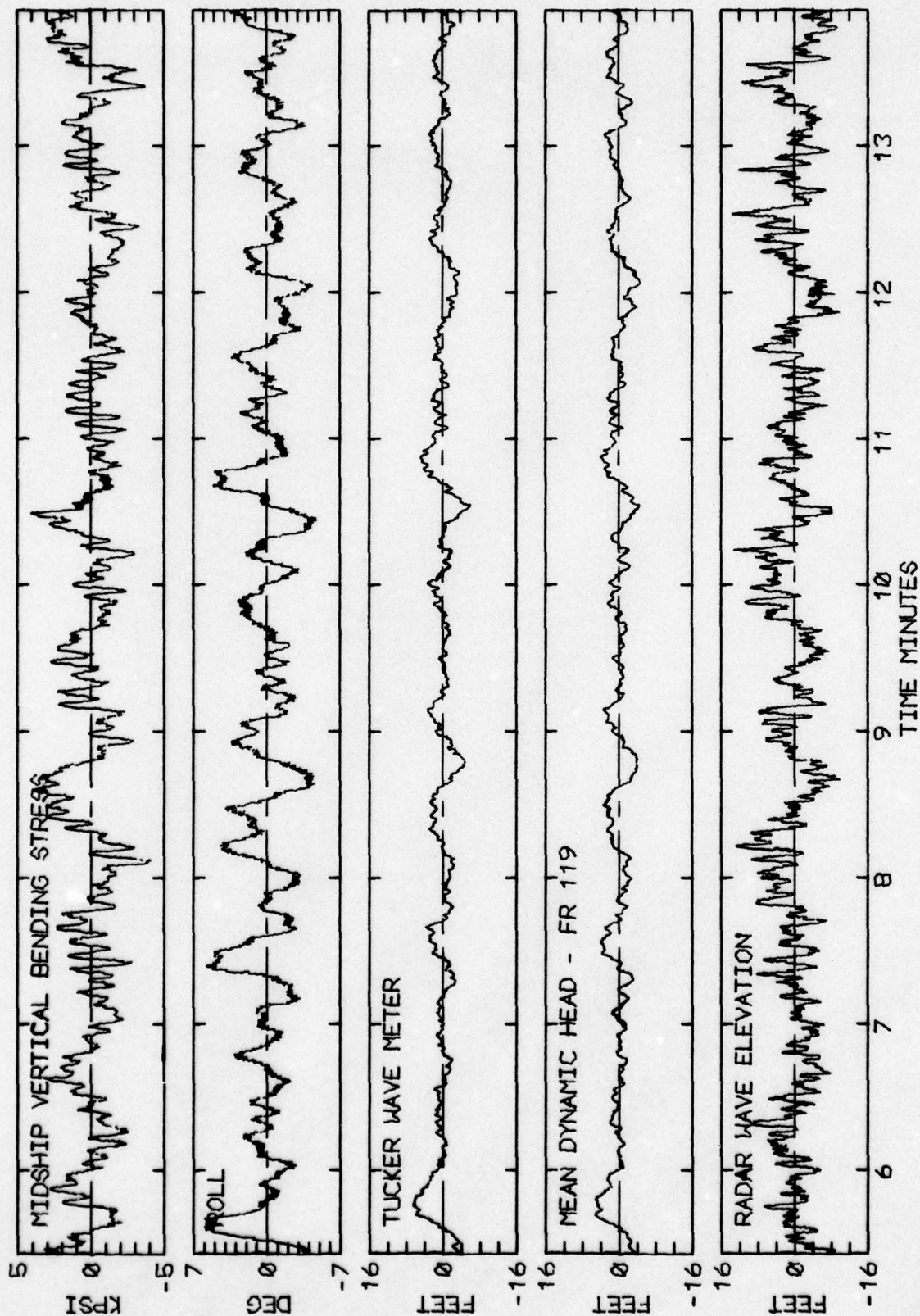
RUN 1237 -- VOYAGE 34W -- TAPE 161 -- INDEX 10 -- INTERVAL 37



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-07-74  | 1200       |      |
| POSITION                              | 54-00 N   | 30-00 W    |      |
| COURSE AND SPEED                      | 241       | 31.6 KNOTS |      |
| SEA STATE                             | 3         |            |      |
| WAVE HEIGHT                           | 3 FEET    |            |      |
| " REL DIR                             | 106 PORT  |            |      |
| SWELL HEIGHT                          | 6 FEET    |            |      |
| " REL DIR                             | 119 STBD  |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST FOG RAIN /                      |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 6.7 KPSI  |            |      |
| 4.0 X RMS                             | 5.8 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 9.0 DEG   |            |      |
| PITCH                                 | 0.87 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.18 G    |            |      |
| DK HSE LAT ACCEL                      | 0.20 G    |            |      |
| RADAR SLANT RANGE                     | 25.1 FEET |            |      |
| VERTICAL RANGE                        | 20.2 FEET |            |      |
| DISPL AT RADAR                        | 7.7 FEET  |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| TUCKER/DYN. HEAD/RADAR                |           |            |      |
| P-T SAMPLE SIZE                       | 113       | 104        | 179  |
| MAXIMUM HEIGHT                        | 7.9       | 10.4       | 19.0 |
| 10TH HIGHEST HTS                      | 6.3       | 6.6        | 14.3 |
| 3RD HIGHEST HTS                       | 4.2       | 4.6        | 11.5 |
| 4.0 RMS(SPECTRA)                      | 8.7       | 8.1        | 17.7 |



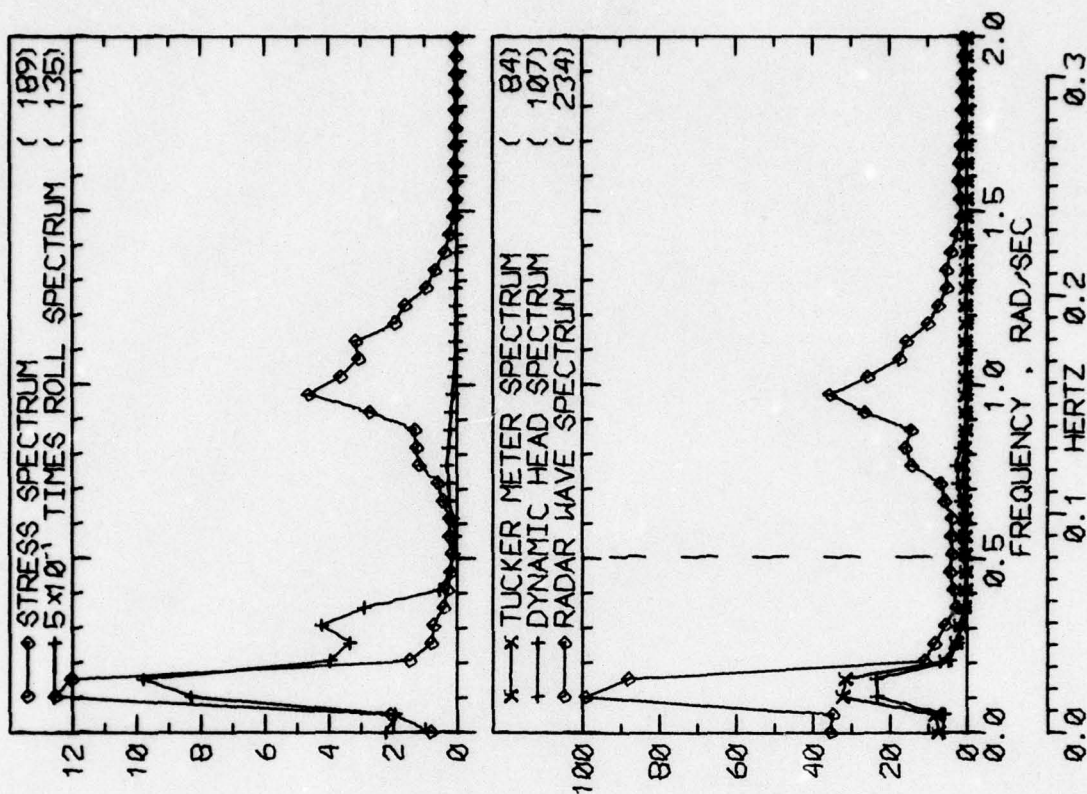
RUN 1241 -- VOYAGE 34W -- TAPE 161 -- INDEX 11 -- INTERVAL 41



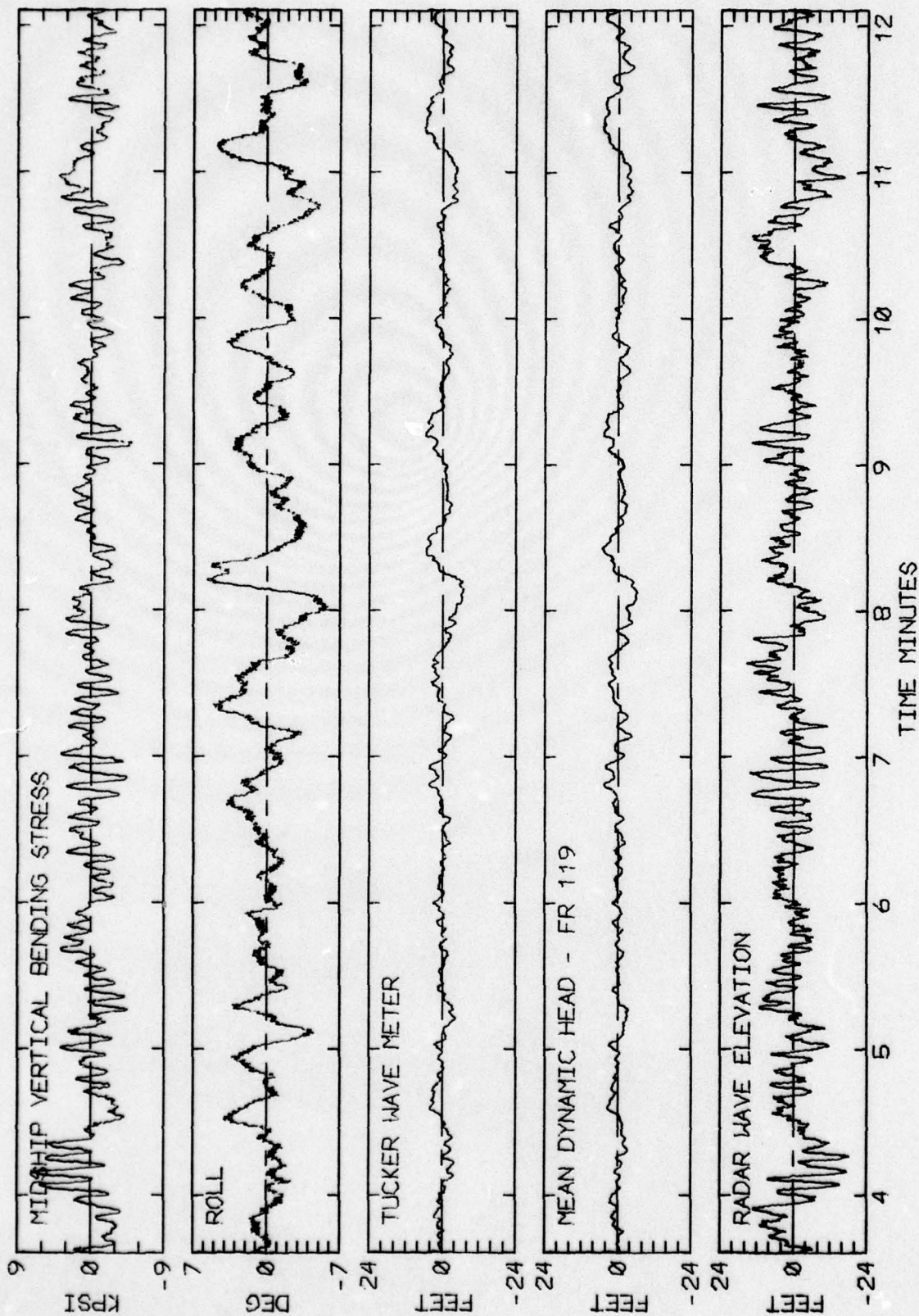
RUN 1241 -- VOYAGE 34W -- TAPE 161 -- INDEX 11 -- INTERVAL 41



