SSC-264

(SL-7-8)

FIRST SEASON RESULTS FROM SHIP RESPONSE INSTRUMENTATION ABOARD THE SL-7 CLASS CONTAINERSHIP S.S. SEA-LAND McLEAN IN NORTH ATLANTIC SERVICE

SHIP STRUCTURE COMMITTEE
1976

SHIP STRUCTURE COMMITTEE

AN INTERAGENCY ADVISORY
COMMITTEE DEDICATED TO IMPROVING
THE STRUCTURE OF SHIPS

MEMBER AGENCIES:
United States Coast Guard
Naval Sea Systems Command
Military Sealift Command
Maritime Administration
American Bureau of Shipping

ADDRESS CORRESPONDENCE TO:
Secretary
Ship Structure Committee
U.S. Coast Guard Headquarters
Washington, D.C. 20590

SR-211

30 DEC 1975

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

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

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

This report contains a portion of the data with a preliminary discussion and evaluation of the third season of data collection from 17 January 1975 to 17 March 1975. The instrumentation was modified this season to emphasize hatch corner and bow side shell strains. The basic instrumentation of prior seasons was retained. Please refer to the outside rear cover for ordering information on the reports from the first two seasons numbered SL-7-8 and SL-7-9.

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

SSC-264

(SL-7-8)

Technical Report

on

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

FIRST SEASON RESULTS FROM SHIP RESPONSE INSTRUMENTATION ABOARD THE SL-7 CLASS CONTAINERSHIP S.S. SEA-LAND McLEAN IN NORTH ATLANTIC SERVICE

by

R. R. Boentgen, R. A. Fain, and J. W. Wheaton

Teledyne Materials Research

under

Department of the Navy
Naval Ship Engineering Center
Contract No. N00024-73-C-5059

U. S. Coast Guard Headquarters

ERRATA: PLEASE REPLACE LAST PARAGRAPH OF INSIDE FRONT COVER LETTER WITH THE FOLLOWING:

This report contains a portion of the data with a preliminary discussion and evaluation of the first season of data collection from 8 October 1972 to 5 April 1973. Similar reports on the second season and third seasons of data collection have been published and are available through the National Technical Information Service. Please refer to the outside rear cover for ordering information on those two documents numbered SL-7-9 and SL-7-10.

ABSTRACT

This report contains data, with appropriate evaluation and discussions, collected during the first season on board the S.S. SEA-LAND McLEAN. Data collection began with westbound Voyage 1 on October 8, 1972 and terminated with the eastbound passage of Voyage 12 on April 5, 1973. A total of 80 data tapes were recorded containing in excess of 50,000 separate data intervals from more than 100 transducers.

Discussions include a description of the digitized data, comparisons of stresses with sea state, simultaneous response data from all transducers during selected portions of a rough voyage, and a consideration of torsional responses.

The reports from the second and third data-collection seasons are not being published in the Ship Structure Committee series of reports but they are available through the National Technical Information Service under the following titles.

SL-7-9 - *Second Season Results From Ship Response Instrumentation Aboard The SL-7 Class Containership S.S. SEA-LAND McLEAN In North Atlantic Service.* 1976. AD-A034162.

SL-7-10- *Third Season Results From Ship Response Instrumentation Aboard The SL-7 Class Containership S.S. SEA-LAND McLEAN In North Atlantic Service.* 1976. AD-A034175.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

SHIP STRUCTURE COMMITTEE

The SHIP STRUCTURE COMMITTEE is constituted to prosecute a research program to improve the hull structures of ships by an extension of knowledge pertaining to design, materials and methods of fabrication.

RADM W. M. Benkert, USCG
Chief, Office of Merchant Marine Safety
U.S. Coast Guard Headquarters

Mr. P. M. Palermo
Asst. for Structures
Naval Ship Engineering Center
Naval Ship Systems Command

Mr. K. Morland
Vice President
American Bureau of Shipping

Mr. M. Pitkin
Asst. Administrator for
Commercial Development
Maritime Administration

Mr. C. J. Whitestone
Maintenance & Repair Officer
Military Sealift Command

SHIP STRUCTURE SUBCOMMITTEE

The SHIP STRUCTURE SUBCOMMITTEE acts for the Ship Structure Committee on technical matters by providing technical coordination for the determination of goals and objectives of the program, and by evaluating and interpreting the results in terms of ship structural design, construction and operation.

NAVAL SEA SYSTEMS COMMAND

Mr. C. Pohler - Member
Mr. J. B. O'Brien - Contract Administrator
Mr. G. Sorkin - Member

U.S. COAST GUARD

LCDR E. A. Chazal - Secretary
CAPT C. B. Glass - Member
LCDR S. H. Davis - Member
LCDR J. N. Naegle - Member

MARITIME ADMINISTRATION

Mr. N. Hammer - Member
Mr. F. Dashnaw - Member
Mr. F. Seibold - Member
Mr. R. K. Kiss - Member

MILITARY SEALIFT COMMAND

Mr. D. Stein - Member
Mr. T. W. Chapman - Member
Mr. A. B. Stavovy - Member
CDR J. L. Simmons - Member

NATIONAL ACADEMY OF SCIENCES
SHIP RESEARCH COMMITTEE

Mr. R. W. Rumke - Liaison
Prof. J. E. Goldberg - Liaison

AMERICAN BUREAU OF SHIPPING

Mr. S. G. Stiansen - Chairman
Mr. I. L. Stern - Member
Dr. H. Y. Jan - Member

SOCIETY OF NAVAL ARCHITECTS & MARINE ENGINEERS

Mr. A. B. Stavovy - Liaison

WELDING RESEARCH COUNCIL

Mr. K. H. Koopman - Liaison

INTERNATIONAL SHIP STRUCTURES CONGRESS

Prof. J. H. Evans - Liaison

U.S. COAST GUARD ACADEMY

CAPT W. C. Nolan - Liaison

STATE UNIV. OF N.Y. MARITIME COLLEGE

Dr. W. R. Porter - Liaison

AMERICAN IRON & STEEL INSTITUTE

Mr. R. H. Sterne - Liaison

U.S. NAVAL ACADEMY

Dr. R. Bhattacharyya - Liaison

I. INTRODUCTION

The S.S. SEA-LAND McLEAN is the first of the new SL-7 class of high-speed containerships. Salient particulars of the vessel are given in Table I, and the vessel is shown in Figure 1. A multifaceted program of analysis and experiments, coordinated by the SL-7 Program Advisory Committee of the National Academy of Sciences--National Research Council, has been instituted to study this ship's structure and its responses to imposed loading. One important facet of this program is the collection of data on structural and dynamic responses of the actual (i.e., full scale) ship's structure. This is being accomplished by an on-board instrumentation system with sensors located throughout the vessel measuring strains, stresses, accelerations, various sea characteristics and ship operating parameters (see Reference 1). Presented in this report is a cross-section and summary of the data gathered during the first season of operation on North Atlantic Voyages 1-12 during the period 8 October 1972 to 5 April 1973.

Collection of full-scale data is necessary from a number of standpoints. Any predictions resulting from mathematical analyses or experimental models must accurately characterize the actual structure, or must be correctable, in a known way, to correlate the technique to the actual structure. Full-scale data, properly interpreted, provides the criterion against which all predictive techniques of structural response must be judged. A second but equally important use of full-scale data is to provide the input loads which form the basis of the rational design. Such load criteria can be gathered directly from a characterization of observed service conditions, such as wind and wave probability distributions, or inferred from the response of the vessel to the combination of these conditions. The latter scheme requires a knowledge of the structure's input-output or transfer function which again can be provided by adequate full-scale data describing loads and responses. In sum, full-scale data provides three indispensable parts of rational design: input loads, responses, and the derived characteristics of the link between the two.

Since different aspects of the full-scale data are of interest to different investigators, no summary can provide an exhaustive or even adequate characterization of all the gathered data. Indeed, the basic form of the data, analog or digital records on magnetic tape, is not reproducible here. The objective of this report, therefore, is to document the quantity, limits, and formats of the data now available and to present a cross-section and summary of it in a few of the forms most obviously useful to investigators. As a further aid to those interested, a description is given of some further possible data summary characterization and analysis schemes, along with their relative costs.

II. INSTRUMENTATION SYSTEM

The shipboard instrumentation system is described in detail in Reference 1; therefore, no attempt will be made in this report to duplicate that information. Rather, a brief description of the important features, with special emphasis on the data flow, will be presented as a convenient summary.

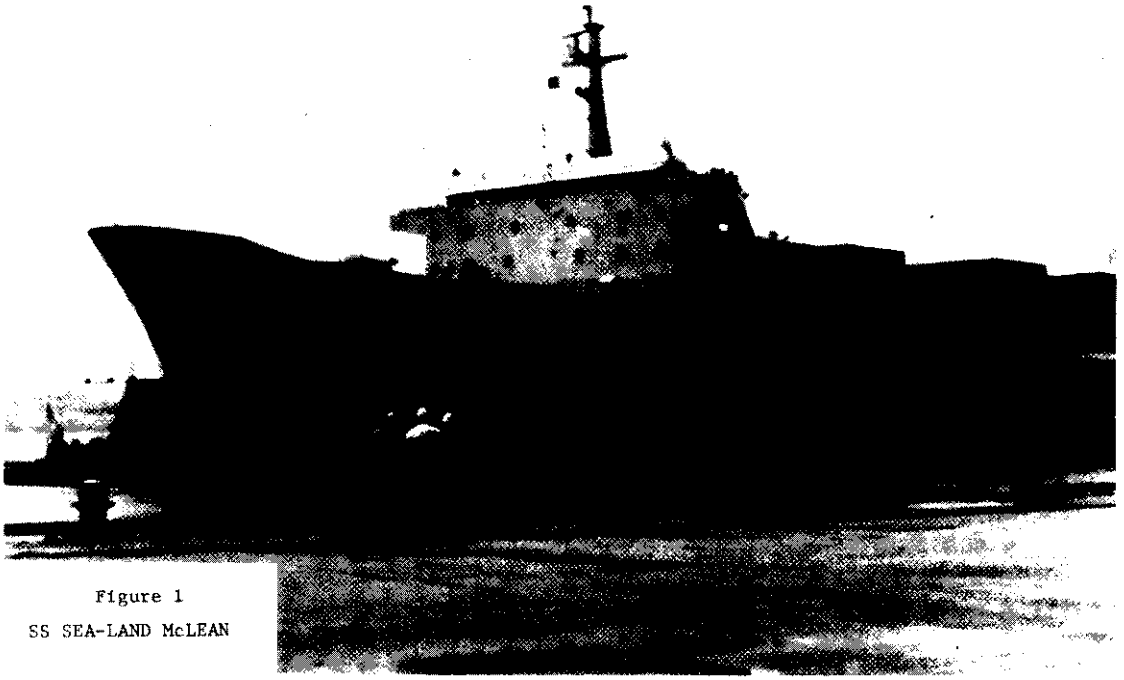


Figure 1

SS SEA-LAND McLEAN

TABLE I

CHARACTERISTICS OF S.S. SEA-LAND McLEAN

Name:	SEA-LAND McLEAN
Builder:	Rotterdam Dry Dock (Hull 330)
Class:	SL-7 Containership
Length, overall	946' 1 1/2"
Length, between perpendiculars	880' 6"
Beam, molded	105' 6"
Depth to main deck, forward	64' 0"
Depth to main deck, aft	68' 6"
Draft, design	30' 0"
Draft, scantling	34' 0"
Dead weight - long tons	27,315
Displacement (34' 0" draft) - long tons	50,315
Machinery	Two separate cross-compound steam turbines driving two propeller shafts
Shaft horsepower-maximum continuous, both shafts	120,000
Propeller RPM	135
Speed, maximum, knots	33
Center of gravity - full load	399.32' forward of aft perpendicular 42.65' above base line

	Container Capacity		
	8' x 8.5' x 35'	8' x 8.5' x 40'	Total
Below deck	554	140	694
Above deck	342	60	402
TOTAL	896	200	1,096

A. Shipboard

All of the information obtained from the various transducers located throughout the vessel is recorded on two 14-track analog FM tape recorders located in the instrumentation room. Recorder No. 1, designated the primary recorder, records the same 13 signals whenever it is placed in operation. The fourteenth channel is used as a noise compensation channel during reproduction.

The second recorder has its first thirteen channels switched through four modes, designated A, B, C, and D. Each mode is recorded for thirty minutes sequentially. Channel 14 is again used as a compensation channel in all modes. Each 30-minute period is a data "interval", and is assigned an interval number. Any particular segment of data can thus be identified by referring to the following nomenclature.

1. Tape number--(All odd numbers are from No. 1 Recorder and all even numbers are from Recorder No. 2).

2. Voyage number and direction (E = East, W = West).

3. Index number (sequential numbering of each four-hour logbook entry accompanying each data tape).

4. Channel number and mode letter (Recorder No. 2 only)

5. Interval number.

Thus, by specifying "Tape No. 1, Voyage 1-W, Index 1, Channel 1-A, Interval 1" a very specific 30-minute data interval is identified. A complete summary of the signal assignments is provided in Table II. This presentation is in the same format used in Reference 1. Table III contains a list of sensor and signal abbreviations used in Table II and throughout this report.

Each interval of 30 minutes, whether on Recorder No. 1 or No. 2 is automatically preceded by a one-minute electrical zero and a one-minute period of calibration signals.

1. Strain Gage Signals

The majority of the transducers used in this system are obtained from various configurations of single-element strain gages with associated bridge completion and calibration resistors. These gages are attached to the surface of various hull structural elements. Each strain gage is constructed with inherent temperature compensation. That is, if the gage is attached to a plate which is subsequently warmed (or cooled) but is otherwise unrestrained, no change in strain will be indicated. If that plate is now restrained from expansion due to the temperature change, a strain, associated with the degree of restoring stress necessary, will be indicated even though no change in length occurred. Such a restraint is generated, for example, when the sun warms the deck or upper hull girder while the lower hull is in cooler water. This diurnal variation tends to induce compressive deck stresses and tensile stresses under the waterline even though the displacement tends to hog the ship.

TABLE II

SENSOR LIST

72/73 Season and Calibration

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

TABLE II (Continued)

SENSOR LIST

72/73 Season and Calibration

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

TABLE II (Continued)

SENSOR LIST

72/73 Season and Calibration

Sensor No.	Sensor Nom.	Location(2) Frame	Location(2) Position	Config.	Orient	Sensitive to	Recorder	Channel	Mode	Full Cal	Units	Circuit No.
42 (1)	LVB						2	1	C			6
43	R A	291	Port Side Gird	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
44	R B	291	Near Deck Cutout	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
45	R1C	291	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
46	R2A	291	Stbd Side Gird	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
47	R2B	291	Near Deck Cutout	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
48	R3C	291	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
49	R3A	291	Stbd Tunnel	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
50	R3B	291	In Board	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
51	R3C	291	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
52	R4A	291	Stbd Tunnel	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
53	R4B	291	Out Board	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
54	R4C	291	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
55	R5A	258	Stbd Side Gird	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
56	R5B	259	In Corn. Hat 2	Single	Didg	N. Strain	2	VIA	C	334.6	μ"/"	6
57	R5C	258	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
58	R6A	258	Stbd Side Gird	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
59	R6B	258	Out Corn. Hat 2	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
60	R6C	258	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
61	R7A	258	Stbd Side Gird	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
62	R7B	258	Near Deck Cutout	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
63	R7C	258	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6
64	R8A	258	Stbd Tunnel	Single	Long.	N. Strain	2	2-13	C	334.6	μ"/"	6
65	R8B	258	In Board	Single	Diag.	N. Strain	2	VIA	C	334.6	μ"/"	6
66	R8C	258	Under Deck	Single	Trans.	N. Strain	2	RSB	C	334.6	μ"/"	6

TABLE II (Continued)

SENSOR LIST

72/73 Season and Calibration

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

TABLE II (Continued)

SENSOR LIST

72/73 Season and Calibration

Sensor No.	Sensor Nom.	Location (2) Frame	Position	Config.	Orient	Sensitive to	Recorder	Channel	Mode	Full Cal	Units	Circuit No.
87	HLSST	289	S Side 1' BT	Single	Long.	N. Stress	2	2 (a)	D	10038	PSI	6
88	TGFS2	244	Fwd Bot.	Single	Trans.	N. Stress	2	3	D	10038	PSI	6
89	HLSSB	289	S Side 1' ATT	Single	Long.	N. Stress	2	3 (a)	D	10038	PSI	6
90	TGFS3	242	Aft Bot	Single	Trans.	N. Stress	2	4	D	10038	PSI	6
91	HLSPT	289	P Side 1' BT	Single	Long.	N. Stress	2	4 (a)	D	10038	PSI	6
92	TGFS4	242	Aft Top	Single	Trans.	N. Stress	2	5	D	10038	PSI	6
93	HLSPB	289	P Side 1' ATT	Single	Long.	N. Stress	2	5 (a)	D	10038	PSI	6
94	TGMS1	196	Fwd Gird. Top	Single	Trans.	N. Stress	2	6	D	10038	PSI	6
95	TGMS2	196	Fwd Gird Bot.	Single	Trans.	N. Stress	2	7	D	10038	PSI	6
96	TGMS3	194	Aft Gird Bot.	Single	Trans.	N. Stress	2	8	D	10038	PSI	6
97	TGMS4	194	Aft Gird Top	Single	Trans.	N. Stress	2	9	D	10038	PSI	6
98	TGMS1X	194	Fwd Gird Mid	Single	Trans.	N. Stress	2	6 (a)	D	10038	PSI	6
99	TGMS2X	195	Bot Gird Mid	Single	Trans.	N. Stress	2	7 (a)	D	10038	PSI	6
100	TGMS3X	194	Aft Gird Mid	Single	Trans.	N. Stress	2	8 (a)	D	10038	PSI	6
101	TGMS4X	195	Top Gird Mid	Single	Trans.	N. Stress	2	9 (a)	D	10030	PSI	6
102	TGSS1X	196	Fwd Gir Q Top	Shear	Trans.	Shear	2	6 (a)	D	5000	PSI	4
103	TGSS2X	196	Fwd Gir Q Bot	Shear	Trans.	Shear	2	7 (a)	D	5000	PSI	4
104	TGSS3X	194	Aft Gir Q Bot	Shear	Trans.	Shear	2	8 (a)	D	5000	PSI	4
105	TGSS4X	194	Aft Gir Q Top	Shear	Trans.	Shear	2	9 (a)	D	5000	PSI	4
106	TGAS1	80	Fwd Top	Single	Trans.	N. Stress	2	10	D	10038	PSI	6
107	TGAS2	80	Fwd Bot	Single	Trans.	N. Stress	2	11	D	10038	PSI	6
108	TGAS3	78	Aft Bot	Single	Trans.	N. Stress	2	12	D	10038	PSI	6
109	TGAS4	78	Aft Top	Single	Trans.	N. Stress	2	13	D	10038	PSI	6

TABLE II (Concluded)

SENSOR LIST

72/73 Season and Calibration

Notes: (1) LVBS is Recorded on Channel 1 of Both Recorders in All Modes
(2) To Nearest Frame
(3) Slant Range: Deckhouse to Wave
(4) Calibration Step 2g (± 1g from zero)

Abbreviations: Sensor Nomenclature - See Table II

Position - ATT is Above Tank Top
NA is Neutral Axis; BT is Below Tunnel
FR is Frame; Q is Quarterpoint
S is Starboard; P is Port; CL is Centerline (longitudinal)

Sensitive to - V Bend is Vertical Bending; H. Bend is Horizontal Bending
H.T. Shear is Horizontal and Torsional Shear
N. Stress is Normal Stress (as opposed to shear stress)
V. Accel., T. Accel., L. Accel. is Vertical, Transverse, Longitudinal, Acceleration, respectively

Channel - (a) Denotes alternate channel assignment.

TABLE III

SENSOR AND SIGNAL NOMENCLATURE

ADHL	After Deck House Longitudinal (Acceleration)
ADHT	After Deck House Transverse (Acceleration)
$AR_{1-4}(Z)$	Aft Rosettes, (Z) denotes gage element: A is longitudinal orientation B is diagonal (45°) orientation C is transverse (athwart) to longitudinal
BGSB	Box Girder Shear Bottom
BGST	Box Girder Shear Top
FAV	Forward Acceleration Vertical (Hull)
FAT	Forward Acceleration Transverse (Hull)
FDHT	Forward Deck House Transverse (Acceleration)
FDHV	Forward Deck House Vertical (Acceleration)
HLSPB	Hull Longitudinal Strain Port Bottom
HLSPT	Hull Longitudinal Strain Port Top
HLSSB	Hull Longitudinal Strain Starboard Bottom
HLSST	Hull Longitudinal Strain Starboard Top
LHB	Longitudinal Horizontal Bending (Combination of LHBP and LHBS)
LHBP	Longitudinal Horizontal Bending Port (Stress)
LHBS	Longitudinal Horizontal Bending Starboard (Stress)
LSBP	Longitudinal Stress Bottom Port
LSBS	Longitudinal Stress Bottom Starboard
LSMP	Longitudinal Stress Mid Port
LSMS	Longitudinal Stress Mid Starboard
LSTP	Longitudinal Stress Top Port
LSTS	Longitudinal Stress Top Starboard
LVB	Longitudinal Vertical Bending (Combination of LVBP and LHBS)
LVBP	Longitudinal Vertical Bending Port (Stress)
LVBS	Longitudinal Vertical Bending Starboard (Stress)
MAT	Midship Acceleration Transverse (Hull)
MAV	Midship Acceleration Vertical (Hull)
$R_{1-4}(Z)$	Rosettes (Forward), (Z) denotes gage element: A is longitudinal orientation B is diagonal (45°) orientation C is transverse (athwart) to longitudinal
SAP	Shear Aft Port
SAS	Shear Aft Starboard
SFP	Shear Forward Port
SFS	Shear Forward Starboard
TGAS	Transverse Girder Aft Starboard (Strain)
TGFS	Transverse Girder Forward Starboard (Strain)
$TGMS_{1-4}$	Transverse Girder Midship Starboard (Strain)
$TGMS_{1X-4X}$	Transverse Girder Midship Starboard (Strain, midpoints)
$TGSS_{1X-4X}$	Transverse Girder Shear Starboard (Midships, vertical quarterpoints)
TSM	Torsional Shear Midship (Combination of TSMP and TSMS)
TSMP	Torsional Shear Midship Port
TSMS	Torsional Shear Midship Starboard

Sketches summarizing the locations of the strain gage sets are presented in Figures 2 and 3. It should be noted that the single-element strain gages used are installed in various configurations which have different properties. These are described in detail in Reference 1, but can be summarized as follows:

a. Single element (quarter bridge) - a single strain gage element. Its output is proportional to the strain along the element.

b. Dyadic gage - two single elements at an angle of 56° to each other. In this configuration the output is proportional to the stress along the axis of symmetry.

c. A dyadic pair of gages oriented longitudinally on each side of the ship, each pair connected to one arm of the bridge circuit. Depending on whether the arms are opposite or adjacent, the output of this arrangement is proportional to the vertical or horizontal bending stress.

d. Shear gage (half bridge) - two single elements at right angles to each other. The output is proportional to the shearing stress along the axis of symmetry.

e. A shear gage half bridge on each side of the ship connected to form a full bridge. Depending on the polarity of the connection, the output is proportional to the vertical or torsional shearing stress.

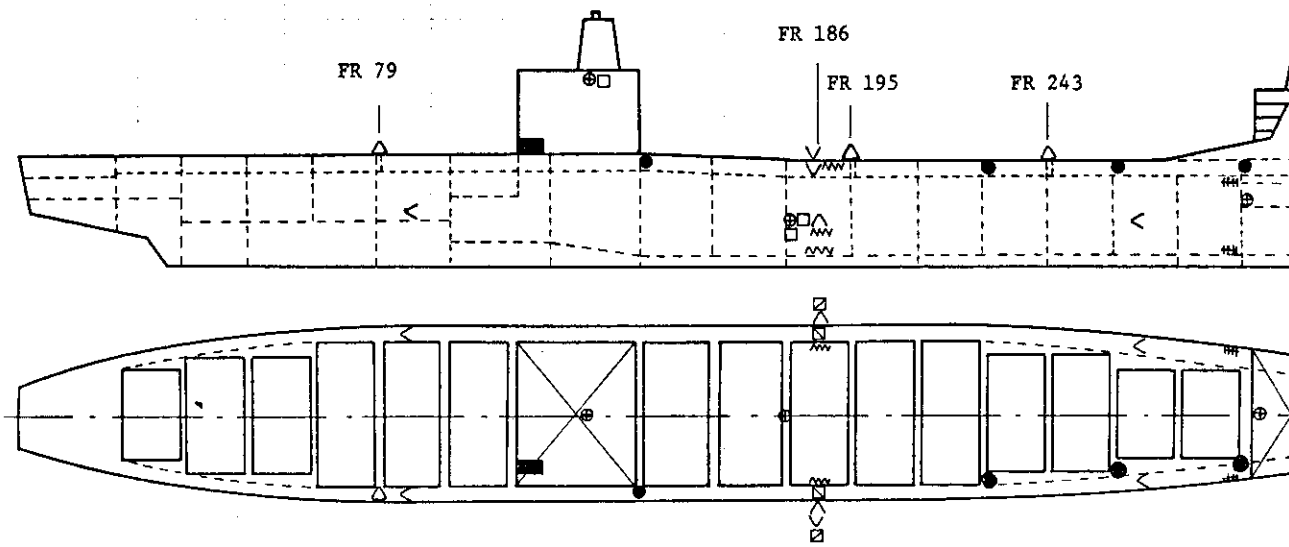
f. Rosette - three single strain gage elements, each in a different direction, near a point. This is a special case of the single element gage. Each signal output is recorded separately and simultaneously. These readings completely define the state of strain (both the normal and shearing strains, in any direction) at this point. In the McLEAN installation, the rosette gage elements were oriented in a longitudinal, athwartship and diagonal (from forward port to aft starboard) direction.

2. Transducer Signals

In addition to the strain gage signals discussed above, 10 additional transducer signals are provided as inputs to the recording system. These signals, eight linear accelerometers and two angular displacement pendulums, are fully described in Table IV. The primary function of these signals is to provide a record of ship motions occurring at the same time as the recorded strain gage information.

3. Ship Operating Parameters

In order to supplement the logbook information, several of the ship operating parameters are obtained from various ship transducers using repeater devices located in the instrumentation room. Electrical outputs are taken from these devices and multiplexed prior to recording on Channel 10 of Recorder No. 1. The five parameters obtained in this manner are rudder angle, port and starboard shaft RPM, and wind speed and direction. A physical record of ship's course is obtained from an analog recorder located in the sea cabin behind the bridge. These records are available at any time and will be obtained for the manned voyage when no longer required by regulation to be kept aboard the vessel.



LEGEND

- Bidirectional Accelerometer
- Pitch & Roll Pendulum
- Longitudinal Vertical Bending Element
- Torsional Shear Gage
- Shear Gage
- Longitudinal Stress Gage
- Transverse Girder Gage
- Three Arm Rosette
- Midship Torsional Shear Element
- Longitudinal Horizontal Bending
- Hull Longitudinal Strain

FIGURE 2 GENERAL SENSOR LAYOUT

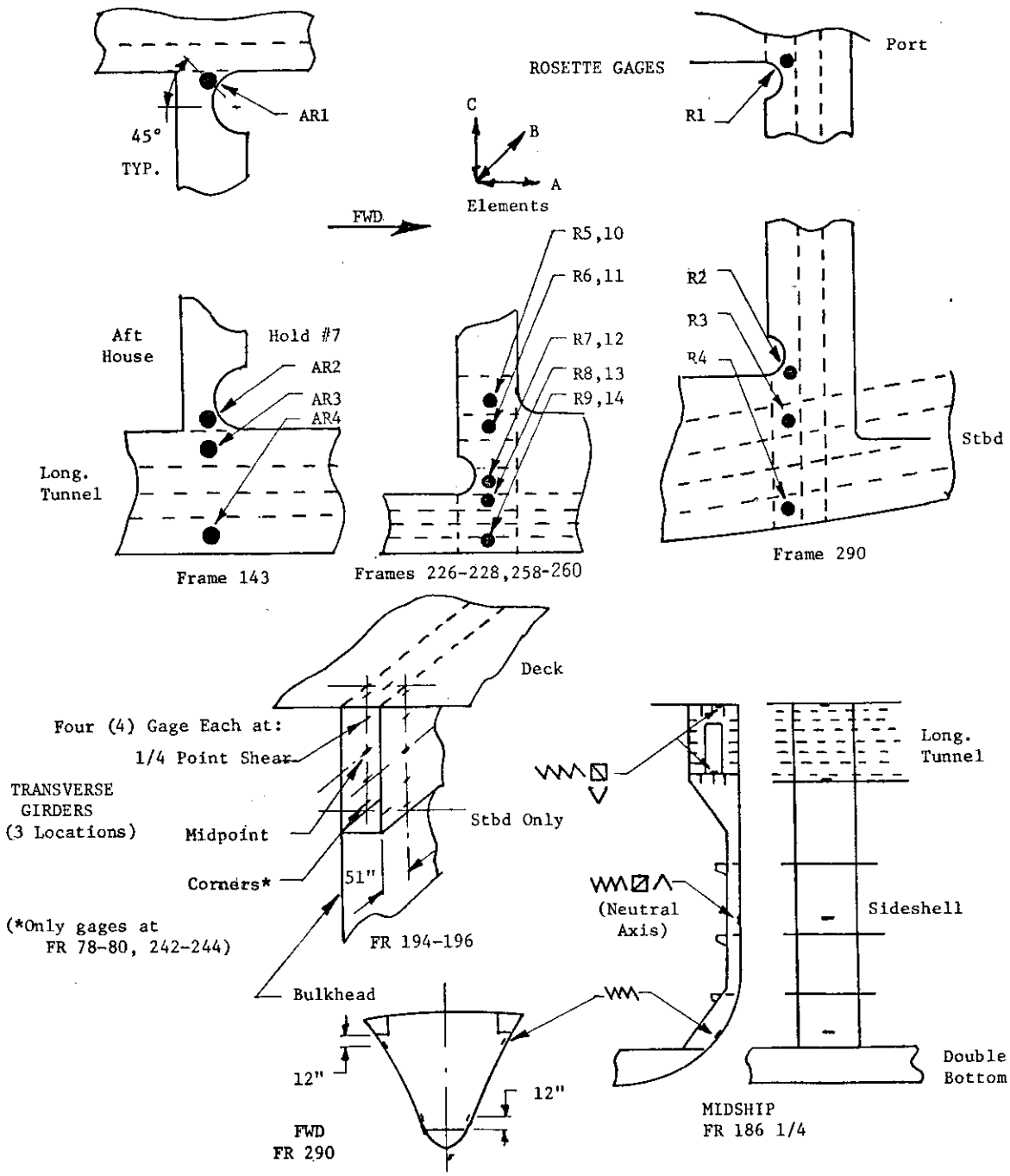


FIGURE 3

DETAILS OF STRAIN GAGE LAYOUT

TABLE IV

TRANSDUCER INFORMATION
(As Initially Installed)

Signal	Location	Transducer	Range	Full-Scale	S
Forward Hull Vertical Acceleration	No. 2 Cargo Hold Second Deck, 14 1/2" Fwd of FR. 290, 40" Port of ℄	Setra Model 100, S/N 068 Accelero-meter	± 5g's	1.49 VDC	
Forward Hull Transverse Acceleration	Same	Setra Model 100, S/N 071 Accelero-meter	± 5g's	1.72 VDC	
Midship Hull Vertical Acceleration	No. 6 Cargo Hold 23 1/2" Fwd FR. 178 11 1/2" Port of ℄ 30' 11" Above Tank Top	Setra Model 100, S/N 072 Accelero-meter	± 5g's	1.66 VDC	
Midship Hull Transverse Acceleration	Same	Setra Model 100, S/N 070 Accelero-meter	± 5g's	1.58 VDC	
Forward Deckhouse Vertical Acceleration	Wheelhouse Overhead 04 Level, on ℄ at FR 307 1/2	Setra Model 100, S/N 069 Accelero-meter	± 5g's	1.55 VDC	
Forward Deckhouse Transverse Acceleration	Same	Setra Model 100, S/N 1361 Accelero-meter	± 2.5g's	1.70 VDC	
Aft Deckhouse Longitudinal Acceleration	Fan Room Overhead 05 Level, 1" to Port of ℄, FR 130	Setra Model 100, S/N 1362 Accelero-meter	± 2.5g's	1.60 VDC	
Aft Deckhouse Transverse Acceleration	Same	Setra Model 100, S/N 1360 Accelero-meter	± 2.5g's	1.72 VDC	
Midship Pitch	26" Fwd of FR 178 26" to Port of ℄ 30' 11" Above Tank Top	Humphrey Pendulum Model CP17-0601-1 S/N H3390	± 45°	±2.25 VDC	
Midship Roll	Same	Humphrey Pendulum Model CP17-0601-1 S/N H2075	± 45°	±2.25 VDC	

4. Wave Height Radar

One parameter which has always presented a problem to the researcher is the measurement of the actual wave condition in a continuous manner. A new attempt to solve this problem has been made by including an "Ocean Wave Height Radar System" (OWHRS) developed by the Naval Research Laboratory as part of the instrumentation package. This device was operational for several voyages during the past season and the data, in the form of slant-range information, was recorded on Channel 3 of Recorder 1.

The signal, as recorded, contains the components of the various ship motions. These parameters must be removed before the true sea profile can be reproduced. No detailed analysis of this information will be presented in this document, but several samples of the data will be presented in subsequent sections.

5. Tucker Wave Meter System

A second attempt to achieve wave data has been made in this program by the inclusion of a Tucker Wave Meter aboard the vessel. This British device, which consists primarily of pressure cells and accelerometers mounted both port and starboard, was installed at the end of the first season's operation. Evaluation of data from this device will be one of the tasks undertaken when reducing second-season data.

6. Scratch Gages

As a supplementary program, mechanical scratch gage installations at a midship location have been installed on all eight vessels of the class. The device consists of a simple extensometer with mechanical amplification which causes a stylus to mark on sensitive paper. The paper is advanced once every four hours and the record thus obtained shows the maximum positive to maximum negative excursion of the stylus in a four-hour period. One scratch gage is located in each ship's starboard tunnel near the midship frame except for the McLEAN, which has one scratch gage in each tunnel. Data tapes are being sent directly to the Ship Structure Committee after collection by Teledyne. No data analysis is presently being undertaken by TMR, nor is the data presented in this report.

7. Logbook

An important adjunct to the data recorded on the two magnetic tape recorders is the data logbook kept by the instrumentation observer. Figure 4 shows typical logbook entries. Environmental conditions are noted here along with information to index the tape recordings. All sea, wind and wave conditions reported in this document are derived from tnis source.

8. Quick-looks

The data reduction process actually begins with "quick-look" playbacks made aboard the ship. Each tape is played back on an oscillograph at a relatively high speed, with a low paper speed. This produces a compact hard-copy record for review. Signal peaks, relative levels and overall variations may be judged from these records but details of the waveform cannot be seen.

Figure 4-A

DATA LOG

Issue: 12/2/68

15 SEA

6 Index No.	21 SWELL 21a Avg. Height'	21b Avg. Length	21c Relative Direct.	22 Barometer Reading	23 Sea Temp.	24 Air Temp.	25 Weather	26 Initials	WATCH FOR FALSE START TAPE 21-22 27 (Change of Course, Change of Speed, Change of Ballast, Slamming, Change Tape, Reel Number) (Wave buoy launching)
1	2-3'	5-600'	0 E	30.10	54	48/47	CLDY RAIN	ETB	TAPE # 21 & 22 RSB = 1,2,3,4 — GSB = 1,2,3,4
2	10'	5-600'	45 P NE	30.08	52	52/48	O'CAST		FDH ACCEL. & F.T.G.
3	10'	600'	45 P NE	30.30	62	52/48	CLDY		
4	10-12	600	42 P NE	29.97	64	57/54	P'CLDY		
5	10-12	600	42 P NE	29.93	68	53/52	O'CAST RAIN		SHIP PITCHING IN LONG SWELLS - LIGHT ROLL
6	12-15	600	37 P NE	29.80	67	55/52	O'CAST		SPRAY OVER BOW & BRIDGE, FIRST TIME SEEN THIS TYPE SEA
7	12-15	600	37 P NE	29.77	65	54/52	PT CLDY		
8	12-15	600	37 P NE	29.63	68	52/51	CLDY		PITCH & SLIGHT ROLL SPRAY FROM TOP OF BOW
9	10-12	600	31 P NE	29.48	64	53/52	CLDY		
10	10-12	600	31 P NE	29.50	64	58/55	O'CAST		RSB - 5-6-7-8 GSB - 5-6-7-8 & HLG
11	10-12	600	42 P NE×N	29.38	64	62/60	CLDY		
12	8-10	500	34 P NE	29.48	64	62/60	CLDY		
13	8-10	500	53.5 P NNE	29.50	64	66/63	PT CLDY		END TAPE # 21 & 22
14	8-10	500	31 P NE	29.51	66	61/60	PT CLDY		START TAPE # 23 & 24
15	6-8	500	34 P NE	29.63	66	64/63	O'CAST		

DATA LOG

Issue: 12/2/68

Figure 4-B

[1] SHIP: SEA LAND McLEAN

[2] VOYAGE: 04E [3] FROM: Ft. ELIZABETH [4] TO: BREMERHAVEN [5] DATES: 11/11/72 [4] TO: 11/16/72

			[1] SHIP					[12] WIND		[15] SEA				
			[9] Noon Position			[11] (Past 4 hours) Avg.	Avg.	[13] TRUE	[14]					
[6] Index No.	[7] Date(M,D,Y) Time (GMT)	[8] Time Meter Rdg.	[9a] Lat.	[9b] Long.	[10] Course	Speed Knots	Engine R.P.M.	Wind Speed Knots	Wind Direct.	[16] Beaufort Sea State Number	[17] Relative Wave Direct.	[18] (Ft.) Avg. Wave Height	[19] (Sec.) Avg. Wave Period	[20] (Ft.) Avg. Wave Length
1-4 1	11/12/72 0400	000.0			090	32.8	134/132	15	0 E	4-5	0 E	3		
5-8 2	11/12/72 0800	0120.0			090	32.0	129/127	10	90 P N	3	90 P N	3		
9-12 3	11/12/72 1200	0240.0			090	32.0	129/127	15	101 P N x W	4	101 P N x W	3		
13-16 4	11/12/72 1600	0360.1	40.18	62.48	087	32.0	128/128	25	87 P N	6	87 P N	6		
17-20 5	11/12/72 2000	0480.2			087	32.0	128/128	30	66 P N x E	7	66 P N x E	10		
21-24 6	11/12/72 2400	0600.3			082	32.0	128/128	35	60 P NNE	8	60 P NNE	12		
25-28 7	11/13/72 0400	0720.2			082	32.0	128/128	30	84 P N	7	84 P N	10		
29-32 8	11/13/72 0800	0840.6			082	32.0	128/128	30	NW x W P	7	138 P NW	10		
33-36 9	11/13/72 1200	0961.0			076	32.0	128/128	25	143.5 P WNW	6	143.5 P NW	8		
37-40 10	11/13/72 1600	1081.3	41.37	46.51	076	32.0	128/128	30	166 P W	7	166 P W	10		
41-44 11	11/13/72 2000	1201.5			076	32.0	128/128	30	149.5 SW	7	149.5 SW	10		
45-48 12	11/13/72 2400	1322.3			076	32.0	128/128	25	149.5 SW	6	149.5 SW	10		
49-52 13	11/14/72 0400	1442.9			076	32.0	128/128	20	149.5 SW	5	149.5 SW	8		
1-4 14	11/14/72 0800	0000.0			076	32.0	128/128	20	115.5 SxW	5	115.5 SxW	8		
5-8 15	11/14/72 1200	0120.6			077	32.0	128/128	20	125.5 SSW	5	125.5 SSW	6		

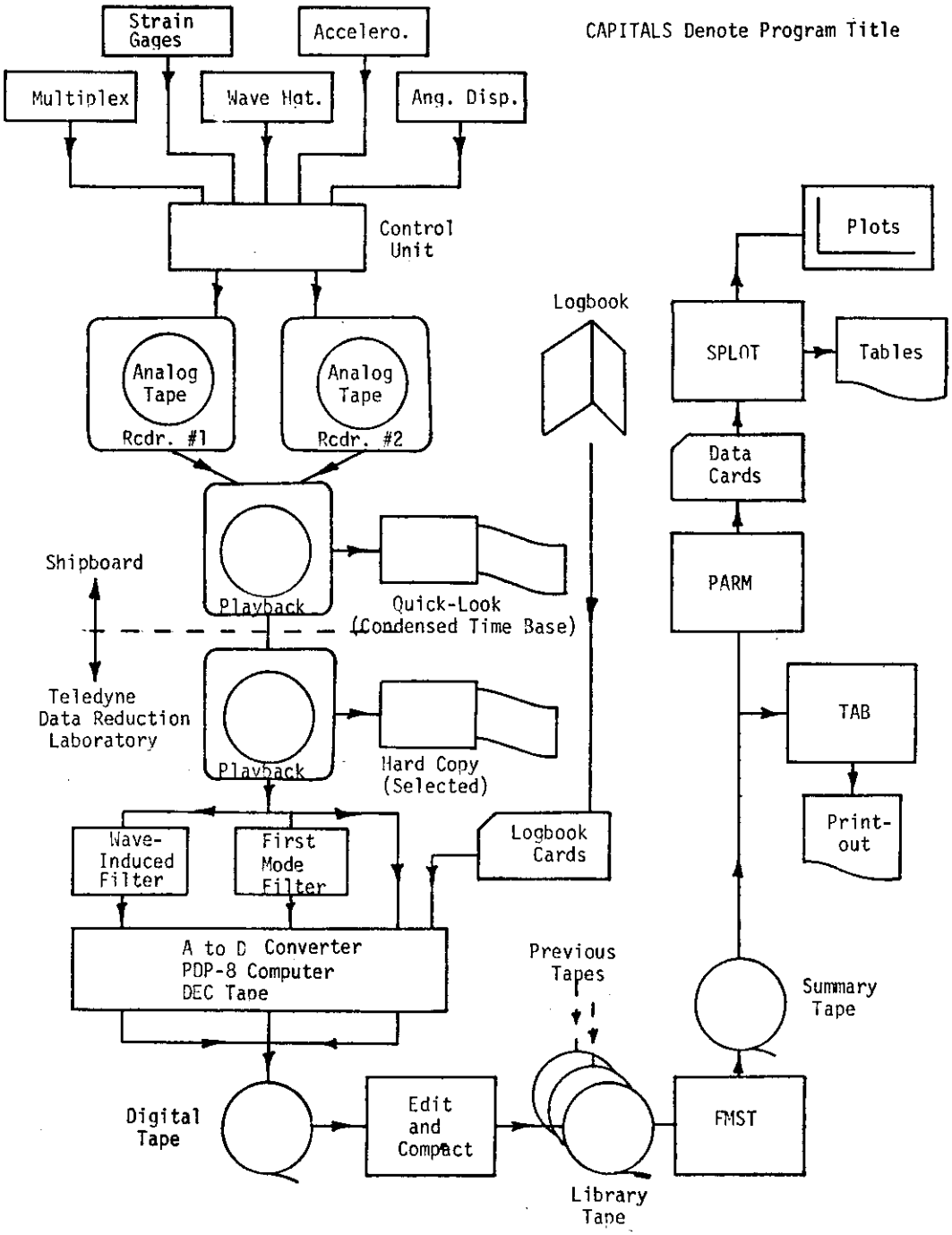


Figure 5 SCHEMATIC OF DATA FLOW

In sum, shipboard data gathering produces analog magnetic tapes of the recorded data from two tape recorders running simultaneously. In addition, a manual logbook record is maintained which correlates the magnetic tape data with the conditions existing at the time of the data. Quick-look records are also produced for on-site quality control purposes, but these have little application to most data analysis procedures except for scaling an overall maximum value for each interval.

B. Data Analysis Operations at TMR

1. Hard-Copy Analog Records

As shown in Figure 5, the preponderance of data reduction takes place after the recordings are removed from the ship. After review of the logbook records and taking into account the notes of the on-board observer, certain sections of data are played back onto hard-copy oscillographic records. Details of this operation depend on the type of analysis being done; it may be desired to compare one channel relative to another for a long period, or only the response for a short period around some event such as a slam. Examples of hard-copy analog records are presented in later sections.