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-07-74  | 1600       |      |
| POSITION                              | 54-00 N   | 30-00 W    |      |
| COURSE AND SPEED                      | 238       | 31.7 KNOTS |      |
| SEA STATE                             | 3         |            |      |
| WAVE HEIGHT                           | 2 FEET    |            |      |
| " REL DIR                             | 103 PORT  |            |      |
| SWELL HEIGHT                          | 6 FEET    |            |      |
| " REL DIR                             | 122 STBD  |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST /                               |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 9.0 KPSI  |            |      |
| 4.0 X RMS                             | 7.0 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 8.0 DEG   |            |      |
| PITCH                                 | 1.26 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.27 G    |            |      |
| DK HSE LAT ACCEL                      | 0.18 G    |            |      |
| RADAR SLANT RANGE                     | 30.7 FEET |            |      |
| VERTICAL RANGE                        | 26.8 FEET |            |      |
| DISPL AT RADAR                        | 11.9 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| P-T SAMPLE SIZE                       | 114       | 117        | 164  |
| MAXIMUM HEIGHT                        | 11.5      | 12.1       | 26.5 |
| 10TH HIGHEST HTS                      | 7.2       | 7.2        | 20.4 |
| 3RD HIGHEST HTS                       | 4.6       | 4.9        | 15.5 |
| 4.0 RMS(SPECTRA)                      | 8.9       | 8.1        | 20.8 |



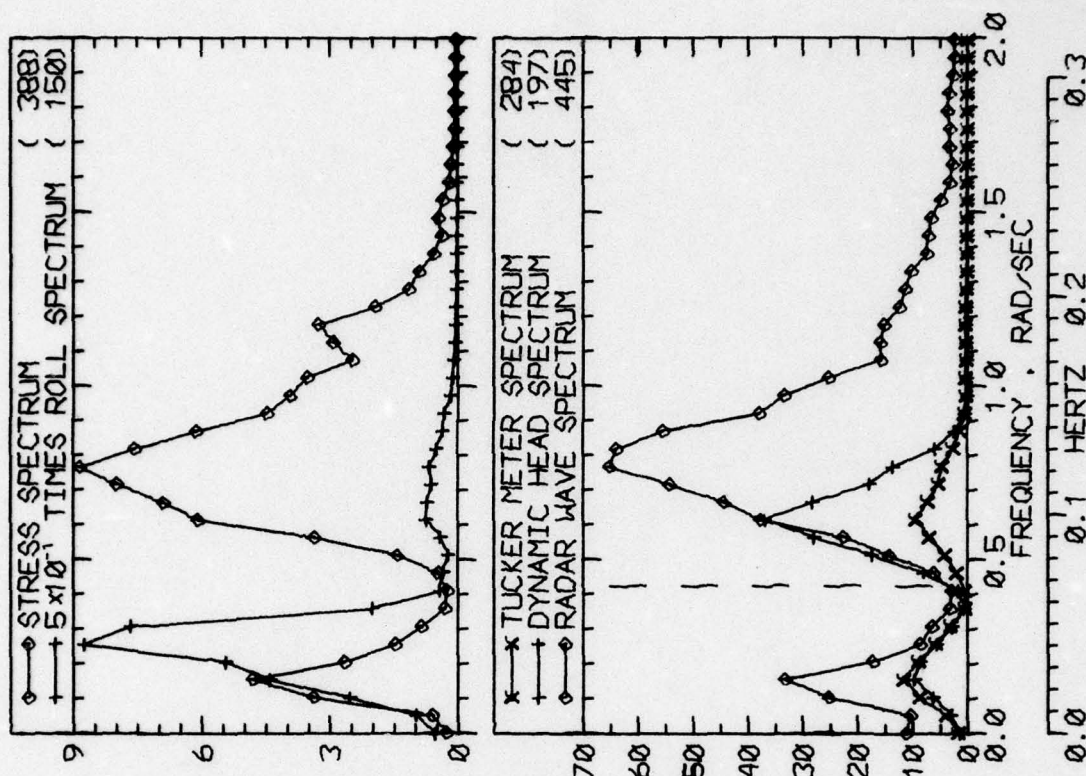
RUN 1245 -- VOYAGE 34W -- TAPE 161 -- INDEX 12 -- INTERVAL 45



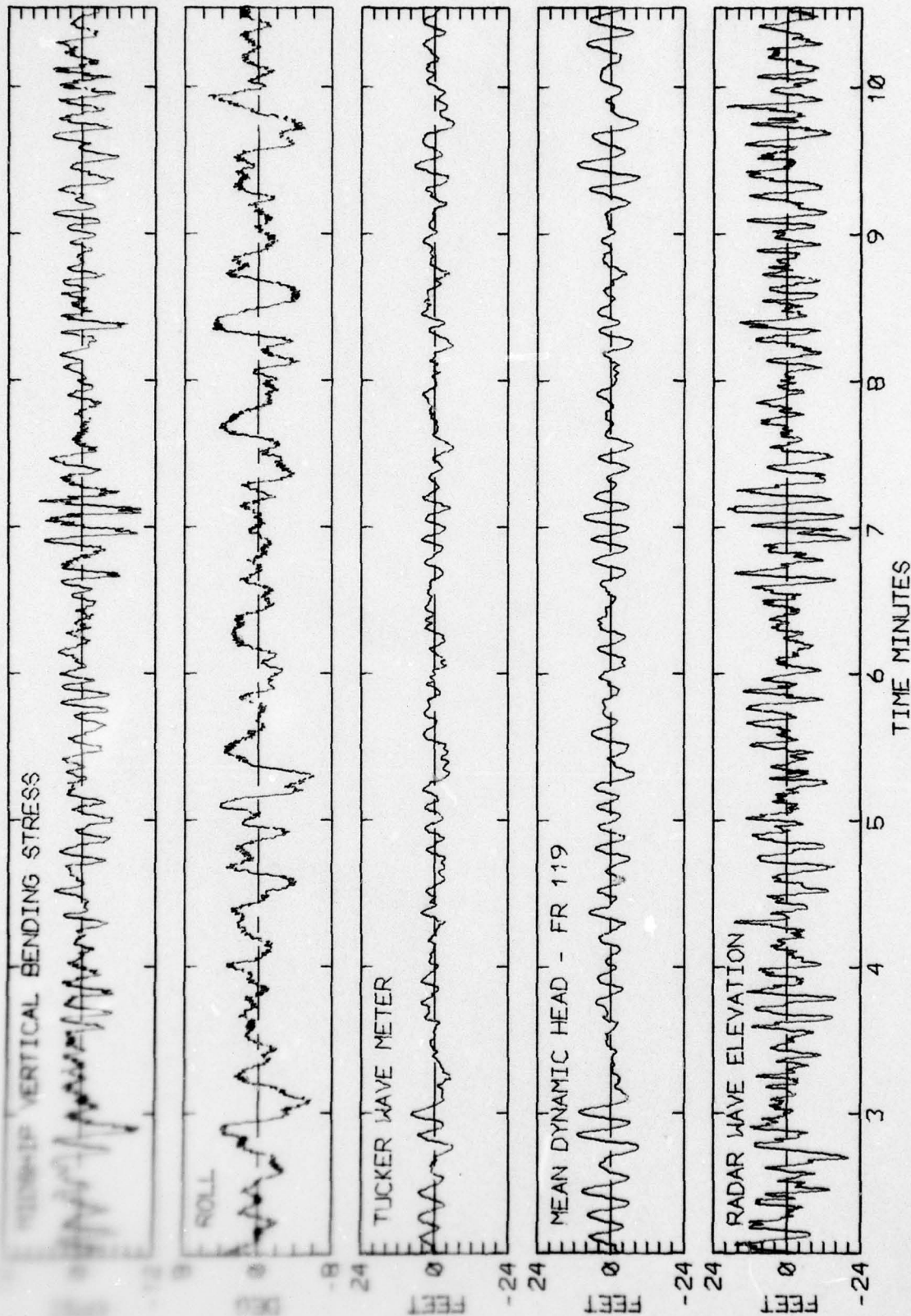
RUN 1245 -- VOYAGE 34W -- TAPE 161 -- INDEX 12 -- INTERVAL 45



| LOG BOOK DATA                   |                                       |      |      |
|---------------------------------|---------------------------------------|------|------|
| DATE AND TIME                   | 02-07-74 2400                         |      |      |
| POSITION                        | 54-00 N 30-00 W                       |      |      |
| COURSE AND SPEED                | 243 . 31.3 KNOTS                      |      |      |
| SEA STATE                       | 3                                     |      |      |
| WAVE HEIGHT                     | 2 FEET                                |      |      |
| " REL DIR                       | 18 PORT                               |      |      |
| SWELL HEIGHT                    | 6 FEET                                |      |      |
| " REL DIR                       | 18 PORT                               |      |      |
| PT CLDY /                       | ----- VISUAL WEATHER / COMMENTS ----- |      |      |
| MIDSHIP VERTICAL BENDING STRESS |                                       |      |      |
| MAXIMUM PK-TR                   | 14.8 KPSI                             |      |      |
| 4.0 X RMS                       | 8.8 KPSI                              |      |      |
| SUMMARY OF MOTIONS (4.0 X RMS)  |                                       |      |      |
| ROLL                            | 8.0 DEG                               |      |      |
| PITCH                           | 2.20 DEG                              |      |      |
| DK HSE VERT ACCEL               | 0.50 G                                |      |      |
| DK HSE LAT ACCEL                | 0.19 G                                |      |      |
| RADAR SLANT RANGE               | 43.5 FEET                             |      |      |
| VERTICAL RANGE                  | 40.7 FEET                             |      |      |
| DISPL AT RADAR                  | 29.5 FEET                             |      |      |
| WAVE HEIGHT STATISTICS (FEET)   |                                       |      |      |
| P-T SAMPLE SIZE                 | 128                                   | 102  | 191  |
| MAXIMUM HEIGHT                  | 12.2                                  | 17.2 | 33.7 |
| 10TH HIGHEST HTS                | 9.0                                   | 15.1 | 29.1 |
| 3RD HIGHEST HTS                 | 7.0                                   | 12.1 | 22.8 |
| 4.0 RMS(SPECTRA)                | 8.8                                   | 12.8 | 24.8 |



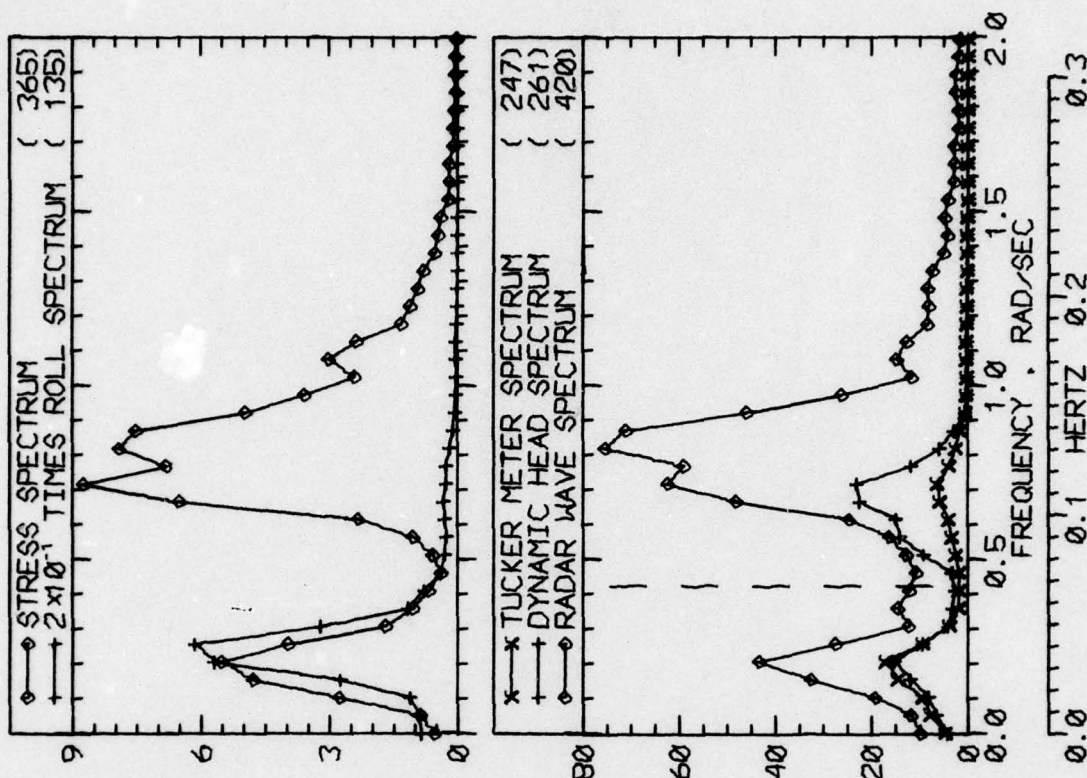
RUN 1305 -- VOYAGE 34W -- TAPE 163 -- INDEX 14 -- INTERVAL 5