2. Filtering and Digitizing

Most large-magnitude stress records, especially those associated with slamming and similar dynamic events, can be separated into two components: wave-induced, and first mode ("whipping", or "springing"). Each component is characterized by its frequency. First-mode frequencies are typically on the order of 1 Hz, while wave-induced components are lower in frequency (i.e., longer in period). Separation of these components is accomplished by passing the electrical signal representing the stress level or sensor output through electrical filters adjusted for the appropriate bandpass frequencies. The resulting filtered signal (or the original combined signal) may then be reproduced on an oscillograph to produce a hard copy, or it may be digitized in order to change its format for further processing.

Certain channels are selected for digitizing and further processing into library tapes. The details of this process are presented in Reference 2. In this step the logbook record is collated with the corresponding stress or motion data. In addition to a digitized data record, this operation also computes numbers characterizing each data interval, such as the maximum peak-to-trough, root-mean-square (RMS), number of peaks, etc. Some of these data have been used further in various analyses described below.

The library tapes can be further summarized by deletion of the complete digitized record. This summary tape can provide a computer-generated listing of environmental and characteristic data. Examples of these data are provided as a separate Appendix to this report. The summary tape also provides the data base for the parametric studies discussed below. Header block and data summary block formats for summary tapes are given in Tables V and VI, respectively. It should be noted that summary tapes do not contain data on which to base spectra, nor, as presently structured, do they contain computed values for the original waveform. Values reported are only for the wave-induced (maximum, RMS) and first-mode (maximum only) components.

A general summary of the SL-7 data formats currently available is presented in Table VII.

TABLE V

DIGITAL TAPE HEADER BLOCK FORMAT

Byte	Information	Format
1 - 134	Tape Identification	8-bit EBCDIC
135 - 138	Number of Voyages on Tape	32-bit binary
139 - 142	First Voyage Number	8-bit EBCDIC
143 - 146	No. Intervals in First Voyage	32-bit binary
147 - 150	Second Voyage Number	8-bit EBCDIC
151 - 154	No. Intervals in Second Voyage	32-bit binary
155 - 158	Third Voyage Number	8-bit EBCDIC
159 - 162	No. Intervals in Third Voyage	32-bit binary
	and so forth	
	unused bytes zero-filled	

TABLE VI

INTERVAL SUMMARY BLOCK FORMAT

Byte	Information	Format	Byte	Information	Format
1-7+11-12	Analog Tape Number	8-bit	119- 128	Blanks	8-bit
8- 10	Voyage Number & Direct.	EBCDIC	129- 157	Comments	EBCDIC
13- 15	Logbook Index Number		158- 256	Zeros	
16- 18	Interval Number		257- 260	No. Wave Induced Cycles	32-bit Binary
19- 26	Date				
27- 30	Time (Eastern Std.)		261- 264	No. of Bursts of Wave-Induced Stress	
31- 37	Latitude				
38- 45	Longitude		265- 268	RMS Wave-Induced Stress, psi	
46- 48	Course				
49- 52	Ship Speed (MPH)		269- 272	Max. P-T Wave-Induced Stress, psi	
53- 56	Shaft RPM		273- 276	Max. P-T 1st Mode Stress, psi	
57- 58	Beaufort Sea State				
59- 62	Relative Wind Dir.				
63- 64	Relative Wind Vel. (knots)		277- 280	Mean Relative Stress Level	
65- 66	True Wind Velocity (knots)		401- 404	1st Wave-Induced P-T Detected	32-bit Binary
67- 70	Relative Wind Dir.		405- 408	2nd Wave-Induced P-T Detected	
71- 72	Wave Height (feet)				
73- 74	Wave Period (sec.)		409- 412	3rd Wave-Induced P-T Detected	
75- 77	Wave Length				
78- 81	Relative Swell Dir.			.	
82- 84	Swell Height (feet)			.	
85- 88	Swell Length (feet)			.	
89- 93	Barometric Press, "Hg		2273-2276	469th Wave-Induced P-T Detected	
94- 95	Sea Temp. (°F)				
96- 98	Air Temp. (°F)		2277-2280	470th Wave-Induced P-T Detected	
99- 118	Weather				

TABLE VII

SUMMARY OF CURRENT DATA FORMATS

Format	Characteristics
Analog Tapes	Recorded at 0.3 ips, FM IRIG low-band, 270 Hz center frequency--13 data tracks, 1 compensation track--tape 1" wide, 0.001" thick, 3600 feet on 10 1/2-inch reels. Each 30-minute interval preceded by zero and calibration signals.
Oscillograph Records	Quick-looks reproduced aboard ship at 200:1 speed up--3 to 4 tracks per record--all tracks reproduced--30 minutes occupies about 3 inches of record. Expanded time-histories of selected tracks--used for instantaneous comparisons.
Digital Library Tape*	12,000 data points at 10 samples/second (real time) (unfiltered) from each interval of selected transducers on Recorder No. 1, plus logbook data, plus computed values--approximately 700 intervals.
Summary Tape*	The Digital Library Tape with the digital record deleted, leaving computed results and logbook data. One Summary Tape contains data from the entire season from one transducer.
Logbook	Environmental and ship operational data manually entered by system operator. Data is coded and entered on Digital Library Tape.
TAB Printout*	All logbook data plus computed data characteristics for each transducer, from the Summary Tape.
PARM Data Cards*	RMS and maximum data values plus selected logbook data for parametric studies.
SPLOT Output	Plots of data means vs. any parameter (such as Beaufort Number), classified into families of five subgroups. Tabulations also available (see Appendix B).

*See Reference 2-b.

III. RESULTS

In general, the results of the first season of manual data acquisition were gratifying. Large quantities of high-quality data were recorded. In any equipment of this complexity operating over an extended period, some failures or breakdowns are expected. However, due to the presence of the observer/operator, the effects of these were minimized and they were quickly corrected. His presence also assured proper correlation of the vital environmental data.

A. 1972-1973 Operating Season

It was originally planned to have the system operational in time to take part in both builder's and owner's sea trials. Unfortunately, due to the number of additional passengers scheduled during these tests, it was not physically possible to have Teledyne engineers aboard the vessel. At the time of the first trial, the system had been fully installed but had not had its final adjustments completed.

1. Manned Operations

Two Teledyne engineers met the vessel in Rotterdam upon her return from her first sea trials on September 16, 1972. These engineers worked aboard until September 28, 1972 when the vessel went on its second trial. It was decided that it was still impossible for Teledyne engineers to take part in the trials, although the system was operational and ready to record data. The ship left on Sunday, October 8, 1972, for New Jersey with two Teledyne engineers aboard. Recordings began on that date and continued throughout the westbound leg of Voyage 1. Both engineers rode the vessel to New Jersey. During this voyage and subsequent roundtrip Voyages 2 and 3, two Teledyne engineers rode the vessel. This manning scheme allowed TMR to have four engineers trained in system operation, and provided the additional manpower required during the system start-up.

2. Voyage Summaries

A summary of the voyage and data as recorded by dates and tape number is listed in Table VIII. With the exception of the westbound leg of Voyage 5, the vessel was manned by TMR personnel during each crossing from Voyage 1 in October, 1972 to Voyage 12 in April of 1972. Manning was terminated for the season when the ship returned to Rotterdam for drydocking in April, 1973.

3. Logbook Data

During each crossing the operator kept a data log in which he made indicated entries once every four hours. Logbook index numbers begin at No. 1 for each crossing and typically there are 30 to 32 entries per crossing.

The recording plan during the past season was to record for two out of every four hours when operating in the automatic mode. Thus, there are normally four data intervals associated with each log index entry, and, since a tape can run for a maximum of 40 hours real time and each data interval is 30 minutes in length, it is theoretically possible to have 80 intervals per tape. In practice, the operators have changed tape in each machine at the beginning of each voyage. These first tapes normally contain 68 to 72 intervals, allowing for unused tape at the beginning and end of each reel. Usually a little more than half way across two new tapes are loaded. These second tapes have varying numbers of intervals dependent on such items as the ship's speed, associated progress, and just when the system is secured. This

TABLE VIII

ANALOG TAPE AND VOYAGE SUMMARY

Voyage	Direction	Data Collection Dates	Data Tapes Produced (Tape Numbers)	Number of Tapes
1	West	10/8/72 to 10/13/72	1,2,3,4	4
2	East	10/15/72 to 10/19/72	5,6,7,8	4
2	West	10/23/72 to 10/27/72	9,10,11,12	4
3	East	10/29/72 to 11/2/72	13,14,15,16	4
3	West	11/6/72 to 11/10/72	17,18,19,20	4
4	East	11/12/72 to 11/16/72	21,22,23,24	4
4	West	11/19/72 to 11/24/72	25,26,27,28	4
5	East	11/26/72 to 12/4/72	29,30,31, 32,33,34	6
5	West	Vessel Not Manned No Data Collection		
6	East	12/29/72 to 1/4/73	35,36 One Recorder Time-Shared	2
6	West	1/7/73 to 1/12/73	37,38 One Recorder Time-Shared	2
7	East	1/14/73 to 1/19/73	39,40,41,42	4
7	West	1/24/73 to 1/29/73	43,44,45,46	4
8	East	1/30/73 to 2/4/73	47,48,49,50	4
8	West	2/8/73 to 2/13/73	51,52,53,54	4
9	East	2/15/73 to 2/20/73	55,56,57,58	7
9	West	2/24/73 to 3/1/73	59,60,61,62	4
10	East	3/3/73 to 3/8/73	63,64,65,66	4
10	West	3/11/73 to 3/15/73	67,68,69,70	4
11	East	3/19/73 to 3/24/73	71,72,73,74	4
11	West	3/26/73 to 3/30/73	75,76,77,78	4
12	East	4/1/73 to 4/5/73	79,80	2

past season an average of 48 to 50 intervals are found on the second tapes. In summary, during each crossing 2 tapes are usually recorded on each tape machine. The interval numbers on each tape can run from 1 to 80 and these intervals are associated with logbook indexes 1 to 32 for each crossing.

4. Sea State Profiles

To assist in understanding the distribution of sea states encountered during the first data season, Figure 6 has been prepared. This figure depicts the occurrences of the various Beaufort Numbers reported divided into eastbound and westbound voyages. The basis for these data is the logbook entry for sea state recorded once every four hours by the operator. A total of 623 entries were made during the recording season; 324 during eastbound crossings and 299 during westbound. Normally, four data intervals (30-minute recording periods) are associated with each log entry. Thus, to obtain the total number of data intervals available at each sea state, it is necessary to multiply the number of logbook entries by four. The dominant Beaufort Numbers are in the range of 3 to 7, with the most entries obtained at Beaufort 4.

A summary of the more important logbook data is presented in Appendix A. This listing contains the following data:

a. Voyage Number and Direction
b. Recorder No. 1 Tape Number
c. Interval Number
d. Index Number
e. Date
f. Time (GMT)
g. Ship Speed in Knots
h. Beaufort Number
i. Relative Wave Direction
j. Weather Observation
k. General Comments

5. Static Calibration

In order to obtain verification of the accuracy of the instrumentation system operation a static calibration test was performed on the vessel at the loading terminal in Rotterdam on April 9 and 10, 1973. This test sequence, by judiciously controlling the unloading sequence, was designed to create known, or at least calculable levels of bending and torsional stresses. By comparing calculated values with system outputs a judgment of instrumentation system performance is obtained. The results of this experiment are not reported here but have been issued as a separate document (see Reference 3). However, the following general conclusions can be drawn based on the data gathered during the calibration experiment:

a. The maximum observed normal stress for the calibration loadings occurs in the hatch corner doublers (Hatch 9) just forward of the aft house in a direction parallel to the deck and at an angle of 22 degrees to the ship centerline. Other hatch corners, at stations where hatch width changes are encountered, exhibited high shear stresses near the stress relief cutouts.

b. The maximum calibration stresses are one-eighth to one-half of the maximum peak-to-trough stress observed under normal seaway conditions. To put it

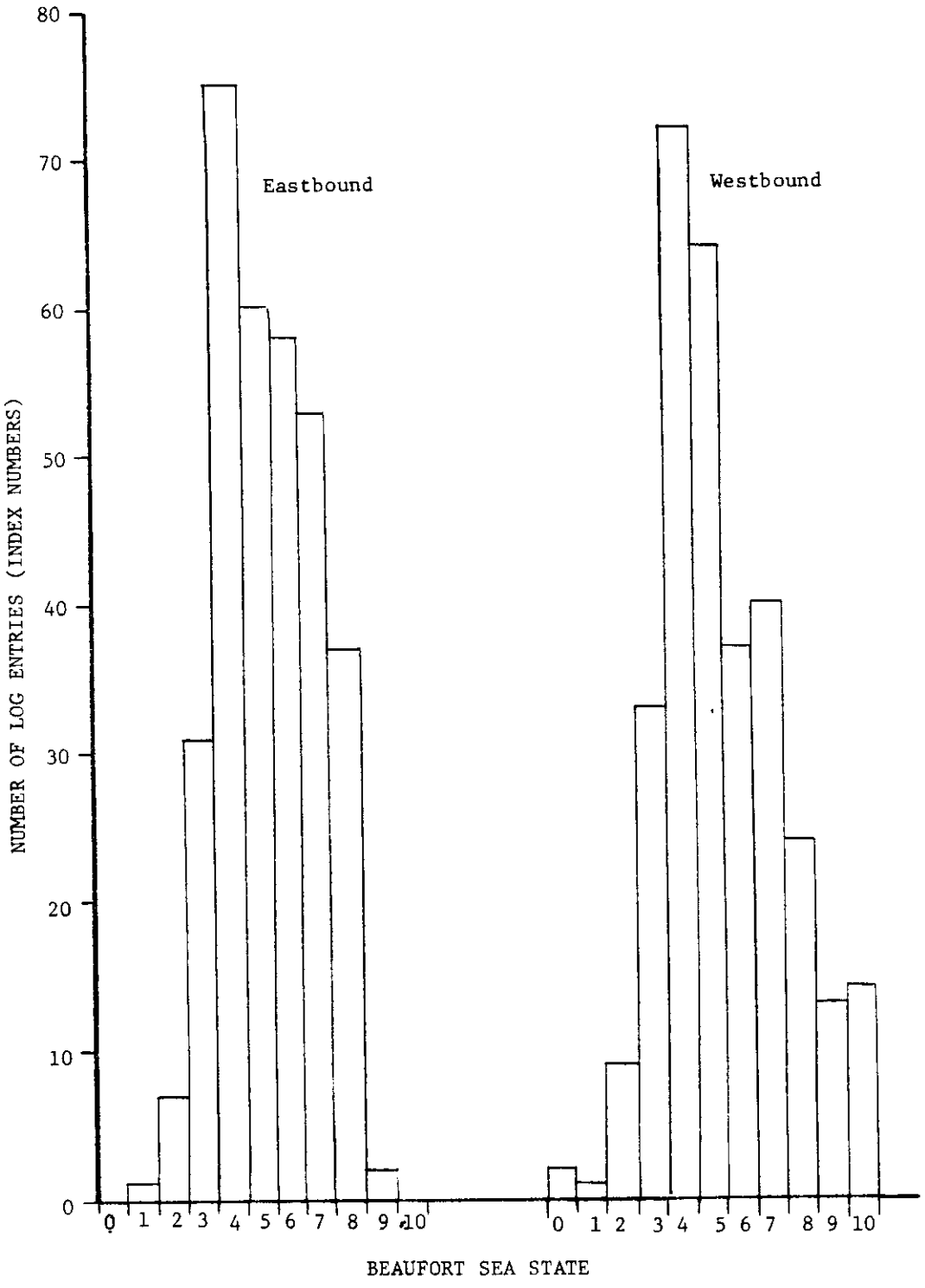


FIGURE 6
Sea State Profiles 1972/73 Season

another way, the applied calibration loads, or load distributions are approximately one-eighth to one-half of those generated in a seaway for most gages.

c. Due to the low strain levels induced and the temperature differences encountered during the calibration, thermal effects could account for a substantial portion of most measured strains.

d. The midship transverse girder is a more sensitive indicator of torsion than the midships torsional shear sensor installation.

6. System Reliability and Performance

System performance during the first season was consistent with that expected from an installation of this magnitude. No strain gage circuits experienced any failures. During Voyage 6 and part of Voyage 7 tape recorder problems were encountered which required the time-sharing of one unit until an additional machine could be obtained and the defective unit repaired. It should be pointed out that most of the equipment in the system is not new and has seen previous sea duty on both the ABS "Large Tanker Program" and two years of operation aboard Sea-Land's S.S. BOSTON.

Several data amplifiers did fail but on-board spares permitted replacement within a short time. In addition, failure of several of the accelerometer units were experienced. By selective switching of units, it was possible to keep the signals of primary interest operational during most of the data intervals.

In general, system performance was good and the fact that it was operator-controlled contributed to its overall excellent reliability.

The system was re-energized in the Fall of 1973 prior to the first manned voyages of the second season.

B. Data Presentation

1. General

As listed in Table VIII, 80 analog data tapes were produced during the past operating season, 40 from each recorder. A data summary book has been prepared for reference wherein every interval on every tape is identified by transducer.

During the first season, Voyage No. 4 presented some of the most interesting data from the standpoint of exhibiting the heaviest weather with a variety of relative sea directions. Since some characterization of the response data from all transducers was desired, but the volume of data available was large, this voyage was chosen for presentation in detail. Parametric studies were undertaken for all voyages, however.

2. Parametric Studies

Starting with the Summary Tapes, eight Recorder No. 1 data channels were selected for processing by the parametric studies computer program (see Reference 2 and Figure 5). These channels were:

a. Channel 1 - Longitudinal Vertical Bending (LVB)

b. Channel 2 - Torsional Shear Midships (TSM)

c. Channel 4 - Roll

d. Channel 5 - Pitch

e. Channel 8 - Forward Vertical Acceleration (FAV)

f. Channel 11 - Longitudinal Horizontal Bending (LHB)

g. Channel 12 - Shear Forward Port (SFP)

h. Channel 13 - Shear Forward Starboard (SFS)

The RMS and maximum peak-to-trough wave-induced component of each of the above parameters was plotted against Beaufort Number (although this is a wind scale, the number reported corresponds generally to a well-defined sea condition) in various families of ship speed or relative sea directions. In order to derive a single characteristic value within each Beaufort Number, the mean of both the maximum and RMS values per interval were plotted. These results are presented in Appendix B. Three types of data presentations are included for each data set:

a. A dot-plot of all values, interval RMS or maximum peak-to-trough.

b. A mean value plot of interval data set against ship speed or relative wave direction groups.

c. A tabular listing giving the number of points upon which the curves are based and the set of standard deviations.

Extensive tabulations of digitized stress, motion, and logbook data are available to those interested through the Ship Structure Committee.

3. Maxima Observed on Recorder No. 2, Voyage 4

In order to present a sampling of the extreme data seen by Recorder 2, all of the data for Voyage 4 (E&W) was played back on an oscillograph, annotated, and scaled. In this manner a maximum peak-to-trough value was measured for each transducer for each interval. These data are presented in Table IX. As noted previously, Recorder No. 2 data are monitored in four consecutive modes. Some of these modes are switched, however, to record other data. This is reflected in Table IX. It should also be noted that the various maxima listed for any one interval did not necessarily occur at the same time.

4. Simultaneous Response Data

It is often useful to compare a response waveform occurring at one spot with that occurring at another spot at the same time. The complete records (all Recorder No. 1 and No. 2 signals recorded at the selected instances) from four examples of high sea state conditions are presented in Figures 7, 8, 9, and 10, each representing a different relative sea direction; i.e., head, broad-on-the-bow, quartering and following.

5. Averaged Midship Maximum Stresses, Voyage 4

Six longitudinal strain gage arrays are located at midship, on the top, mid and bottom sideshell, port and starboard. These are some of the most interesting

(Text continued on Page 105)

TABLE IX

VOYAGE 04 EASTBOUND
TAPE 22 RECORDER #2

"A" MODE — MAXIMUM PEAK-TO-TROUGH SIGNAL VALUE (psi)

Index No.	Interval No.	Sea State	LSTS	LSMS	LSBS	LSTP	LSMP	LSBP	SAP	SAS	BGST	BGSB	FWD HOUSE VERTICAL (G's)	FWD HOUSE TRANS. (G's)
1	1	4	2017	659	1281	2746	484	1236	1111	1200	277	333	.18	.12
2	5	3	4852	1648	2014	4504	1260	1977	2333	2333	444	599	.40	.12
3	9	4	7049	2636	2197	6921	1744	1977	3333	3000	833	733	.53	.16
4	13	6	6866	2966	4486	8899	2423	5850	3722	4066	833	733	.71	.20
5	17	7	9430	4944	5218	9338	3392	8240	4666	5466	1277	799	.98	.34
6	21	8	10712	6592	5676	10986	4362	8157	5166	5266	1222	1066	1.16	.46
7	25	7	7690	4065	3021	5273	3199	5932	3055	2800	833	666	.89	.34
8	29	7	5310	3076	2563	4724	2423	4120	2333	2133	666	599	.71	.38
9	33	6	8697	3296	4577	8439	2617	6427	4111	4333	944	733	.89	.40
10	37	7	5493	2526	3112	4504	1938	3213	1777	2600	611	533	.93	.28
11	41	7	5584	2856	3387	5053	2035	3625	2277	2266	833	599	.62	.40
12	45	6	5127	2966	2746	4174	1841	3296	2000	2666	833	466	.67	.34
13	49	5	7324	3405	3662	8789	2423	4532	2555	2800	888	466	.76	.44
						TAPE 24 RECORDER #2								
14	1	5	7873	3186	3939	6921	2472	5022	3222	3600	833	533	.67	.32
15	5	5	5493	2966	2929	5822	2197	4316	2222	2733	777	666	.67	.32
16	9	5	5218	2526	3204	4065	1831	3845	1944	2666	611	733	.49	.26
17	13	5	4303	2526	2655	4065	1831	3139	2333	1866	722	466	.49	.28
18	17	4	4852	2417	2197	3845	1464	2982	2055	2066	444	333	.58	.20
19	21	4	4211	2197	2014	3735	1648	3139	1555	1733	444	400	.49	.22
20	25	5	2838	2197	1922	2746	1556	2354	1611	1733	555	466	.53	.26
21	29	6	3204	2197	2472	3296	1464	2197	1166	2200	777	400	.36	.30
22	33	6	3021	2197	2014	2856	1556	2040	1277	1600	666	466	.22	.26
23	37	5	4303	3076	4211	4394	2288	2511	1722	2400	888	400	.22	.26
24	41	6	2380	1538	2197	2307	1007	1412	1111	1133	388	266	.13	.20

TABLE IX (Continued)

VOYAGE 04 EASTBOUND
TAPE 22 RECORDER #2

"B" MODE

MAXIMUM PEAK-TO-TROUGH SIGNAL VALUE (psi)

Index No.	Interval No.	Sea State	AR_1A	AR_1B	AR_1C	AR_2A	AR_2B	AR_2C	AR_3A	AR_3B	AR_3C	AR_4
1	2	4	1896	4015	1003	2141	826	903	2788	1338	557	187
2	6	3	4015	8030	1896	3346	1535	1806	4572	2409	1003	307
3	10	4	8030	11242	3457	5755	2598	3513	7361	4015	1673	535
4	14	6	10038	12447	4349	8298	3306	5019	10595	5487	2007	789
5	18	7	12491	14990	5799	11777	5904	8130	10930	9770	2899	1030
6	22	8	12268	18336	6022	10439	4723	6926	12268	8164	2788	1124
7	26	7	6134	12580	2788	5353	2361	3011	6915	3747	1449	481
8	30	7	8699	13380	3011	8164	3542	4316	10818	5353	1673	682
9	34	6	6468	11644	2899	7093	2716	2911	9368	4684	1338	642
10	38	7	6580	11777	2230	5219	2598	2107	6692	3747	1338	548
11	42	7	5799	9904	2565	6290	2598	3513	7807	4282	1003	428
12	46	6	6692	10439	2230	4684	2243	3412	5911	3346	1449	361
13	50	5	6245	12045	2788	6692	2479	3714	7807	4684	1561	374
						TAPE 24	RECORDER #2					
14	2	5	5799	8030	2565	5755	2119	2868	7138	3747	1226	441
15	6	5	5688	10573	3011	5353	2119	3346	6245	3613	1338	307
16	10	5	6357	10573	2342	5621	1896	2294	6692	3613	1449	428
17	14	5	4684	8967	2788	5353	2119	3250	6022	3479	1115	347
18	18	4	3680	8298	2230	5487	1561	2581	6692	3613	1115	307
19	22	4	3792	5219	1449	3479	1449	2007	4126	2007	669	227
20	26	5	4238	6156	1784	4684	1673	2294	5799	3212	892	267
21	30	6	3457	6424	1784	4282	1784	2485	5019	2944	780	254
22	34	6	2788	6022	1449	3479	1449	2007	4126	2275	669	187
23	38	5	4684	7227	2342	5085	2230	3059	6022	3479	892	240
24	42	6	2453	4952	892	2944	1226	1338	3680	1873	669	227

TABLE IX (Continued)

VOYAGE 04 EASTBOUND
TAPE 22 RECORDER #2

"C" MODE — MAXIMUM PEAK-TO-TROUGH SIGNAL VALUE (psi)

Index No.	Interval No.	Sea State	R_1A	R_1B	R_1C	R_2A	R_2B	R_2C	R_3A	R_3B	R_3C	R_4A
1	3	4	2342	1338	557	2141	1417	502	–	803	669	1204
2	7	3	2899	1738	669	4015	2834	602	–	1338	1003	1606
3	11	4	4507	2676	892	8565	6022	903	–	2810	1673	3212
4	15	6	9034	4282	1561	13517	8857	1606	8922	4149	2453	5621
5	19	7	9480	4149	1784	11911	8975	1606	8922	4282	2676	5353
6	23	8	10372	5487	1896	14856	10864	1706	9034	4818	3122	6825
7	27	7	12268	4952	1449	13250	9447	2007	6915	4149	3569	5487
8	31	7	9926	4952	1449	12714	8857	1806	7026	4015	2788	4550
9	35	6	9257	3881	1226	9636	7203	1505	5465	3078	2565	3747
			R_5A	R_5B	R_5C	R_6A	R_6B	R_6C	R_7A	R_7B	R_7C	R_8A
10	39	7	1561	936	1784	1606	2598	1204	3346	5353	1784	4416
11	43	7	1896	936	2119	1739	3306	1003	2899	4952	2007	3613
12	47	6	1896	936	2007	1472	3306	1204	2899	4818	2230	4416
13	51	5	1896	1070	2230	2007	3306	1003	3346	5755	1784	4952
						TAPE 24 RECORDER #2						
14	3	5	1784	803	2230	1873	3122	956	2899	4684	1896	3881
15	7	5	1561	936	1896	1472	2342	1051	3234	6022	1673	4416
			$R_{10}A$	$R_{10}B$	$R_{10}C$	$R_{11}A$	$R_{11}B$	$R_{11}C$	$R_{12}A$	$R_{12}B$	$R_{12}C$	$R_{13}A$
16	11	5	1338	936	1338	803	1673	764	–	3346	1115	3747
17	15	5	1561	936	1226	1070	2119	860	–	2810	1226	3747
18	19	4	1338	1204	1003	803	1896	764	–	3078	892	4282
19	23	4	1338	803	669	803	1561	573	–	2542	892	2810
20	27	5	1338	803	892	803	1784	573	–	2409	1338	2810
21	31	6	1561	1070	669	803	2007	573	–	2676	1226	2409
22	35	6	1449	1070	780	803	1673	669	–	2810	1115	2810
23	39	5	1896	936	1226	936	2676	669	1226	2944	1338	2676
24	43	6	1226	669	669	803	1338	573	1115	2007	1003	2810

TABLE IX (Continued)

VOYAGE 04 EASTBOUND
TAPE 22 RECORDER #2

"D" MODE — MAXIMUM PEAK-TO-TROUGH SIGNAL VALUE (psi) — Sheet 4 of 8

Index No.	Interval No.	Sea State	TGFS-1	TGFS-2	TGFS-3	TGFS-4	TGMS-1	TGMS-2	TGMS-3	TGMS-4	TGAS-1	TGAS-2	TGAS-3	TGAS-4
1	4	4	2007	1873	1115	2007	2125	1806	1226	2409	1115	1070	1226	1472
2	8	3	5242	3881	1784	4149	3306	2810	1673	4282	2788	2275	2230	2810
3	12	4	5353	5487	3011	7361	6022	4416	3346	6959	3792	3212	2788	6015
4	16	6	6692	9502	5576	12045	8620	6825	5019	10841	6580	5353	4349	6156
5	20	7	9814	9101	3680	12714	8975	6022	4684	9636	8141	6558	4572	6959
6	24	8	14945	9904	6468	13785	12399	8030	5799	11510	7584	6022	4907	6959
7	28	7	11153	8833	4684	10305	7794	5420	3903	7495	5019	4015	4015	5755
8	32	7	8365	5621	4126	8030	6495	4215	3346	6692	3903	2944	2788	2944
9	36	6	7361	4952	3011	6959	7321	4316	3792	7628	3349	3078	2676	3613
			HLSS-1	HLSS-2	HLSS-3	HLSS-4	TGMS-1X	TGMS-2X	TGMS-3X	TGMS-4X				
10	40	7	3011	3881	3234	4282	2834	803	780	1070	2899	2810	3457	4684
11	44	7	3903	4684	3903	4952	2834	803	892	1070	4238	3212	3569	4684
12	48	6	3792	4550	3680	4282	3188	803	1003	803	5576	4282	3569	5487
13	52	5	2899	4149	3792	4684	3070	803	892	1070	4461	4149	3680	5353
			TAPE 24 RECORDER #2											
14	4	5	3011	3747	3680	3881	3457	764	892	936	3792	3212	2453	3479
15	8	5	3346	4149	4461	4416	3569	669	892	936	3569	3747	3011	4149
			TGFS-1	TGFS-2	TGFS-3	TGFS-4	TGSS-1X	TGSS-2X	TGSS-3X	TGSS-4X				
16	12	5	7138	5888	3011	7093	1277	1714	1388	2133	5242	4149	3569	5487
17	16	5	7138	4416	2788	6022	1166	1285	1055	1933	3903	3212	2342	3747
18	20	4	6803	4684	2899	5888	1388	1285	888	2066	2565	2007	2342	3212
19	24	4	6803	4818	2788	6022	1055	1142	944	1666	2565	2542	1896	2944
20	28	5	5019	4550	3234	6959	1166	857	833	1866	2676	3346	1784	2409
21	32	6	5688	3747	3122	6692	1333	857	944	2133	3680	2810	1896	3078
22	36	6	6468	4282	2899	6290	1166	714	777	2000	2899	2141	1561	2141
23	40	5	5465	3613	2788	5888	1166	666	833	2000	3903	2810	1449	2676
24	44	6	4238	2944	2119	4684	1111	571	722	1533	2453	2409	1673	2409

TABLE IX (Continued)

VOYAGE 04 WESTBOUND
TAPE 26 RECORDER #2

"A" MODE — MAXIMUM PEAK-TO-TROUGH SIGNAL VALUE (psi) —

Index No.	Interval No.	Sea State	LSTS	LSMS	LSBS	LSTP	LSMP	LSBP	SAP	SAS	BGST	BGSB	(G's) FWD HOUSE VERTICAL	FWD HOUSE TRANS.
1	1	7	1854	659	732	1098	640	863	555	666	222	200	.13	.10
2	5	7	3399	1867	1464	3076	1464	3060	1666	1400	666	400	.18	.18
3	9	8	5974	2746	1831	4724	2380	4708	2388	2333	611	599	.49	.16
4	13	9	16995	3076	9338	16919	2472	7847	7777	8399	1111	1066	1.07	.18
5	17	10	20806	5273	11261	17249	4852	8240	7777	8999	1555	1466	1.20	.30
6	21	10	16583	4944	10712	16809	4669	9181	7222	9666	1611	1133	.93	.36
7	25	10	17510	4724	13550	16919	3936	8318	8611	8999	1777	999	1.20	.30
8	29	10	15141	3735	10528	17029	4028	8867	6722	8466	1388	1133	1.11	.28
9	33	9	10815	4394	7599	11755	4120	5100	4388	5599	1333	866	.89	.30
10	37	5	9064	4394	8972	12854	4120	6748	5277	5733	1722	799	.98	.34
11	41	4	7416	3296	4577	7141	2563	2982	3111	3666	833	733	.80	.30
12	45	5	3914	2966	3662	4284	2197	3060	1944	1933	777	466	.53	.44
13	49	7	5562	3735	5676	6921	2929	4080	2611	3000	1111	599	.74	.60
14	53	7	6386	5493	6317	9887	3753	5493	3222	3333	1722	666	.49	.90
15	57	8	5768	3296	5493	8459	2838	4551	3333	3600	944	599	.53	.62
16	61	7	6695	4504	6042	9338	3479	4002	3388	3600	1111	599	.40	.52
17	65	7	7107	3186	4760	7800	2563	5100	3666	2600	1000	666	.27	.56
						TAPE 28 RECORDER #2								
18	1	7	6500	3405	5035	7622	3112	3221	2777	3333	1055	599	.22	.42
19	5	7	4944	2417	3662	7416	1831	2254	3277	3666	722	533	.13	.46
20	9	7	6134	4724	4028	4738	3753	6367	3055	3466	1055	666	.49	.40
21	13	5	11352	5163	4028	9476	3622	6891	5111	5133	1000	1133	.80	.36
22	17	4	8056	3625	6408	9064	2838	5168	3777	4600	1222	1133	.58	.36
23	21	3	6225	2746	4303	7210	2380	3071	2555	2666	1111	533	.58	.40
24	25	7	4577	2966	2746	4429	2014	2621	2555	2600	833	599	.44	.38
25	29	9	9979	3515	5676	9682	2929	5693	5555	6199	1277	1200	.27	.54
26	33	9	10437	4065	7599	13493	3753	5618	6111	6666	1777	1133	.49	.64
27	37	10	9979	6152	8972	12669	5035	7715	6055	6733	1888	666	.49	.94
28	41	10	9979	5163	7690	15450	2288	6891	5666	6333	1277	999	.53	.68
29	45	10	5493	4504	6042	8034	1648	4494	3333	4000	1333	533	.53	.52
30	49	8	3479	3296	3845	4635	3570	2322	1277	2333	888	533	.31	.28
31	53	5	3021	2197	2288	2575	3936	1573	888	1333	555	400	.22	.24
32	57	5	1556	1648	1281	1339	1007	1348	833	999	388	466	.22	.24

TABLE IX (Continued)

VOYAGE 04 WESTBOUND
TAPE 26 RECORDER #2

"B" MODE — MAXIMUM PEAK-TO-TROUGH SIGNAL VALUE (psi) —

Index No.	Interval No.	Sea State	AR_1A	AR_1B	AR_1C	AR_2A	AR_2B	AR_2C	AR_3A	AR_3B	AR_3C	AR_4A	AR_4B	AR_4C
1	2	7	1380	2275	669	1070	557	573	1338	803	334	752	446	401
2	6	7	4391	6424	1673	3747	1449	1912	4238	2542	892	2509	780	936
3	10	8	4015	7361	1673	2676	1115	1720	3569	2007	892	2258	669	803
4	14	9	15809	22083	3457	15391	6468	7074	15057	10707	2788	12547	4461	4015
5	18	10	14555	22217	4349	16462	7138	6883	18291	11510	2342	12296	4572	3881
6	22	10	12547	21146	4461	17131	7361	6883	18403	12045	2453	11920	4238	3479
7	26	10	14304	22217	3457	16328	8365	8317	18960	13651	2230	11543	3903	3747
8	30	10	11794	20611	3346	15926	6803	7074	18626	10974	2342	12171	4349	3747
9	34	9	12672	16997	3234	16462	7026	6022	18960	11108	1673	10665	3569	3479
10	38	5	7026	13517	3011	12447	4684	4588	16395	8565	1226	7653	2788	2542
11	42	4	6022	10573	2342	6558	2788	3250	8030	4550	1338	3387	1226	1204
12	46	5	5646	9234	2565	5621	2230	3346	7138	3881	1226	3136	1338	1204
13	50	7	8155	14187	3011	6558	2899	3919	8365	4952	1673	4642	1673	1472
14	54	7	6901	12045	3122	7361	3122	4302	9257	5353	1449	4391	1561	1606
15	58	8	7904	15257	4126	8030	3680	4971	10484	5621	1896	4642	1449	1472
16	62	7	8030	13651	2899	6692	3122	4397	9480	4684	1784	4642	1673	1338
17	66	7	8908	15123	3903	7093	3346	3537	8922	7495	1561	4893	4572	1739
						TAPE 28 RECORDER #2								
18	2	7	6803	15793	3457	7152	3346	4380	9480	5353	1673	4391	1449	1472
19	6	7	-	-	-	-	-	-	-	-	-	-	-	-
20	10	7	9480	20879	4572	7277	3346	6022	9368	5219	2230	5395	1673	1739
21	14	5	8141	17666	3346	8155	3346	3741	11487	6022	1561	6148	2119	2007
22	18	4	9034	16060	4015	7528	3346	5110	9591	5219	1673	5144	1784	1472
23	22	3	5242	10573	2565	5646	2565	2920	7918	4149	1226	3889	1561	1070
24	26	7	4238	8565	2453	4266	1673	2098	5799	2810	1115	3011	1115	1070
25	30	9	8699	18202	4461	8281	3680	5110	10038	6022	2342	5897	2007	2007
26	34	9	11934	23957	5353	12547	4907	5292	17399	9368	2453	9159	2788	3078
27	38	10	12603	23020	4572	12045	5576	6387	16395	8164	2676	7904	3122	2944
28	42	10	11487	22083	4572	11669	2565	4197	15280	8565	1896	5897	2565	2007
29	46	10	7918	17533	4461	7403	1338	4927	11153	5888	1561	4768	1561	1338
30	50	8	4795	9770	2342	5019	4349	3376	6134	3881	1226	2007	1338	936
31	54	5	2565	6022	1226	2634	3903	1551	3122	2007	892	1505	780	803
32	58	5	1673	3346	892	1882	892	1186	2119	1472	669	1505	669	669

TABLE IX (Continued)

VOYAGE 04 WESTBOUND
TAPE 26 RECORDER #2

"C" MODE — MAXIMUM PEAK-TO-TROUGH SIGNAL VALUE (psi) — Sheet 7 of 8

Index No.	Interval No.	Sea State	R_1A	R_1B	R_1C	R_2A	R_2B	R_2C	R_3A	R_3B	R_3C	R_4A	R_4B	R_4C
1	3	7	3011	1204	446	2409	2119	573	1338	936	892	1254	669	535
2	7	7	4768	2007	892	4015	3680	956	2342	1472	1338	2509	1449	936
3	11	8	10038	4684	1338	9234	6357	1434	4795	2676	4015	4266	2330	1606
4	15	9	8406	2810	2007	9502	5799	2390	6915	2944	1896	5771	1896	2007
5	19	10	15558	8030	3457	12447	7807	3728	7472	3613	4795	6524	4015	2409
6	23	10	12547	6692	2230	11376	8253	2963	5465	3881	3903	6273	2899	2542
7	27	10	12547	5487	2119	12179	8141	2963	6468	3881	3346	6273	2119	2275
8	31	10	11041	4684	1896	9368	6915	2103	4907	3078	2565	4768	2342	1338
9	35	9	12672	5487	1784	10171	7695	2007	5353	3346	2453	4015	2119	1338
10	39	5	13927	5621	1449	12714	8588	1912	6915	4015	3346	4391	2342	1472
11	43	4	13551	5621	1449	13384	9034	1720	7026	4015	3346	4391	2565	1739
			R_6A	R_6B	R_6C	R_7A	R_7B	R_7C	R_8A	R_8B	R_8C	R_9A	R_9B	R_9C
12	47	5	2509	3881	1338	3747	6022	2390	3903	3346	1449	3513	2676	1204
13	51	7	3262	6825	1784	4684	7584	3250	5353	4416	1673	4015	3346	1338
14	55	7	2760	5487	1561	4684	6915	2868	5353	4015	1449	3513	3011	1070
15	59	8	2760	4952	1673	5755	8922	3346	5576	4282	1449	3136	2342	1204
16	63	7	2258	4416	1673	4015	6915	3154	3680	3212	1784	3513	2342	1070
17	67	7	2007	3881	1673	3881	6468	2676	4126	3212	1784	4266	2230	1739
						TAPE 28 RECORDER #2								
18	3	7	2007	4550	1561	4015	6468	3011	4795	3346	1561	3513	2676	1338
			$R_{11}A$	$R_{11}B$	$R_{11}C$	$R_{12}A$	$R_{12}B$	$R_{12}C$	$R_{13}A$	$R_{13}B$	$R_{13}C$	$R_{14}A$	$R_{14}B$	$R_{14}C$
19	7	7	-	-	-	-	-	-	-	-	-	-	-	-
20	11	7	1338	3747	1226	2007	3346	1277	-	1873	1784	5897	2007	2007
21	15	5	1449	2944	1561	2634	4349	1551	-	2275	2230	6775	1673	2273
22	19	4	1338	3078	1115	1756	3792	1733	-	1873	1673	3889	1226	1472
23	23	3	892	1873	669	1505	3346	1186	-	1204	1115	3262	1115	1338
24	27	7	1226	2944	1003	1882	4015	1551	5130	1338	1338	4893	1338	1338
25	31	9	1561	3078	1784	3136	6022	1916	8365	2275	2230	6901	1784	2275
26	24	9	1449	3487	2342	3638	7695	1825	9703	2810	2675	8030	2453	2676
27	39	10	1449	6692	2119	3387	6134	1916	9480	2676	2676	7403	3122	2676
28	43	10	1449	5085	1784	2509	3346	2463	6468	2141	2119	5019	2230	2141
29	47	10	1115	4149	1115	2007	2119	2372	5242	1739	1115	4391	1784	1070
30	51	8	1115	3346	780	1380	5799	1642	3457	1338	892	1882	1338	1070
31	55	5	892	1873	557	1003	4126	1095	2230	936	892	1631	780	803
32	59	5	669	1070	446	1003	1226	730	1338	803	669	1756	669	803

VOYAGE 04 WESTBOUND
TAPE 26 RECORDER #2

TABLE IX (Concluded)

"D" MODE

MAXIMUM PEAK-TO-TROUGH SIGNAL VALUE (psi)