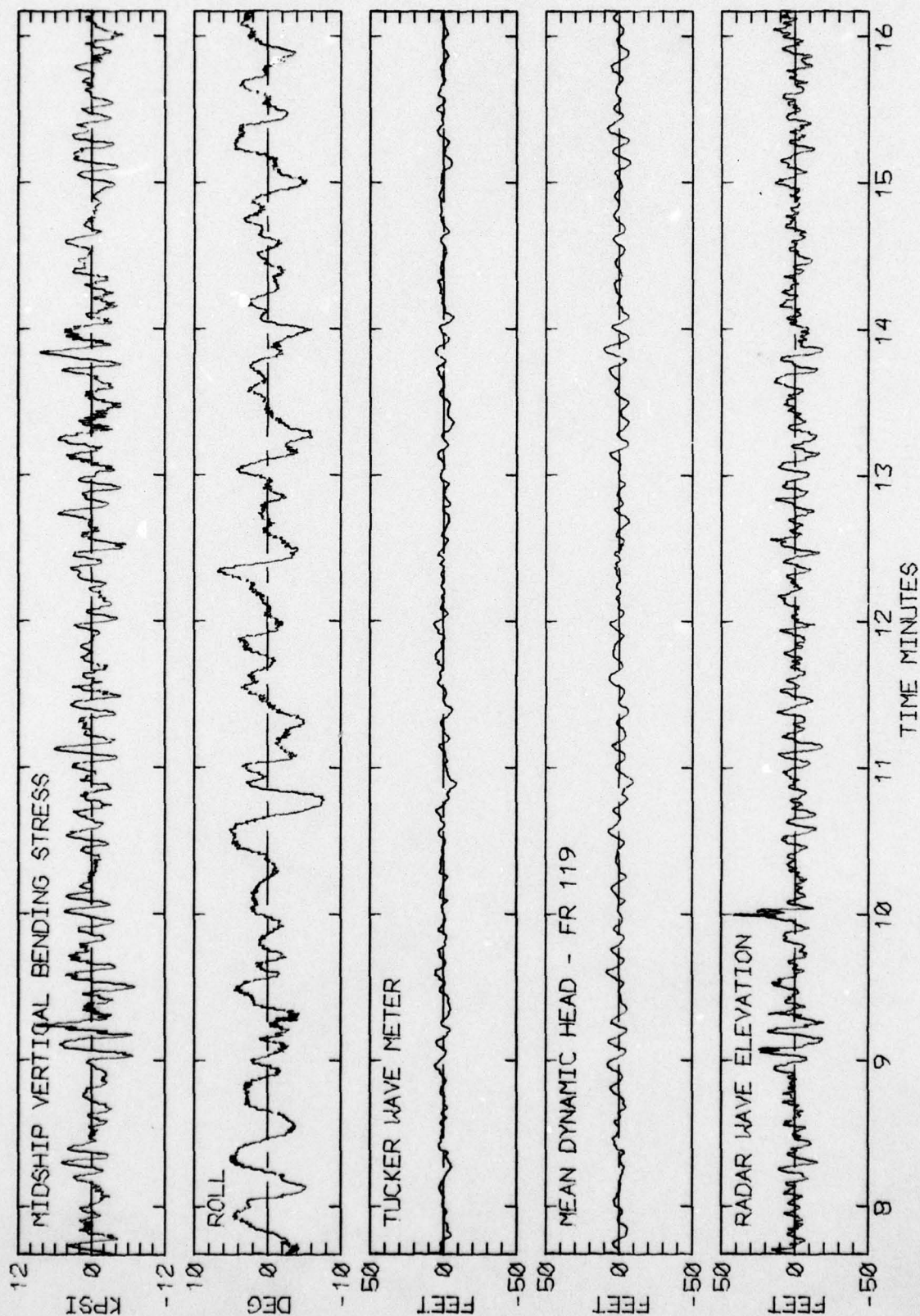
RUN 1305 -- VOYAGE 34W -- TAPE 163 -- INDEX 14 -- INTERVAL 5



| LOG BOOK DATA                          |           |            |      |
|----------------------------------------|-----------|------------|------|
| DATE AND TIME                          | 02-08-74  | 0400       |      |
| POSITION                               | 54-00 N   | 30-00 W    |      |
| COURSE AND SPEED                       | 243       | 31.4 KNOTS |      |
| SEA STATE                              | 6         |            |      |
| WAVE HEIGHT                            | 5 FEET    |            |      |
| " REL DIR                              | 49 STBD   |            |      |
| SWELL HEIGHT                           | 8 FEET    |            |      |
| " REL DIR                              | 18 PORT   |            |      |
| ----- VISUAL WEATHER / COMMENTS -----  |           |            |      |
| HAIL RAIN SQUALLS /                    |           |            |      |
| <u>MIDSHIP VERTICAL BENDING STRESS</u> |           |            |      |
| MAXIMUM PK-TR                          | 14.4 KPSI |            |      |
| 4.0 X RMS                              | 8.5 KPSI  |            |      |
| <u>SUMMARY OF MOTIONS (4.0 X RMS)</u>  |           |            |      |
| ROLL                                   | 10.1 DEG  |            |      |
| PITCH                                  | 2.06 DEG  |            |      |
| DK HSE VERT ACCEL                      | 0.47 G    |            |      |
| DK HSE LAT ACCEL                       | 0.23 G    |            |      |
| RADAR SLANT RANGE                      | 43.1 FEET |            |      |
| VERTICAL RANGE                         | 39.9 FEET |            |      |
| DISPL AT RADAR                         | 27.4 FEET |            |      |
| <u>WAVE HEIGHT STATISTICS (FEET)</u>   |           |            |      |
| TUCKER/DYN. HEAD/RADAR                 |           | 145        | 112  |
| P-T SAMPLE SIZE                        |           | 145        | 180  |
| MAXIMUM HEIGHT                         |           | 14.3       | 17.0 |
| 10TH HIGHEST HTS                       |           | 9.2        | 12.6 |
| 3RD HIGHEST HTS                        |           | 6.7        | 10.6 |
| 4.0 RMS(SPECTRA)                       |           | 9.4        | 12.0 |
|                                        |           |            | 25.5 |



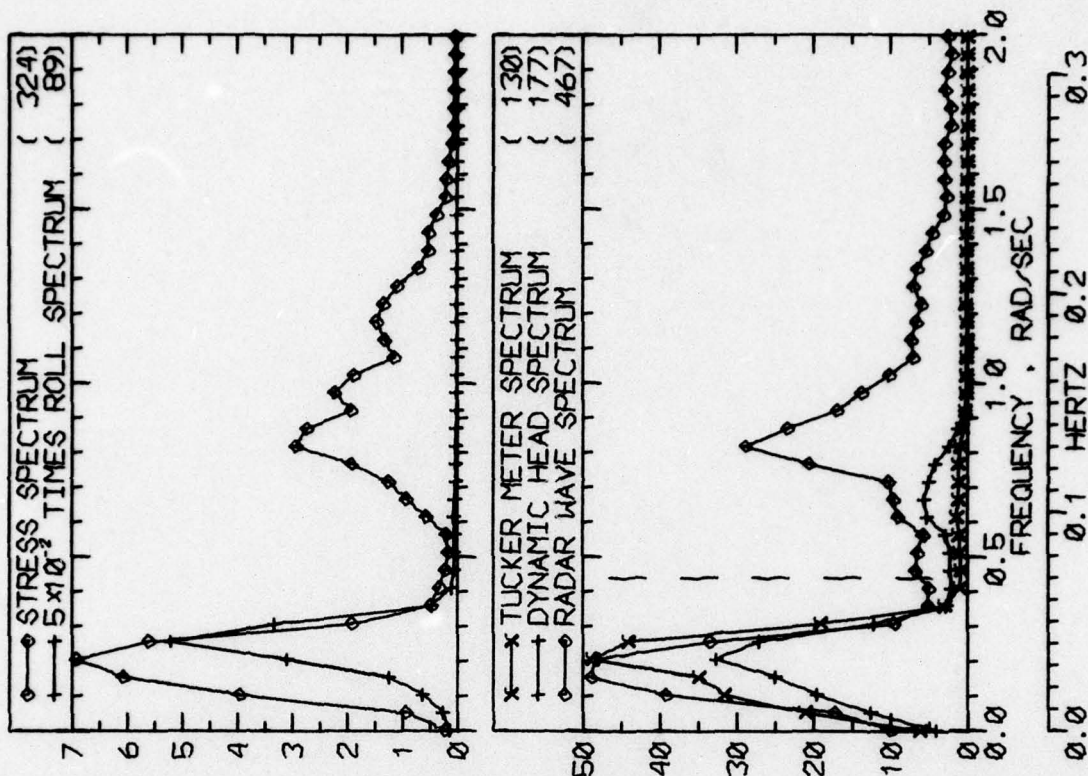
RUN 1309 -- VOYAGE 34W -- TAPE 163 -- INDEX 15 -- INTERVAL 9