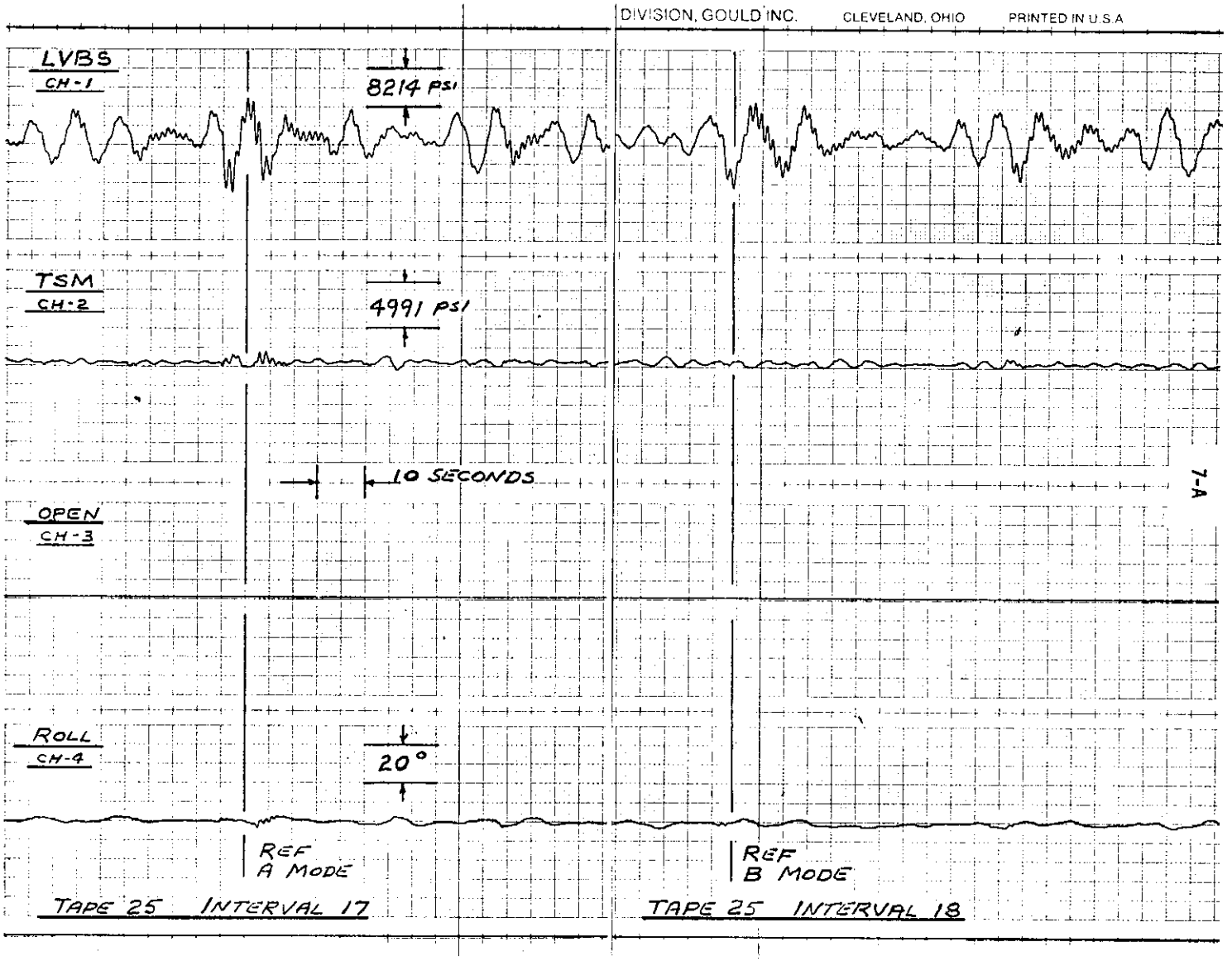
Index No.	Interval No.	Sea State	HLSS-1	HLSS-2	HLSS-3	HLSS-4	TGMS-1	TGMS-2	TGMS-3	TGMS-4	TGAS-1	TGAS-2	TGAS-3	TGAS-4
1	4	7	1882	1606	1673	1739	2230	1720	1226	2676	1896	1631	1449	2676
2	8	7	3764	3212	3122	4416	7584	6309	4572	9368	5576	4391	3909	5755
3	12	8	3764	4952	4907	4550	6692	3824	2788	5755	4572	3513	3792	4684
4	16	9	6524	6558	5911	6692	9703	6883	5242	11108	5576	5520	6022	7361
5	20	10	6524	6692	6580	6022	12157	9655	7807	16328	8365	6273	6022	7227
6	24	10	6148	7495	6803	5487	15057	8986	6468	13919	8476	6273	5911	6959
7	28	10	4140	5888	5465	4952	12491	7265	6022	13116	9591	6901	3792	6692
8	32	10	7528	10707	7249	7628	13941	9273	6915	15123	7249	6775	5576	7495
9	36	9	3889	7762	6468	6290	10372	6118	8030	10305	9480	7152	4684	7896
10	40	5	3638	5487	4349	4952	7918	5353	4126	8967	6915	5144	3457	5888
11	44	4	3387	4952	3903	4416	5576	3824	3122	6558	6022	4140	2230	4416
			TGFS-1	TGFS-2	TGFS-3	TGFS-4	TGMS-1X	TGMS-2X	TGMS-3X	TGMS-4X				
12	48	5	14555	8699	5019	11376	3011	860	780	1070	4349	3513	2453	3747
13	52	7	21958	13115	8141	15926	5242	956	1115	1204	5799	4391	2453	4282
14	56	7	16060	10439	5799	13517	4349	1147	892	1070	3457	3262	2899	3747
15	60	8	16939	10439	6580	15257	4461	1147	1115	1338	6357	4517	2788	4015
16	64	7	15057	10707	6022	14722	4126	1051	1115	1204	6692	4517	2899	4684
17	68	7	12547	8164	5019	11242	3680	956	1115	1204	5019	3513	2676	4282
			TAPE 28 RECORDER #2											
18	4	7	11599	8565	4684	11041	3569	638	1115	936	4795	3011	2342	3613
			HLSS-1	HLSS-2	HLSS-3	HLSS-4	TGSS-1X	TGSS-2X	TGSS-3X	TGSS-4X				
19	8	7	--	--	--	--	--	--	--	--	--	--	--	--
20	12	7	5019	6692	6357	6022	1722	1772	2111	3666	7026	4893	4572	6692
21	16	5	3680	5755	4572	5144	2277	2000	2333	3200	6692	4893	4795	6959
22	20	4	4126	5755	4349	4266	1888	1409	1555	3200	5353	4768	3457	5085
23	24	3	2899	4952	3680	3513	1277	1500	1222	2000	4238	3262	2788	4015
24	28	7	3234	4015	3792	3638	1333	1318	1888	2000	3903	2509	2230	3479
25	32	9	4461	7762	7695	4768	2722	1909	3000	4066	7138	5269	5019	6156
26	36	9	6803	10305	8699	7152	2500	3181	2500	5466	7249	5395	6134	8699
27	40	10	7695	11108	11153	7026	2333	2818	2611	5199	6134	6524	7472	10171
28	44	10	5576	8164	7249	6901	1500	2045	2000	4466	7026	5019	3234	7227
29	48	10	4349	6424	5911	5395	1000	1863	1888	3933	5130	3764	2565	4282
30	52	8	3122	3881	2788	3011	2722	909	1166	2600	3680	3011	1673	3346
31	56	5	2007	2275	1449	1882	2222	454	722	1333	2230	2007	1449	2676
32	60	5	1115	1472	1784	1380	388	318	777	999	1561	1380	780	1338

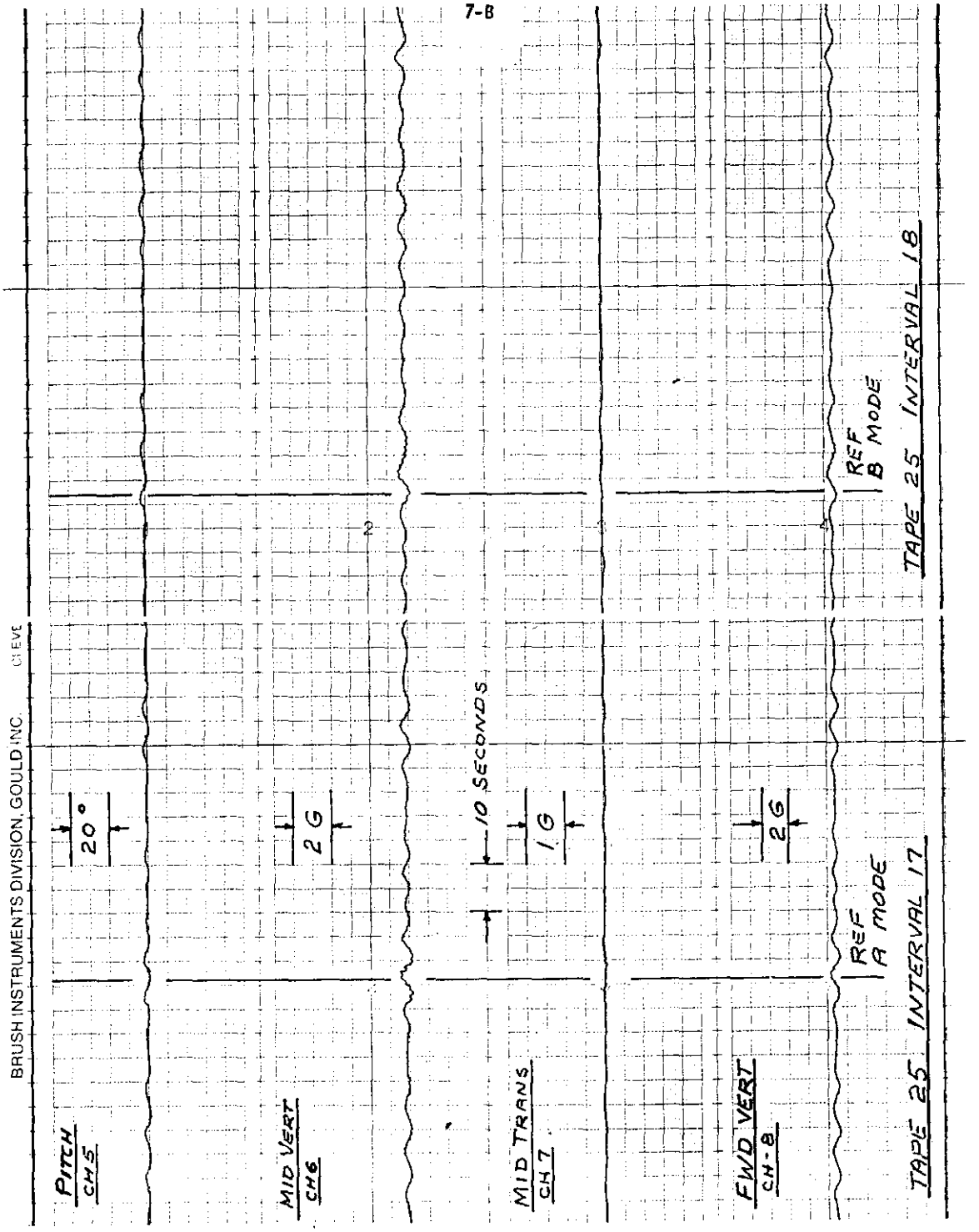
FIGURE 7

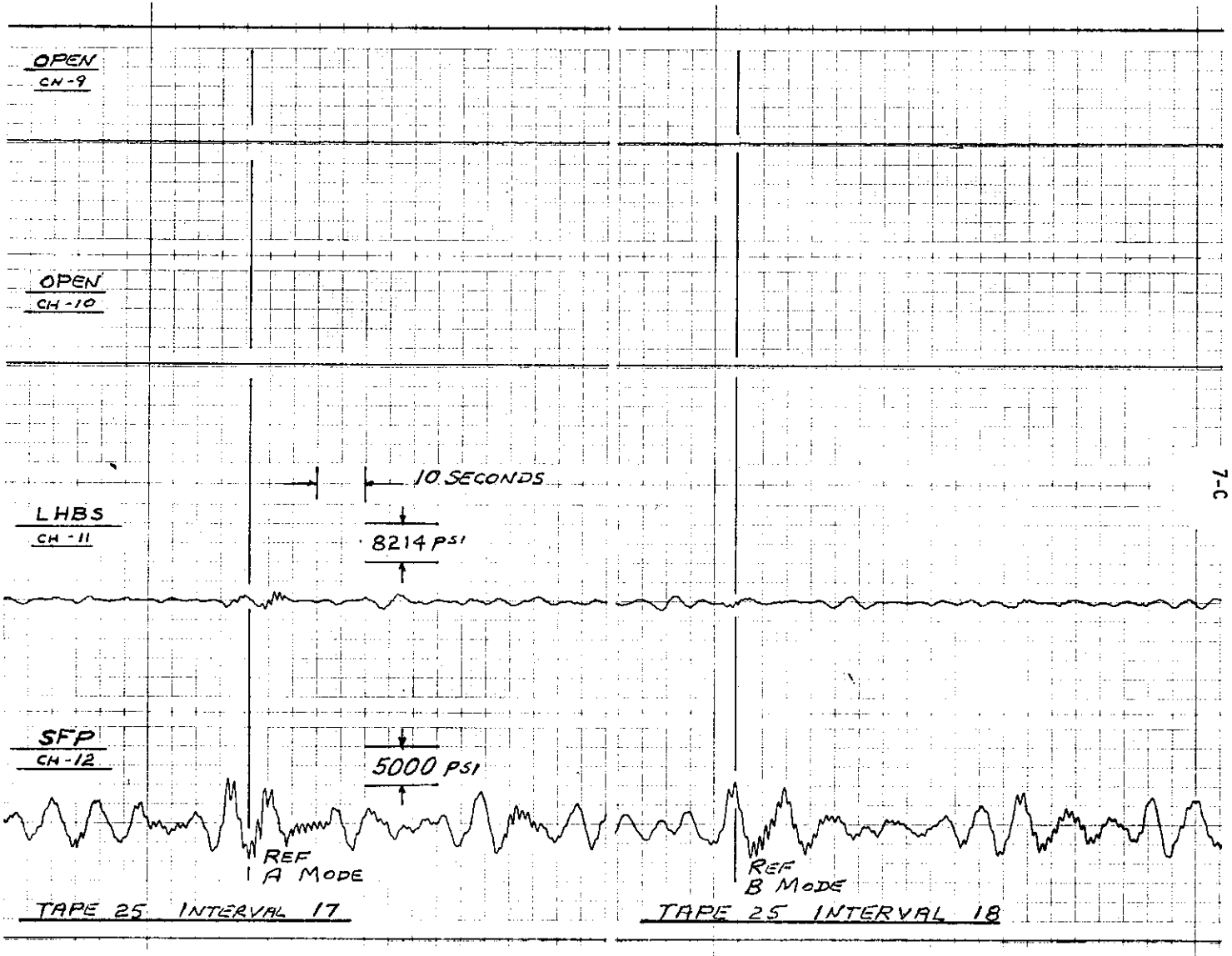
SAMPLE SIMULTANEOUS RESPONSE DATA

The following pages present representative simultaneous samples of all recorded signals on both tape recorders for:

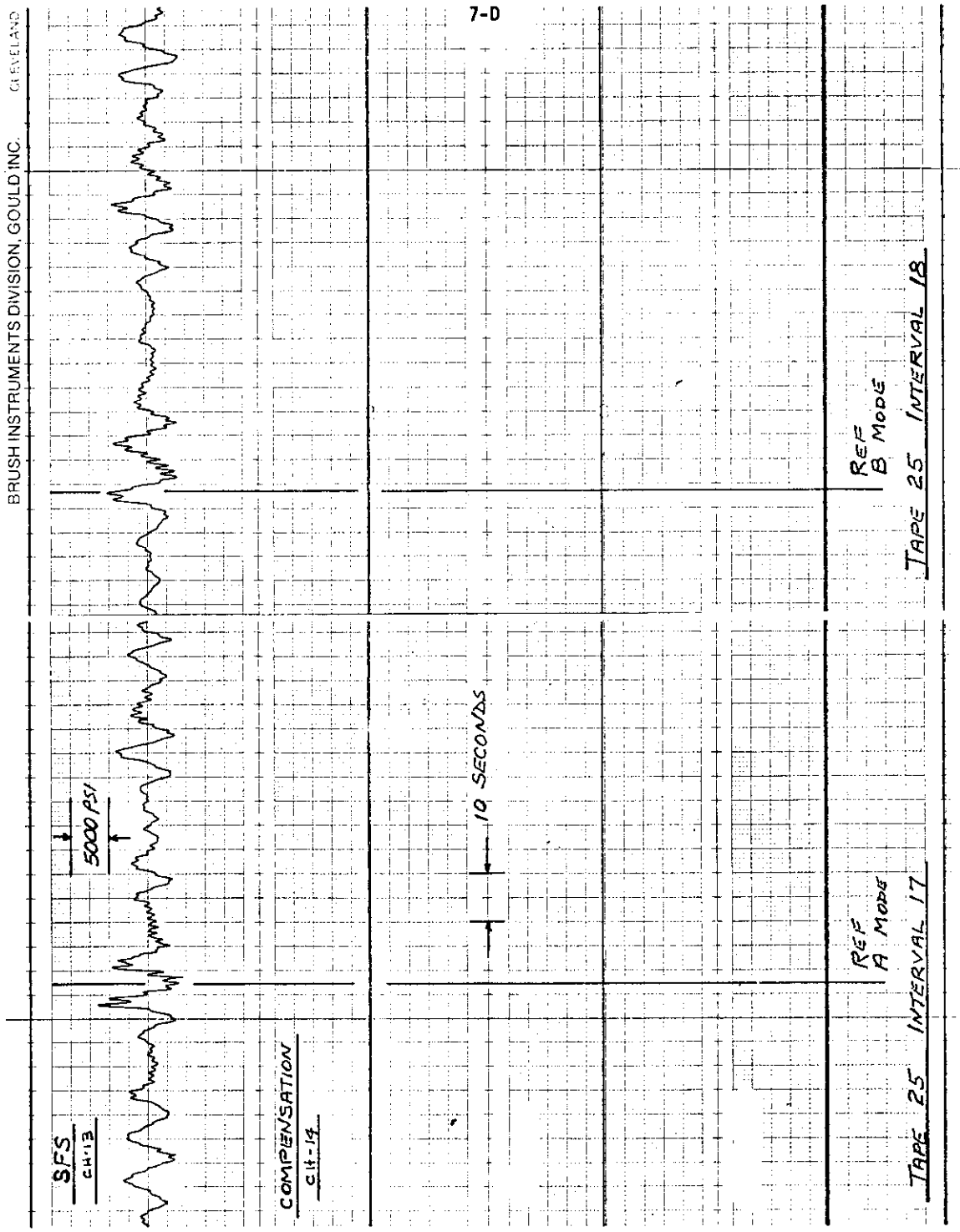
Voyage	4 Westbound
Index	5
Interval	17 ("A" Mode)
	18 ("B" Mode)
	19 ("C" Mode)
	20 ("D" Mode)
Tape	25 (Recorder No. 1)
	26 (Recorder No. 2)
Beaufort Sea State	10
Relative Sea Direction	Head
Ship Speed	22 Knots

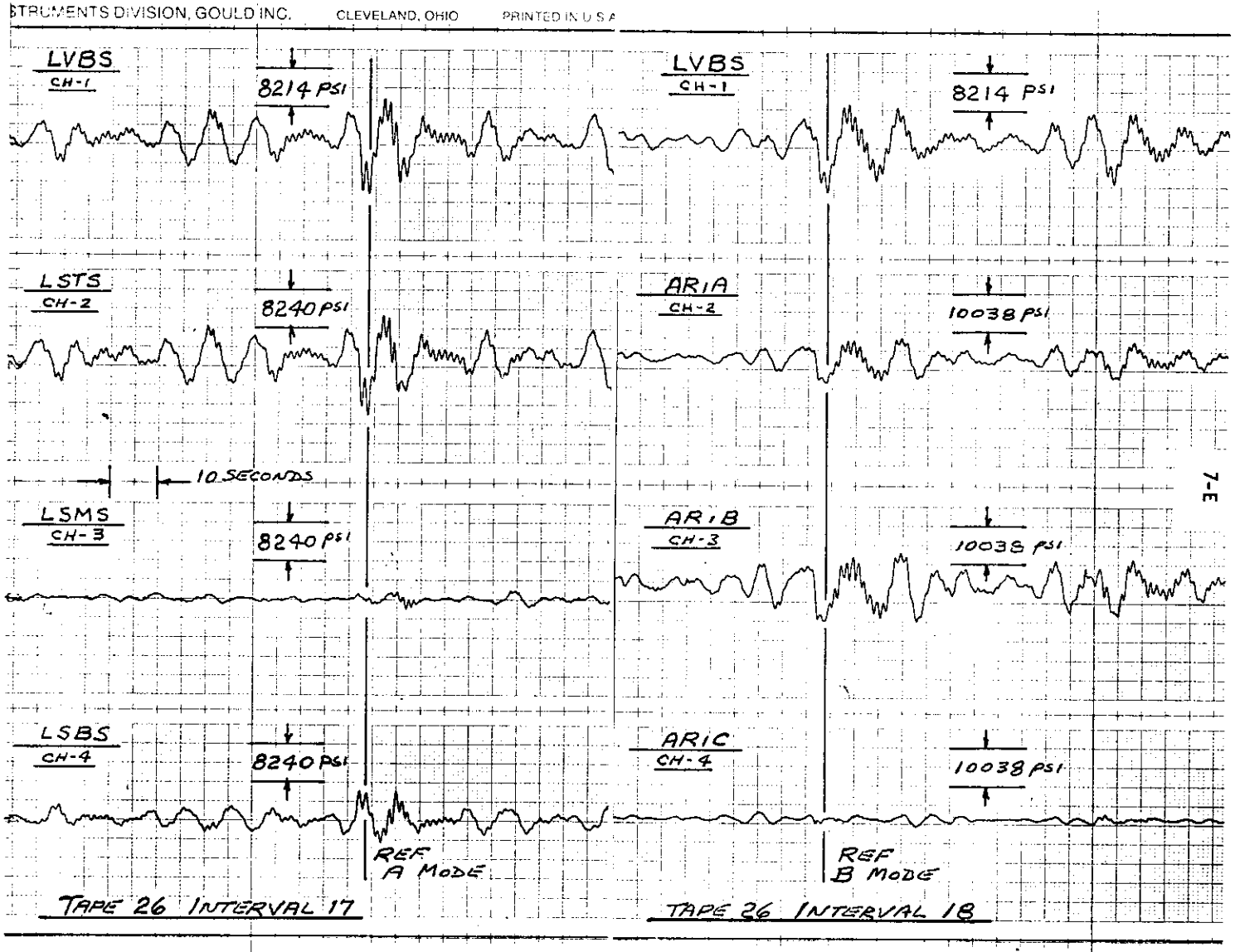

DIVISION, GOULD INC. CLEVELAND, OHIO PRINTED IN U.S.A
LVBS
CH-1
8214 PSI
TSM
CH-2
4991 PSI
10 SECONDS
OPEN
CH-3
ROLL
CH-4
20°
REF
A MODE
REF
B MODE
TAPE 25 INTERVAL 17
TAPE 25 INTERVAL 18
7-A

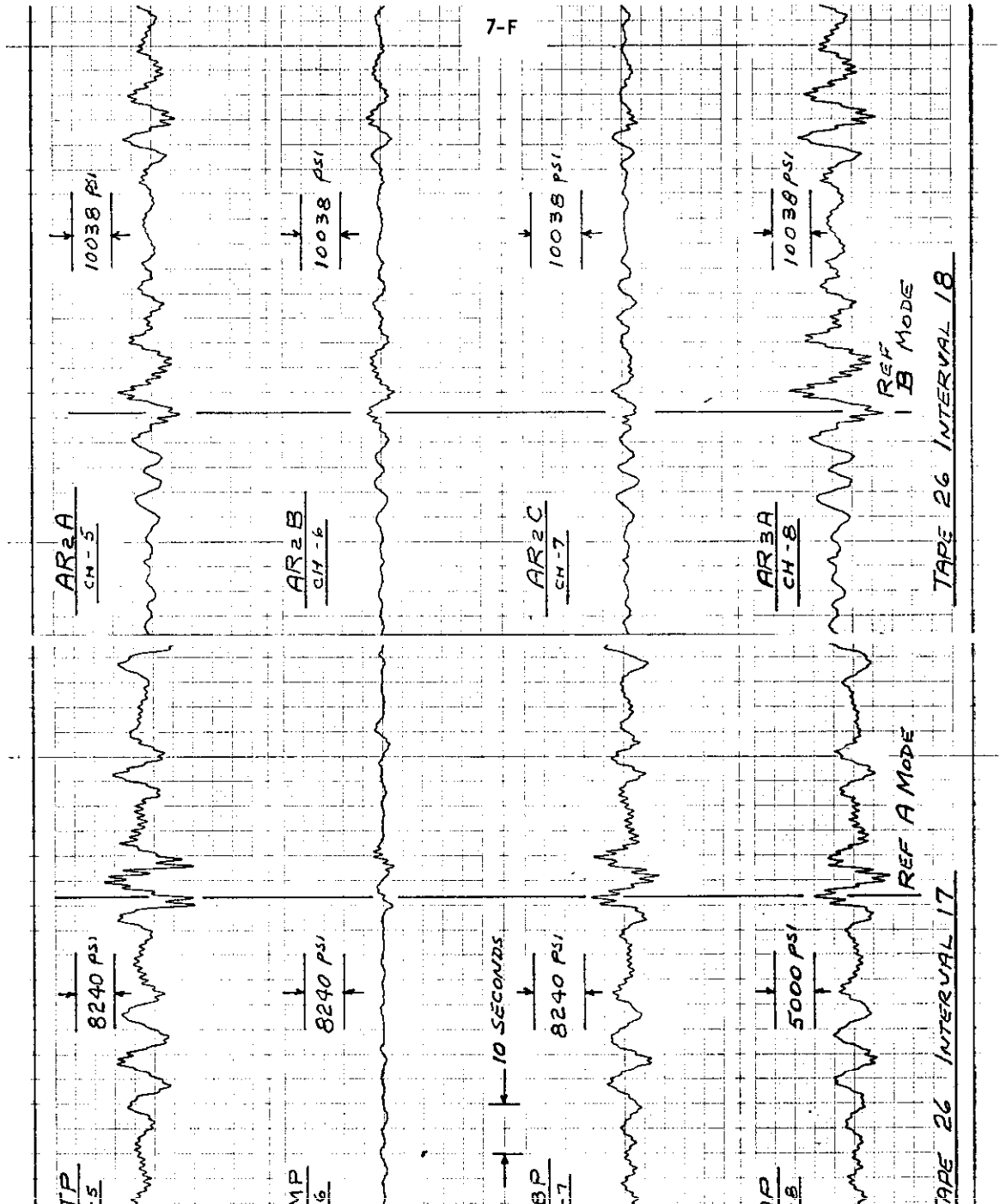

7-B
BRUSH INSTRUMENTS DIVISION, GOULD INC. CLEVE
PITCH
CH5
20°
MID VERT
CH6
2G
10 SECONDS
MID TRANS
CH7
1G
FWD VERT
CH-8
2G
REF
A MODE
TAPE 25 INTERVAL 17
REF
B MODE
TAPE 25 INTERVAL 18

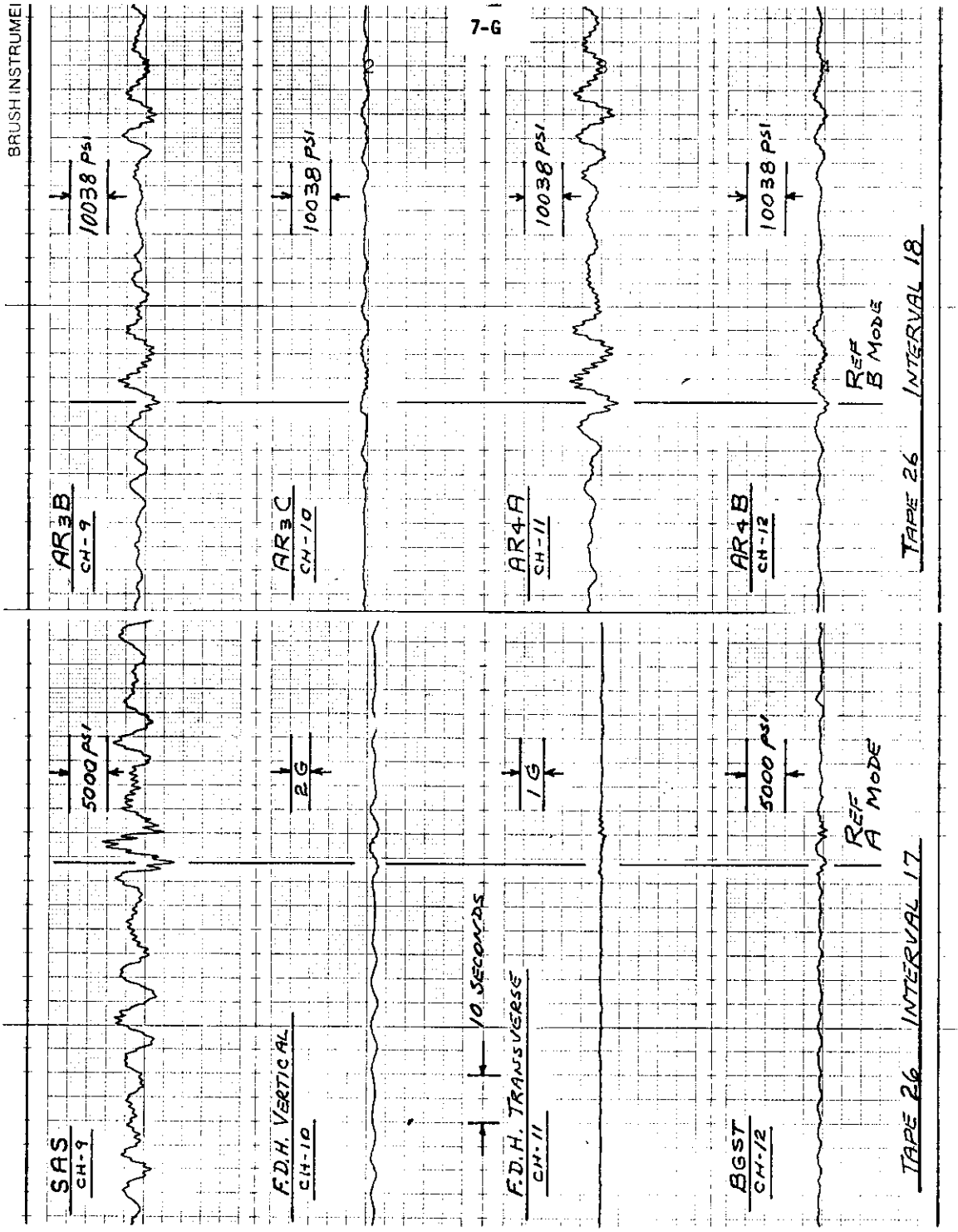

OPEN
CH-9
OPEN
CH-10
10 SECONDS
LHBS
CH-11
8214 PSI
SFP
CH-12
5000 PSI
REF
A MODE
REF
B MODE
TAPE 25 INTERVAL 17
TAPE 25 INTERVAL 18

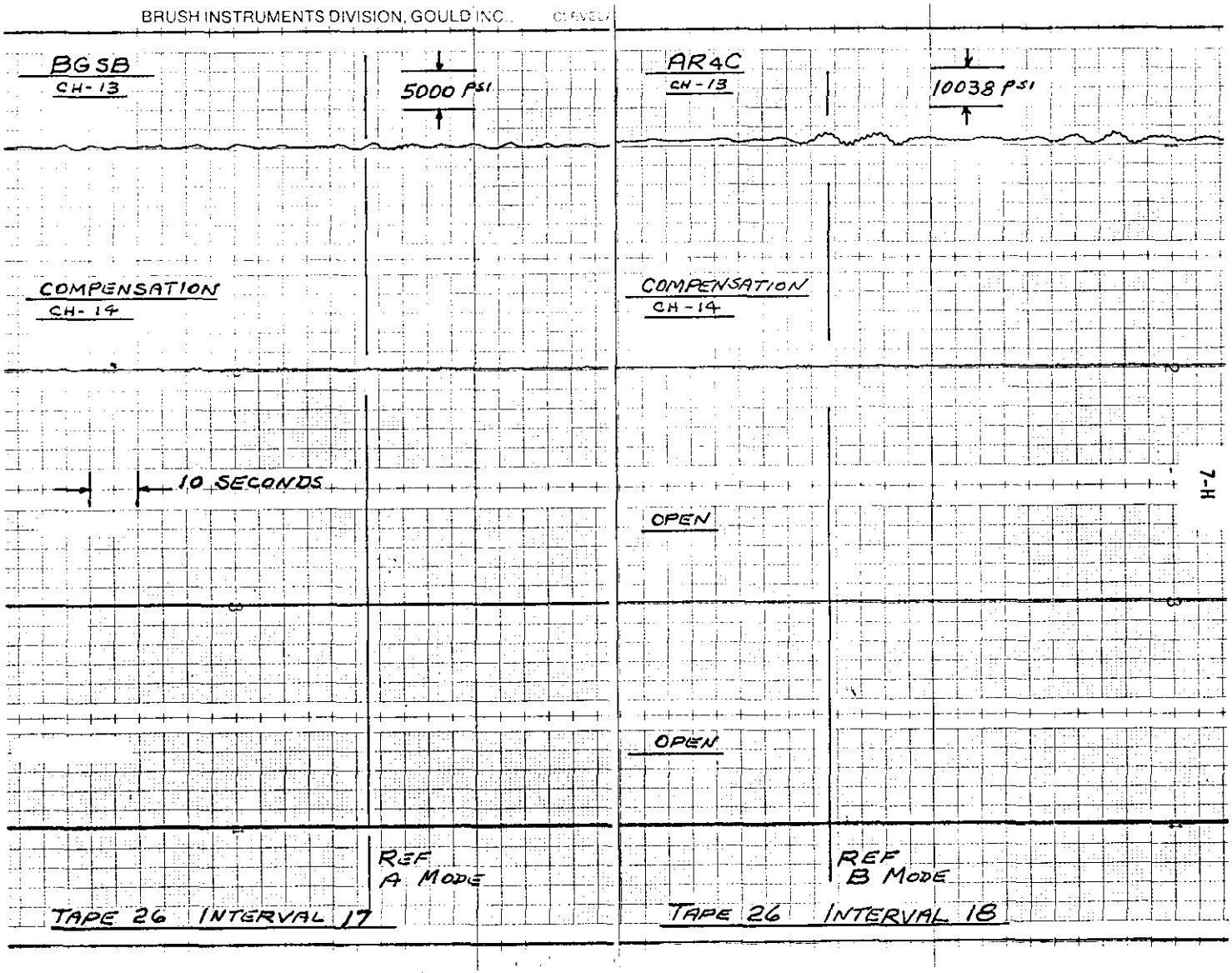
7-C

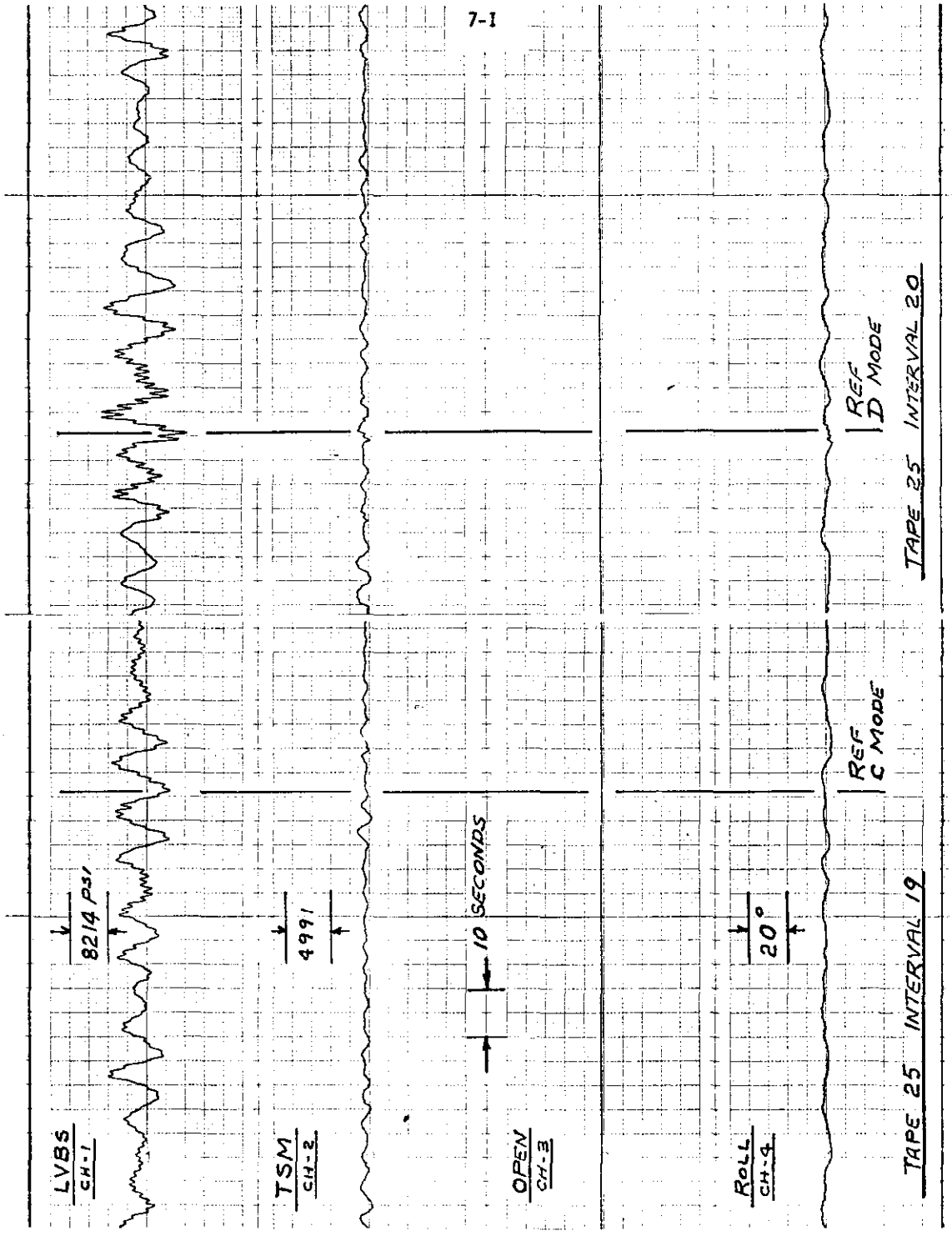

BRUSH INSTRUMENTS DIVISION, GOULD INC. CLEVELAND
7-D
SFS
CH-13
5000 PSI
COMPENSATION
CH-14
10 SECONDS
REF
A MODE
TAPE 25 INTERVAL 17
REF
B MODE
TAPE 25 INTERVAL 18

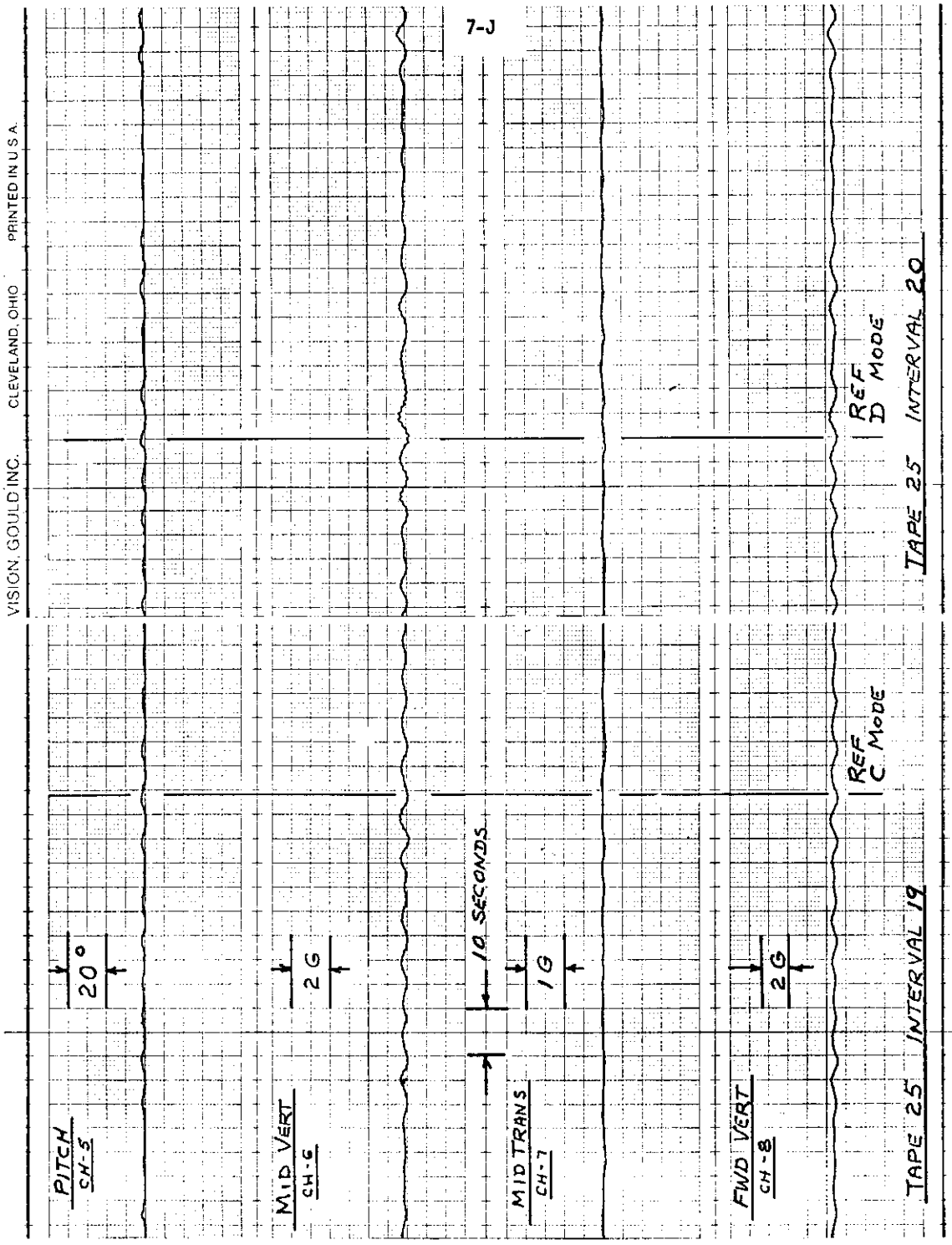

STRUMENTS DIVISION, GOULD INC. CLEVELAND, OHIO PRINTED IN U.S.A.
LVBS
CH-1
8214 PSI
LSTS
CH-2
8240 PSI
10 SECONDS
LSMS
CH-3
8240 PSI
LSBS
CH-4
8240 PSI
REF
A MODE
TAPE 26 INTERVAL 17
LVBS
CH-1
8214 PSI
ARIA
CH-2
10038 PSI
ARIB
CH-3
10038 PSI
ARIC
CH-4
10038 PSI
REF
B MODE
TAPE 26 INTERVAL 18
7-E

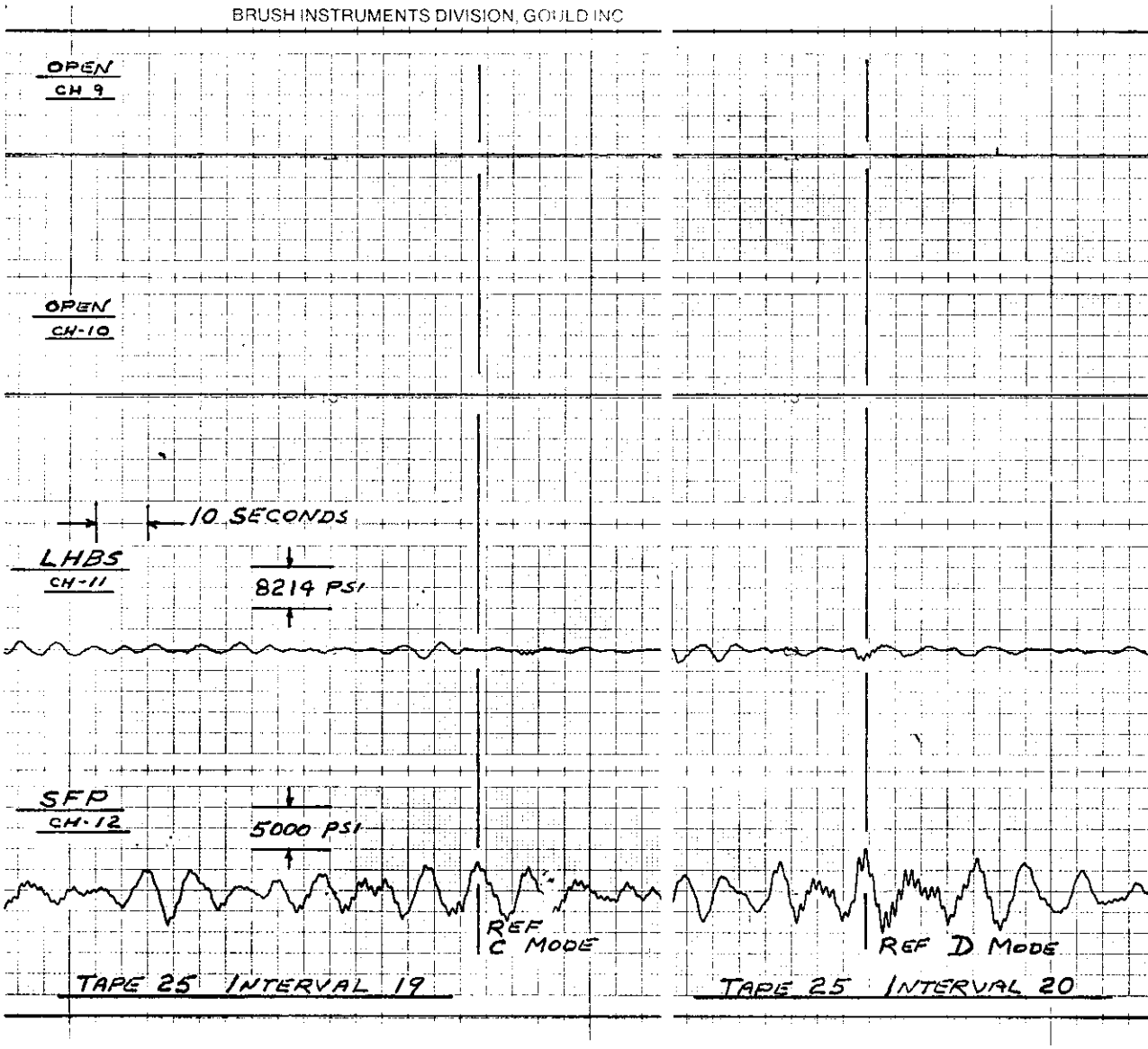

7-F
AR2A
CH-5
10038 PSI
AR2B
CH-6
10038 PSI
AR2C
CH-7
10038 PSI
AR3A
CH-8
10038 PSI
REF
B MODE
TAPE 26 INTERVAL 18
8240 PSI
8240 PSI
10 SECONDS
8240 PSI
5000 PSI
REF A MODE
TAPE 26 INTERVAL 17