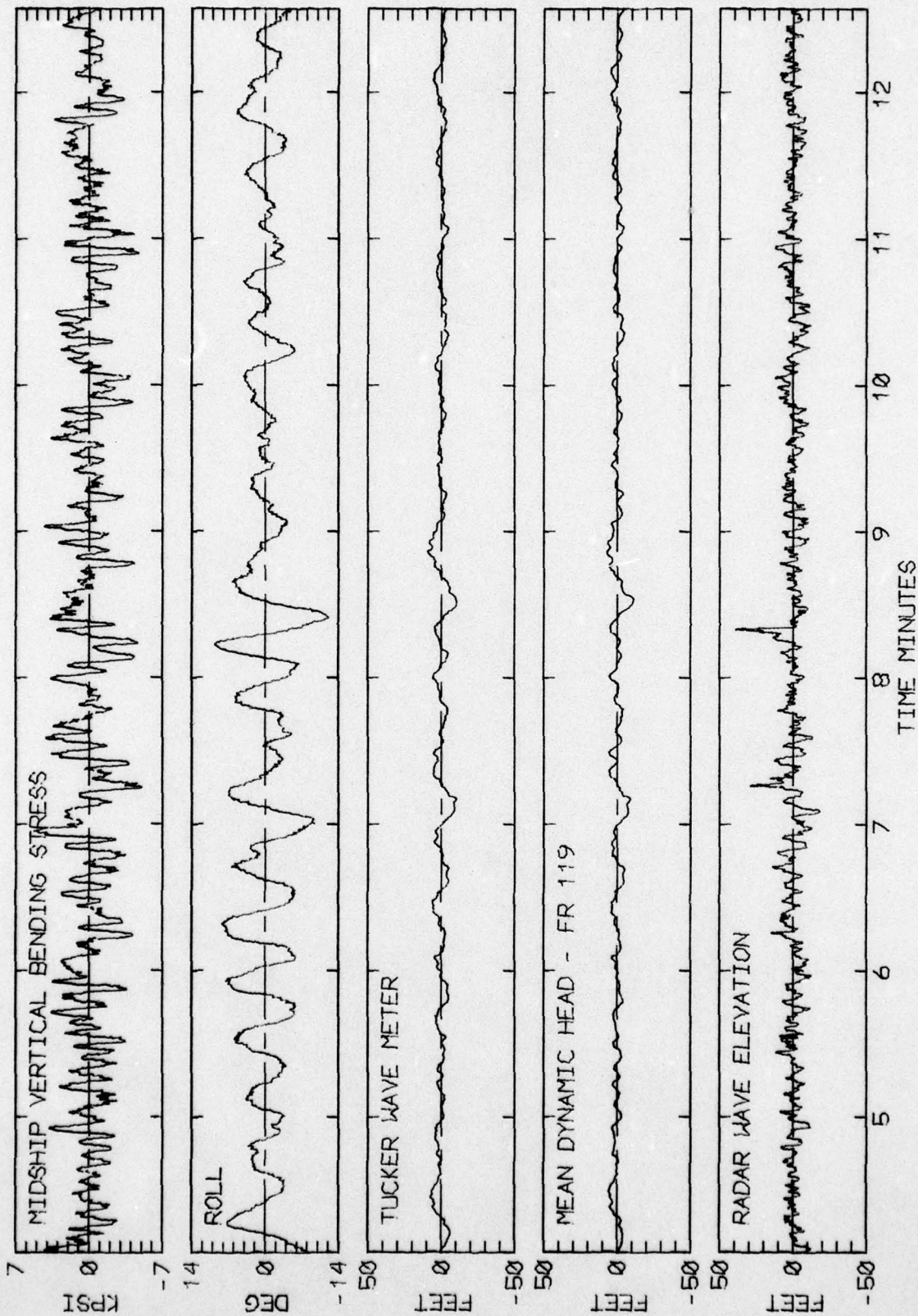
RUN 1309 -- VOYAGE 34W -- TAPE 163 -- INDEX 15 -- INTERVAL 9



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-08-74  | 1200       |      |
| POSITION                              | 48-09 N   | 47-18 W    |      |
| COURSE AND SPEED                      | 243       | 31.4 KNOTS |      |
| SEA STATE                             | 2         |            |      |
| WAVE HEIGHT                           | 5 FEET    |            |      |
| " REL DIR                             | 49 STBD   |            |      |
| SWELL HEIGHT                          | 8 FEET    |            |      |
| " REL DIR                             | 27 STBD   |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| CLEAR FOG SNOW /                      |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 9.3 KPSI  |            |      |
| 4.0 X RMS                             | 6.7 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 15.7 DEG  |            |      |
| PITCH                                 | 1.33 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.30 G    |            |      |
| DK HSE LAT ACCEL                      | 0.35 G    |            |      |
| RADAR SLANT RANGE                     | 40.2 FEET |            |      |
| VERTICAL RANGE                        | 27.6 FEET |            |      |
| DISPL AT RADAR                        | 15.7 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| TUCKER/DYN. HEAD/RADAR                |           | 75         | 87   |
| P-T SAMPLE SIZE                       |           | 15.9       | 16.1 |
| MAXIMUM HEIGHT                        |           | 12.6       | 11.4 |
| 10TH HIGHEST HTS                      |           | 9.1        | 8.3  |
| 3RD HIGHEST HTS                       |           | 13.4       | 11.8 |
| 4.0 RMS(SPECTRA)                      |           | 236        | 20.4 |



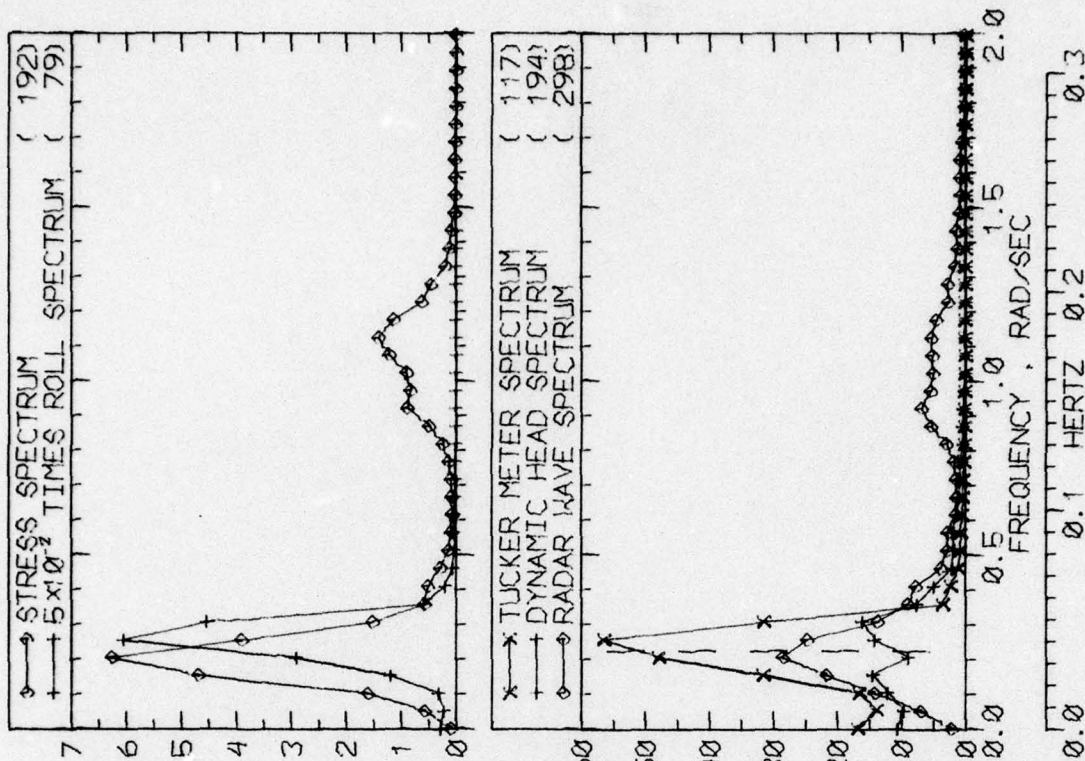
RUN 1317 -- VOYAGE 34W -- TAPE 163 -- INDEX 17 -- INTERVAL 17



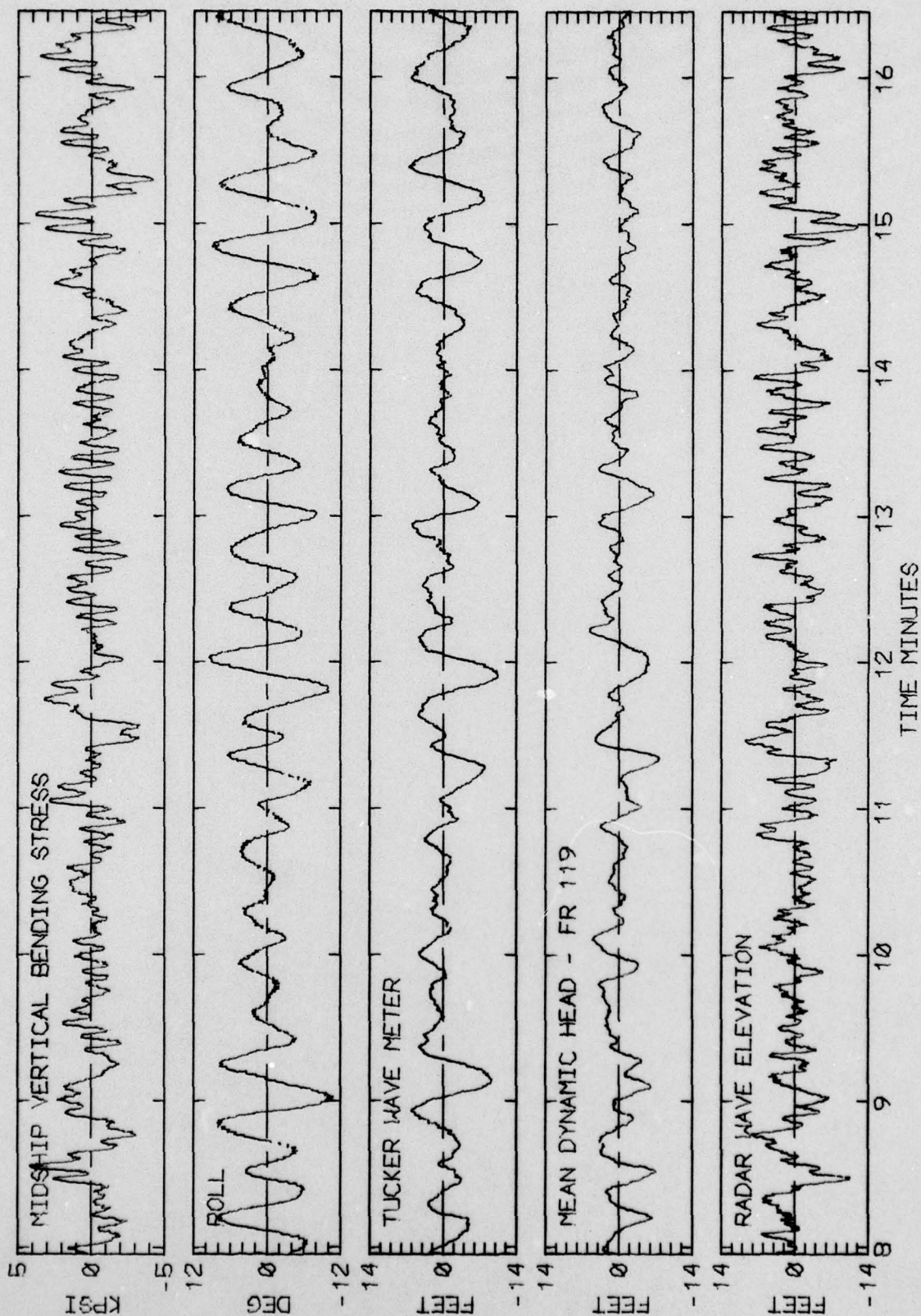
RUN 1317 -- VOYAGE 34W -- TAPE 163 -- INDEX 17 -- INTERVAL 17



| LOG BOOK DATA                             |           |            |      |
|-------------------------------------------|-----------|------------|------|
| DATE AND TIME                             | 02-08-74  | 1600       |      |
| POSITION                                  | 48-09 N   | 47-18 W    |      |
| COURSE AND SPEED                          | 245       | 31.8 KNOTS |      |
| SEA STATE                                 | 4         |            |      |
| WAVE HEIGHT                               | 0 FEET    |            |      |
| " REL DIR                                 | 47 STBD   |            |      |
| SWELL HEIGHT                              | 15 FEET   |            |      |
| " REL DIR                                 | 25 STBD   |            |      |
| ----- VISUAL WEATHER / COMMENTS -----     |           |            |      |
| OCAST SNOW / ICE FIELD ROLLING HIGH SWELL |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS           |           |            |      |
| MAXIMUM PK-TR                             | 8.3 KPSI  |            |      |
| 4.0 X RMS                                 | 4.9 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)            |           |            |      |
| ROLL                                      | 16.4 DEG  |            |      |
| PITCH                                     | 0.69 DEG  |            |      |
| DK HSE VERT ACCEL                         | 0.15 G    |            |      |
| DK HSE LAT ACCEL                          | 0.36 G    |            |      |
| RADAR SLANT RANGE                         | 33.2 FEET |            |      |
| VERTICAL RANGE                            | 16.1 FEET |            |      |
| DISPL AT RADAR                            | 13.6 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)             |           |            |      |
| TUCKER/DYN. HEAD/RADAR                    |           | 76         | 95   |
| P-T SAMPLE SIZE                           |           | 167        |      |
| MAXIMUM HEIGHT                            | 16.1      | 10.8       | 16.3 |
| 10TH HIGHEST HTS                          | 14.1      | 8.6        | 12.4 |
| 3RD HIGHEST HTS                           | 9.8       | 6.1        | 9.5  |
| 4.0 RMS(SPECTRA)                          | 13.3      | 9.3        | 12.9 |