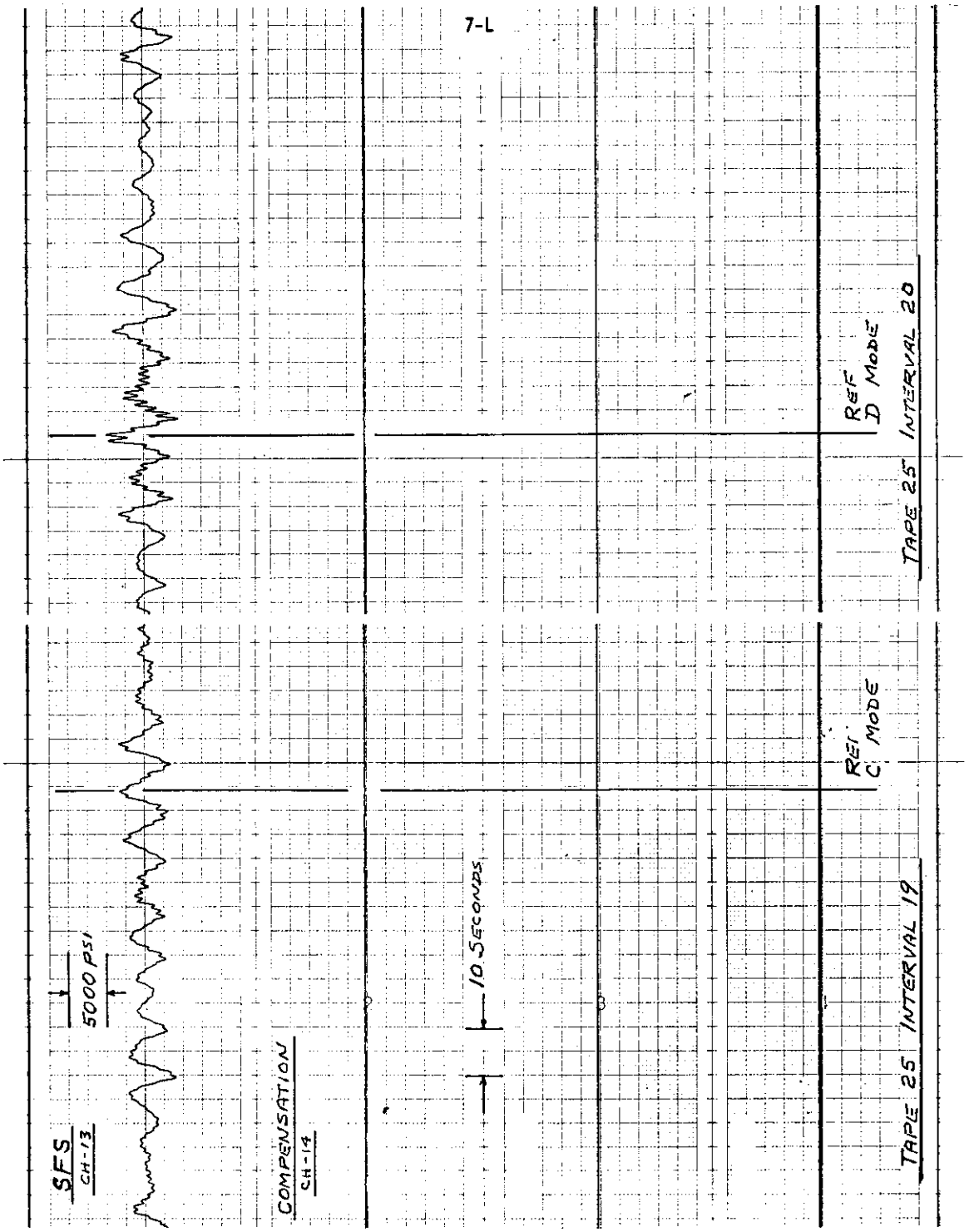

BRUSH INSTRUMEI
7-G
SAS
CH-9
5000 PSI
AR3B
CH-9
10038 PSI
AR3C
CH-10
10038 PSI
F.D.H. VERTICAL
CH-10
2G
10 SECONDS
F.D.H. TRANSVERSE
CH-11
1G
AR4A
CH-11
10038 PSI
BGST
CH-12
5000 PSI
AR4B
CH-12
10038 PSI
REF
A MODE
REF
B MODE
TAPE 26 INTERVAL 17
TAPE 26 INTERVAL 18


BRUSH INSTRUMENTS DIVISION, GOULD INC.
BG SB
CH-13
5000 PSI
AR4C
CH-13
10038 PSI
COMPENSATION
CH-14
COMPENSATION
CH-14
10 SECONDS
OPEN
OPEN
REF
A MODE
REF
B MODE
TAPE 26 INTERVAL 17
TAPE 26 INTERVAL 18
7-H

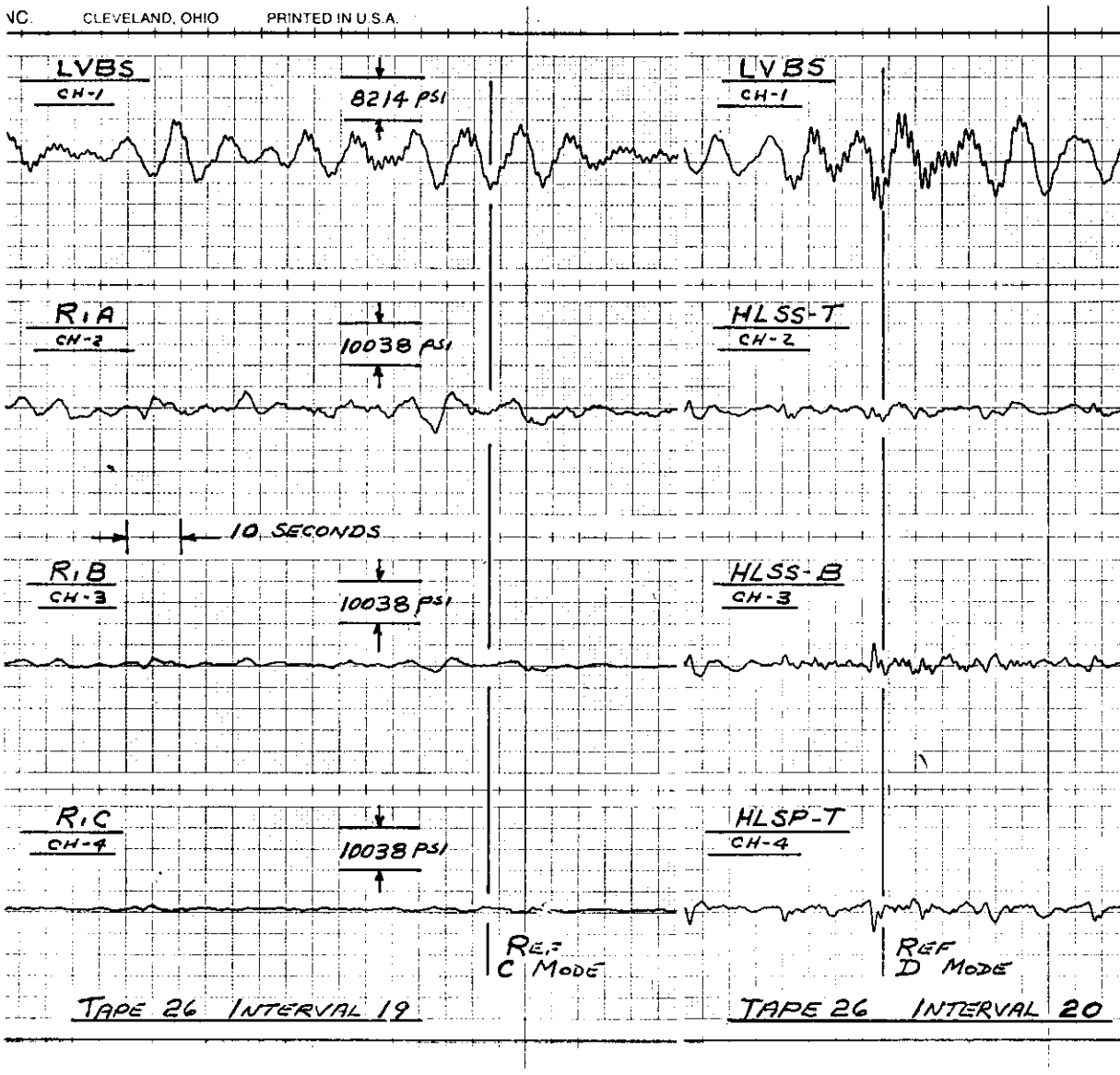

7-1
LVBS
CH-1
8214 PSI
TSM
CH-2
4991
10 SECONDS
OPEN
CH-3
ROLL
CH-4
20°
REF
C MODE
REF
D MODE
TAPE 25 INTERVAL 19
TAPE 25 INTERVAL 20


VISION GOULD INC. CLEVELAND, OHIO PRINTED IN U.S.A.
7-J
PITCH
CH-5
20°
MID VERT
CH-6
2G
10 SECONDS
MID TRANS
CH-7
1G
FWD VERT
CH-8
2G
REF
C MODE
REF
D MODE
TAPE 25 INTERVAL 19
TAPE 25 INTERVAL 20


OPEN
CH 9
OPEN
CH-10
10 SECONDS
LHBS
CH-11
8214 PSI
SFP
CH-12
5000 PSI
REF
C MODE
REF D MODE
TAPE 25 INTERVAL 19
TAPE 25 INTERVAL 20

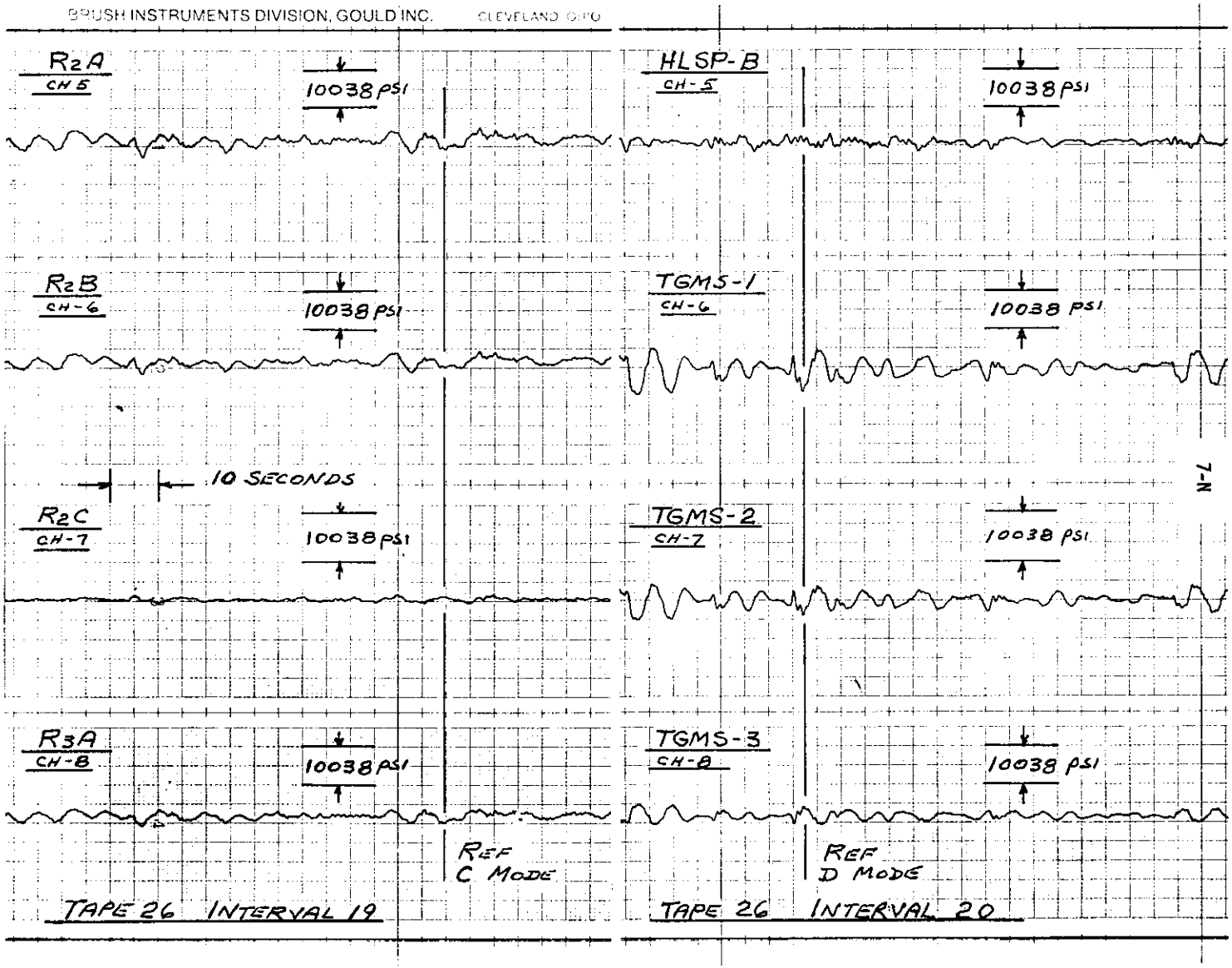

7-L
SFS
CH-13
5000 PSI
COMPENSATION
CH-14
10 SECONDS
REF
C MODE
TAPE 25 INTERVAL 19
REF
D MODE
TAPE 25 INTERVAL 20

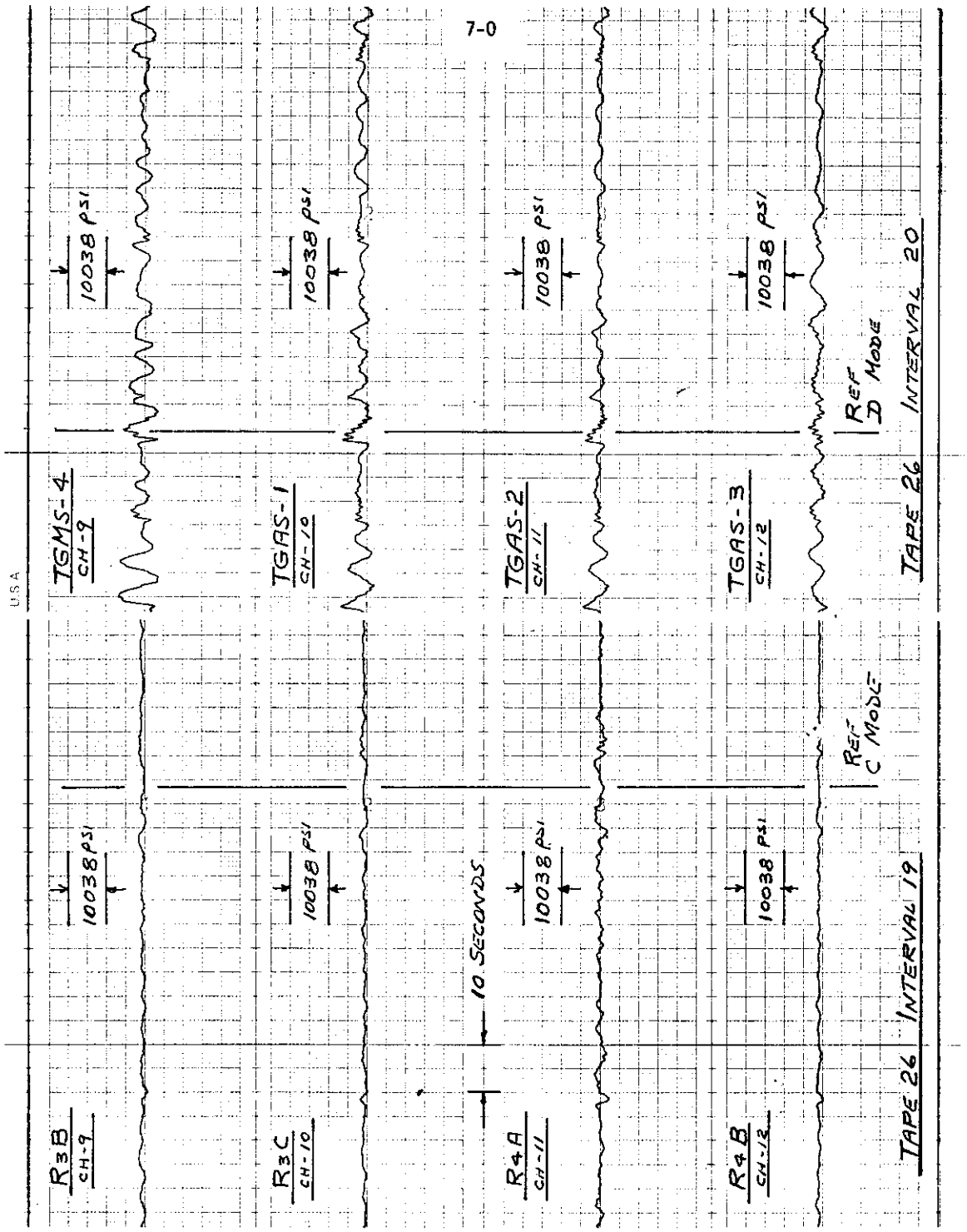
NC. CLEVELAND, OHIO PRINTED IN U.S.A.



TAPE 26 INTERVAL 19

TAPE 26 INTERVAL 20


BRUSH INSTRUMENTS DIVISION, GOULD INC. CLEVELAND OHIO
R2A
CH 5
10038 PSI
HLSP-B
CH-5
10038 PSI
R2B
CH-6
10038 PSI
TGMS-1
CH-6
10038 PSI
10 SECONDS
R2C
CH-7
10038 PSI
TGMS-2
CH-7
10038 PSI
R3A
CH-8
10038 PSI
TGMS-3
CH-8
10038 PSI
REF
C MODE
REF
D MODE
TAPE 26 INTERVAL 19
TAPE 26 INTERVAL 20
7-N


7-0
U.S.A
R3B CH-9
1003B PSI
TGMS-4 CH-9
1003B PSI
R3C CH-10
1003B PSI
TGAS-1 CH-10
1003B PSI
R4A CH-11
1003B PSI
TGAS-2 CH-11
1003B PSI
R4B CH-12
1003B PSI
TGAS-3 CH-12
1003B PSI
10 SECONDS
REF C MODE
REF D MODE
TAPE 26 INTERVAL 19
TAPE 26 INTERVAL 20

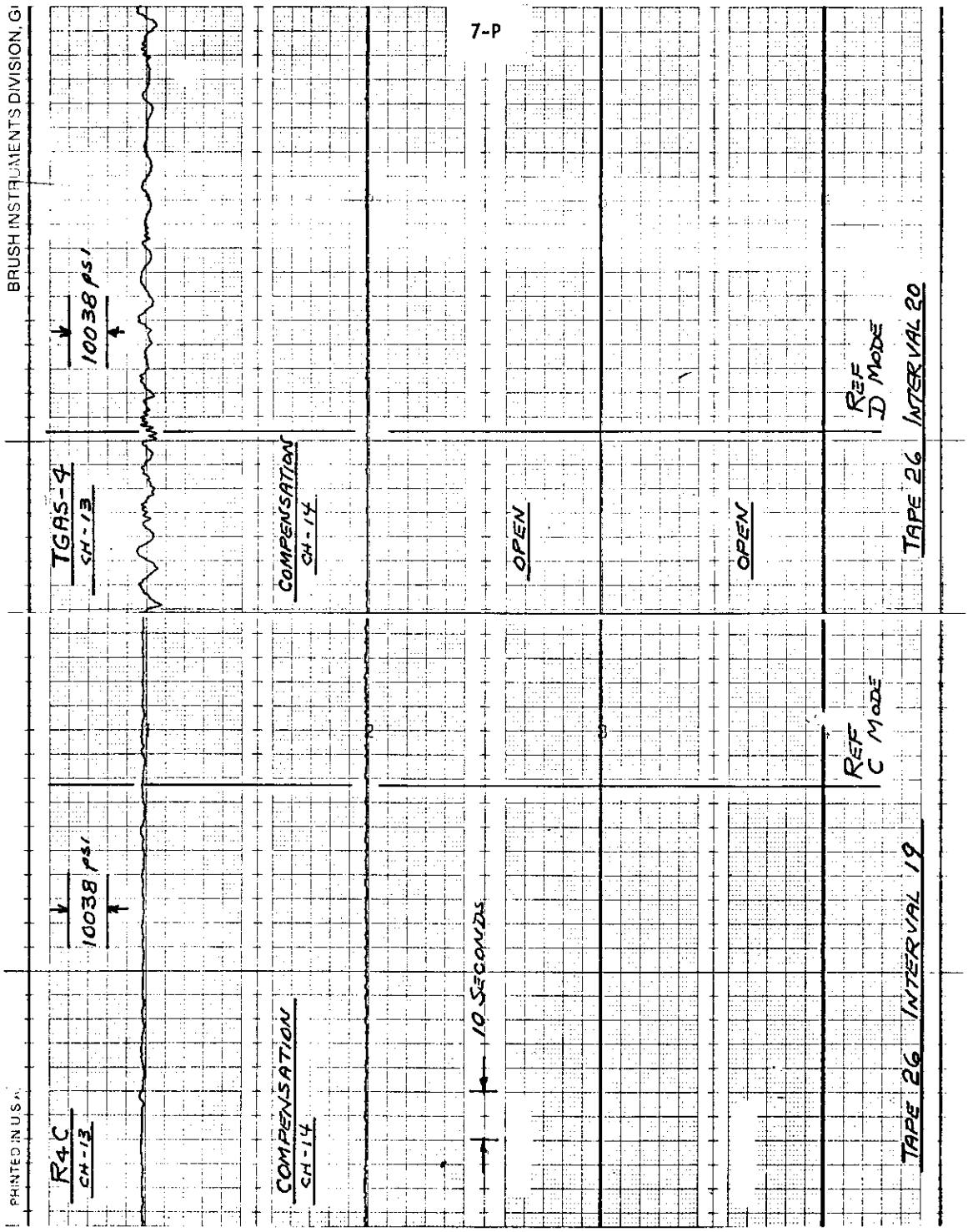
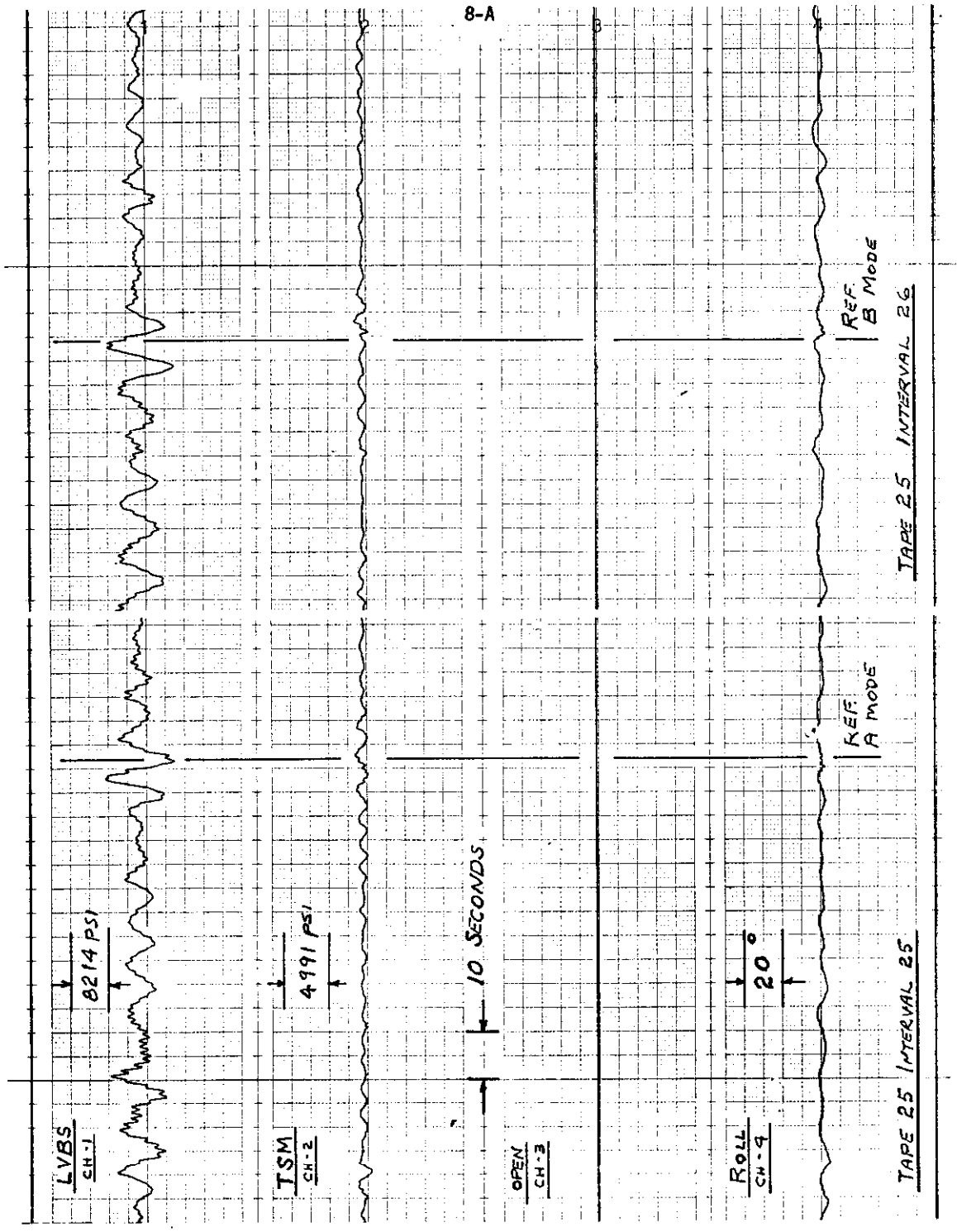

BRUSH INSTRUMENTS DIVISION, G
PRINTED IN U.S.A.
7-P
R4C
CH-13
10038 psi
TGAS-4
CH-13
10038 psi
COMPENSATION
CH-14
COMPENSATION
CH-14
10 SECONDS
OPEN
OPEN
REF
C Mode
REF
D Mode
TAPE 26 INTERVAL 19
TAPE 26 INTERVAL 20

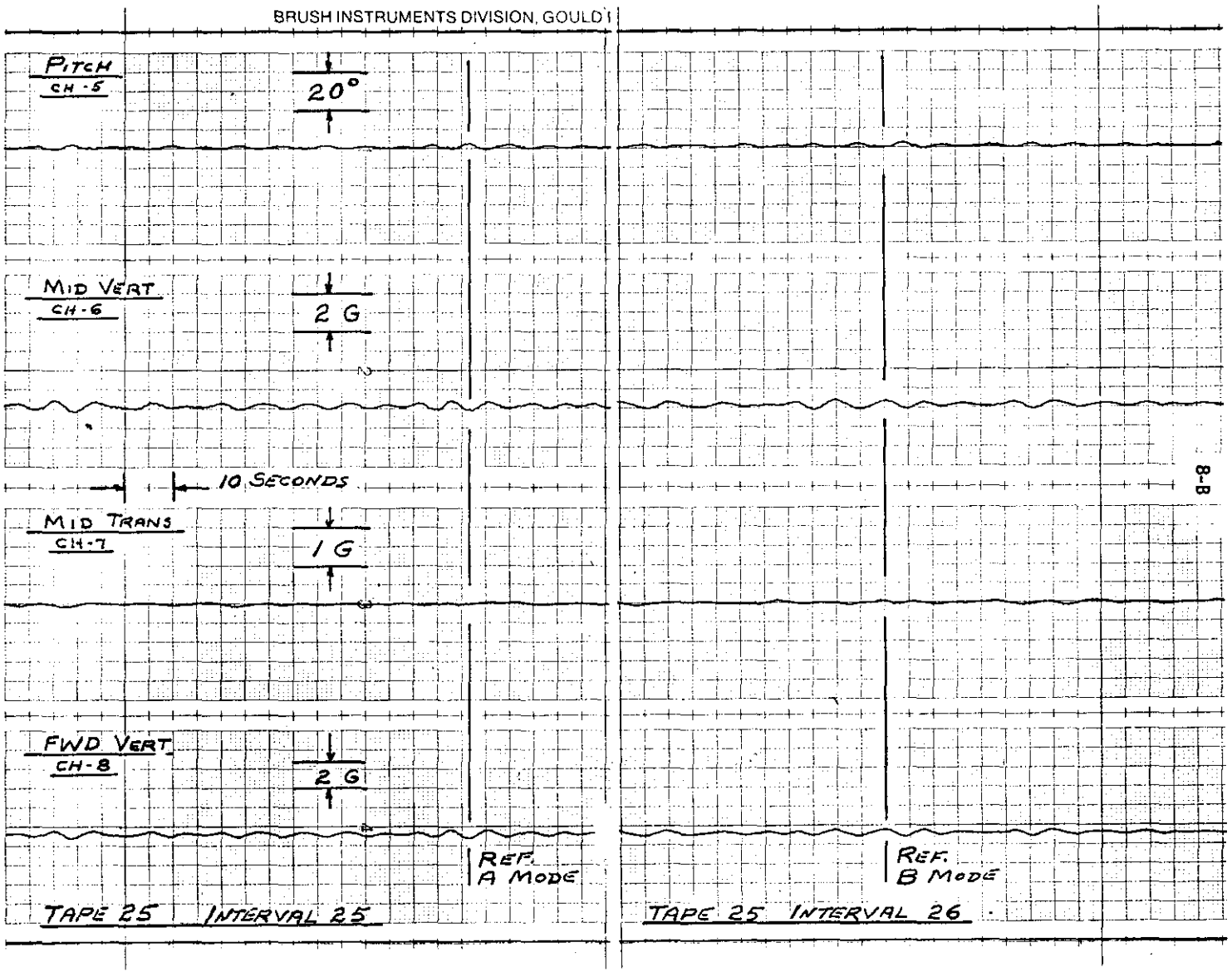
FIGURE 8

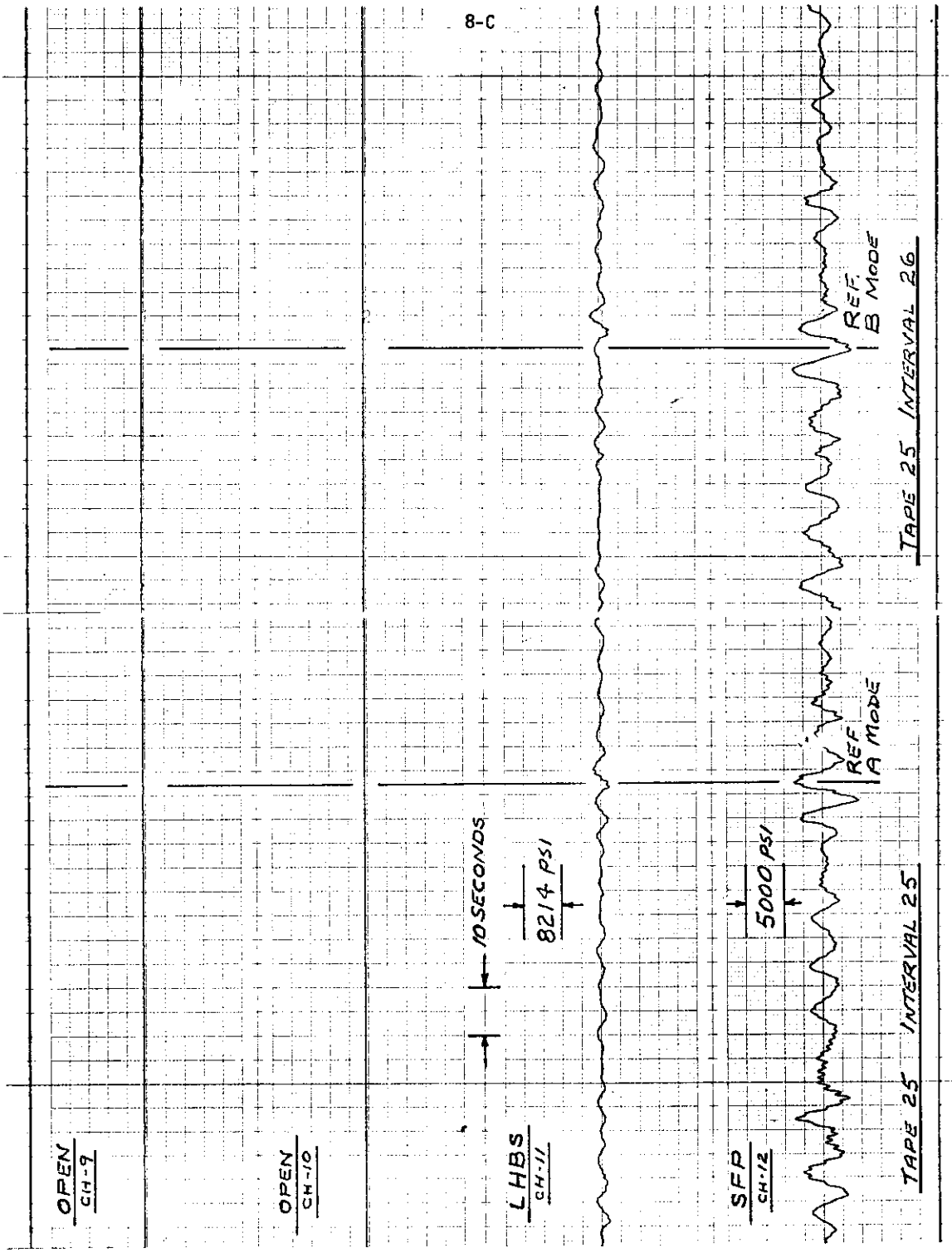
SAMPLE SIMULTANEOUS RESPONSE DATA

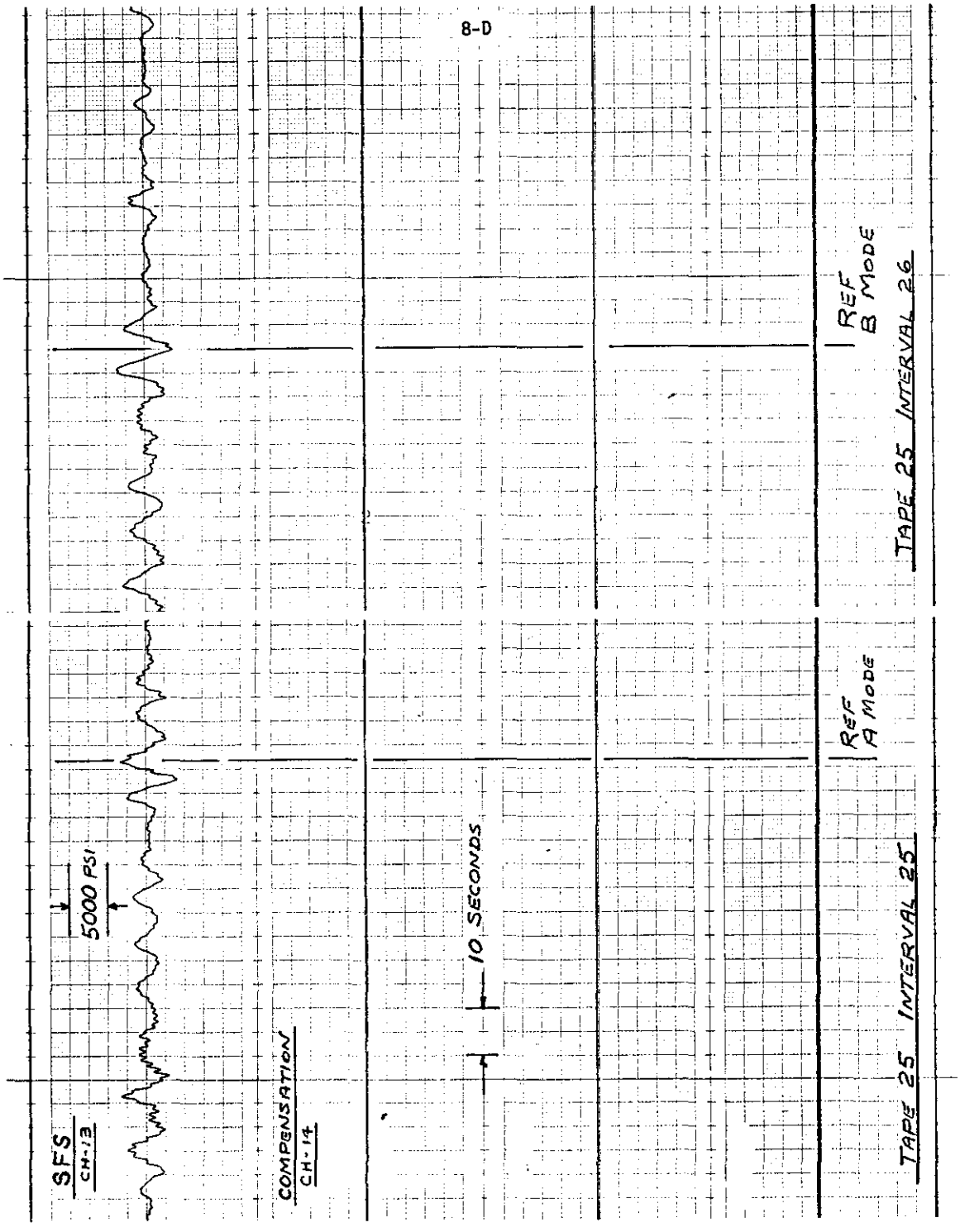
The following pages present representative simultaneous samples of all recorded signals on both tape recorders for:

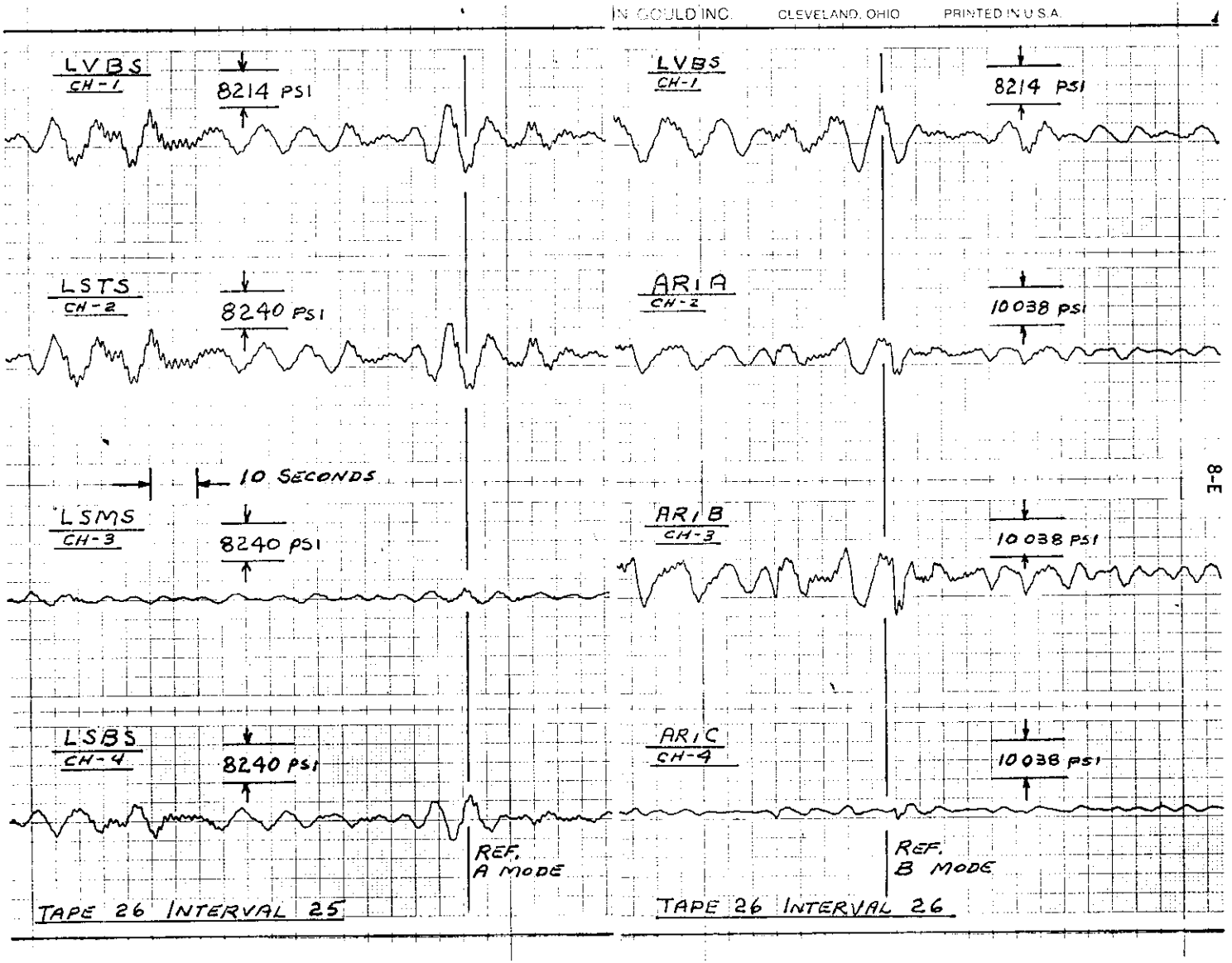
Voyage	4 Westbound
Index	7
Interval	25 ("A" Mode)
	26 ("B" Mode)
	27 ("C" Mode)
	28 ("D" Mode)
Tape	25 (Recorder No. 1)
	26 (Recorder No. 2)
Beaufort Sea State	10
Relative Sea Direction	Broad on Stbd Bow
Ship Speed	20 Knots

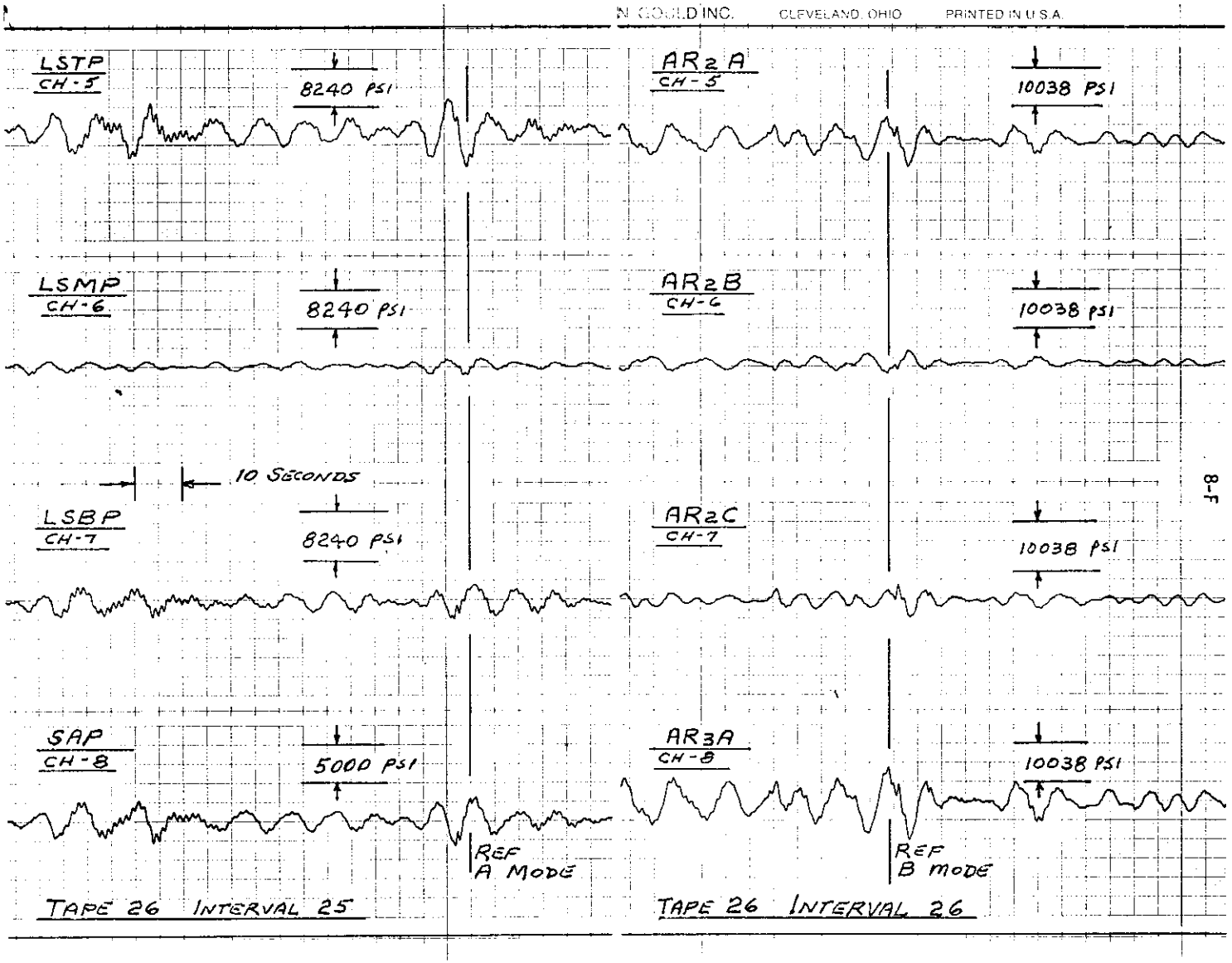

8-A
LVBS
CH-1
8214 PSI
TSM
CH-2
4991 PSI
10 SECONDS
OPEN
CH-3
ROLL
CH-4
20°
REF.
A MODE
REF.
B MODE
TAPE 25 INTERVAL 25
TAPE 25 INTERVAL 26

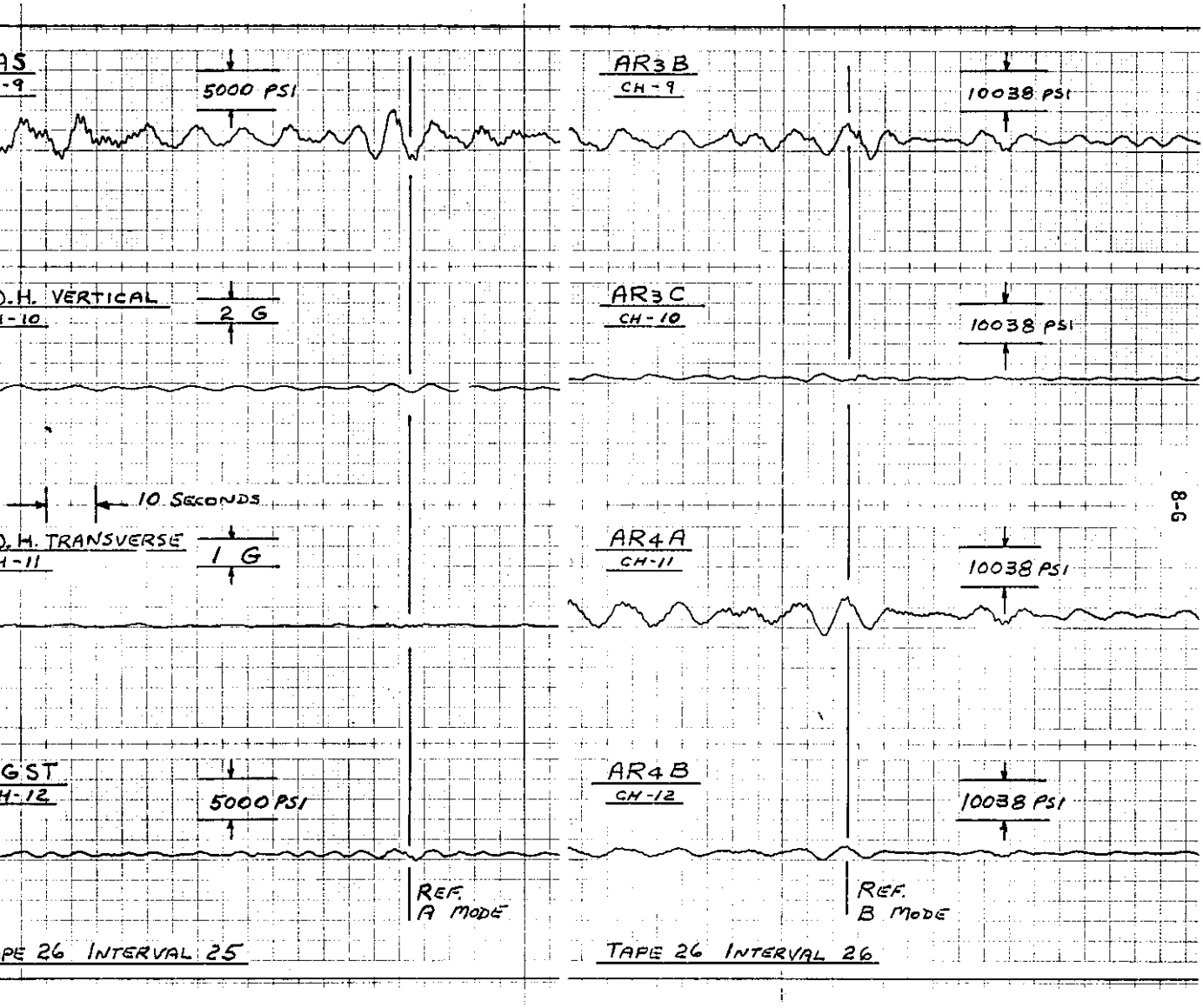

BRUSH INSTRUMENTS DIVISION, GOULD
PITCH
CH-5
20°
MID VERT
CH-6
2 G
10 SECONDS
MID TRANS
CH-7
1 G
FWD VERT
CH-8
2 G
REF.
A MODE
TAPE 25 INTERVAL 25
REF.
B MODE
TAPE 25 INTERVAL 26
8-8


8-C
OPEN
CH-9
OPEN
CH-10
LHBS
CH-11
SFP
CH-12
10 SECONDS
8214 PSI
5000 PSI
REF.
A MODE
REF.
B MODE
TAPE 25 INTERVAL 25
TAPE 25 INTERVAL 26

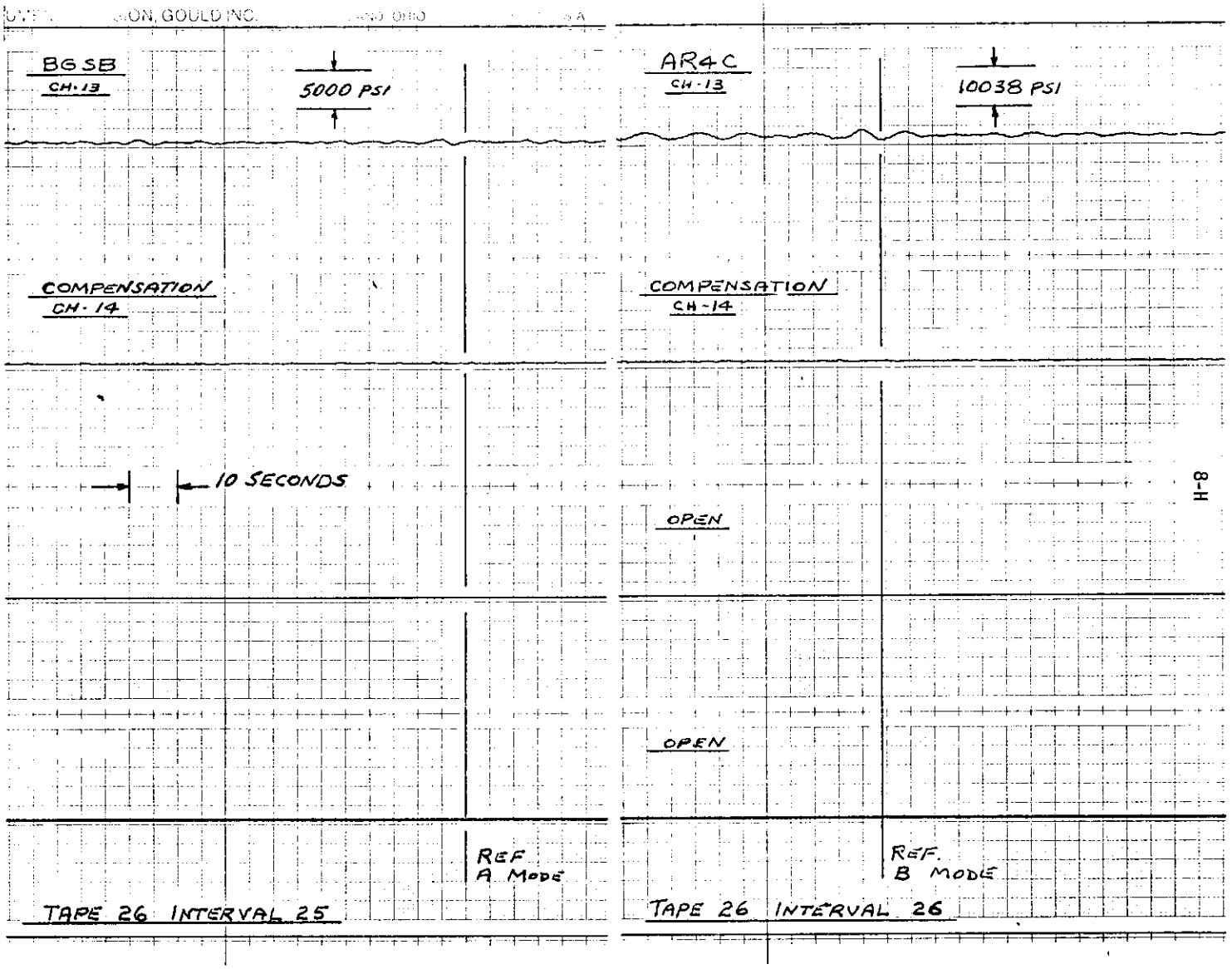

8-D
SFS
CH-13
5000 PSI
COMPENSATION
CH-14
10 SECONDS
REF
A MODE
REF
B MODE
TAPE 25 INTERVAL 25
TAPE 25 INTERVAL 26


N. GOULD INC. CLEVELAND, OHIO PRINTED IN U.S.A.
LVBS CH-1
8214 PSI
LSTS CH-2
8240 PSI
10 SECONDS
LSMS CH-3
8240 PSI
LSBS CH-4
8240 PSI
REF. A MODE
TAPE 26 INTERVAL 25
LVBS CH-1
8214 PSI
ARIA CH-2
10038 PSI
ARIB CH-3
10038 PSI
ARIC CH-4
10038 PSI
REF. B MODE
TAPE 26 INTERVAL 26
8-E

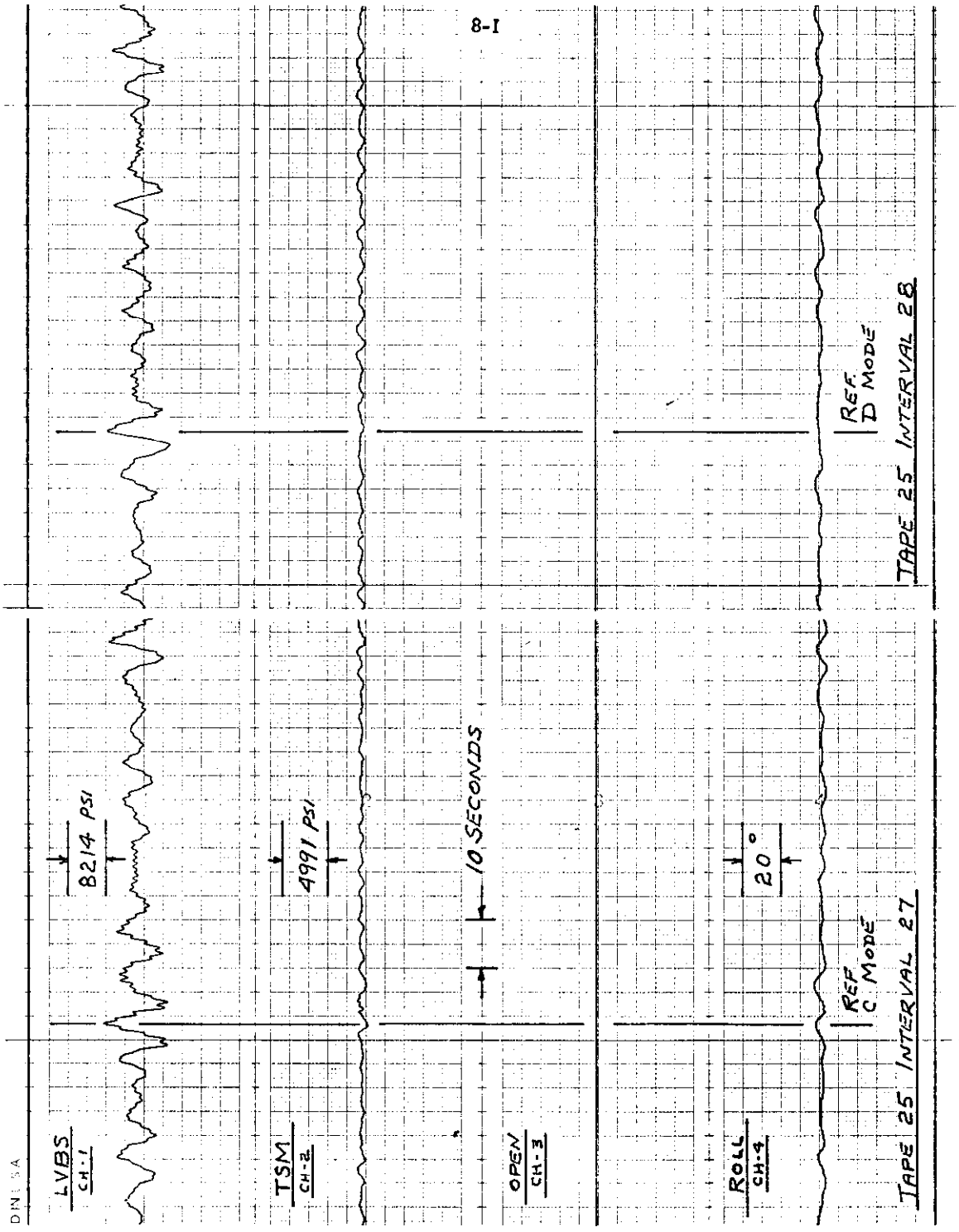

N. GOULD INC. CLEVELAND, OHIO PRINTED IN U.S.A.
LSTP
CH-5
8240 PSI
LSMP
CH-6
8240 PSI
10 SECONDS
LSBP
CH-7
8240 PSI
SAP
CH-8
5000 PSI
REF
A MODE
TAPE 26 INTERVAL 25
AR2A
CH-5
10038 PSI
AR2B
CH-6
10038 PSI
AR2C
CH-7
10038 PSI
AR3A
CH-8
10038 PSI
REF
B MODE
TAPE 26 INTERVAL 26
8-F

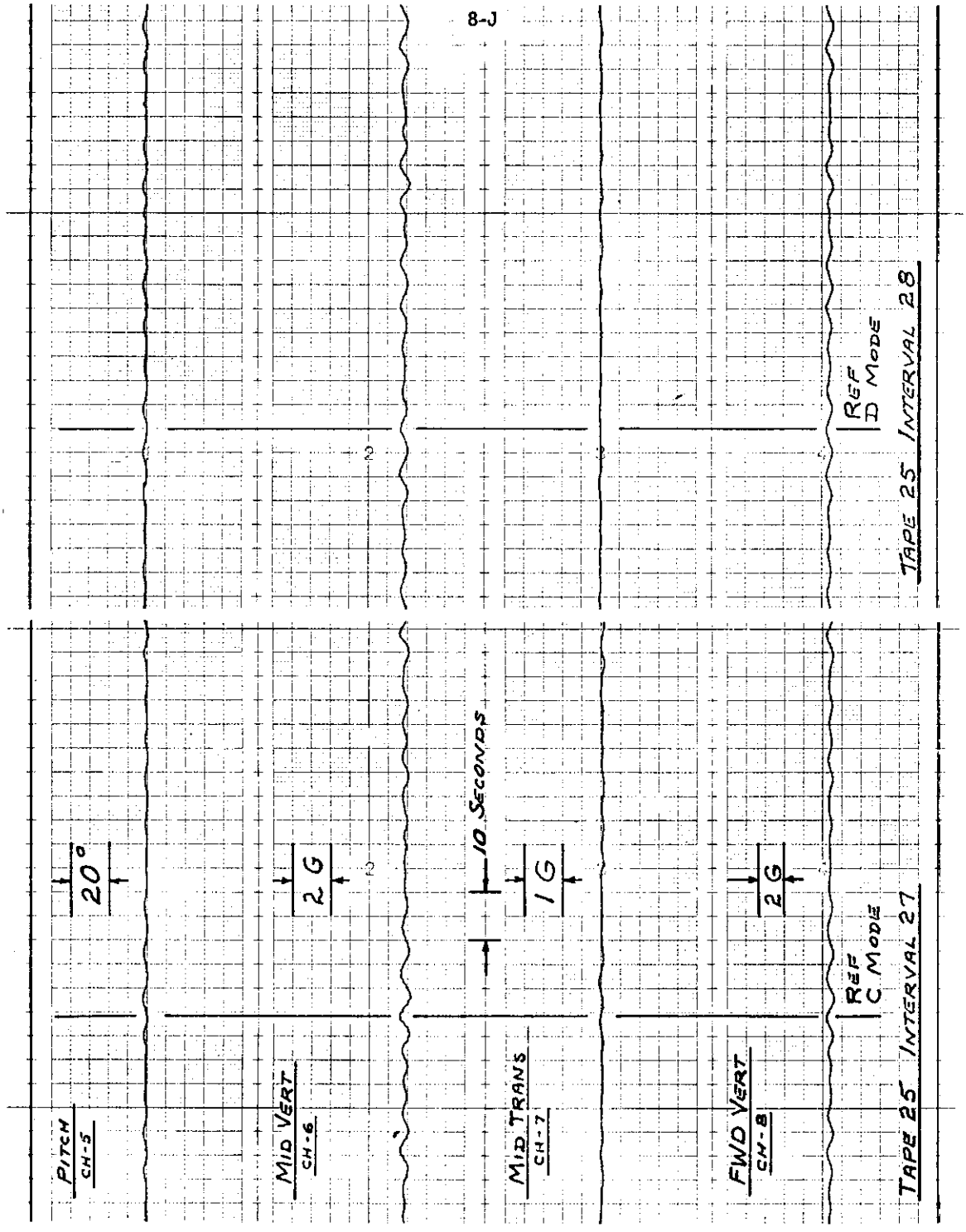

AS
-9
5000 PSI
AR3B
CH-9
10038 PSI
O.H. VERTICAL
-10
2 G
AR3C
CH-10
10038 PSI
10 SECONDS
O.H. TRANSVERSE
H-11
1 G
AR4A
CH-11
10038 PSI
GST
H-12
5000 PSI
AR4B
CH-12
10038 PSI
REF.
A MODE
REF.
B MODE
PE 26 INTERVAL 25
TAPE 26 INTERVAL 26

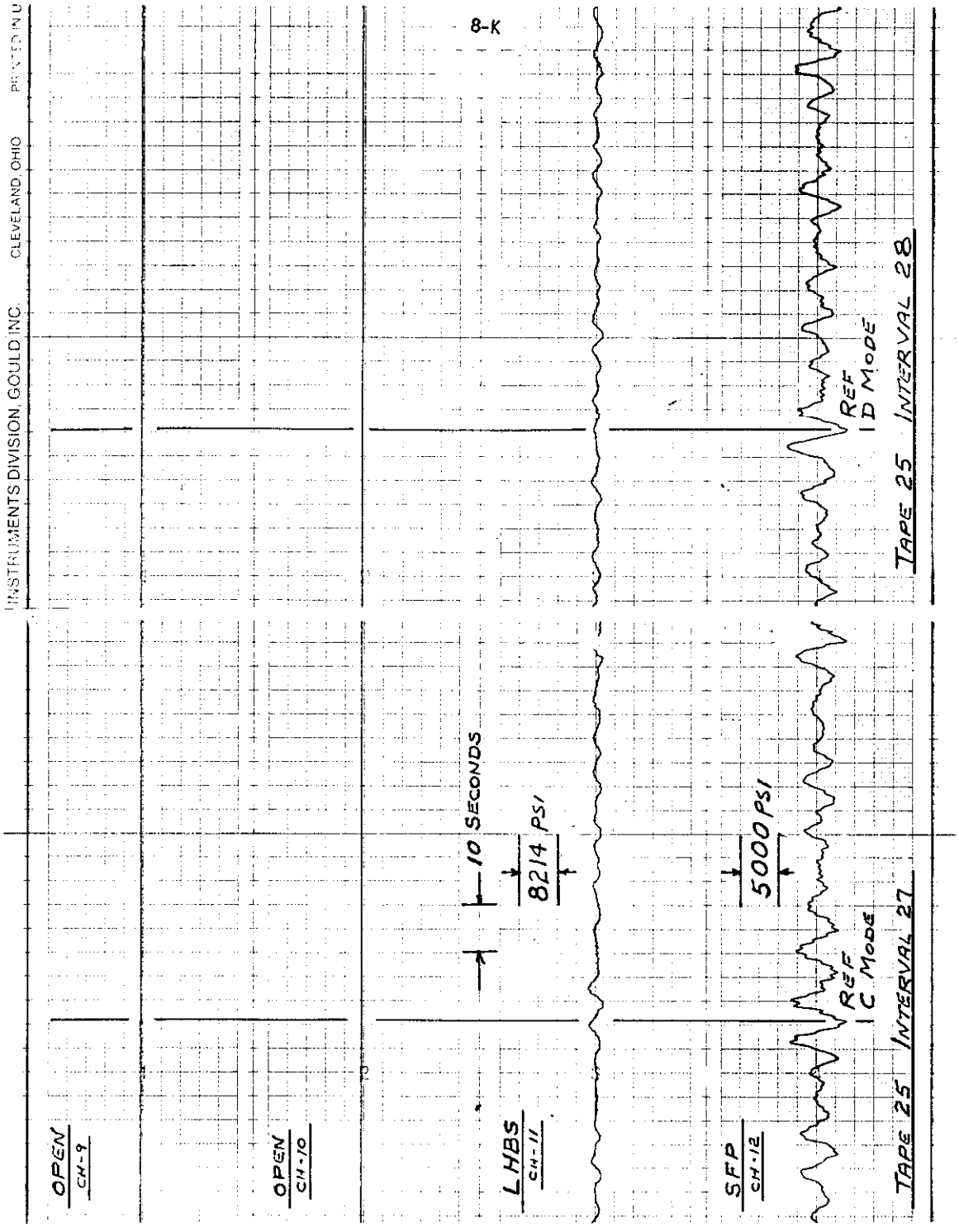
8-6

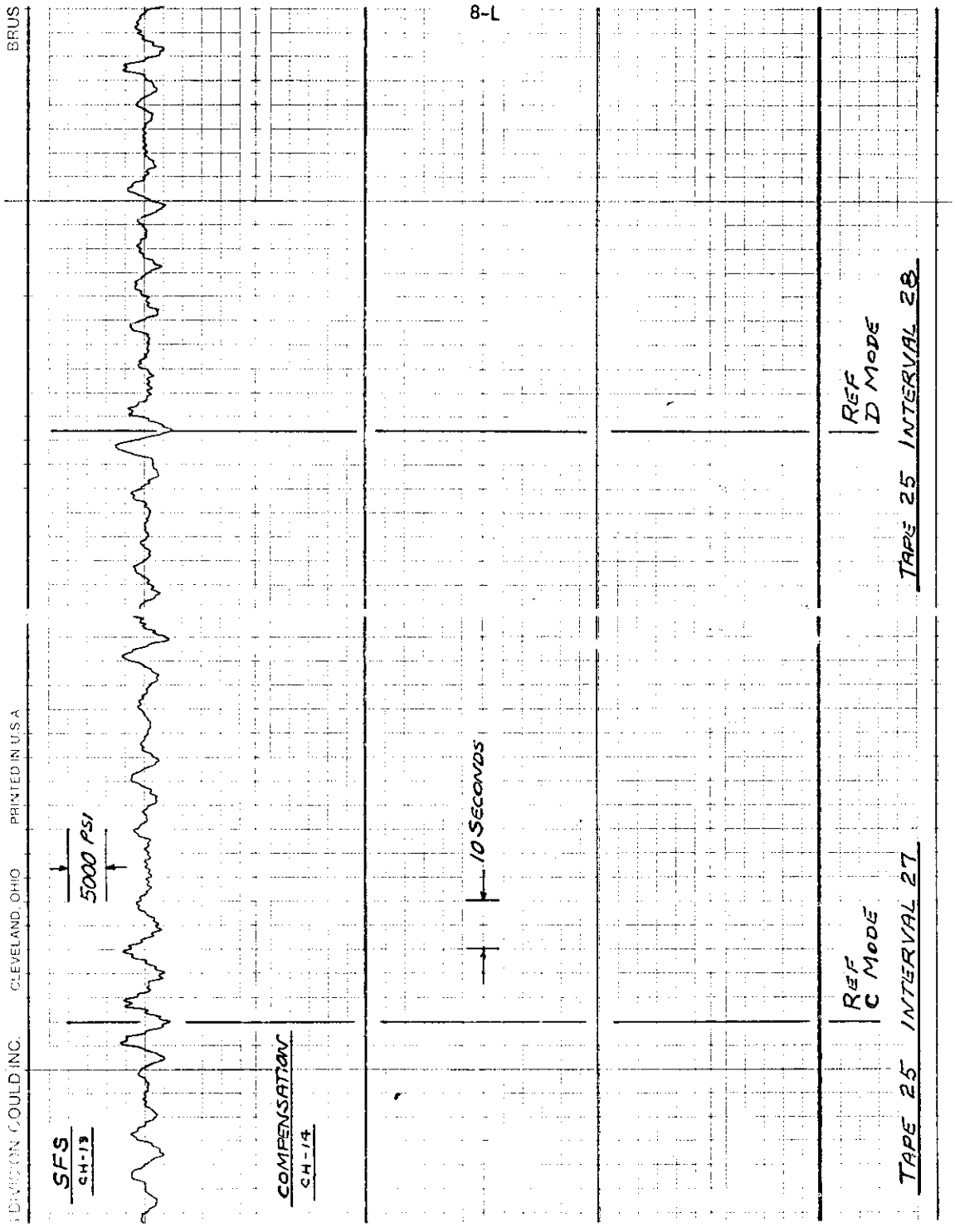

BG SB
CH-13
5000 PSI
AR4C
CH-13
10038 PSI
COMPENSATION
CH-14
COMPENSATION
CH-14
10 SECONDS
OPEN
OPEN
REF
A MODE
REF.
B MODE
TAPE 26 INTERVAL 25
TAPE 26 INTERVAL 26

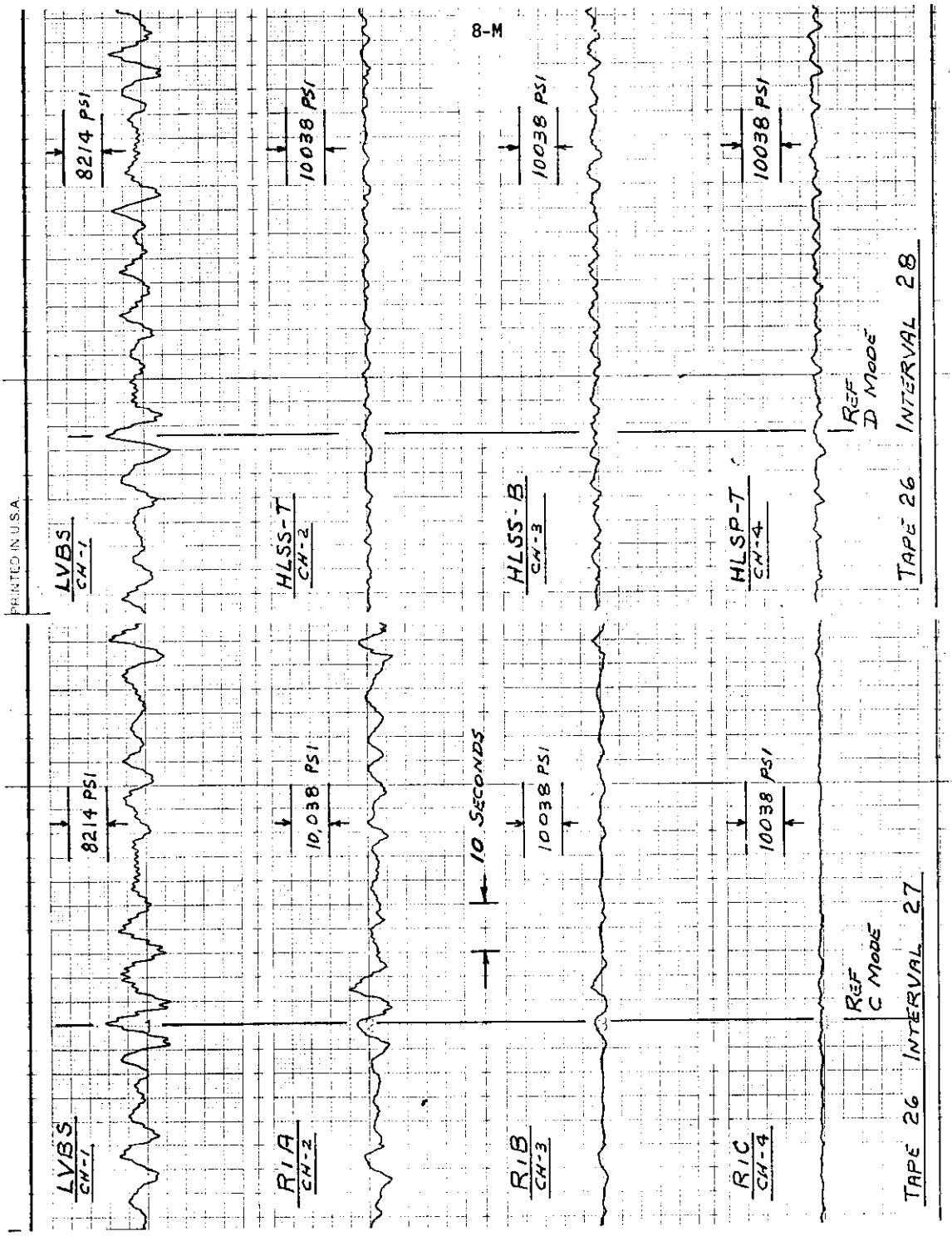
8-H

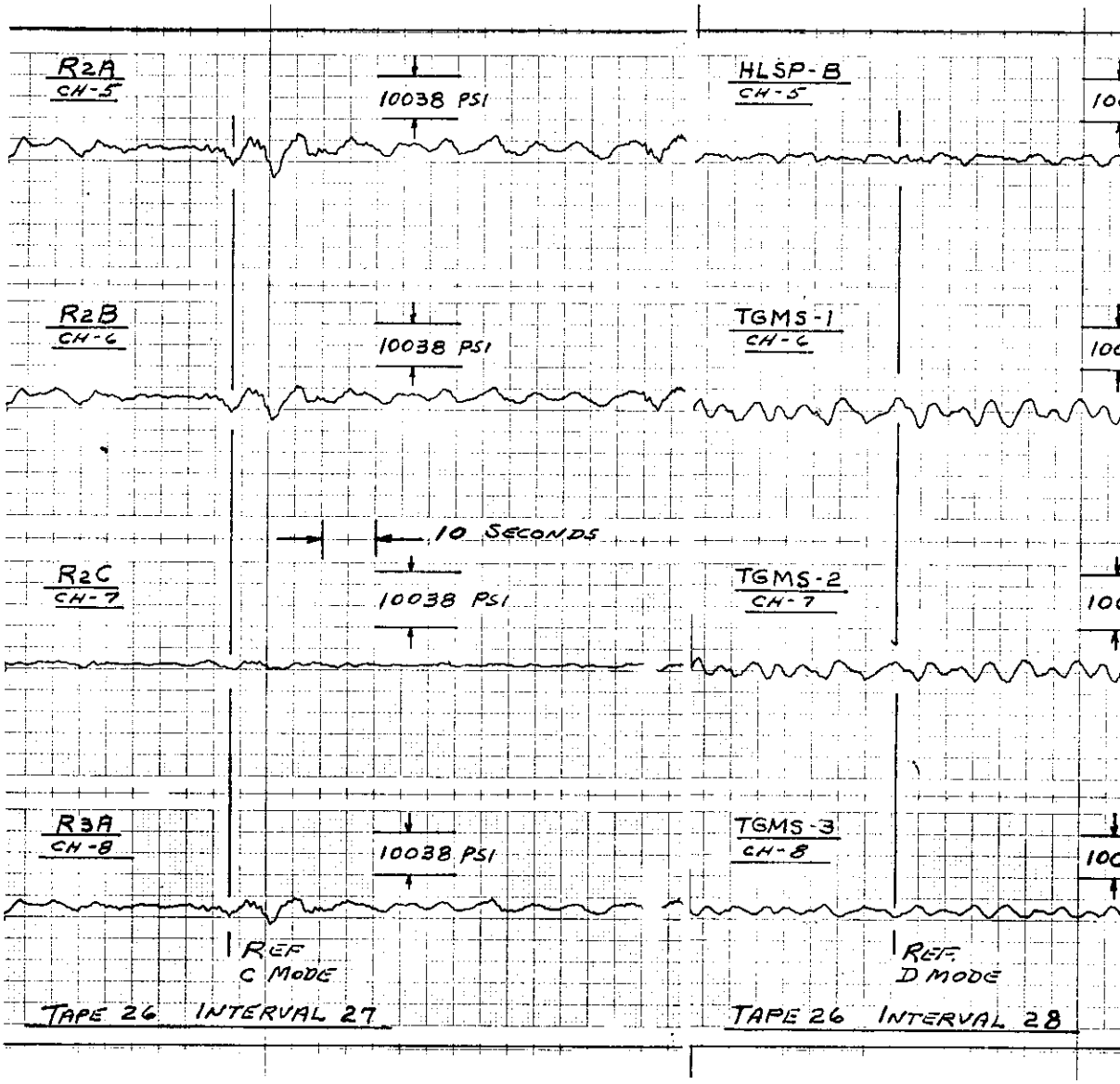

8-I
LVBS
CH-1
8214 PSI
TSM
CH-2
4991 PSI
OPEN
CH-3
10 SECONDS
ROLL
CH-4
20°
REF
C MODE
TAPE 25 INTERVAL 27
REF
D MODE
TAPE 25 INTERVAL 28

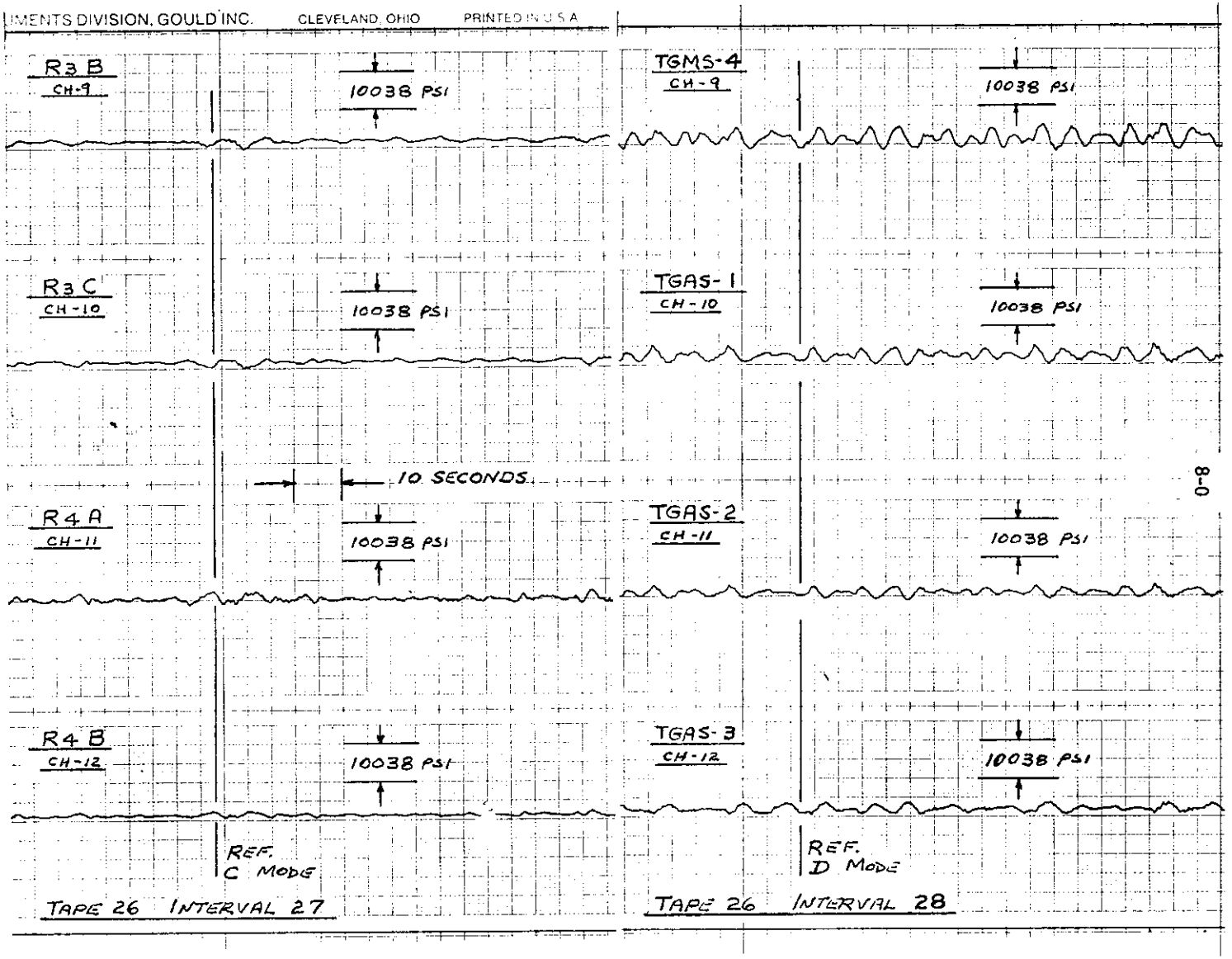

8-J
PITCH
CH-5
20°
MID VERT
CH-6
2 G
10 SECONDS
MID TRANS
CH-7
1 G
FWD VERT
CH-8
2 G
REF
C MODE
TAPE 25 INTERVAL 27
REF
D MODE
TAPE 25 INTERVAL 28


INSTRUMENTS DIVISION, GOULD INC. CLEVELAND, OHIO
OPEN
CH-9
OPEN
CH-10
LHBS
CH-11
SFP
CH-12
8-K
10 SECONDS
8214 PSI
5000 PSI
REF
C Mode
REF
D Mode
TAPE 25 INTERVAL 27
TAPE 25 INTERVAL 28


BRUS
PRINTED IN U.S.A
CLEVELAND, OHIO
GOULD INC.
SFS
CH-13
5000 PSI
COMPENSATION
CH-14
10 SECONDS
REF
C MODE
REF
D MODE
TAPE 25 INTERVAL 27
TAPE 25 INTERVAL 28


PRINTED IN U.S.A.
8-M
LVBS CH-1
8214 PSI
HLSS-T CH-2
10038 PSI
HLSS-B CH-3
10038 PSI
HLSP-T CH-4
10038 PSI
REF D MODE
TAPE 26 INTERVAL 28
LVBS CH-1
8214 PSI
RIA CH-2
10,038 PSI
10 SECONDS
RIB CH-3
10038 PSI
RIC CH-4
10038 PSI
REF C MODE
TAPE 26 INTERVAL 27


R2A
CH-5
10038 PSI
HLSP-B
CH-5
R2B
CH-6
10038 PSI
TGMS-1
CH-6
10 SECONDS
R2C
CH-7
10038 PSI
TGMS-2
CH-7
R3A
CH-8
10038 PSI
TGMS-3
CH-8
REF.
C MODE
REF.
D MODE
TAPE 26 INTERVAL 27
TAPE 26 INTERVAL 28


IMENTS DIVISION, GOULD INC. CLEVELAND, OHIO PRINTED IN U.S.A.
R3 B
CH-9
10038 PSI
R3 C
CH-10
10038 PSI
10 SECONDS
R4 A
CH-11
10038 PSI
R4 B
CH-12
10038 PSI
REF.
C MODE
TAPE 26 INTERVAL 27
TGMS-4
CH-9
10038 PSI
TGAS-1
CH-10
10038 PSI
TGAS-2
CH-11
10038 PSI
TGAS-3
CH-12
10038 PSI
REF.
D MODE
TAPE 26 INTERVAL 28
8-0