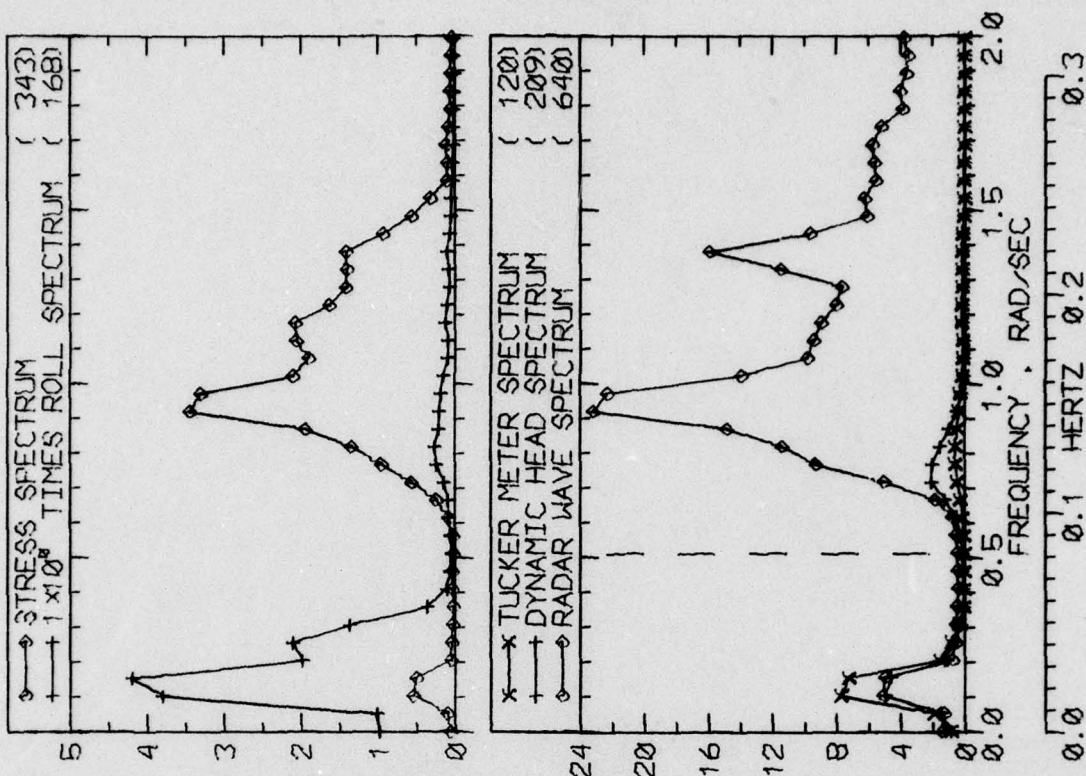
RUN 1321 -- VOYAGE 34W -- TAPE 163 -- INDEX 18 -- INTERVAL 21



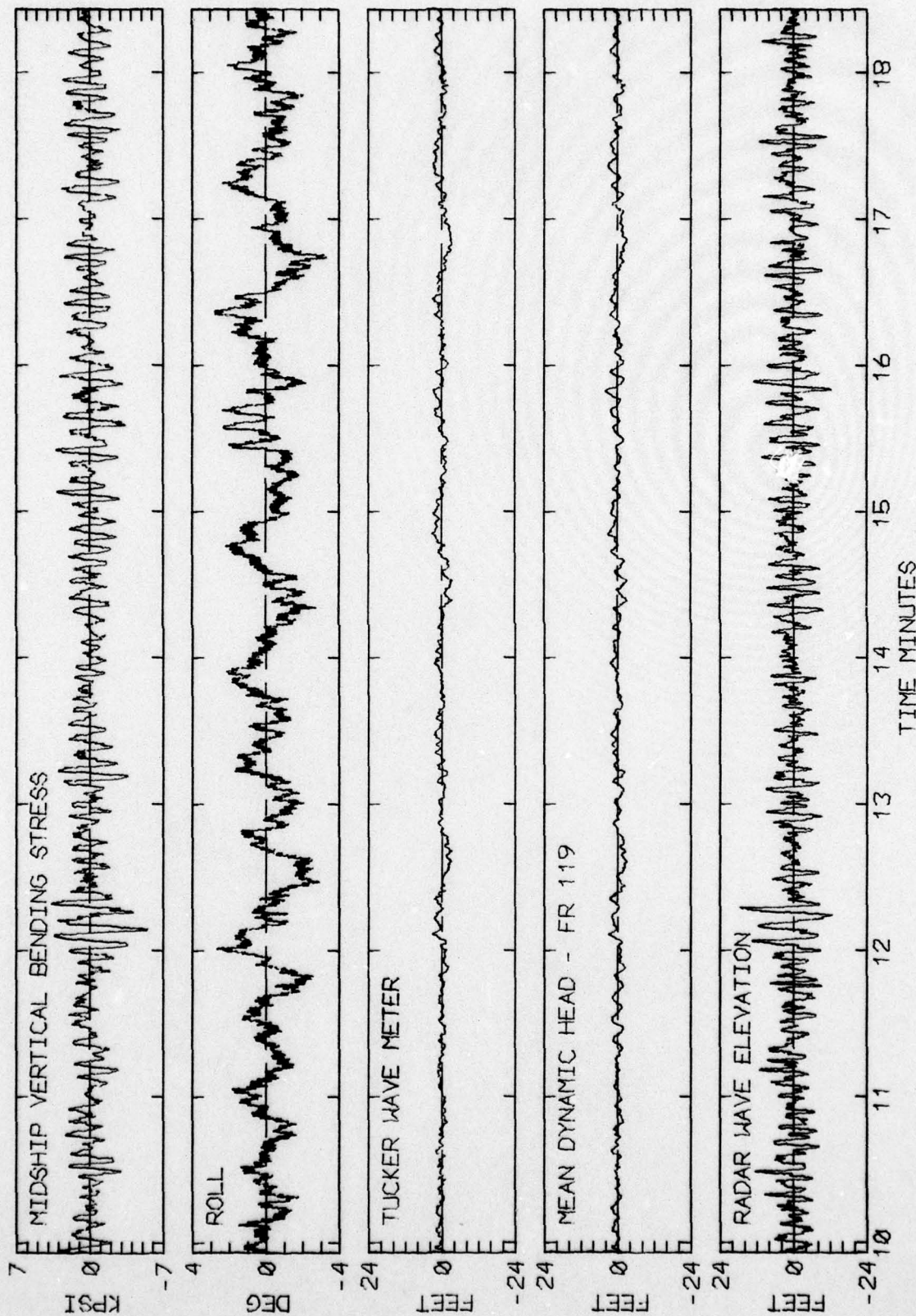
RUN 1321 -- VOYAGE 34W -- TAPE 163 -- INDEX 18 -- INTERVAL 21



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-08-74  | 2400       |      |
| POSITION                              | 48-09 N   | 47-18 W    |      |
| COURSE AND SPEED                      | 245       | 31.3 KNOTS |      |
| SEA STATE                             | 6         |            |      |
| WAVE HEIGHT                           | 2 FEET    |            |      |
| " REL DIR                             | 92 STBD   |            |      |
| SWELL HEIGHT                          | 5 FEET    |            |      |
| " REL DIR                             | 25 STBD   |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST /                               |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 8.3 KPSI  |            |      |
| 4.0 X RMS                             | 5.1 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 4.0 DEG   |            |      |
| PITCH                                 | 1.20 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.28 G    |            |      |
| DK HSE LAT ACCEL                      | 0.11 G    |            |      |
| RADAR SLANT RANGE                     | 25.3 FEET |            |      |
| VERTICAL RANGE                        | 22.5 FEET |            |      |
| DISPL AT RADAR                        | 10.9 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| TUCKER/DYN. HEAD/RADAR                |           |            |      |
| P-T SAMPLE SIZE                       | 224       | 198        | 290  |
| MAXIMUM HEIGHT                        | 6.4       | 5.8        | 26.9 |
| 10TH HIGHEST HTS                      | 3.6       | 4.0        | 18.3 |
| 3RD HIGHEST HTS                       | 2.6       | 3.1        | 14.6 |
| 4.0 RMS(SPECTRA)                      | 4.7       | 4.6        | 15.9 |



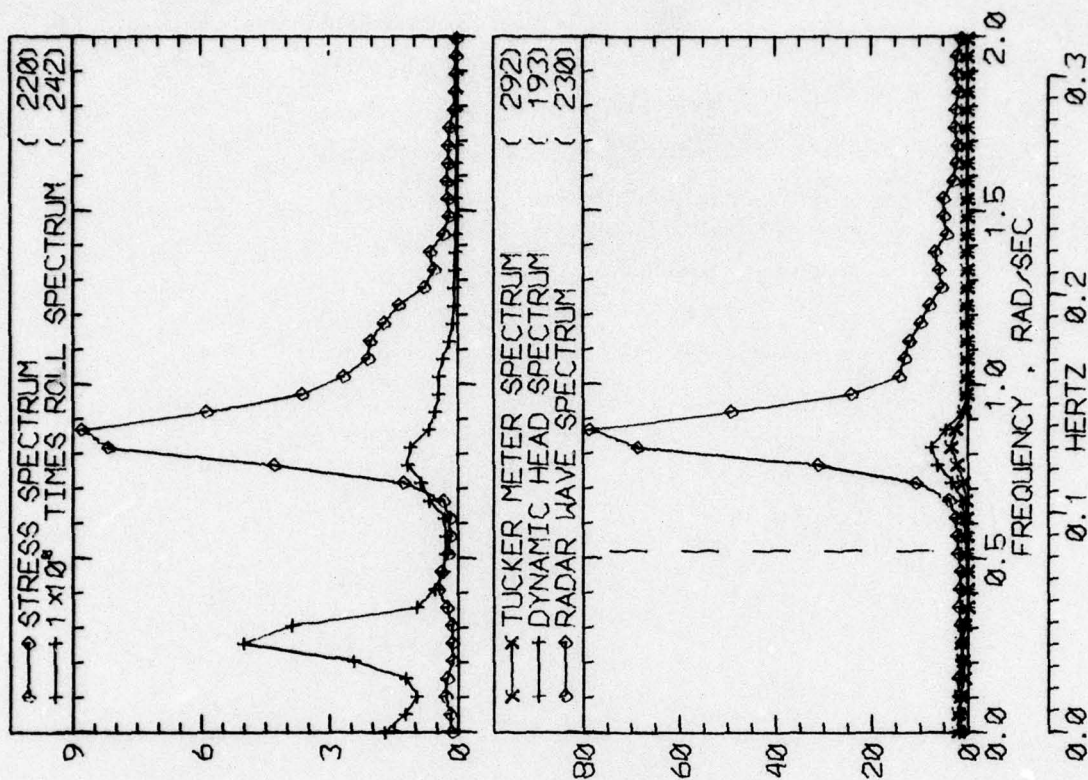
RUN 1329 -- VOYAGE 34W -- TAPE 163 -- INDEX 20 -- INTERVAL 29



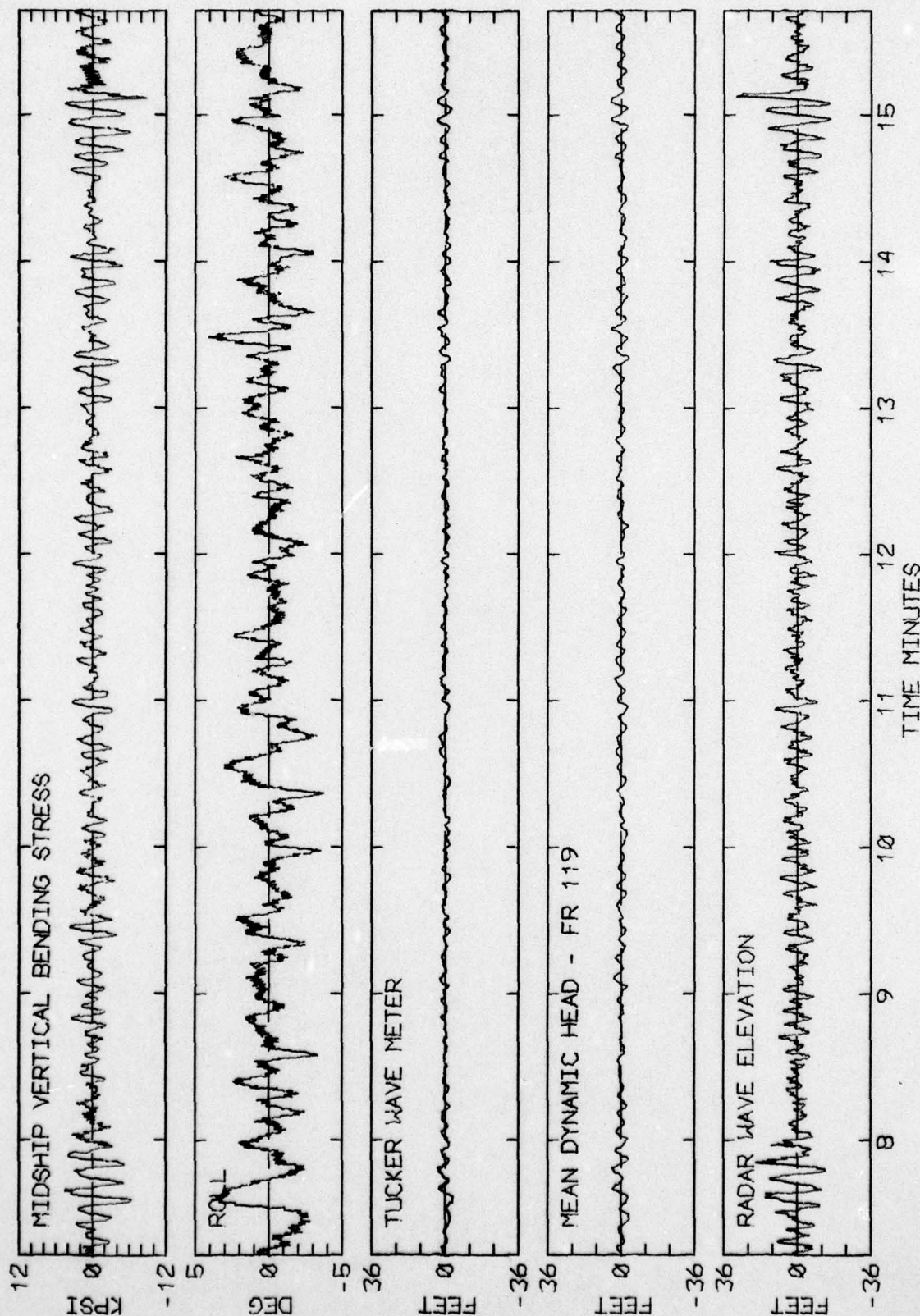
RUN 1329 -- VOYAGE 34W -- TAPE 163 -- INDEX 20 -- INTERVAL 29



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-09-74  | 0400       |      |
| POSITION                              | 48-09 N   | 47-18 W    |      |
| COURSE AND SPEED                      | 240       | 31.4 KNOTS |      |
| SEA STATE                             | 5         |            |      |
| WAVE HEIGHT                           | 2 FEET    |            |      |
| " REL DIR                             | 75 STBD   |            |      |
| SWELL HEIGHT                          | 5 FEET    |            |      |
| " REL DIR                             | 30 STBD   |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST /                               |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 10.5 KPSI |            |      |
| 4.0 X RMS                             | 6.5 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 4.7 DEG   |            |      |
| PITCH                                 | 1.76 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.41 G    |            |      |
| DK HSE LAT ACCEL                      | 0.12 G    |            |      |
| RADAR SLANT RANGE                     | 35.1 FEET |            |      |
| VERTICAL RANGE                        | 33.1 FEET |            |      |
| DISPL AT RADAR                        | 19.0 FEET |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| TUCKER/DYN. HEAD/RADAR                |           |            |      |
| P-T SAMPLE SIZE                       | 255       | 184        | 238  |
| MAXIMUM HEIGHT                        | 6.8       | 7.8        | 36.2 |
| 10TH HIGHEST HTS                      | 4.3       | 6.0        | 24.5 |
| 3RD HIGHEST HTS                       | 3.2       | 4.7        | 17.5 |
| 4.0 RMS(SPECTRA)                      | 4.4       | 5.5        | 18.7 |



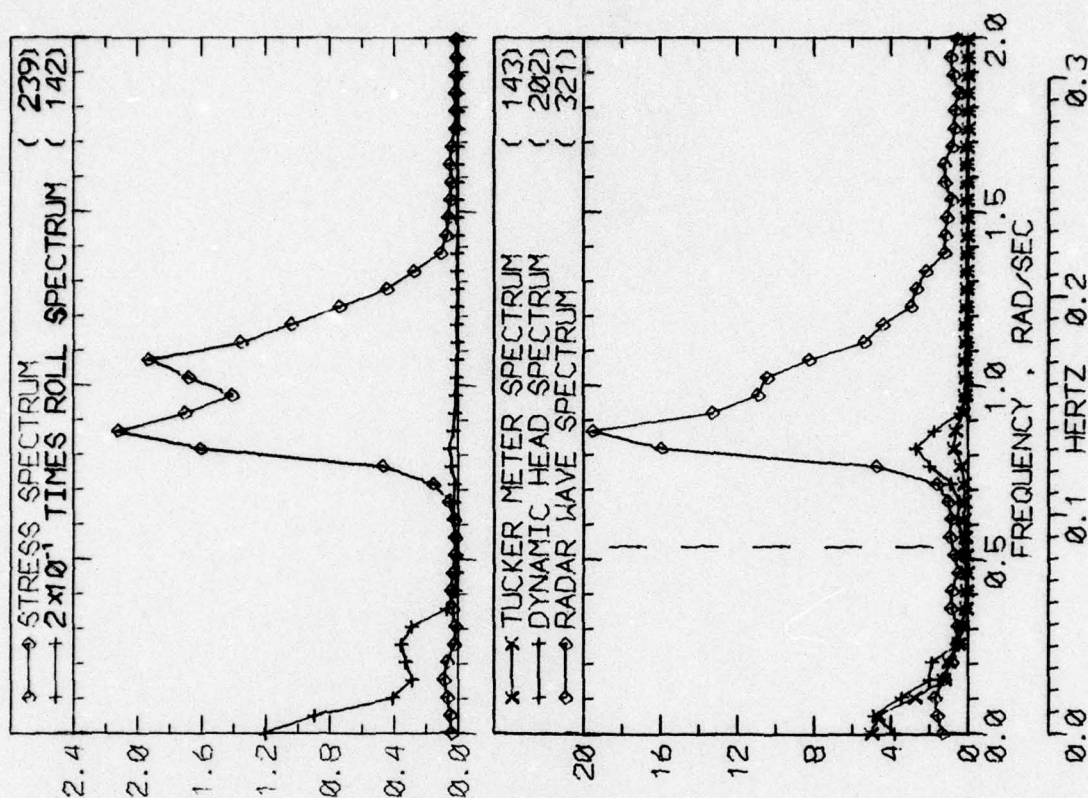
RUN 1333 -- VOYAGE 34W -- TAPE 163 -- INDEX 21 -- INTERVAL 33



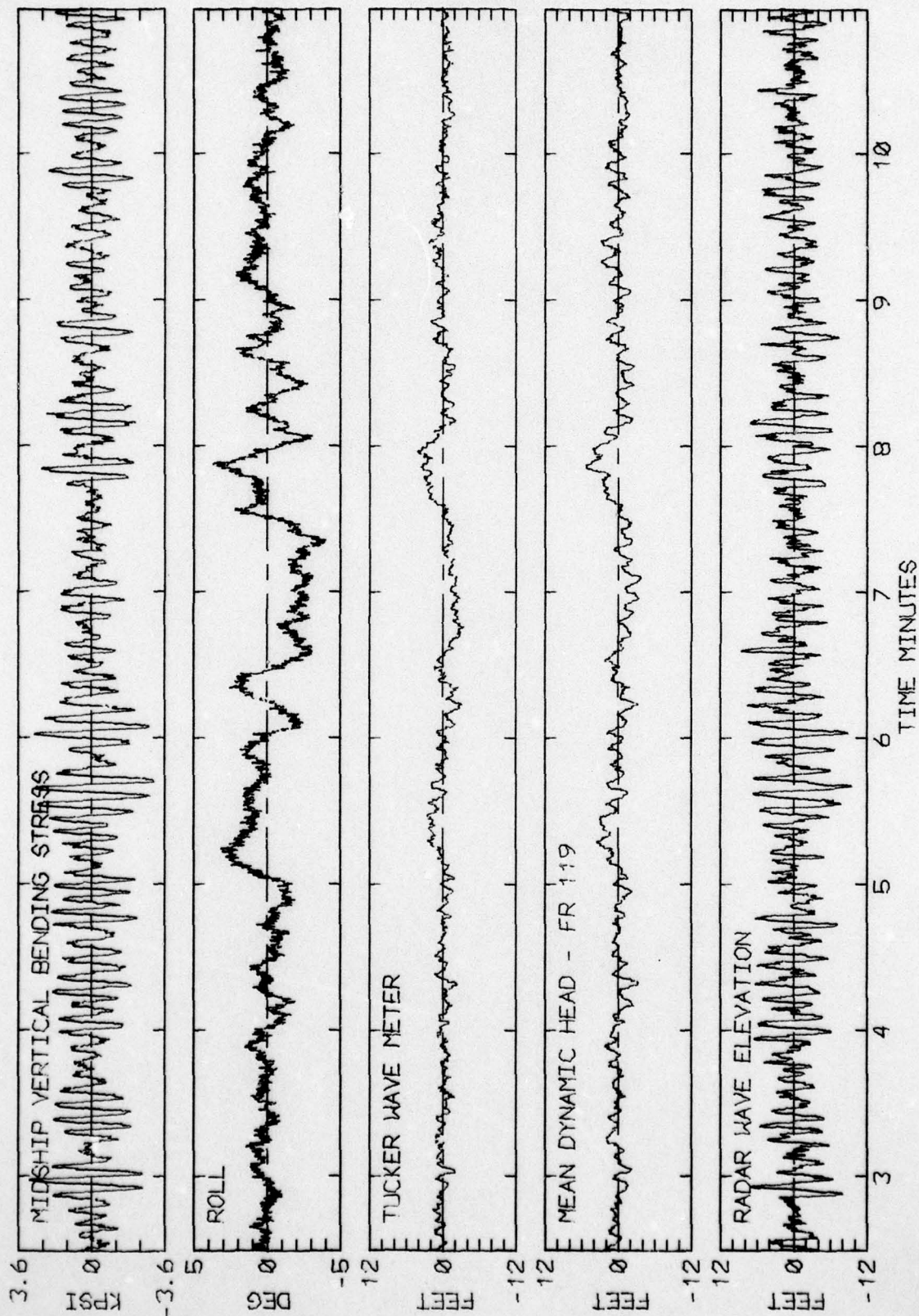
RUN 1333 -- VOYAGE 34W -- TAPE 163 -- INDEX 21 -- INTERVAL 33



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-09-74  | 0800       |      |
| POSITION                              | 48-09 N   | 47-18 W    |      |
| COURSE AND SPEED                      | 246       | 31.8 KNOTS |      |
| SEA STATE                             | 5         |            |      |
| WAVE HEIGHT                           | 2 FEET    |            |      |
| " REL DIR                             | 159 STBD  |            |      |
| SWELL HEIGHT                          | 5 FEET    |            |      |
| " REL DIR                             | 24 STBD   |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST SNOW /                          |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 5.4 KPSI  |            |      |
| 4.0 X RMS                             | 3.7 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 4.0 DEG   |            |      |
| PITCH                                 | 1.01 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.23 G    |            |      |
| DK HSE LAT ACCEL                      | 0.09 G    |            |      |
| RADAR SLANT RANGE                     | 19.0 FEET |            |      |
| VERTICAL RANGE                        | 17.3 FEET |            |      |
| DISPL AT RADAR                        | 9.6 FEET  |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| TUCKER/DYN. HEAD/RADAR                |           |            |      |
| P-T SAMPLE SIZE                       | 333       | 201        | 297  |
| MAXIMUM HEIGHT                        | 6.2       | 7.8        | 16.4 |
| 10TH HIGHEST HTS                      | 2.6       | 3.8        | 11.6 |
| 3RD HIGHEST HTS                       | 1.8       | 2.9        | 8.7  |
| 4.0 RMS(SPECTRA)                      | 3.8       | 4.6        | 10.7 |