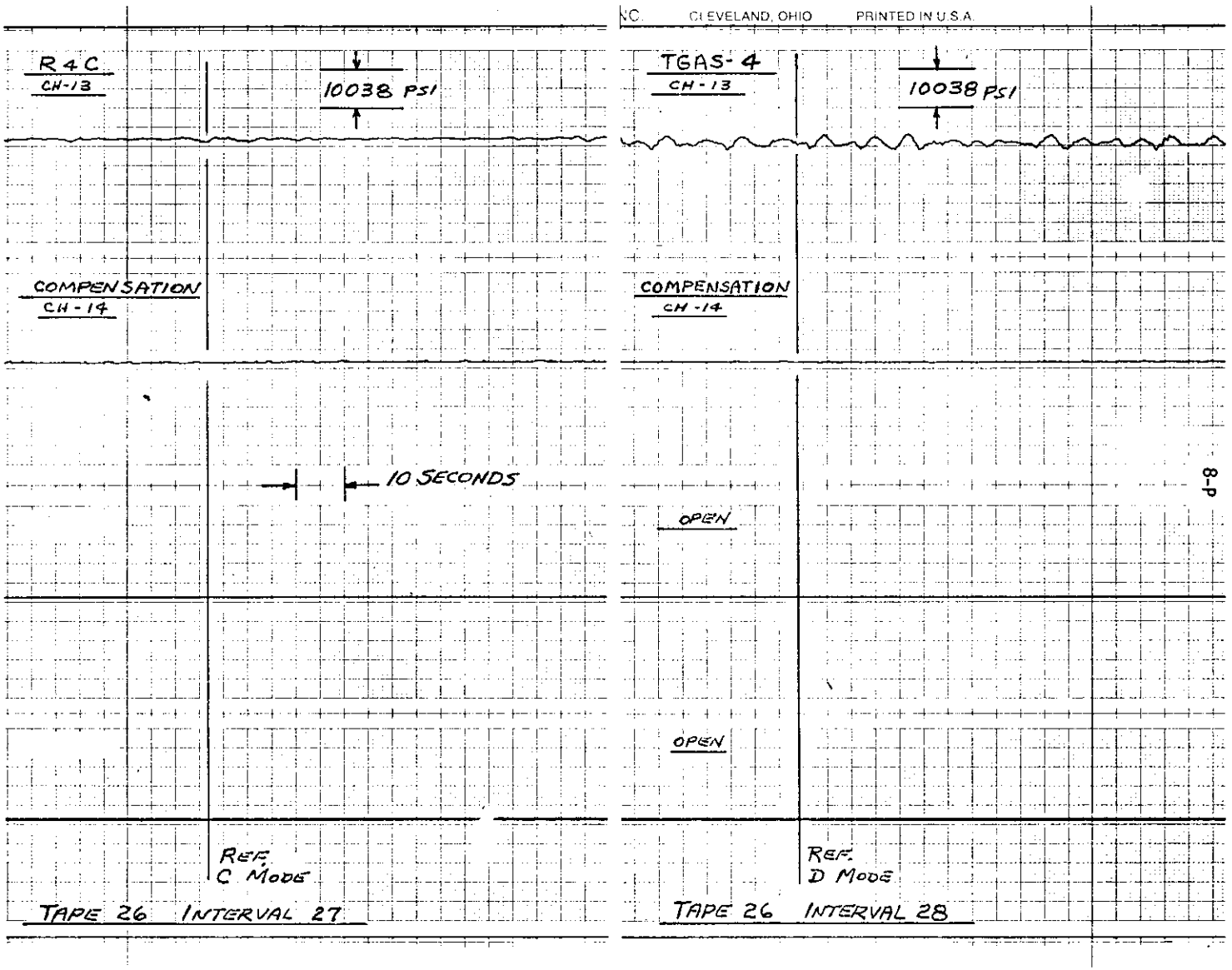
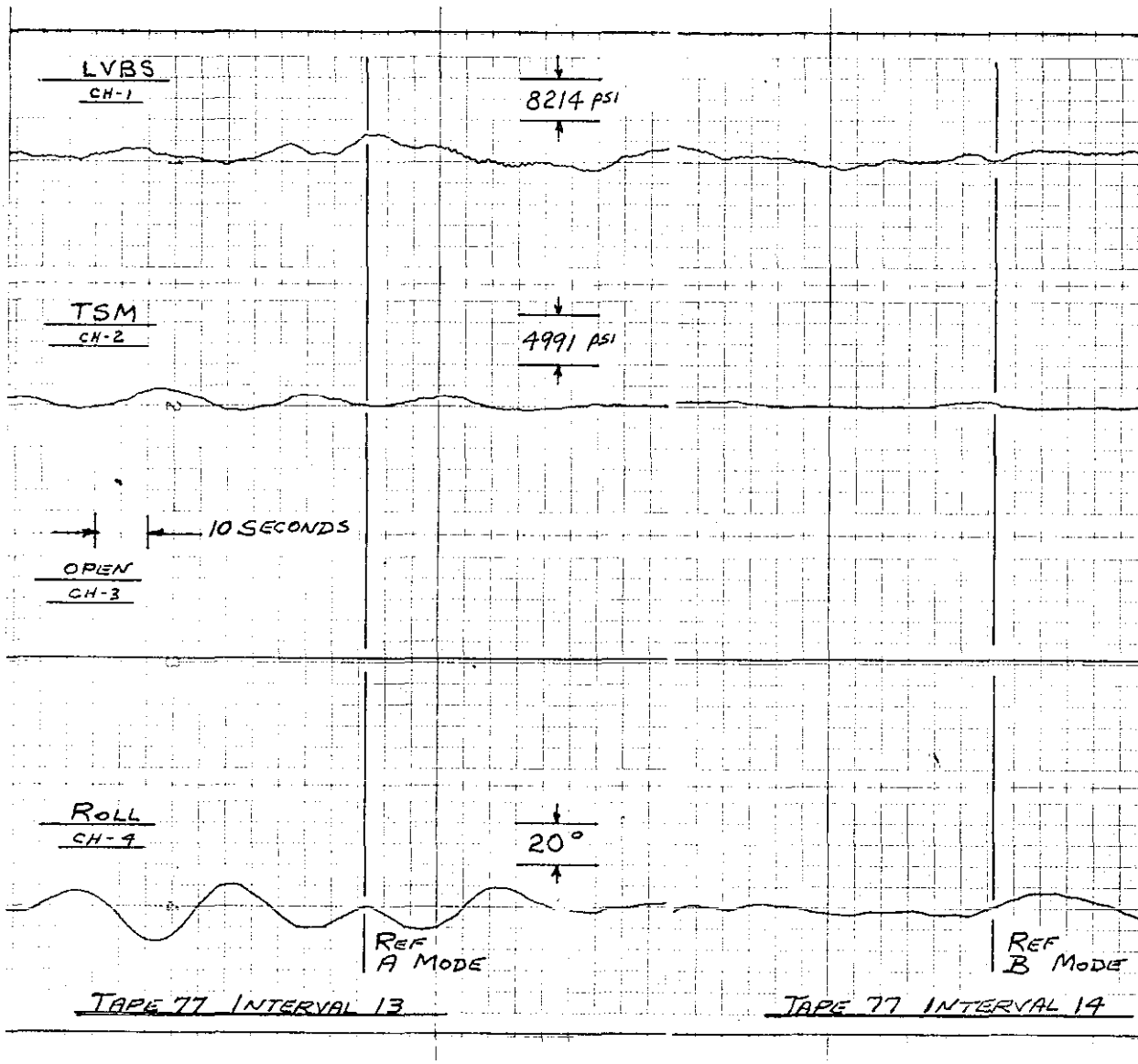

NC. CLEVELAND, OHIO PRINTED IN U.S.A.
R4C
CH-13
10038 PSI
COMPENSATION
CH-14
10 SECONDS
REF.
C MODE
TAPE 26 INTERVAL 27
TGAS-4
CH-13
10038 PSI
COMPENSATION
CH-14
OPEN
OPEN
REF.
D MODE
TAPE 26 INTERVAL 28
8-P

FIGURE 9

SAMPLE SIMULTANEOUS RESPONSE DATA

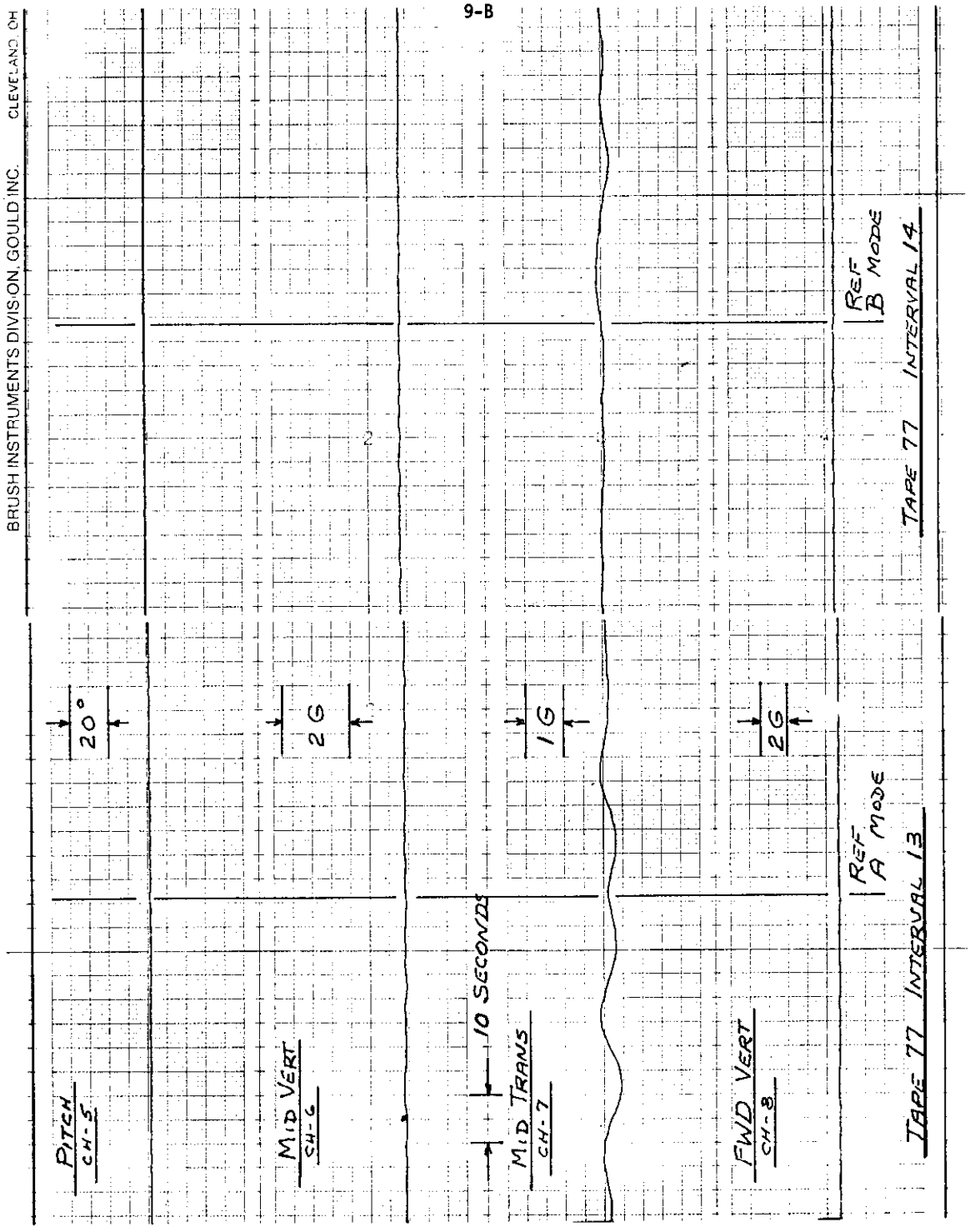
The following pages present representative simultaneous samples of all recorded signals on both tape recorders for:

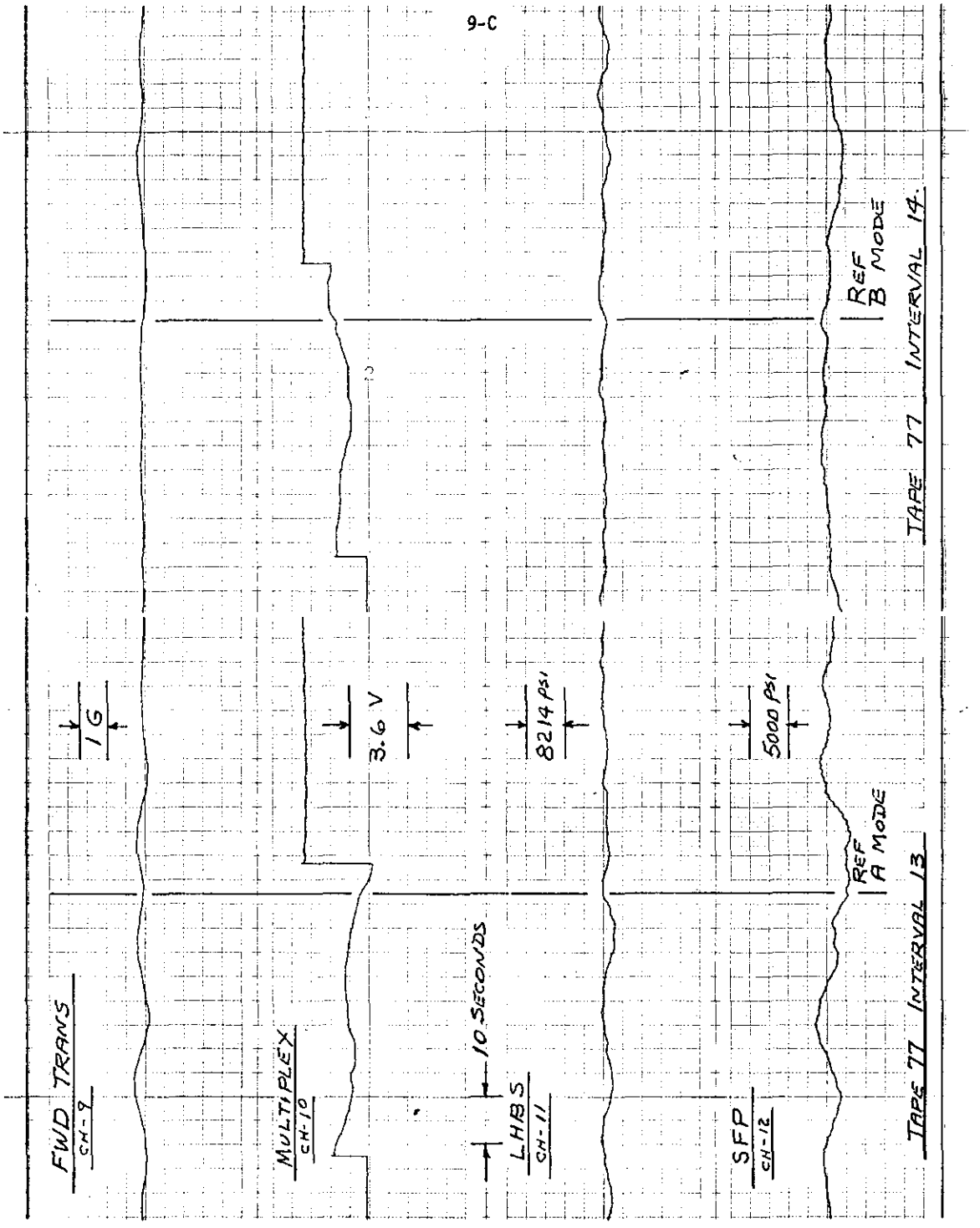
Voyage	11 Westbound
Index	22
Interval	13 ("A" Mode)
	14 ("B" Mode)
	15 ("C" Mode)
	16 ("D" Mode)
Tape	77 (Recorder No. 1)
	78 (Recorder No. 2)
Beaufort Sea State	8
Relative Sea Direction	Quartering
Ship Speed	29 Knots

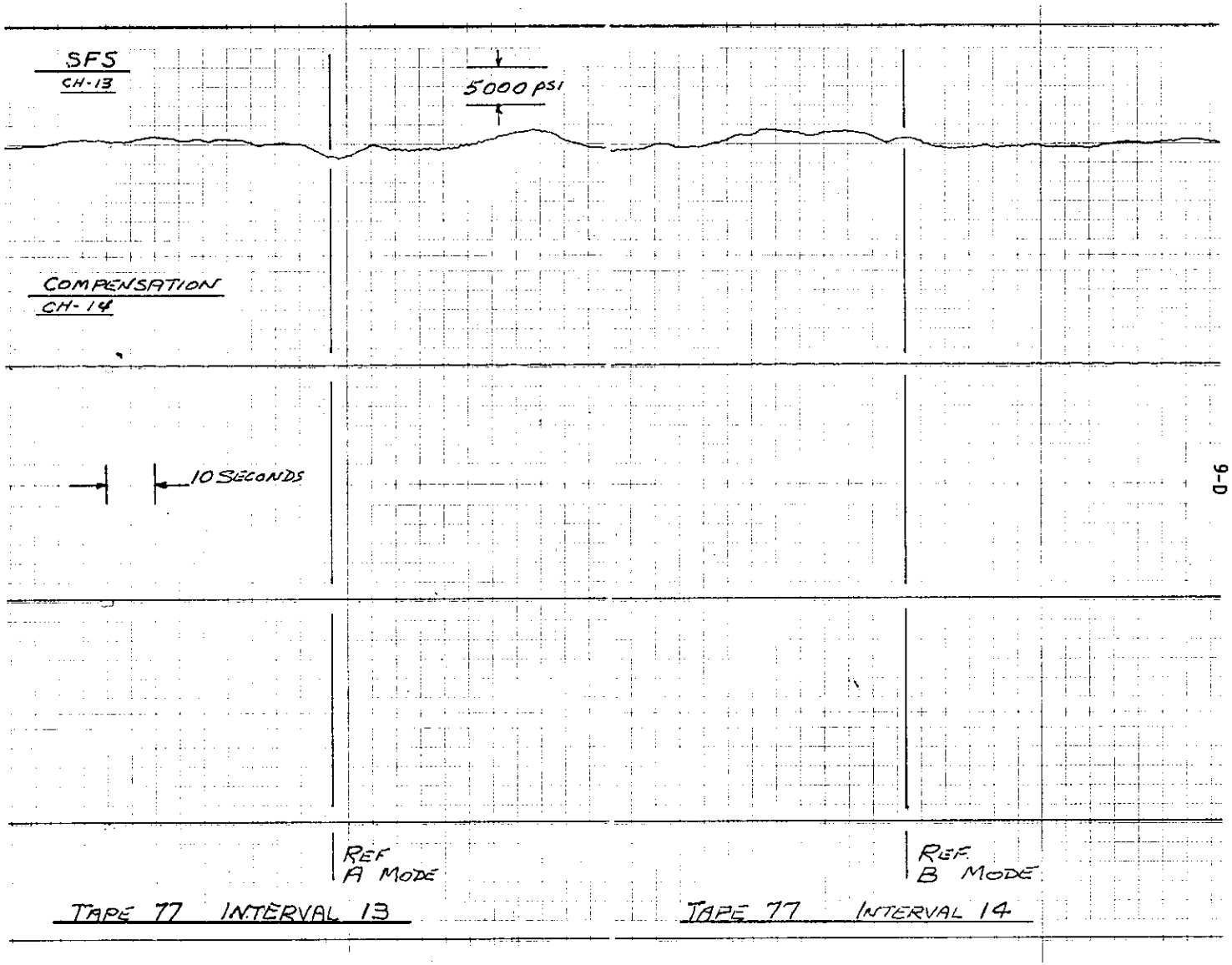


TAPE 77 INTERVAL 13

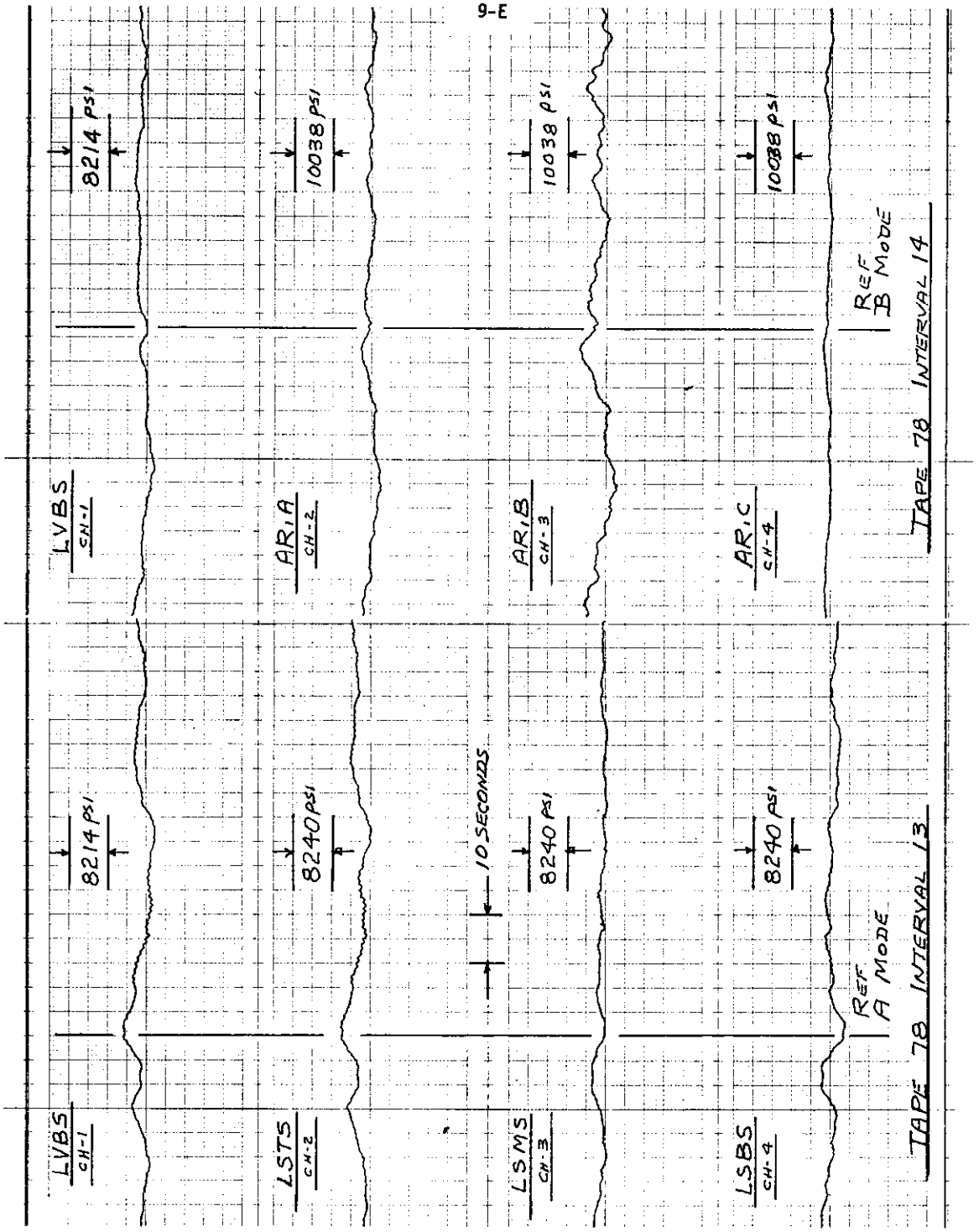
TAPE 77 INTERVAL 14

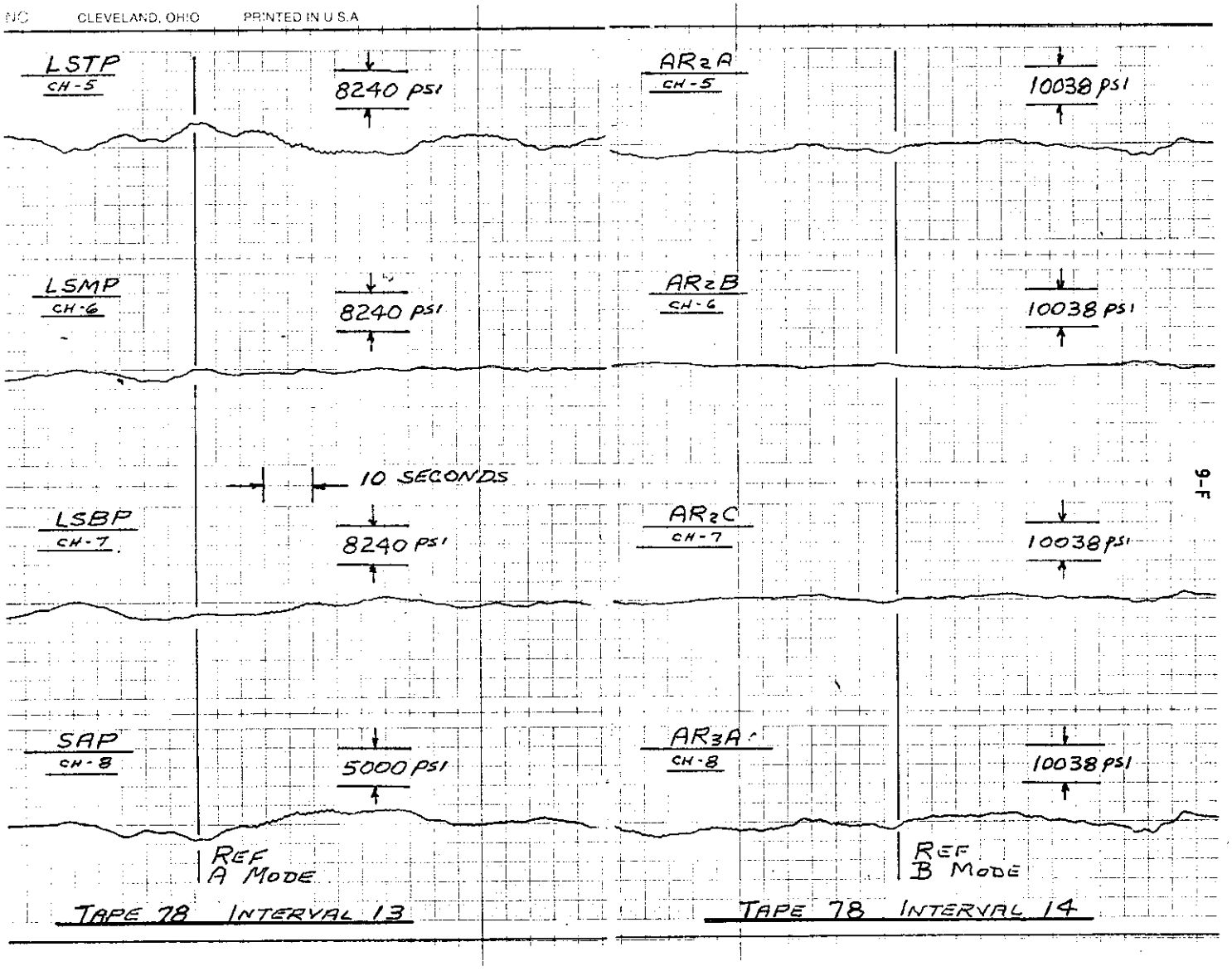

9-B
BRUSH INSTRUMENTS DIVISION, GOULD INC. CLEVELAND, OH
PITCH
CH-5
20°
MID VERT
CH-6
2G
10 SECONDS
MID TRANS
CH-7
1G
FWD VERT
CH-8
2G
REF
A MODE
REF
B MODE
TAPE 77 INTERVAL 13
TAPE 77 INTERVAL 14

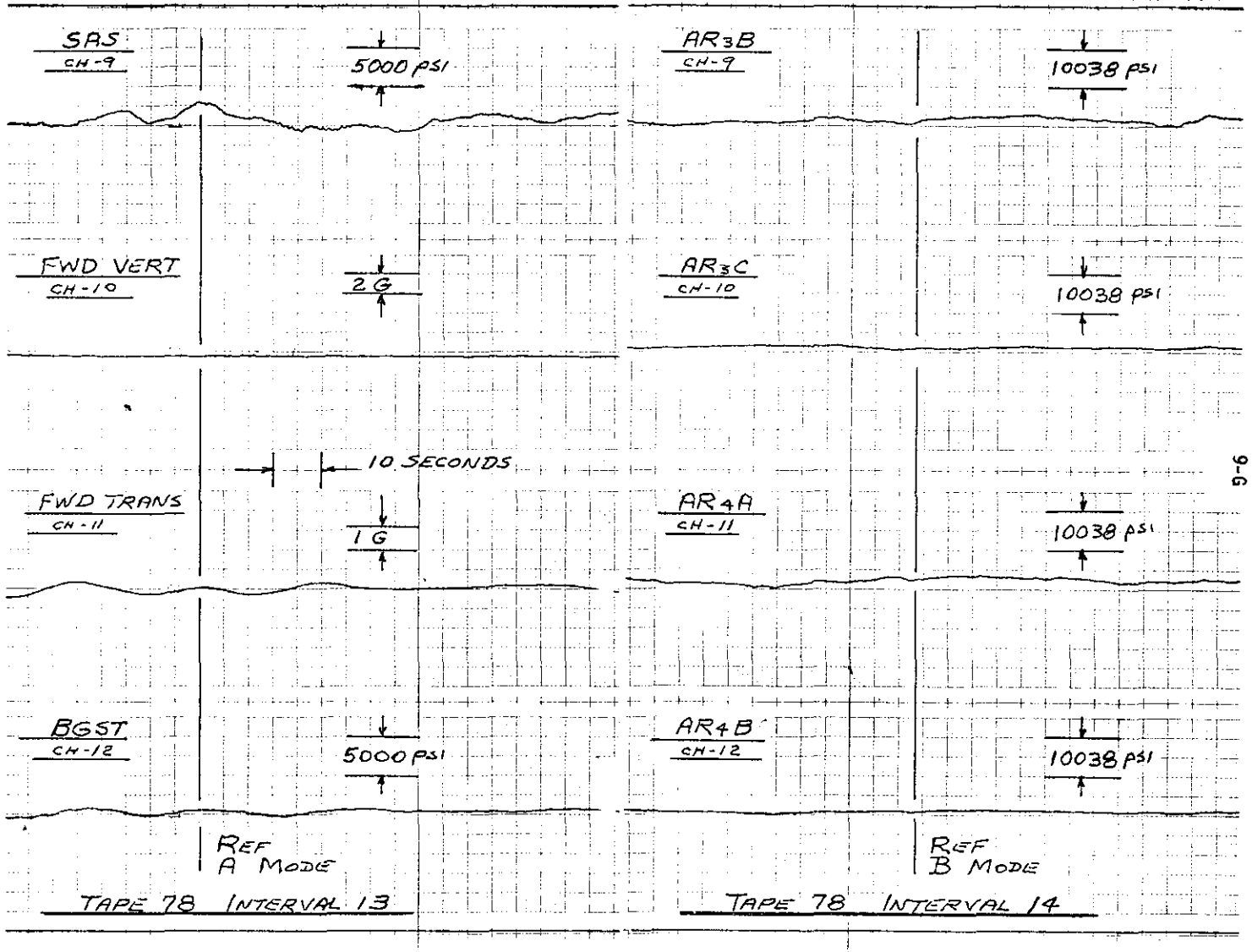

9-C
FWD TRANS
CH-9
1G
MULTIPLEX
CH-10
3.6 V
10 SECONDS
LHBS
CH-11
8214 PSI
SFP
CH-12
5000 PSI
REF
A MODE
REF
B MODE
TAPE 77 INTERVAL 13
TAPE 77 INTERVAL 14.

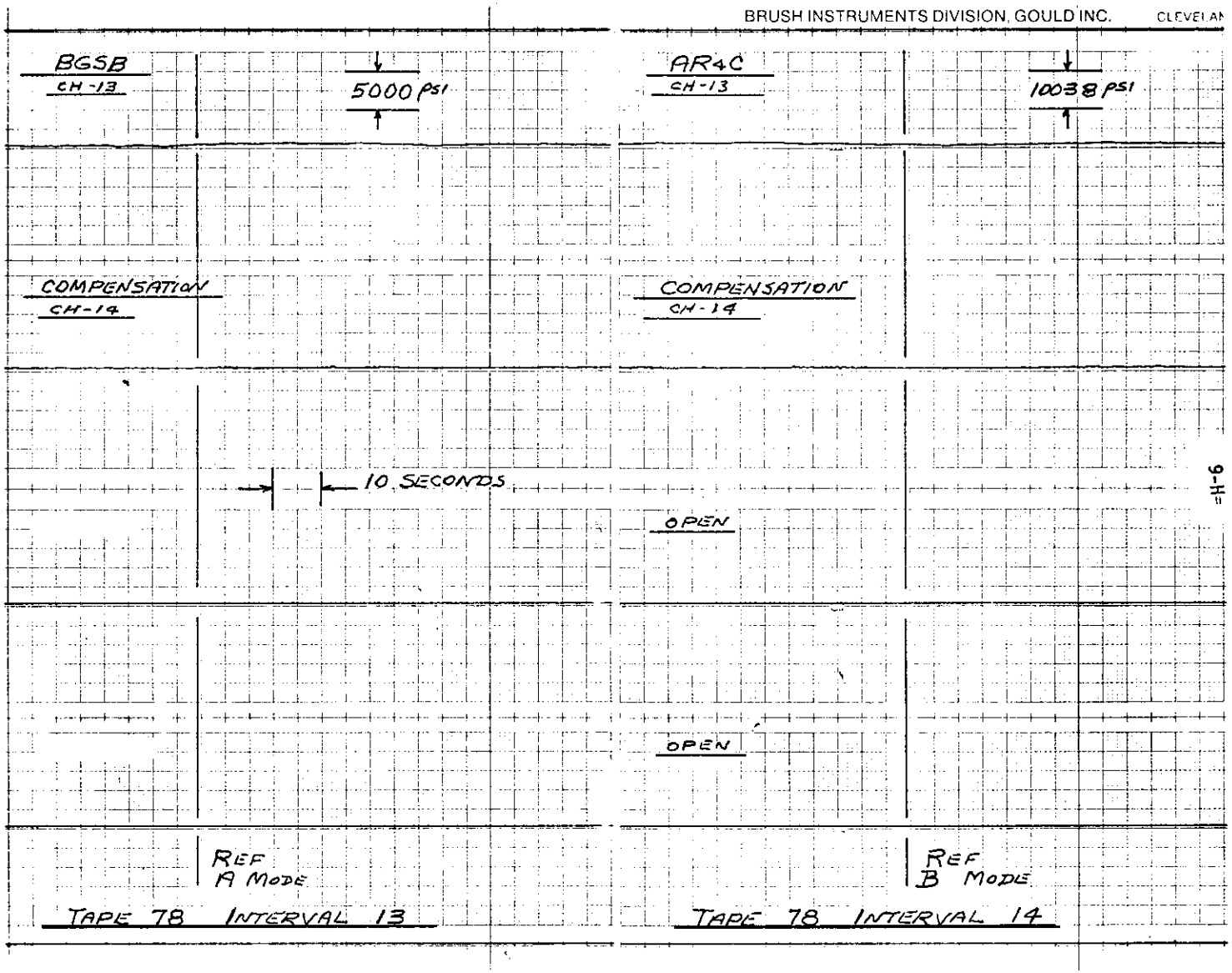

SFS
CH-13
5000 PSI
COMPENSATION
CH-14
10 SECONDS
REF
A MODE
REF
B MODE
TAPE 77 INTERVAL 13
TAPE 77 INTERVAL 14

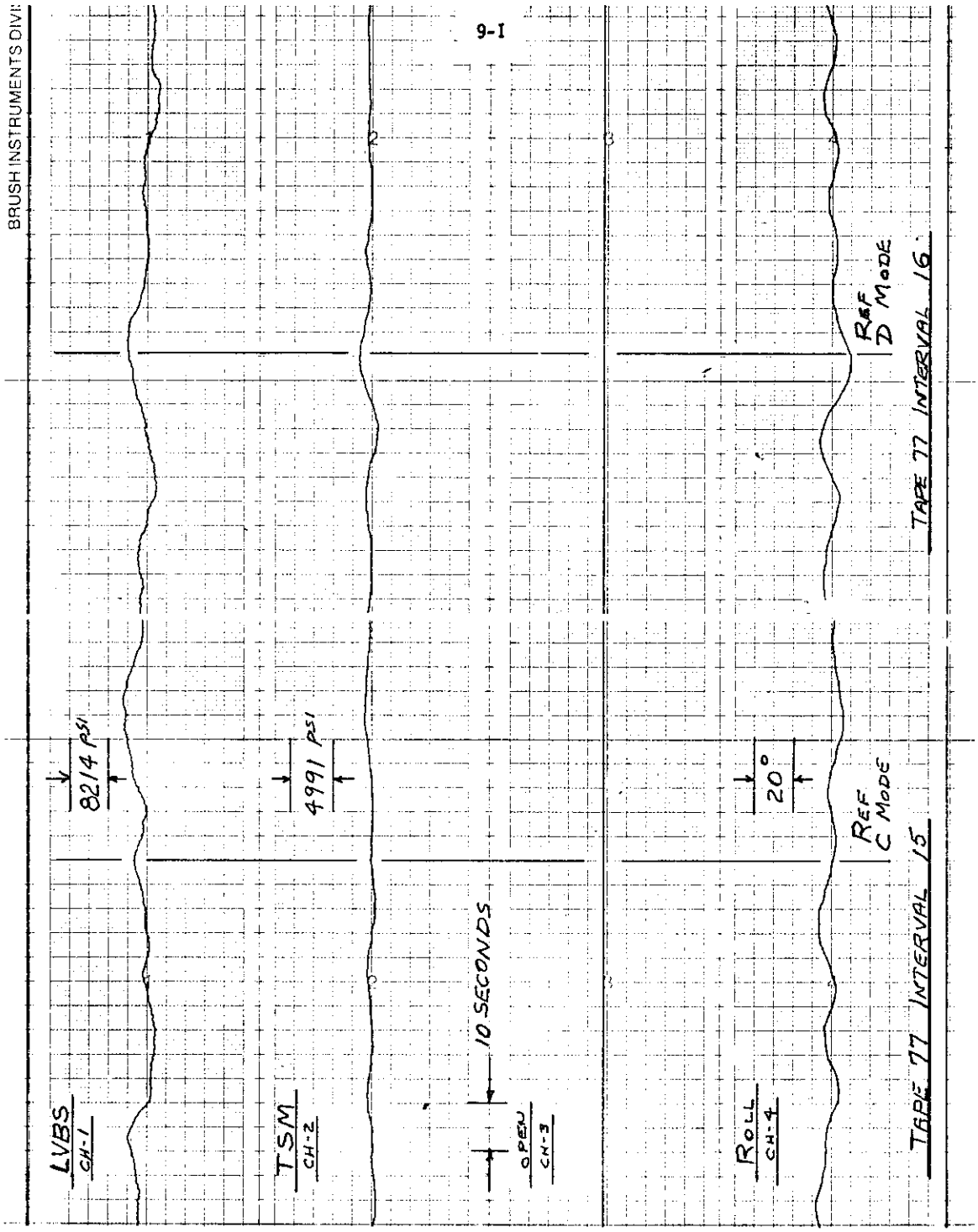
9-D

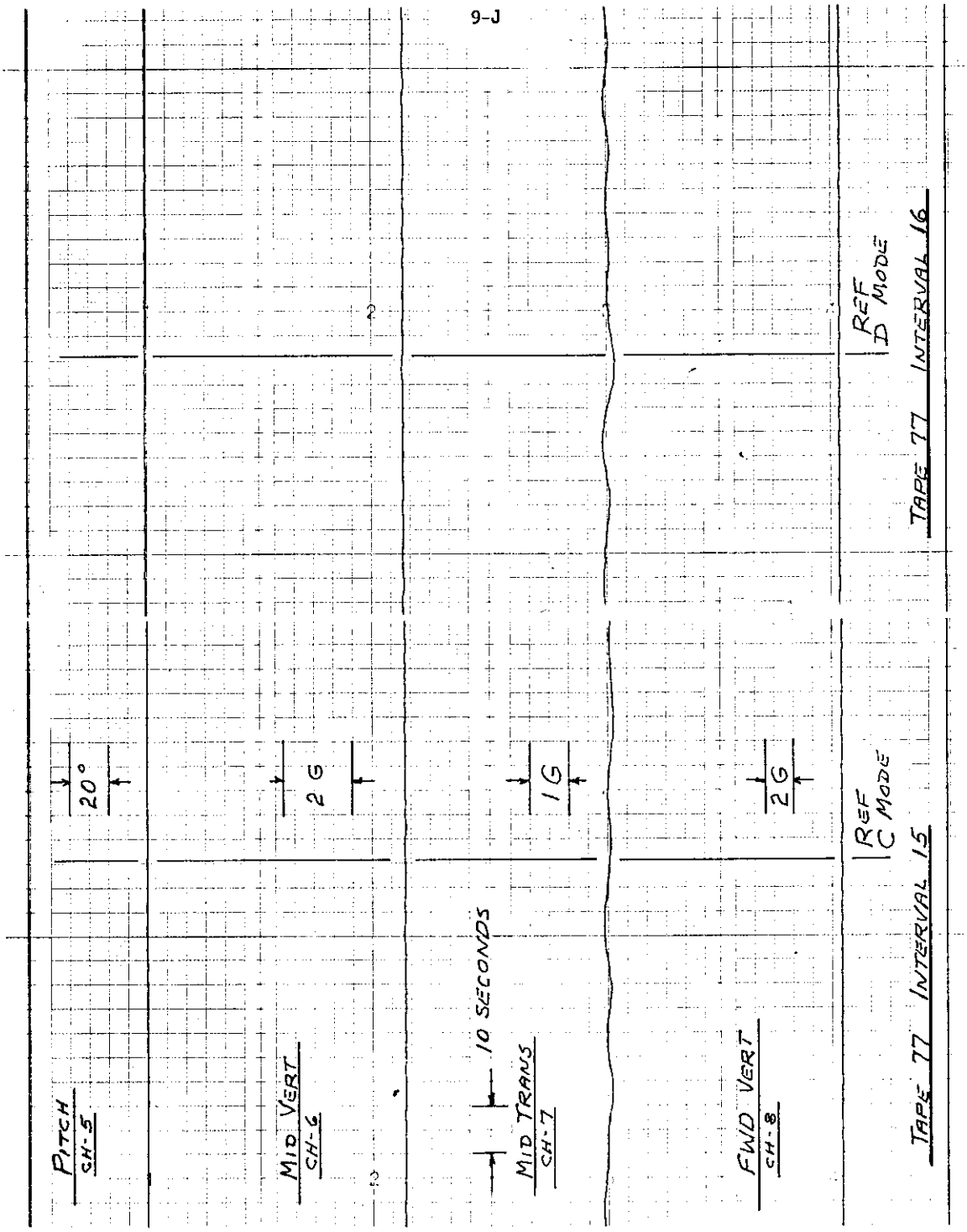

9-E
LVBS
CH-1
8214 PSI
LSTS
CH-2
8240 PSI
LSMS
CH-3
8240 PSI
LSBS
CH-4
8240 PSI
10 SECONDS
REF
A MODE
TAPE 78 INTERVAL 13
LVBS
CH-1
8214 PSI
AR,A
CH-2
10038 PSI
AR,B
CH-3
10038 PSI
AR,C
CH-4
10038 PSI
REF
B MODE
TAPE 78 INTERVAL 14

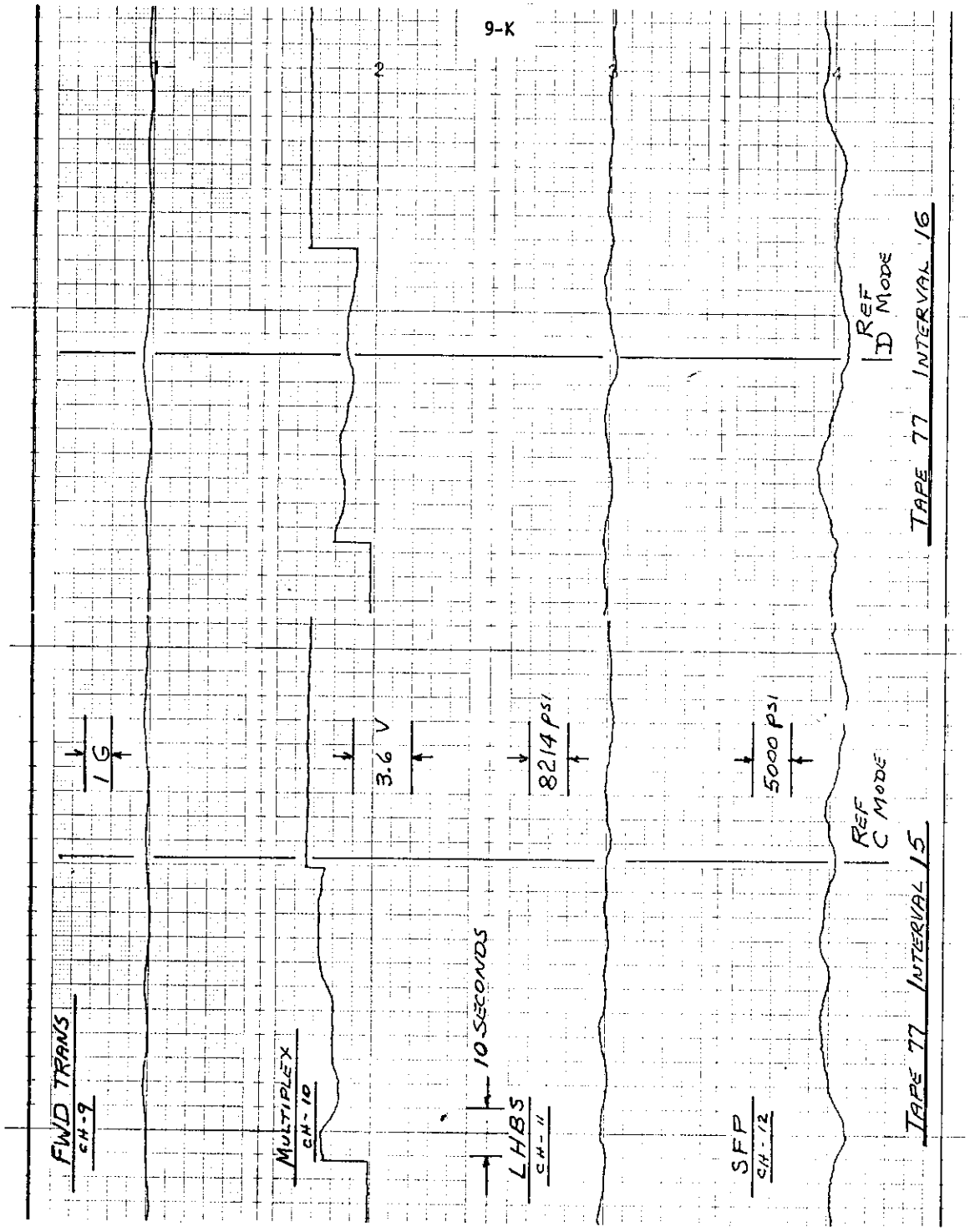

NC CLEVELAND, OHIO PRINTED IN U.S.A.
LSTP
CH-5
8240 PSI
LSMP
CH-6
8240 PSI
10 SECONDS
LSBP
CH-7
8240 PSI
SAP
CH-8
5000 PSI
REF
A MODE
TAPE 78 INTERVAL 13
AR2A
CH-5
10038 PSI
AR2B
CH-6
10038 PSI
AR2C
CH-7
10038 PSI
AR3A
CH-8
10038 PSI
REF
B MODE
TAPE 78 INTERVAL 14
9-F