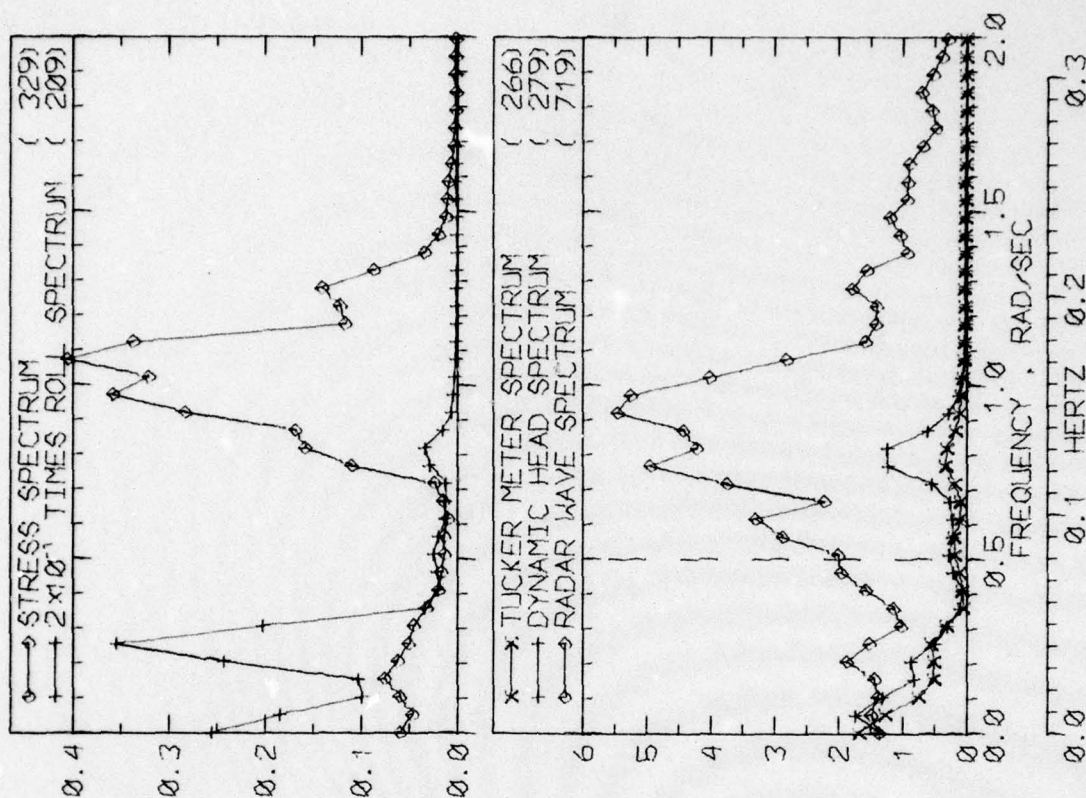
RUN 1337 -- VOYAGE 34W -- TAPE 163 -- INDEX 22 -- INTERVAL 37



RUN 1337 -- VOYAGE 34W -- TAPE 163 -- INDEX 22 -- INTERVAL 37



| LOG BOOK DATA                         |           |            |      |
|---------------------------------------|-----------|------------|------|
| DATE AND TIME                         | 02-09-74  | 1200       |      |
| POSITION                              | 42-32 N   | 63-16 W    |      |
| COURSE AND SPEED                      | 245       | 32.1 KNOTS |      |
| SEA STATE                             | 4         |            |      |
| WAVE HEIGHT                           | 2 FEET    |            |      |
| " REL DIR                             | 137 STBD  |            |      |
| SWELL HEIGHT                          | 3 FEET    |            |      |
| " REL DIR                             | 25 STBD   |            |      |
| ----- VISUAL WEATHER / COMMENTS ----- |           |            |      |
| OCAST SNOW /                          |           |            |      |
| MIDSHIP VERTICAL BENDING STRESS       |           |            |      |
| MAXIMUM PK-TR                         | 2.9 KPSI  |            |      |
| 4.0 X RMS                             | 1.7 KPSI  |            |      |
| SUMMARY OF MOTIONS (4.0 X RMS)        |           |            |      |
| ROLL                                  | 2.8 DEG   |            |      |
| PITCH                                 | 0.66 DEG  |            |      |
| DK HSE VERT ACCEL                     | 0.12 G    |            |      |
| DK HSE LAT ACCEL                      | 0.07 G    |            |      |
| RADAR SLANT RANGE                     | 11.0 FEET |            |      |
| VERTICAL RANGE                        | 10.2 FEET |            |      |
| DISPL AT RADAR                        | 5.1 FEET  |            |      |
| WAVE HEIGHT STATISTICS (FEET)         |           |            |      |
| TUCKER/DYN. HEAD/RADAR                |           |            |      |
| P-T SAMPLE SIZE                       | 410       | 254        | 358  |
| MAXIMUM HEIGHT                        | 2.9       | 3.8        | 15.6 |
| 10TH HIGHEST HTS                      | 2.0       | 2.9        | 9.6  |
| 3RD HIGHEST HTS                       | 1.5       | 2.1        | 6.8  |
| 4.0 RMS(SPECTRA)                      | 2.6       | 3.2        | 8.6  |



RUN 1341 -- VOYAGE 34W -- TAPE 163 -- INDEX 23 -- INTERVAL 41

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STEVENS INST OF TECH HOBOKEN N J DAVIDSON LAB  
RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND MCLEAN VOYAGE 34. (U)  
AUG 78 J F DALZELL

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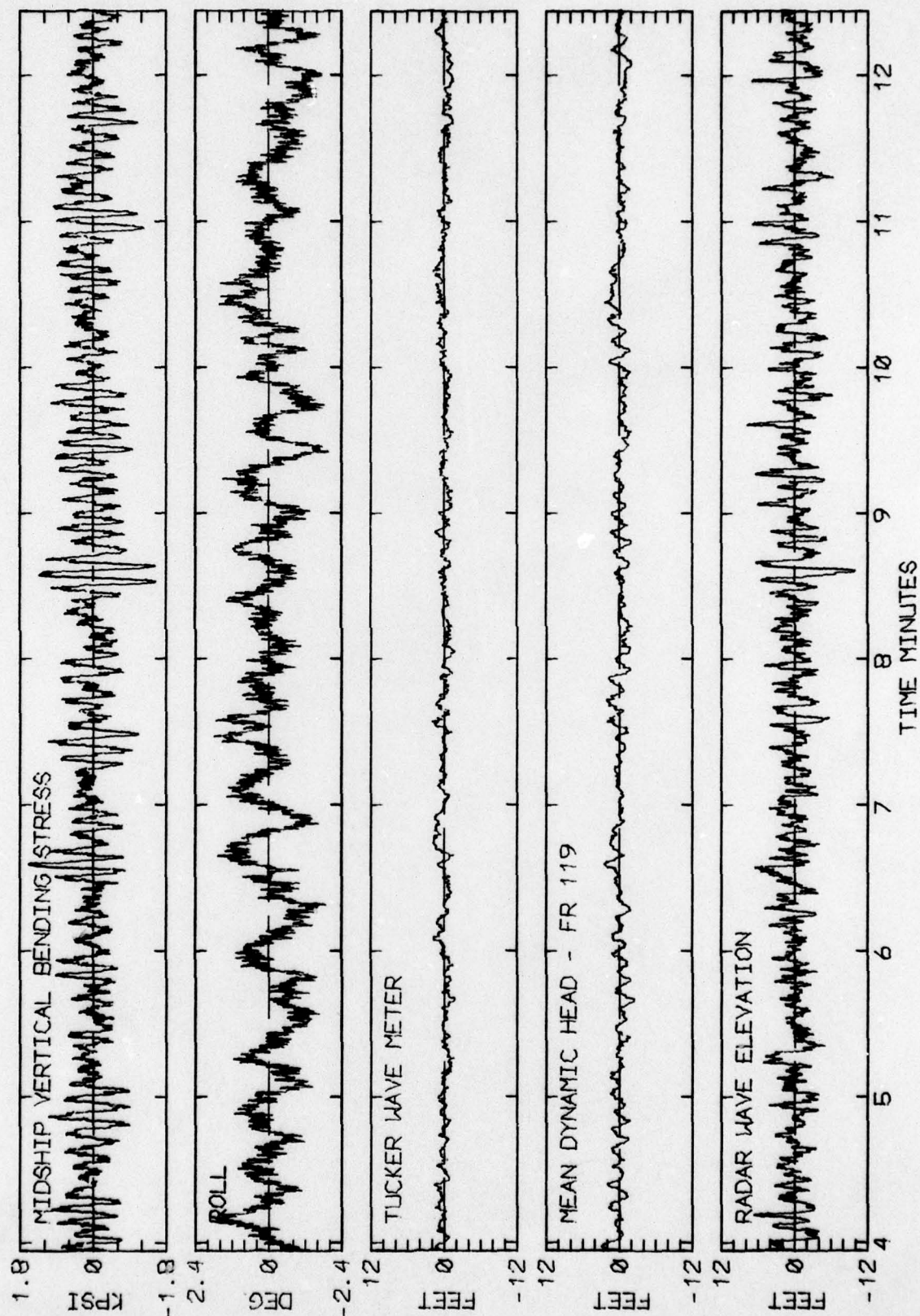
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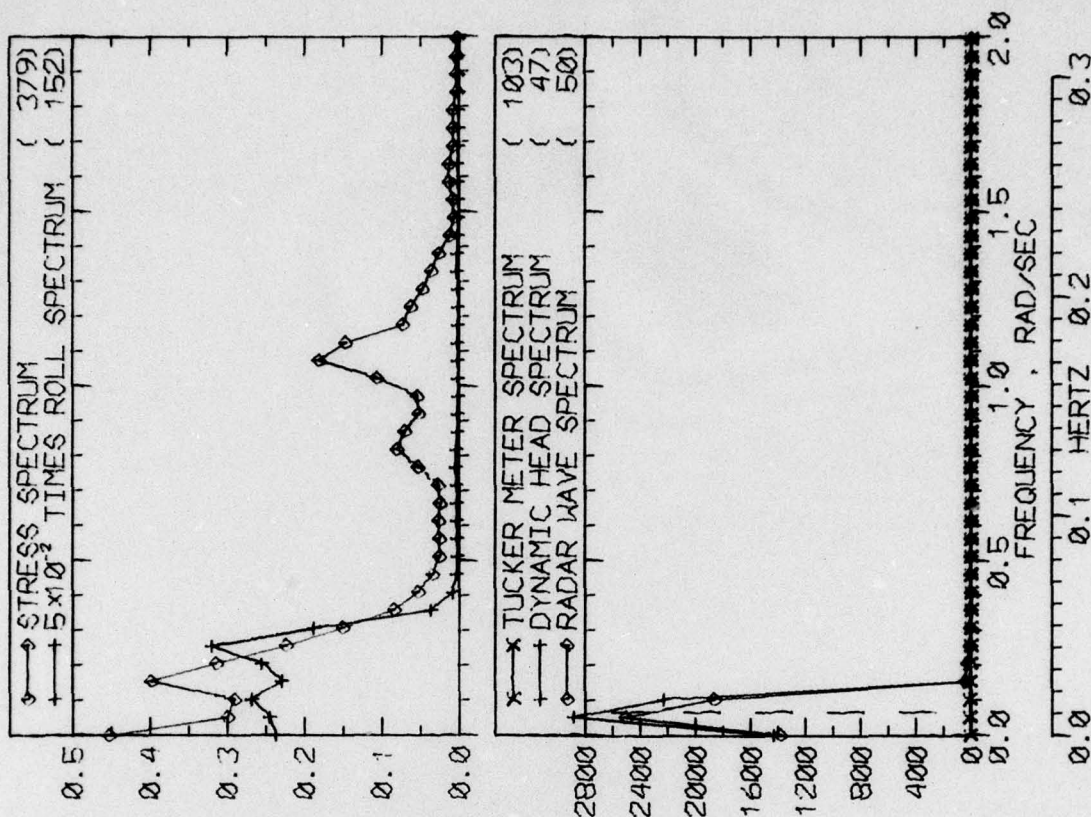






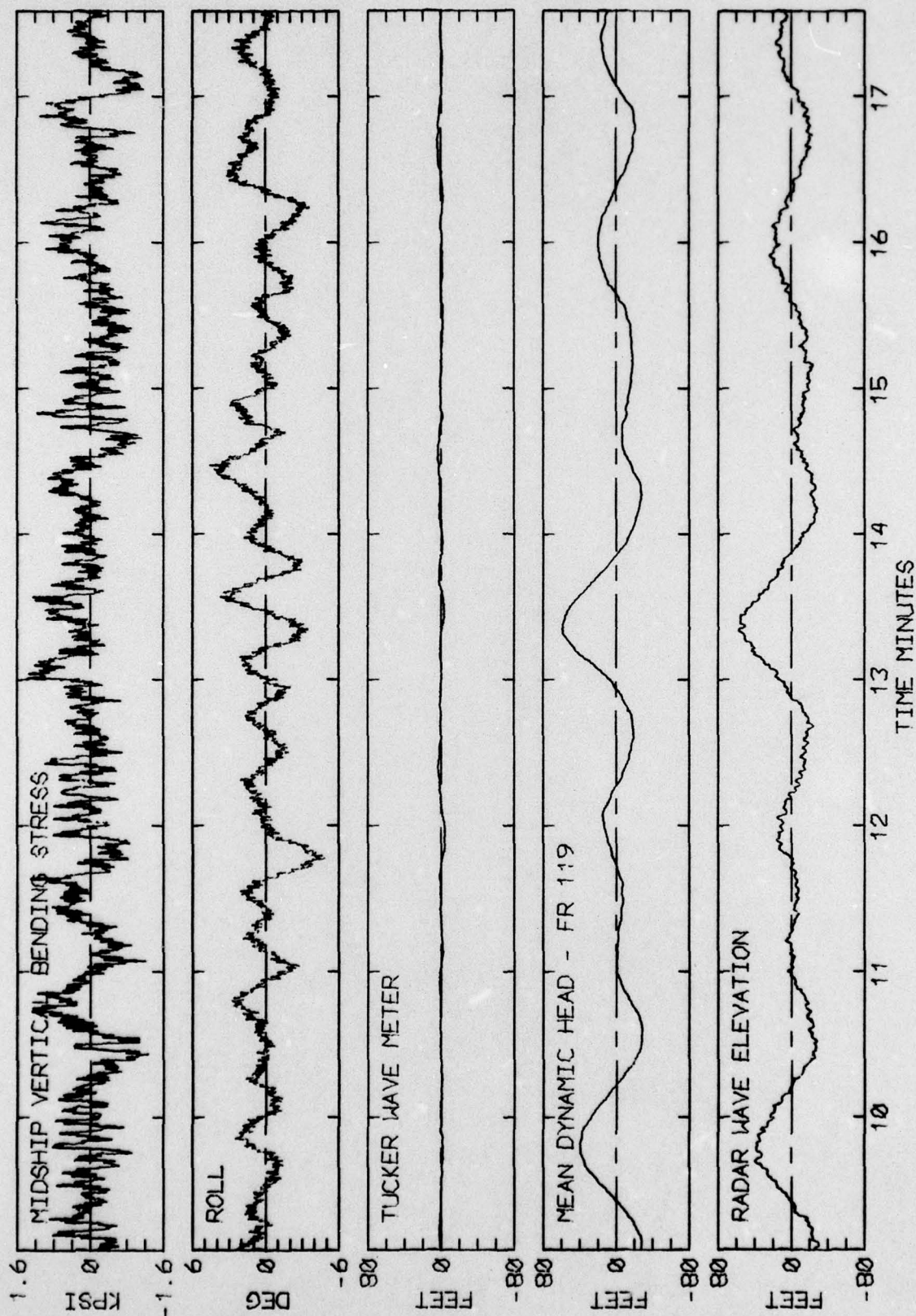
RUN 1341 -- VOYAGE 34W -- TAPE 163 -- INDEX 23 -- INTERVAL 41

| LOG BOOK DATA                   |                                       |      |      |
|---------------------------------|---------------------------------------|------|------|
| DATE AND TIME                   | 02-09-74 1600                         |      |      |
| POSITION                        | 42-32 N 63-16 W                       |      |      |
| COURSE AND SPEED                | 245 , 32.1 KNOTS                      |      |      |
| SEA STATE                       | 4                                     |      |      |
| WAVE HEIGHT                     | 2 FEET                                |      |      |
| " REL DIR                       | 137 STBD                              |      |      |
| SWELL HEIGHT                    | 2 FEET                                |      |      |
| " REL DIR                       | 160 STBD                              |      |      |
| PT CLDY /                       | ----- VISUAL WEATHER / COMMENTS ----- |      |      |
| MIDSHIP VERTICAL BENDING STRESS |                                       |      |      |
| MAXIMUM PK-TR                   | 1.8 KPSI                              |      |      |
| 4.0 X RMS                       | 1.7 KPSI                              |      |      |
| SUMMARY OF MOTIONS (4.0 X RMS)  |                                       |      |      |
| ROLL                            | 5.4 DEG                               |      |      |
| PITCH                           | 0.64 DEG                              |      |      |
| DK HSE VERT ACCEL               | 0.07 G                                |      |      |
| DK HSE LAT ACCEL                | 0.12 G                                |      |      |
| RADAR SLANT RANGE               | 12.0 FEET                             |      |      |
| VERTICAL RANGE                  | 9.7 FEET                              |      |      |
| DISPL AT RADAR                  | 64.4 FEET                             |      |      |
| WAVE HEIGHT STATISTICS (FEET)   |                                       |      |      |
| TUCKER/DYN. HEAD/RADAR          |                                       |      |      |
| P-T SAMPLE SIZE                 | 193                                   | 14   | 48   |
| MAXIMUM HEIGHT                  | 5.6                                   | 87.2 | 87.0 |
| 10TH HIGHEST HTS                | 3.2                                   | 77.8 | 51.1 |
| 3RD HIGHEST HTS                 | 1.8                                   | 53.9 | 27.5 |
| 4.0 RMS(SPECTRA)                | 5.7                                   | 69.1 | 65.3 |



RUN 1345 -- VOYAGE 34W -- TAPE 163 -- INDEX 24 -- INTERVAL 45





RUN 1345 -- VOYAGE 34W -- TAPE 163 -- INDEX 24 -- INTERVAL 45

## 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 above the sample mean, a trough was the smallest instantaneous value in an excursion below 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 ( $\text{kpsi}^2/\text{rad/sec}$ ) and those of the roll spectral density are ( $\text{deg}^2/\text{rad/sec}$ ).

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 ( $\text{feet}^2/\text{rad/sec}$ ). In the wave spectrum plot there is a vertical (slightly jogged) dashed line. This line marks the position of the low frequency cutoff,  $\omega_0$ , 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-spaced 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<br>Lower Bound | Factor for<br>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  $\pm 15\%$  for TDF = 60 to the sample rms  $\pm 5\%$  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 attained 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.



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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 Second Season Voyage 34.

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# METRIC CONVERSION FACTORS

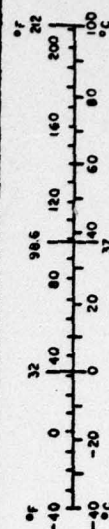
## Approximate Conversions to Metric Measures

| Symbol                     | When You Know          | Multiply by               | To Find             | Symbol          |
|----------------------------|------------------------|---------------------------|---------------------|-----------------|
| <b>LENGTH</b>              |                        |                           |                     |                 |
| in                         | inches                 | 2.5                       | centimeters         | cm              |
| ft                         | feet                   | 30                        | centimeters         | cm              |
| yd                         | yards                  | 0.9                       | meters              | m               |
| m                          | miles                  | 1.6                       | kilometers          | km              |
| <b>AREA</b>                |                        |                           |                     |                 |
| in <sup>2</sup>            | square inches          | 6.5                       | square centimeters  | cm <sup>2</sup> |
| ft <sup>2</sup>            | square feet            | 0.09                      | square meters       | m <sup>2</sup>  |
| yd <sup>2</sup>            | square yards           | 0.8                       | square meters       | m <sup>2</sup>  |
| mi <sup>2</sup>            | square miles           | 2.6                       | square kilometers   | km <sup>2</sup> |
|                            | acres                  | 0.4                       | hectares            | ha              |
| <b>MASS (weight)</b>       |                        |                           |                     |                 |
| oz                         | ounces                 | 28                        | grams               | g               |
| lb                         | pounds                 | 0.45                      | kilograms           | kg              |
|                            | short tons (2000 lb)   | 0.9                       | tonnes              | t               |
| <b>VOLUME</b>              |                        |                           |                     |                 |
| ts                         | teaspoons              | 5                         | milliliters         | ml              |
| fl oz                      | fluid ounces           | 30                        | milliliters         | ml              |
| c                          | cups                   | 0.24                      | liters              | l               |
| pt                         | pints                  | 0.47                      | liters              | l               |
| qt                         | quarts                 | 0.96                      | liters              | l               |
| gal                        | gallons                | 3.8                       | liters              | l               |
| ft <sup>3</sup>            | cubic feet             | 0.03                      | cubic meters        | m <sup>3</sup>  |
| yd <sup>3</sup>            | cubic yards            | 0.76                      | cubic meters        | m <sup>3</sup>  |
| <b>TEMPERATURE (exact)</b> |                        |                           |                     |                 |
| °F                         | Fahrenheit temperature | 5/9 (also subtracting 32) | Celsius temperature | °C              |

\* 1 in. = 2.54 cm (exact). For other exact conversions and more detailed tables, see NIST Mon. Publ. 781, Units of Lengths and Masses, Price \$2.25, SD Catalog No. C13.10-286.

## Approximate Conversions from Metric Measures

| Symbol                     | When You Know                     | Multiply by       | To Find                | Symbol          |
|----------------------------|-----------------------------------|-------------------|------------------------|-----------------|
| <b>LENGTH</b>              |                                   |                   |                        |                 |
| 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              |
| <b>AREA</b>                |                                   |                   |                        |                 |
| cm <sup>2</sup>            | square centimeters                | 0.16              | square inches          | in <sup>2</sup> |
| m <sup>2</sup>             | square meters                     | 1.7               | square yards           | yd <sup>2</sup> |
| km <sup>2</sup>            | square kilometers                 | 0.4               | square miles           | mi <sup>2</sup> |
| ha                         | hectares (10,000 m <sup>2</sup> ) | 2.5               | acres                  | ac              |
| <b>MASS (weight)</b>       |                                   |                   |                        |                 |
| g                          | grams                             | 0.035             | ounces                 | oz              |
| kg                         | kilograms                         | 2.2               | pounds                 | lb              |
| t                          | tonnes (1000 kg)                  | 1.1               | short tons             | st              |
| <b>VOLUME</b>              |                                   |                   |                        |                 |
| 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 <sup>3</sup>             | cubic meters                      | 35                | cubic feet             | ft <sup>3</sup> |
| m <sup>3</sup>             | cubic meters                      | 1.3               | cubic yards            | yd <sup>3</sup> |
| <b>TEMPERATURE (exact)</b> |                                   |                   |                        |                 |
| °C                         | Celsius temperature               | 9/5 (also add 32) | Fahrenheit temperature | °F              |



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