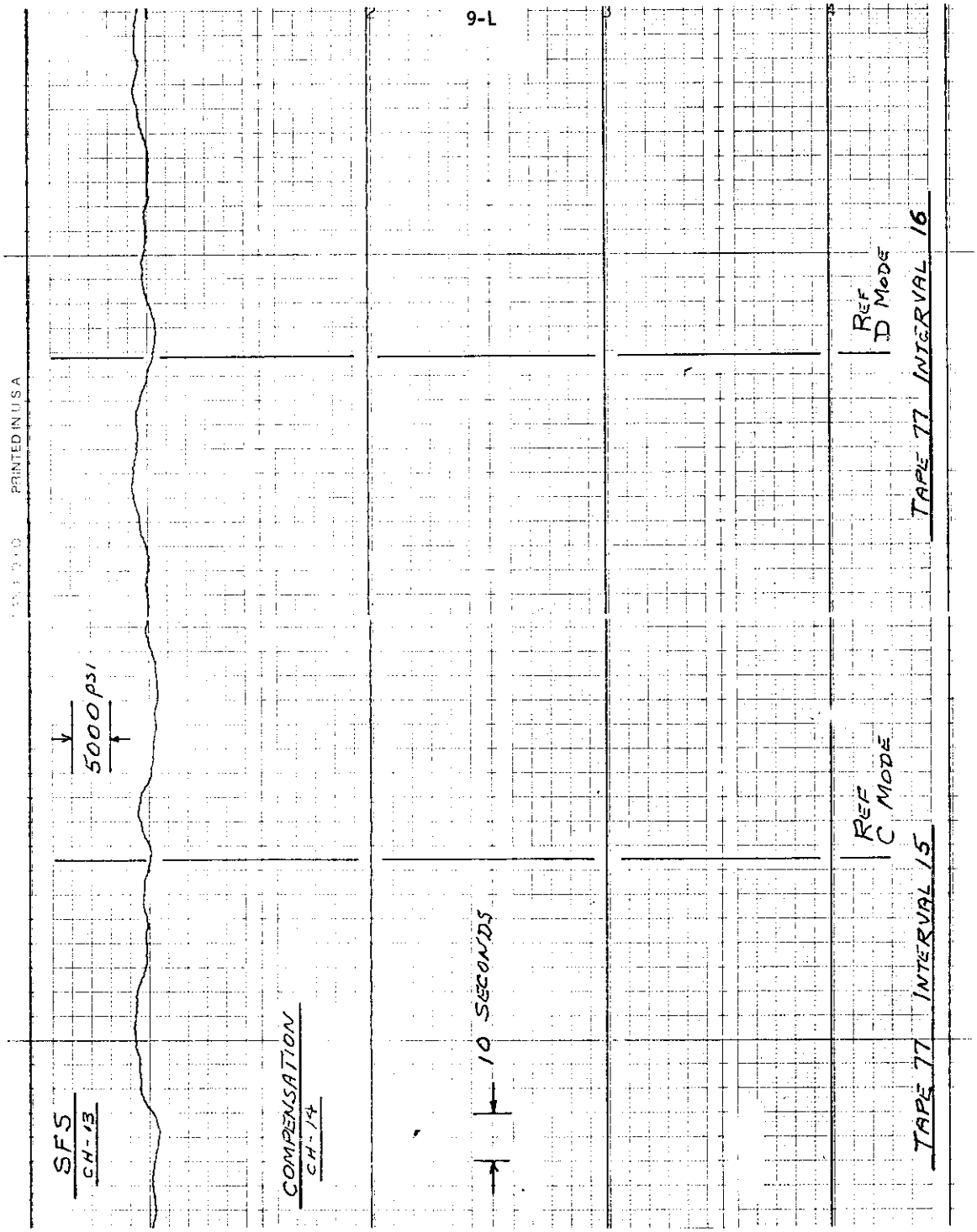

SAS
CH-9
5000 PSI
AR3B
CH-9
10038 PSI
FWD VERT
CH-10
2 G
AR3C
CH-10
10038 PSI
10 SECONDS
FWD TRANS
CH-11
1 G
AR4A
CH-11
10038 PSI
BGST
CH-12
5000 PSI
AR4B
CH-12
10038 PSI
REF
A MODE
REF
B MODE
TAPE 78 INTERVAL 13
TAPE 78 INTERVAL 14

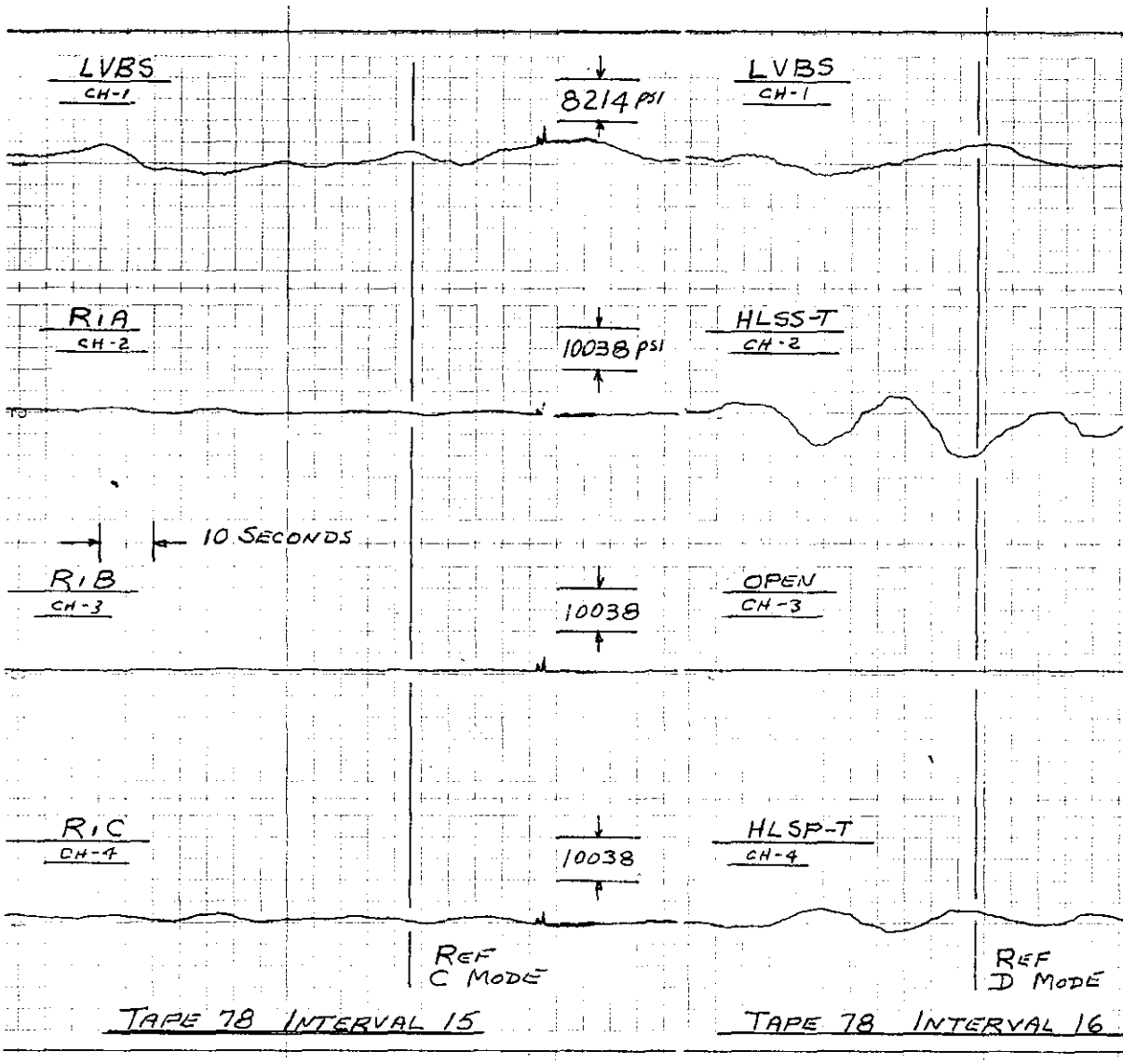

BRUSH INSTRUMENTS DIVISION, GOULD INC.
BGSB
CH-13
5000 PSI
AR4C
CH-13
10038 PSI
COMPENSATION
CH-14
COMPENSATION
CH-14
10 SECONDS
OPEN
OPEN
REF
A MODE
REF
B MODE
TAPE 78 INTERVAL 13
TAPE 78 INTERVAL 14

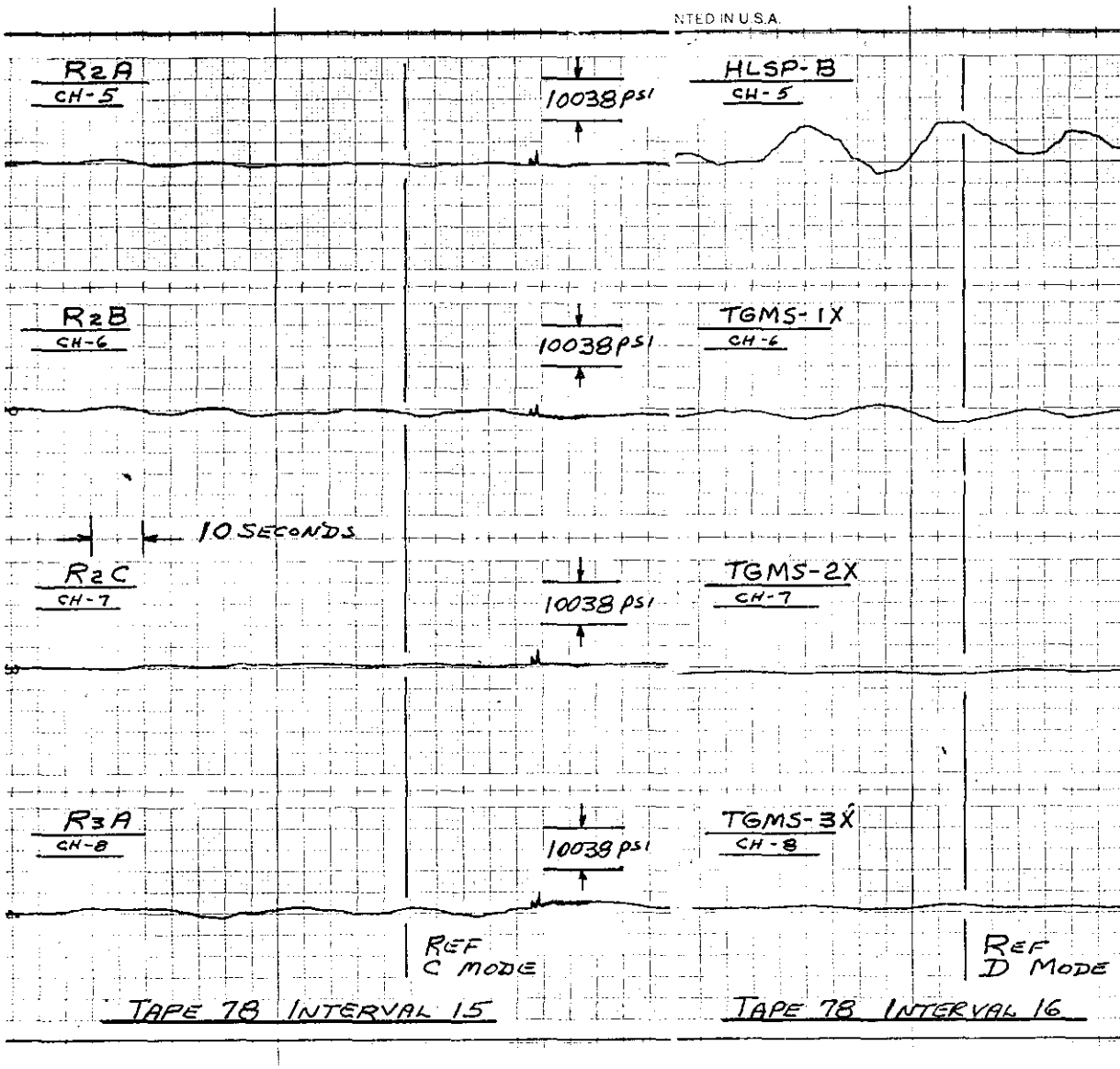

BRUSH INSTRUMENTS DIVI
9-I
LVBS
CH-1
8214 PSI
TSM
CH-2
4991 PSI
10 SECONDS
OPEN
CH-3
ROLL
CH-4
20°
REF
C MODE
REF
D MODE
TAPE 77 INTERVAL 15
TAPE 77 INTERVAL 16


9-J
PITCH
CH-5
20°
MID VERT
CH-6
2 G
10 SECONDS
MID TRANS
CH-7
1 G
FWD VERT
CH-8
2 G
REF
C MODE
TAPE 77 INTERVAL 15
REF
D MODE
TAPE 77 INTERVAL 16


9-K
FWD TRANS
CH-9
1 G
MULTIPLEX
CH-10
3.6 V
10 SECONDS
LHBS
CH-11
8214 PSI
SFP
CH-12
5000 PSI
REF
C MODE
REF
D MODE
TAPE 77 INTERVAL 15
TAPE 77 INTERVAL 16

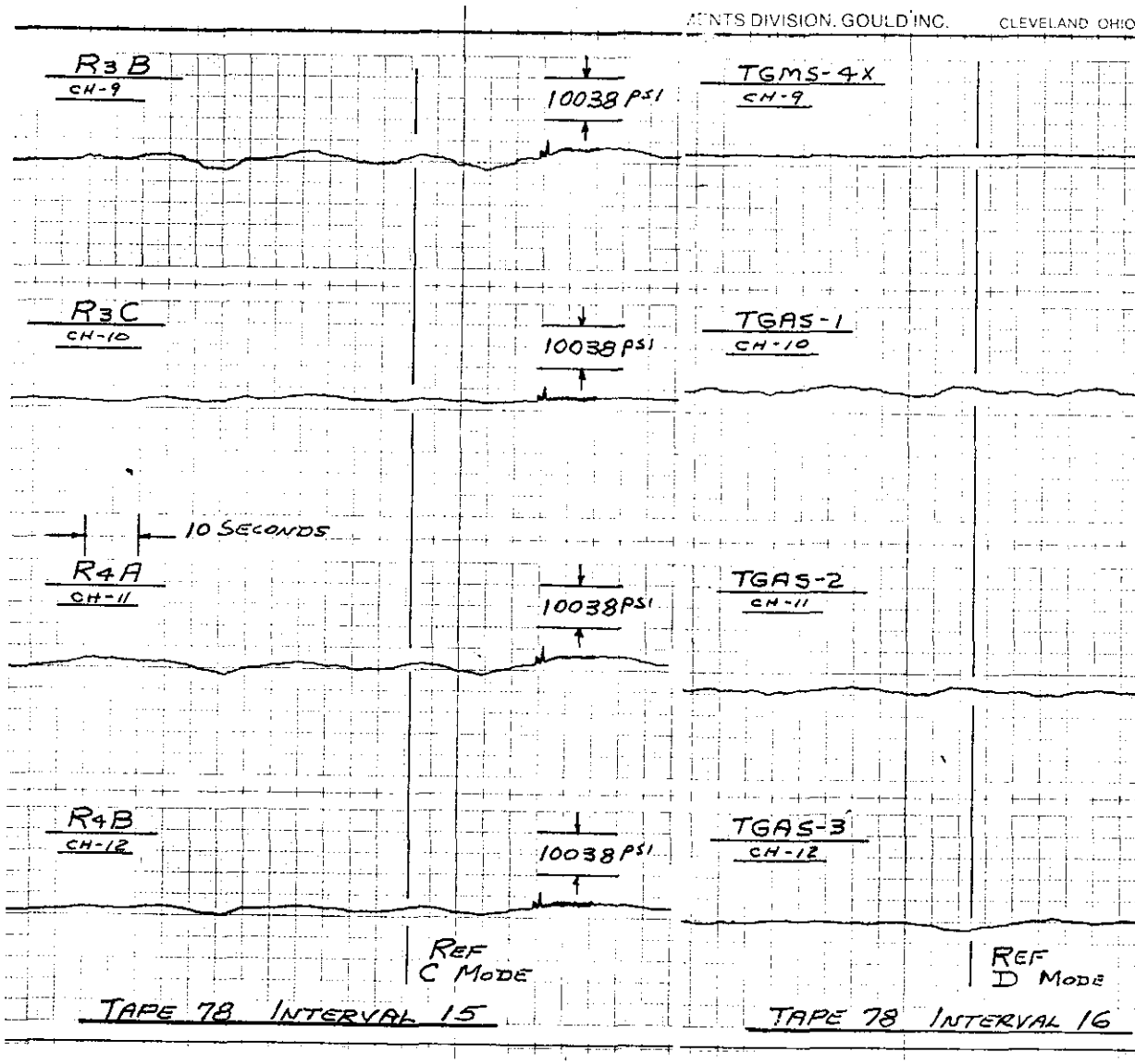

9-L
SFS
CH-13
5000 PSI
COMPENSATION
CH-14
10 SECONDS
REF
C MODE
TAPE 77 INTERVAL 15
REF
D MODE
TAPE 77 INTERVAL 16
PRINTED IN U.S.A.


LVBS
CH-1
8214 psi
LVBS
CH-1
RIA
CH-2
10038 psi
HLSS-T
CH-2
10 SECONDS
RIB
CH-3
10038
OPEN
CH-3
RIC
CH-4
10038
HLSP-T
CH-4
REF
C MODE
REF
D MODE
TAPE 78 INTERVAL 15
TAPE 78 INTERVAL 16



TAPE 78 INTERVAL 15

TAPE 78 INTERVAL 16



TAPE 78 INTERVAL 15

TAPE 78 INTERVAL 16

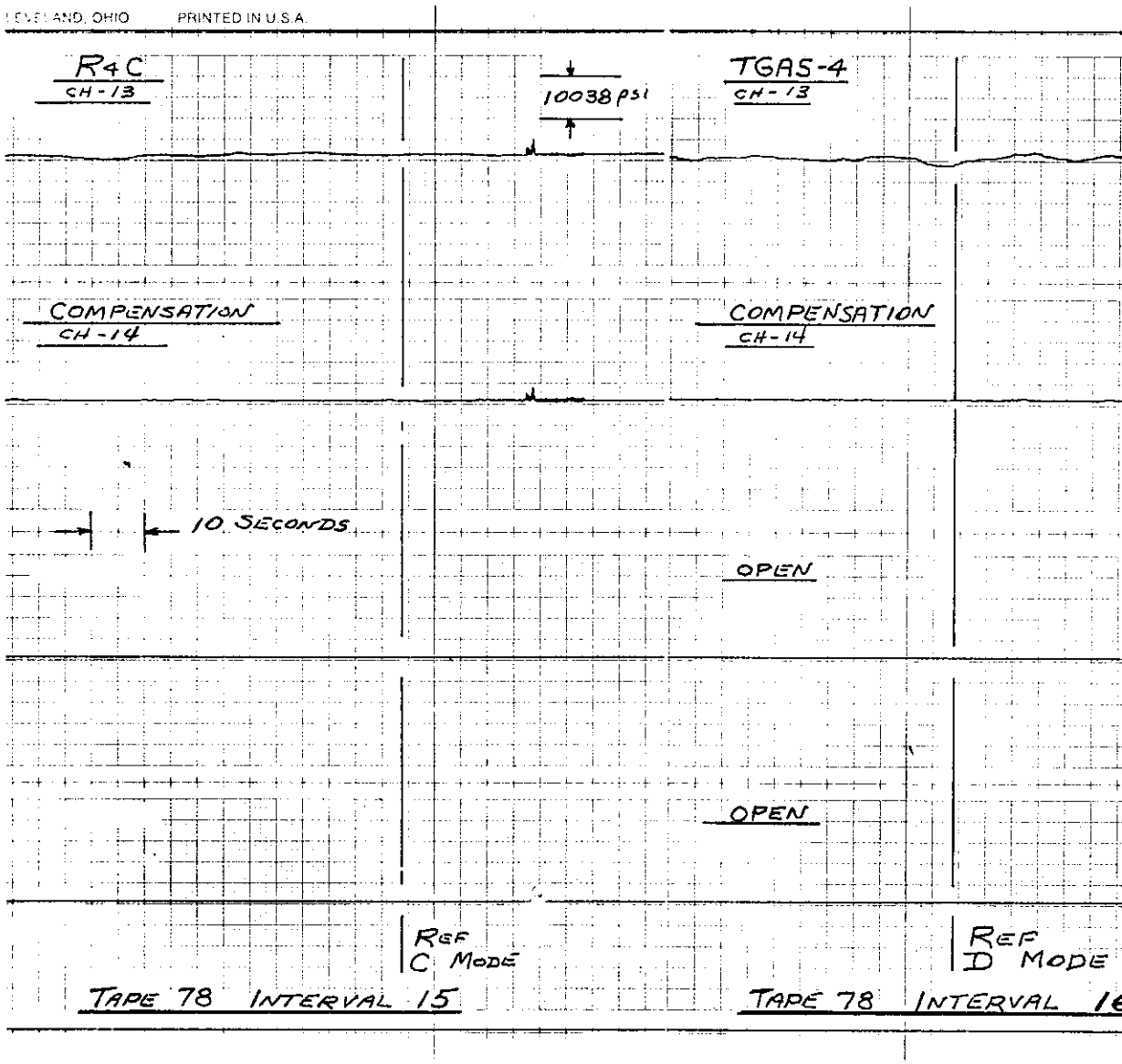
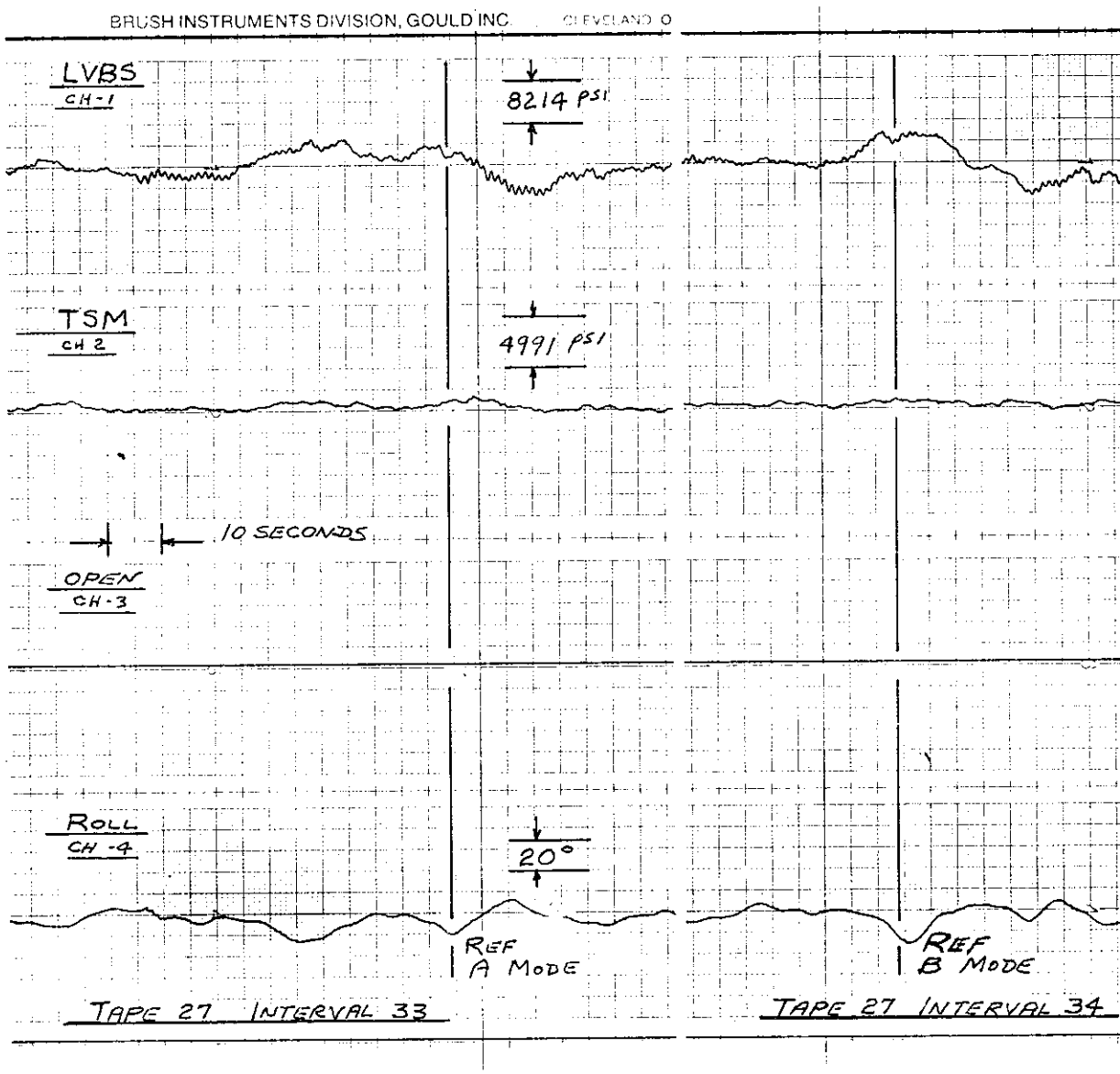


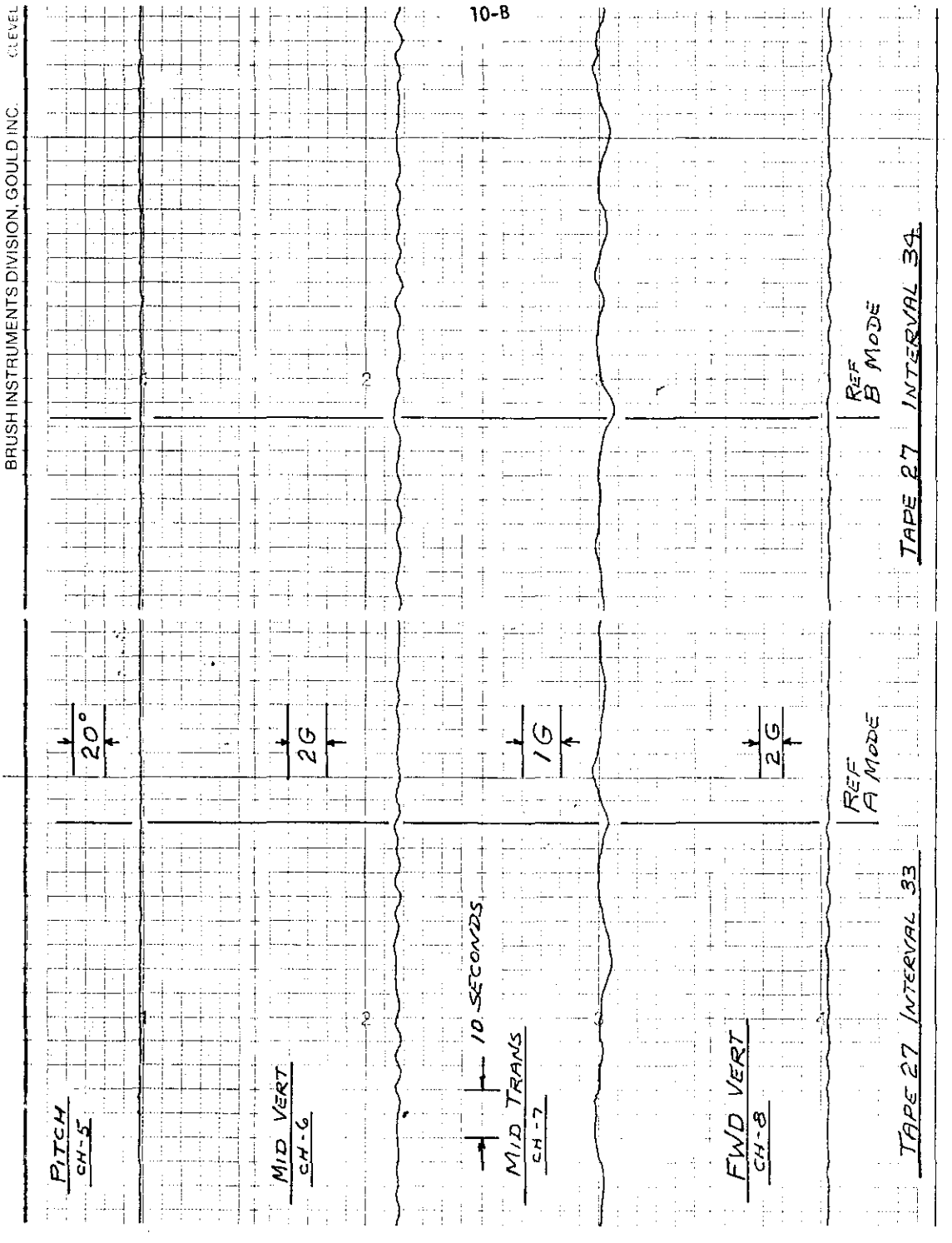
FIGURE 10

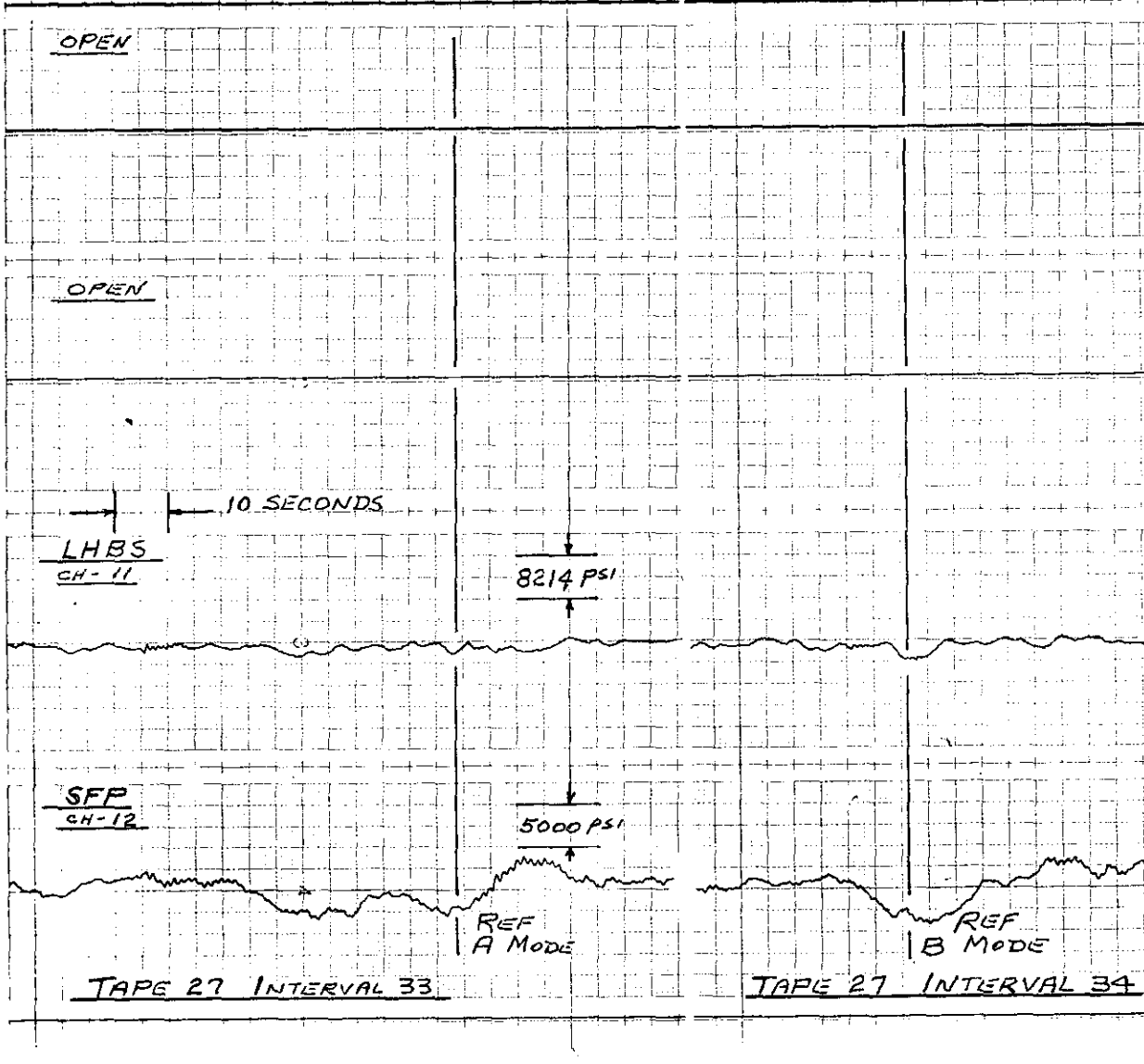
SAMPLE SIMULTANEOUS RESPONSE DATA

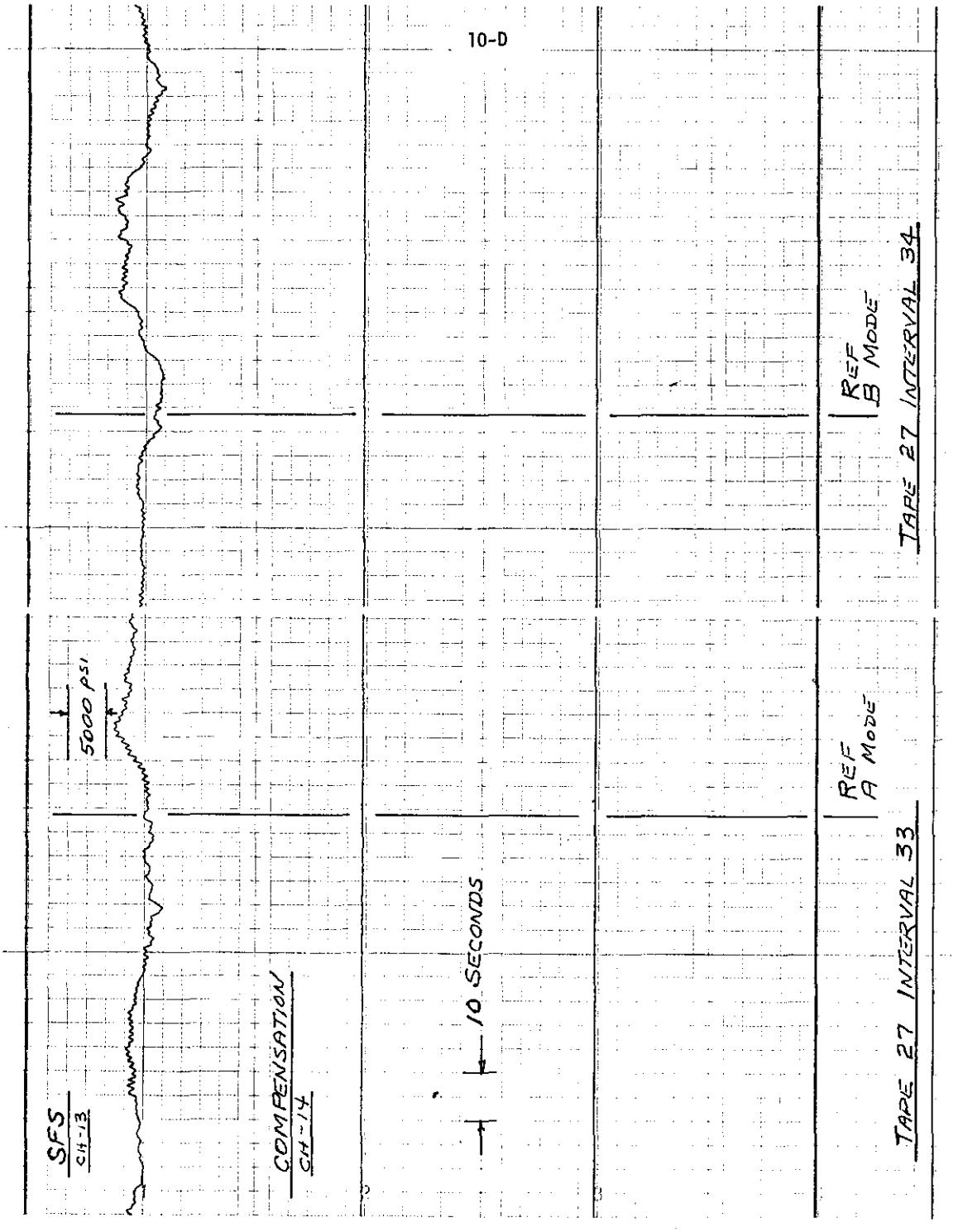
The following pages present representative simultaneous samples of all recorded signals on both tape recorders for:

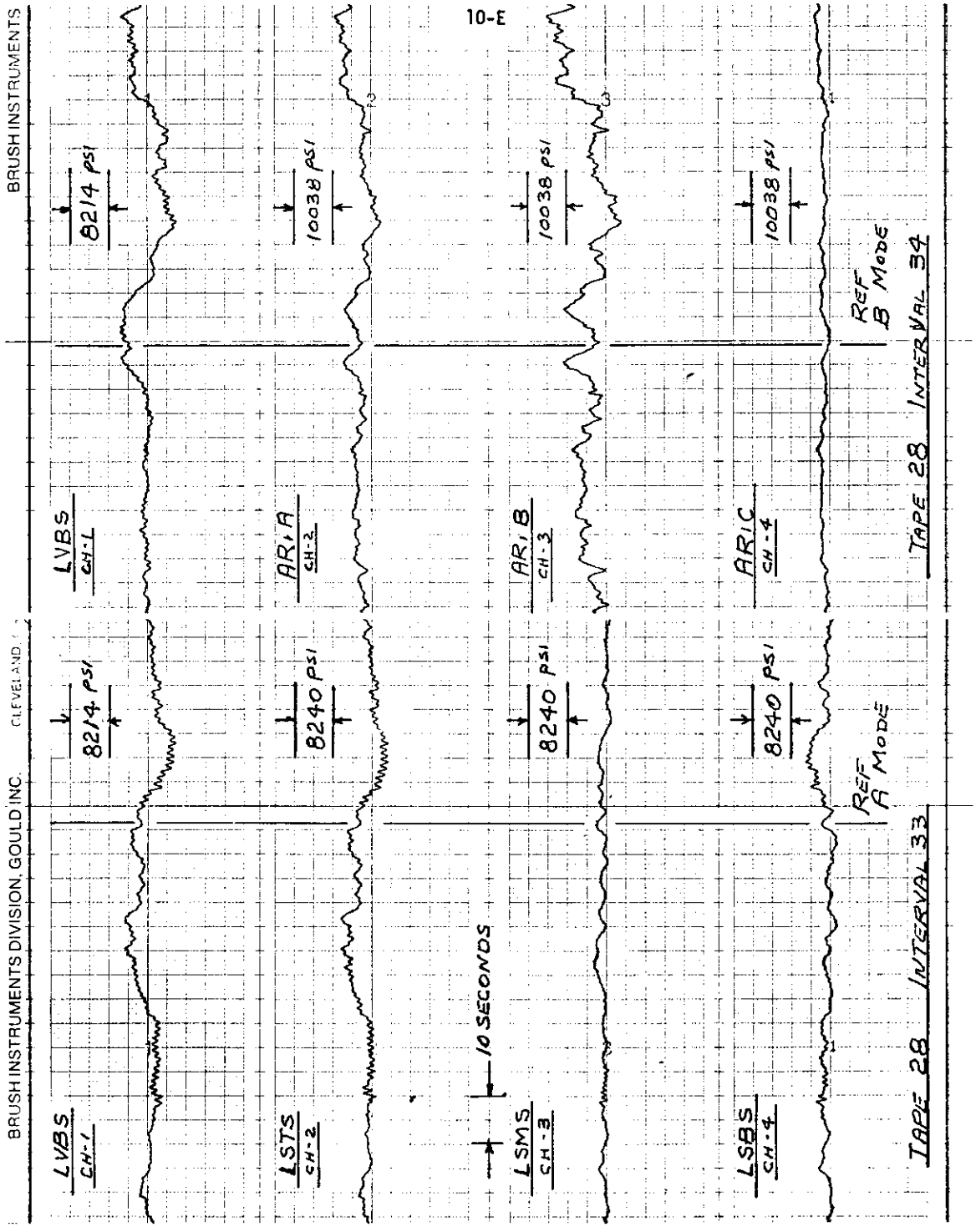
Voyage	4 Westbound
Index	26
Interval	33 ("A" Mode)
	34 ("B" Mode)
	35 ("C" Mode)
	36 ("D" Mode)
Tape	27 (Recorder No. 1)
	28 (Recorder No. 2)
Beaufort Sea State	9-10
Relative Sea Direction	Following
Ship Speed	29 Knots

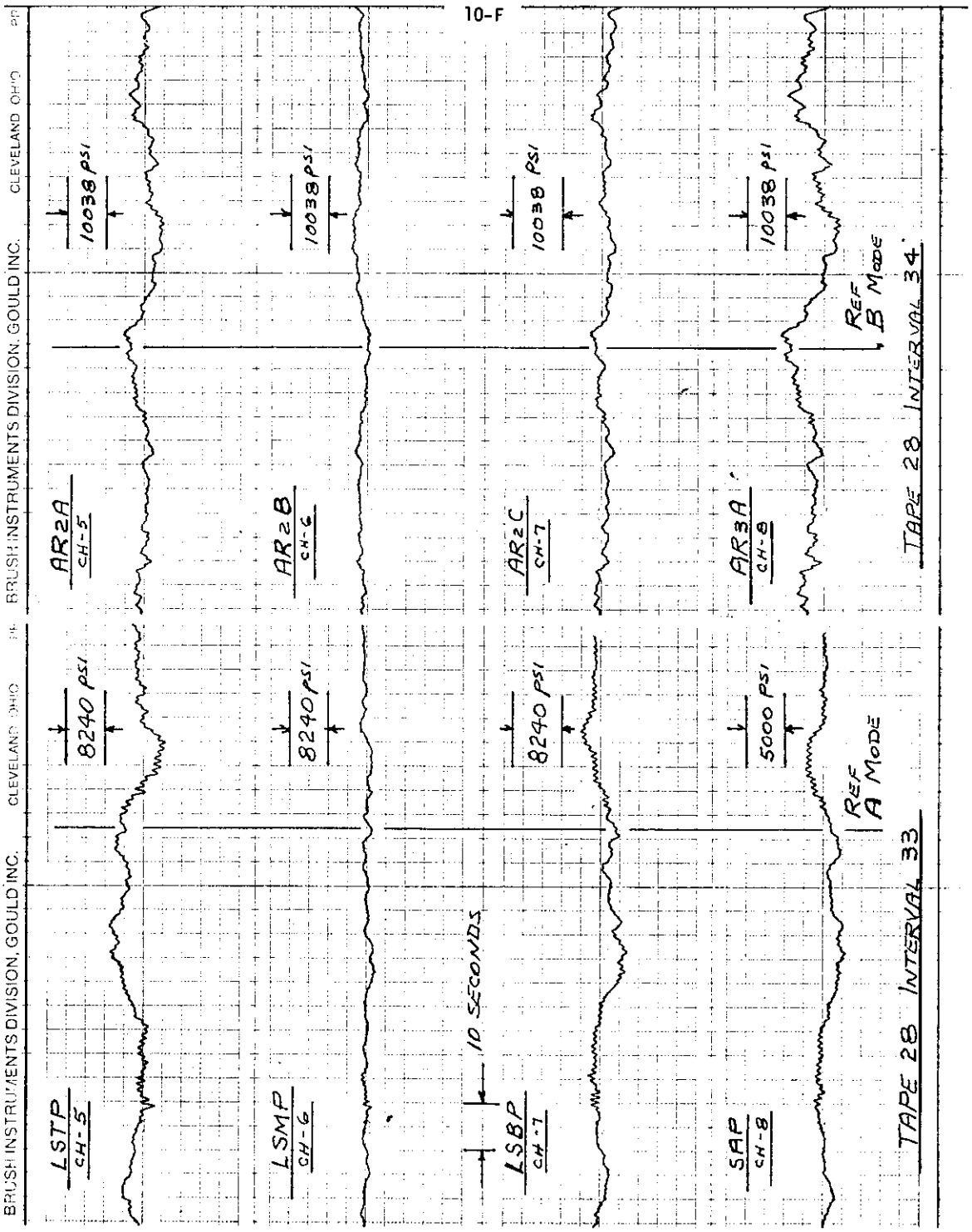

BRUSH INSTRUMENTS DIVISION, GOULD INC. CLEVELAND O
LVBS
CH-1
8214 PSI
TSM
CH 2
4991 PSI
10 SECONDS
OPEN
CH-3
ROLL
CH-4
20°
REF
A MODE
REF
B MODE
TAPE 27 INTERVAL 33
TAPE 27 INTERVAL 34

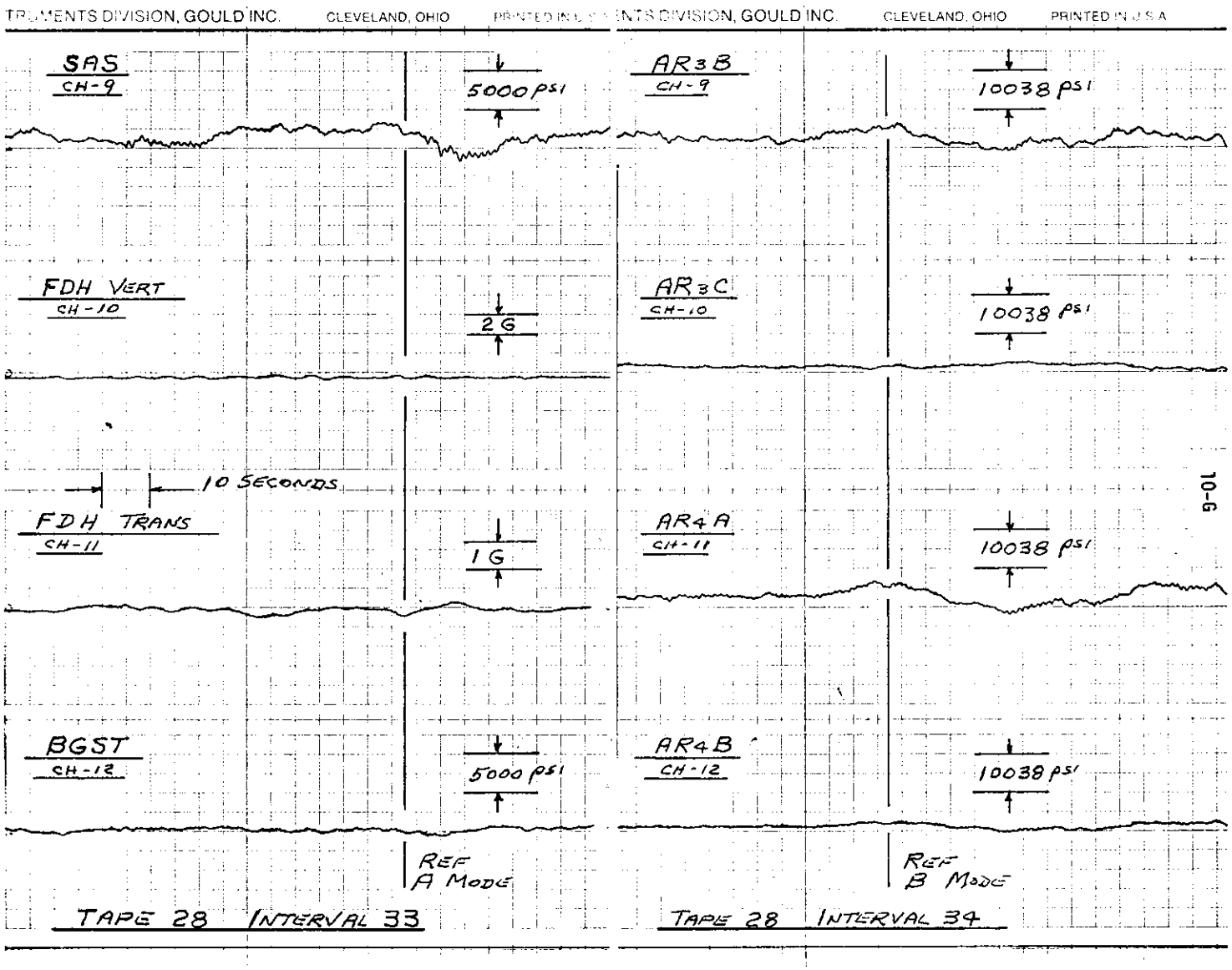

BRUSH INSTRUMENTS DIVISION, GOULD INC. CLEVEL
10-B
PITCH
CH-5
20°
MID VERT
CH-6
2G
10 SECONDS
MID TRANS
CH-7
1G
FWD VERT
CH-8
2G
REF
A MODE
REF
B MODE
TAPE 27 INTERVAL 33
TAPE 27 INTERVAL 34

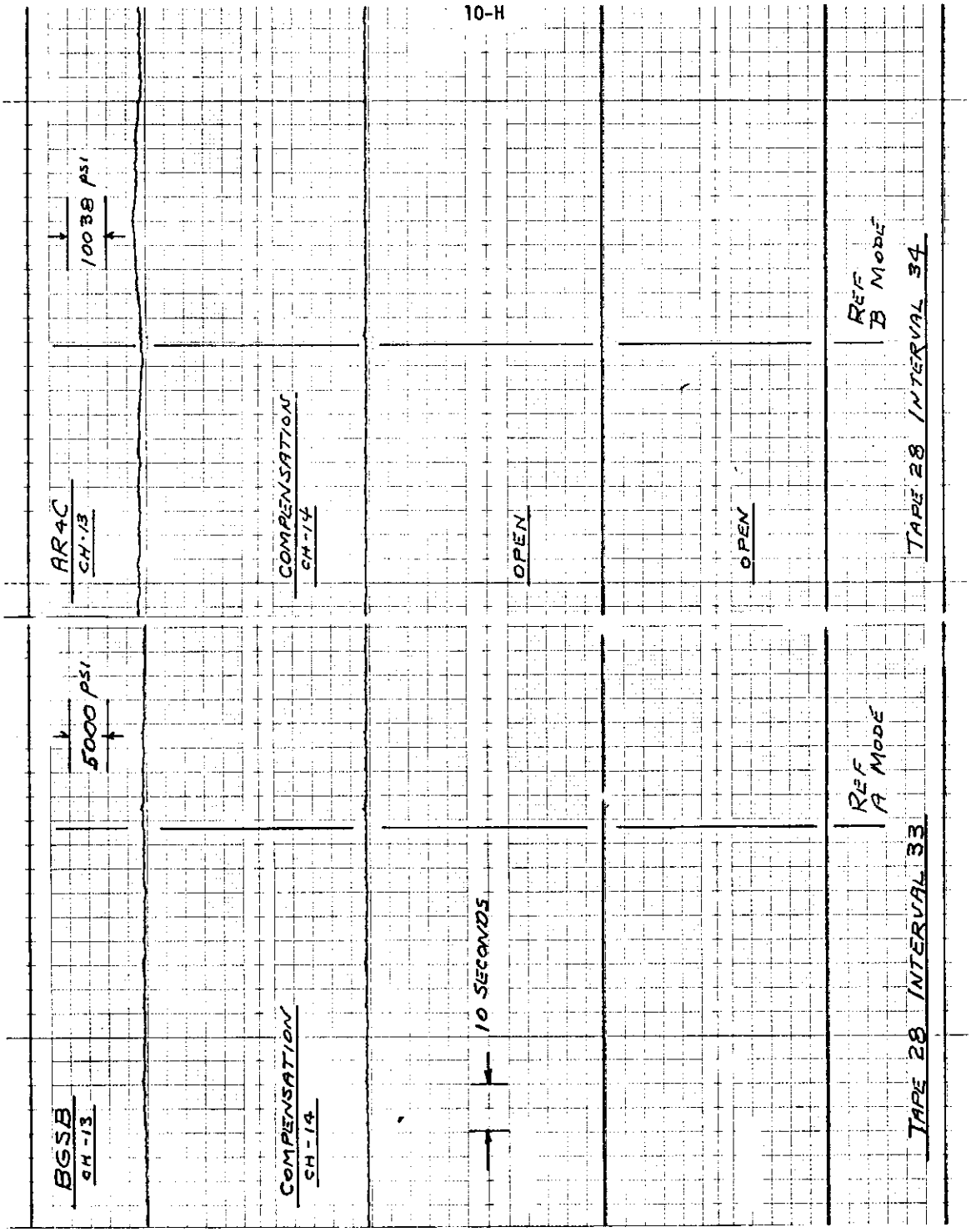

OPEN
OPEN
10 SECONDS
LHBS
CH - 11
8214 PSI
SFP
CH - 12
5000 PSI
REF
A MODE
REF
B MODE
TAPE 27 INTERVAL 33
TAPE 27 INTERVAL 34

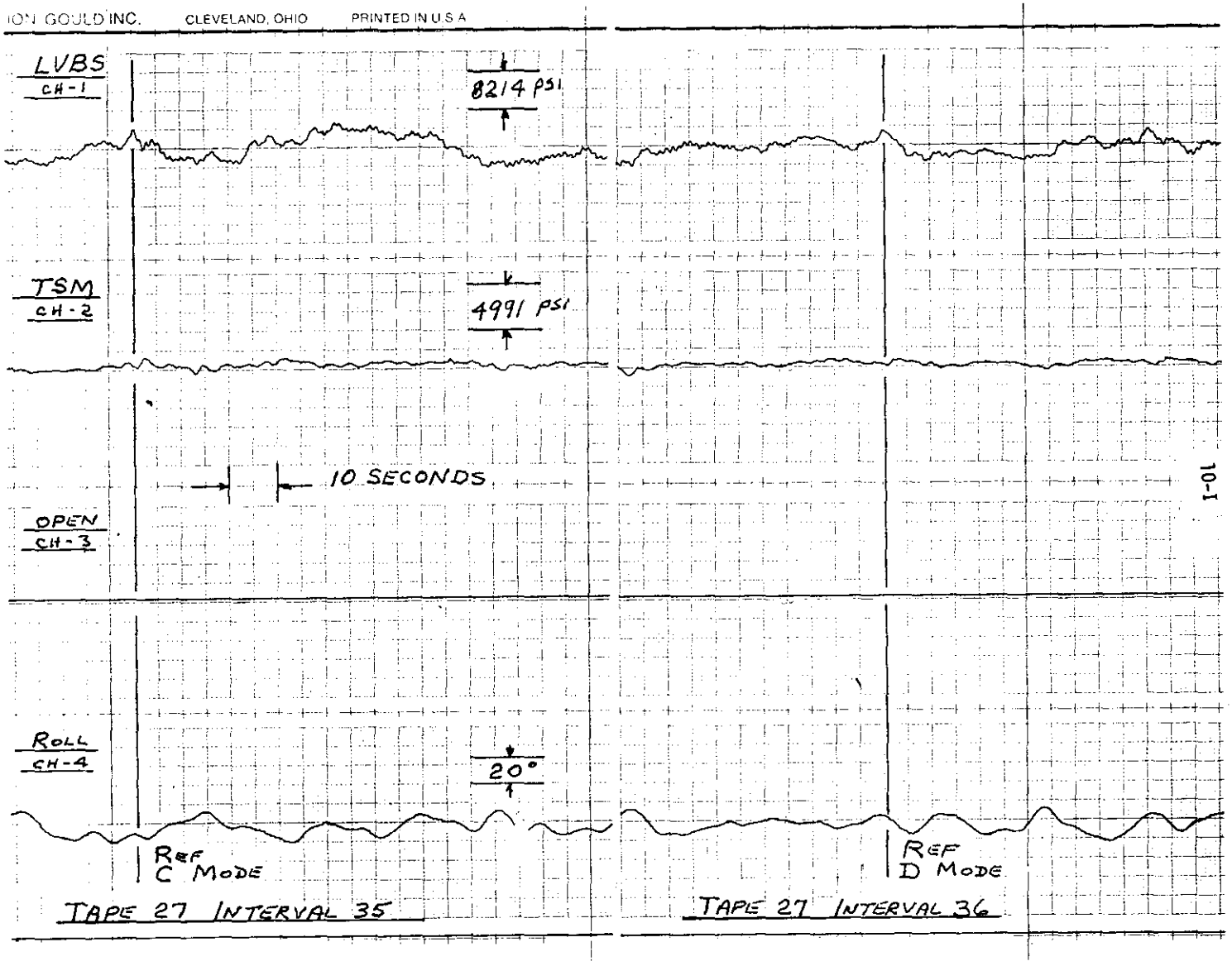

10-D
SFS
CH-13
5000 PSI
COMPENSATION
CH-14
10 SECONDS
REF
A MODE
REF
B MODE
TAPE 27 INTERVAL 33
TAPE 27 INTERVAL 34

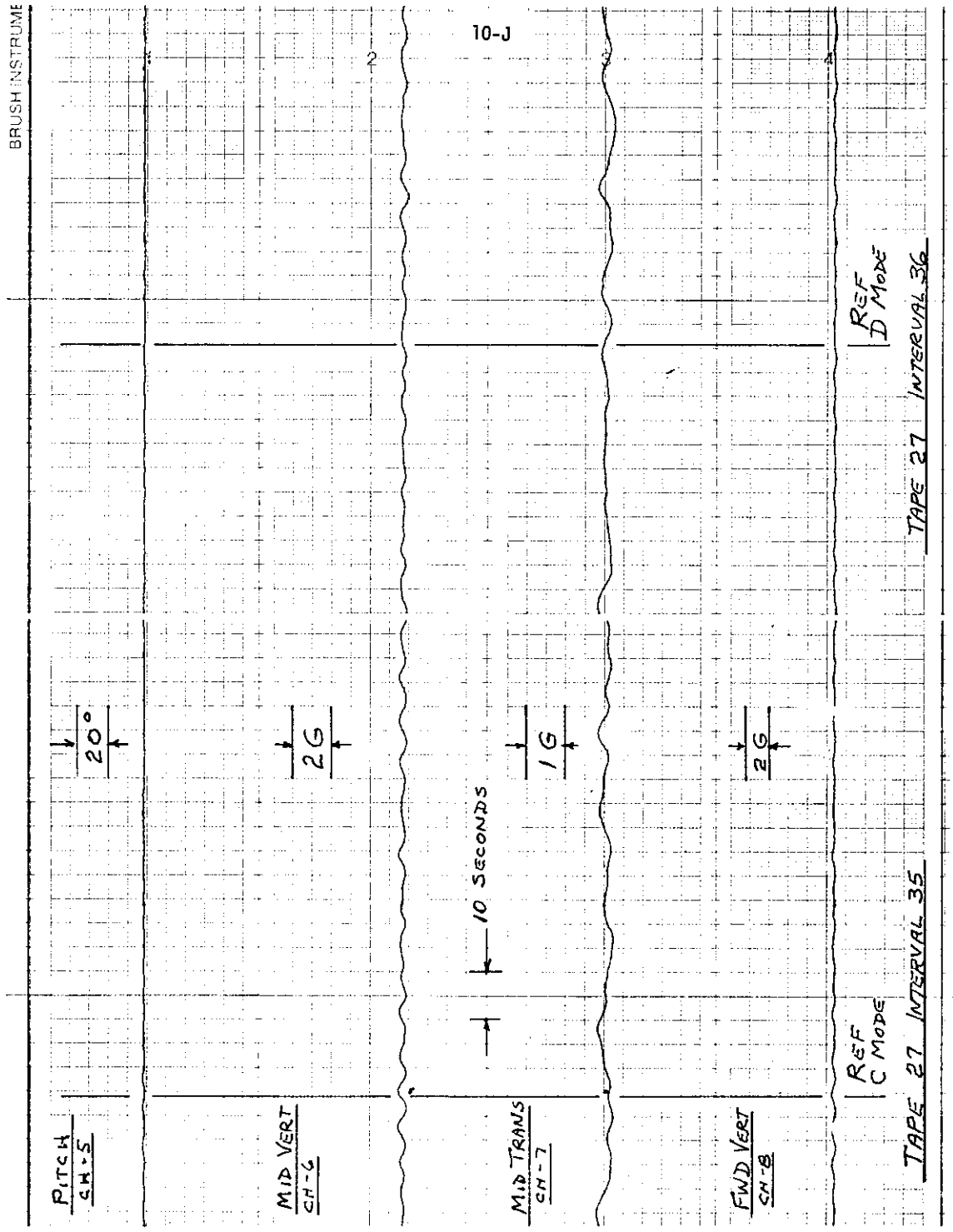

BRUSH INSTRUMENTS DIVISION, GOULD INC. CLEVELAND
BRUSH INSTRUMENTS
10-E
LVBS CH-1
8214 PSI
LVBS CH-1
8214 PSI
LSTS CH-2
8240 PSI
AR, A CH-2
10038 PSI
LSMS CH-3
8240 PSI
AR, B CH-3
10038 PSI
LSBS CH-4
8240 PSI
AR, C CH-4
10038 PSI
10 SECONDS
REF A MODE
REF B MODE
TAPE 28 INTERVAL 33
TAPE 28 INTERVAL 34

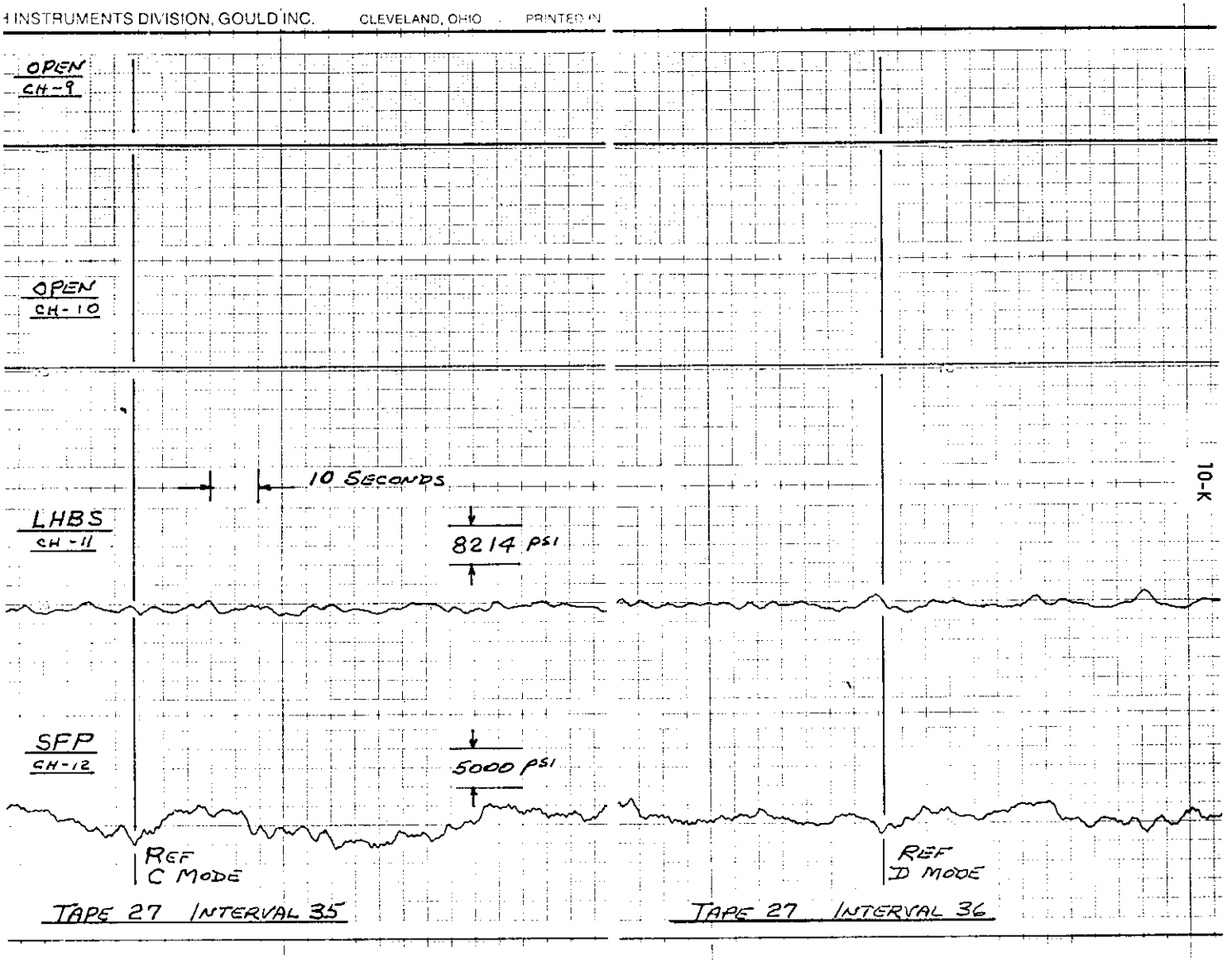

10-F
BRUSH INSTRUMENTS DIVISION, GOULD INC. CLEVELAND OHIO
BRUSH INSTRUMENTS DIVISION, GOULD INC. CLEVELAND OHIO
LSTP CH-5
8240 PSI
AR2A CH-5
10038 PSI
LSMP CH-6
8240 PSI
AR2B CH-6
10038 PSI
10 SECONDS
LSBP CH-7
8240 PSI
AR2C CH-7
10038 PSI
SAP CH-8
5000 PSI
AR3A CH-8
10038 PSI
REF A MODE
REF B MODE
TAPE 28 INTERVAL 33
TAPE 28 INTERVAL 34

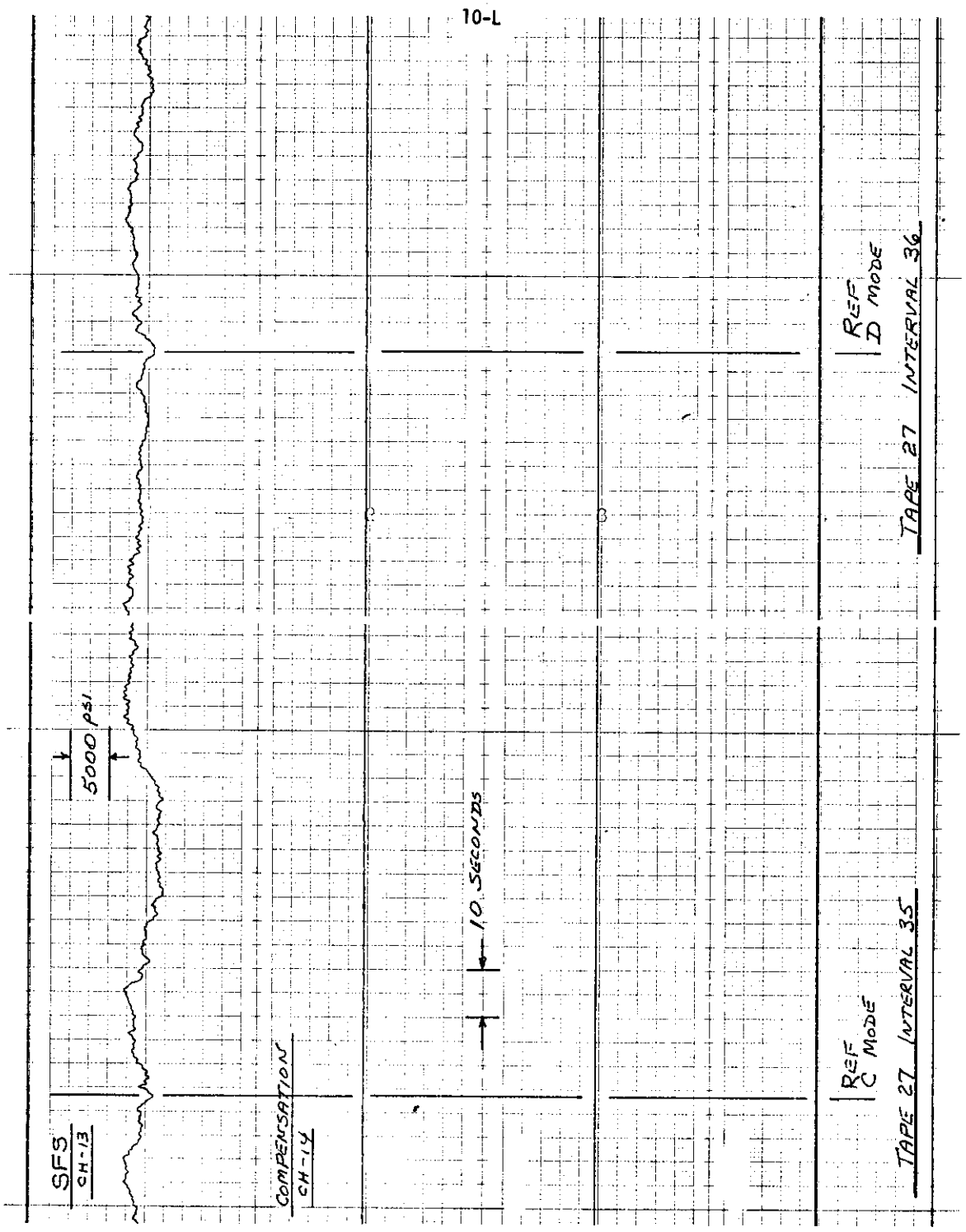

TRUMENTS DIVISION, GOULD INC. CLEVELAND, OHIO PRINTED IN U.S.A.
SAS
CH-9
5000 PSI
FDH VERT
CH-10
2 G
10 SECONDS
FDH TRANS
CH-11
1 G
BGST
CH-12
5000 PSI
REF
A MODE
TAPE 28 INTERVAL 33
NTS DIVISION, GOULD INC. CLEVELAND, OHIO PRINTED IN U.S.A.
AR3B
CH-9
10038 PSI
AR3C
CH-10
10038 PSI
AR4A
CH-11
10038 PSI
AR4B
CH-12
10038 PSI
REF
B MODE
TAPE 28 INTERVAL 34
10-6

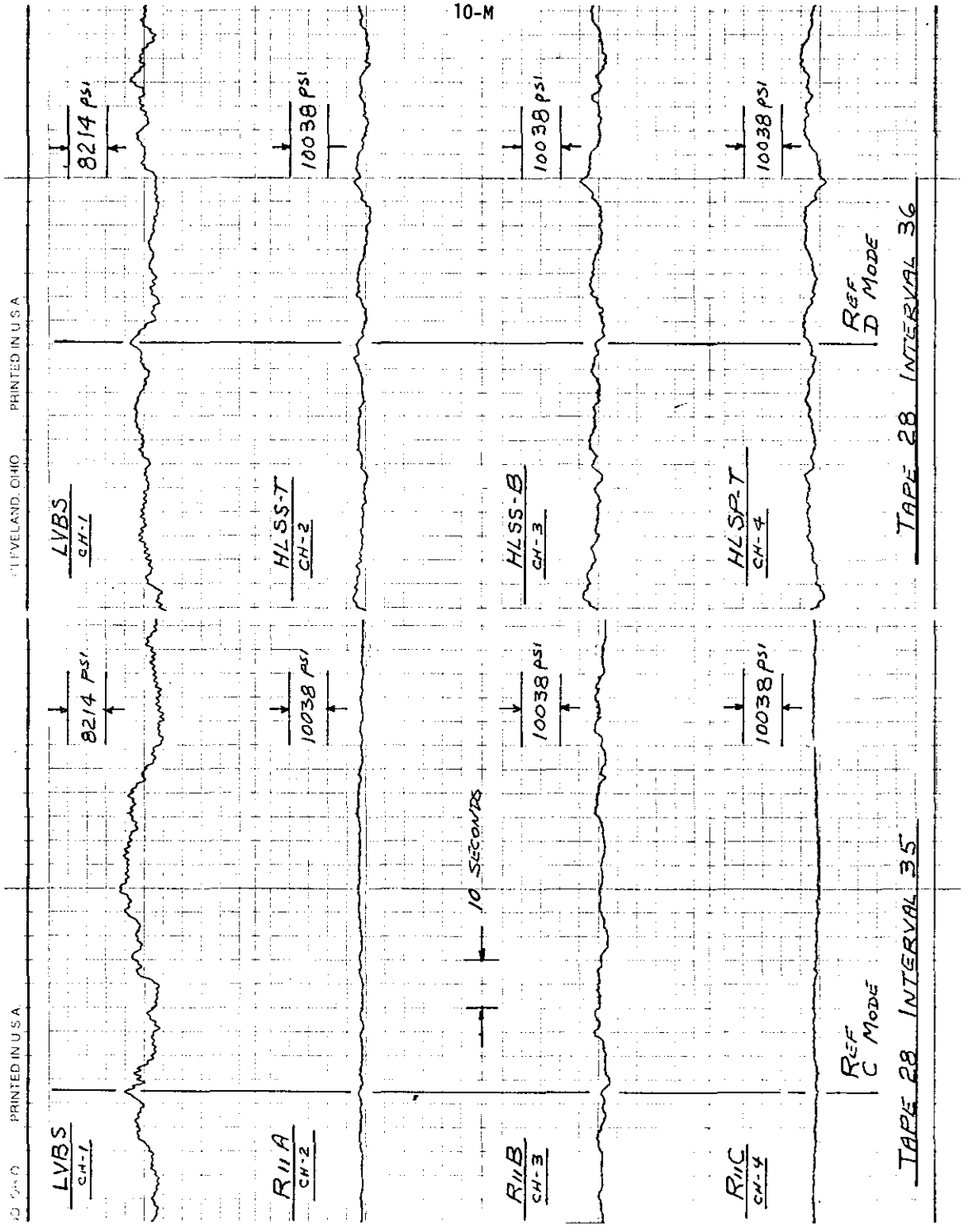

10-H
BGSB
CH-13
5000 psi
ARAC
CH-13
1038 psi
COMPENSATION
CH-14
10 SECONDS
COMPENSATION
CH-14
OPEN
OPEN
REF
A MODE
REF
B MODE
TAPE 28 INTERVAL 33
TAPE 28 INTERVAL 34

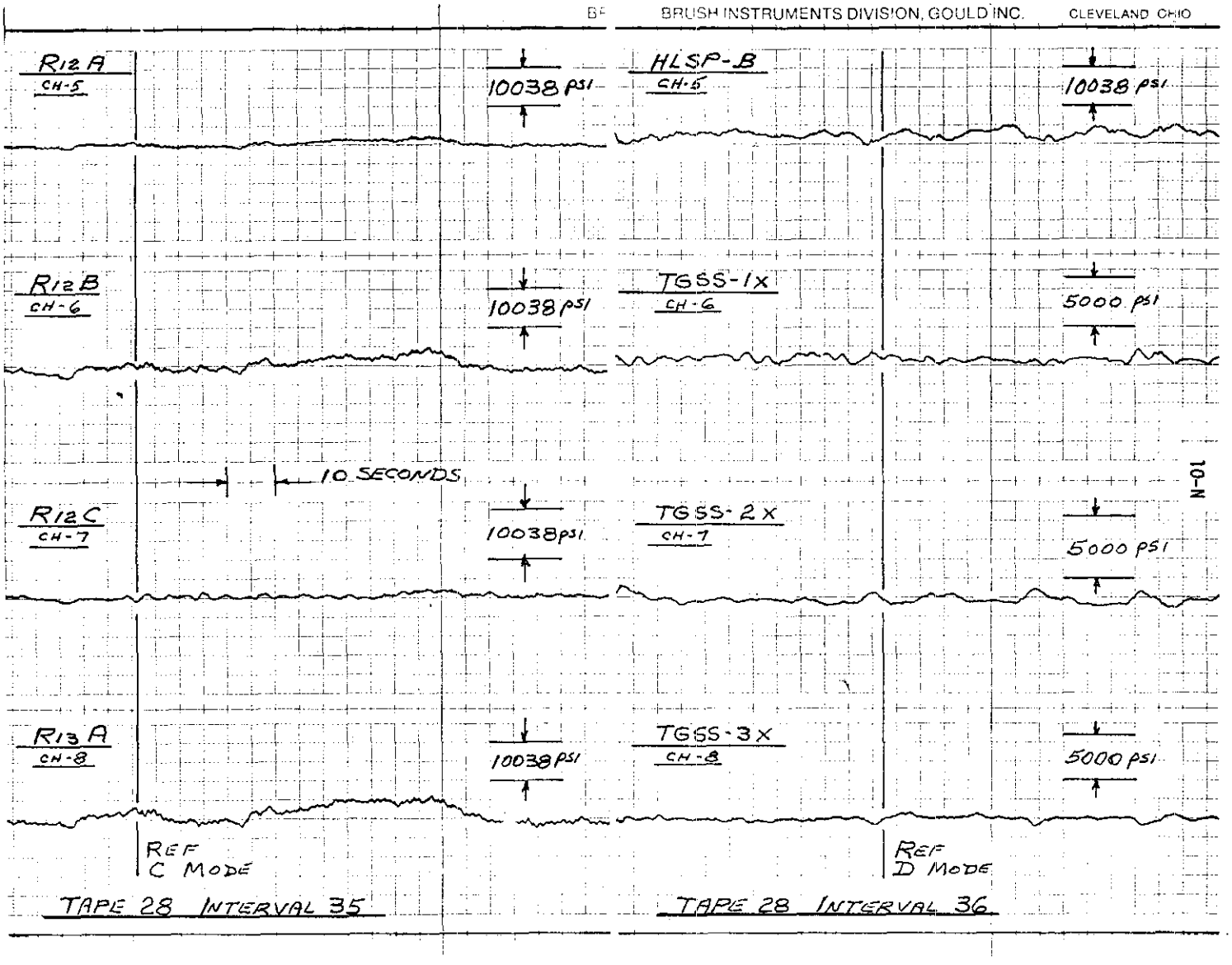

LVBS
CH-1
8214 PSI
TSM
CH-2
4991 PSI
10 SECONDS
OPEN
CH-3
ROLL
CH-4
20°
REF
C MODE
REF
D MODE
TAPE 27 INTERVAL 35
TAPE 27 INTERVAL 36

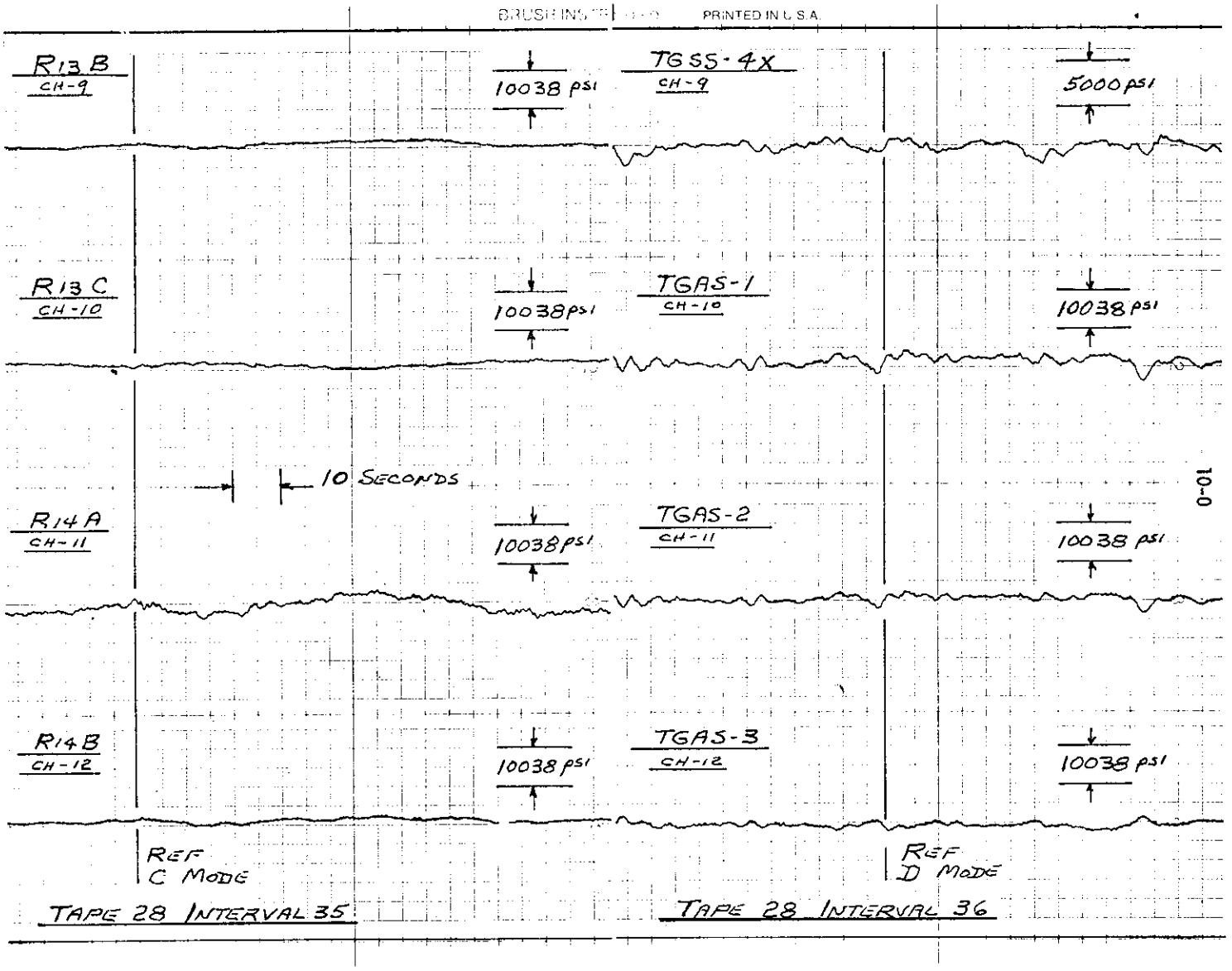

BRUSH INSTRUME
10-J
PITCH
CH-5
20°
MID VERT
CH-6
2G
MID TRANS
CH-7
1G
FWD VERT
CH-8
2G
10 SECONDS
REF
C MODE
REF
D MODE
TAPE 27 INTERVAL 35
TAPE 27 INTERVAL 36

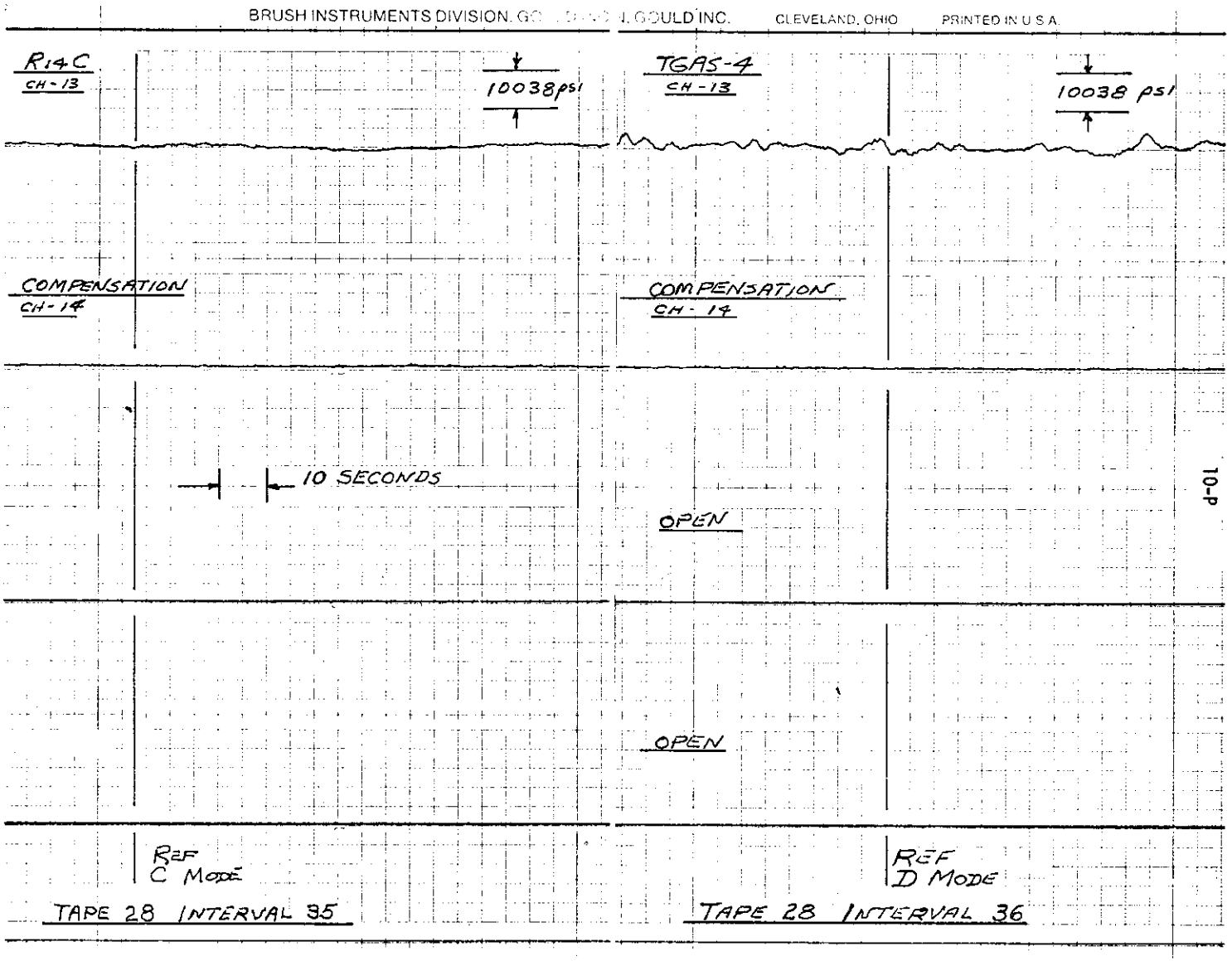

INSTRUMENTS DIVISION, GOULD INC. CLEVELAND, OHIO PRINTED IN
OPEN
CH-9
OPEN
CH-10
10 SECONDS
LHBS
CH-11
8214 PSI
SFP
CH-12
5000 PSI
REF
C MODE
REF
D MODE
TAPE 27 INTERVAL 35
TAPE 27 INTERVAL 36
10-K


10-L
SFS
CH-13
5000 PSI
COMPENSATION
CH-14
10 SECONDS
REF
C MODE
TAPE 27 INTERVAL 35
REF
D MODE
TAPE 27 INTERVAL 36


10-M
LVBS
CH-1
8214 PSI
HLSS-T
CH-2
10038 PSI
HLSS-B
CH-3
10038 PSI
HLSP-T
CH-4
10038 PSI
10 SECONDS
REF
C MODE
REF
D MODE
TAPE 28 INTERVAL 35
TAPE 28 INTERVAL 36
PRINTED IN U.S.A.
CLEVELAND, OHIO


BRUSH INSTRUMENTS DIVISION, GOULD INC. CLEVELAND OHIO
R12A
CH-5
10038 PSI
HLSP-B
CH-5
10038 PSI
R12B
CH-6
10038 PSI
TGSS-1X
CH-6
5000 PSI
10 SECONDS
R12C
CH-7
10038 PSI
TGSS-2X
CH-7
5000 PSI
10-N
R13A
CH-8
10038 PSI
TGSS-3X
CH-8
5000 PSI
REF
C MODE
REF
D MODE
TAPE 28 INTERVAL 35
TAPE 28 INTERVAL 36


BRUSH INSTRUMENTS PRINTED IN U.S.A.
R13B
CH-9
10038 PSI
TGSS-4X
CH-9
5000 PSI
R13C
CH-10
10038 PSI
TGAS-1
CH-10
10038 PSI
10 SECONDS
10-0
R14A
CH-11
10038 PSI
TGAS-2
CH-11
10038 PSI
R14B
CH-12
10038 PSI
TGAS-3
CH-12
10038 PSI
REF
C MODE
REF
D MODE
TAPE 28 INTERVAL 35
TAPE 28 INTERVAL 36


BRUSH INSTRUMENTS DIVISION, GOULD INC. CLEVELAND, OHIO PRINTED IN U.S.A.
R14C
CH-13
10038 psi
TGAS-4
CH-13
10038 psi
COMPENSATION
CH-14
COMPENSATION
CH-14
10 SECONDS
OPEN
OPEN
REF
C MODE
REF
D MODE
TAPE 28 INTERVAL 35
TAPE 28 INTERVAL 36
10-P

gages recorded on Recorder No. 2. The maximum peak-to-trough combined values were scaled from oscillograph records for each interval on Voyage 4, separated into sets by Beaufort Number, and the maximas averaged and plotted. Figures 11-A and 11-B present the results from this process. For general comparison, the averaged results from the Longitudinal Vertical Bending (LVB), the Longitudinal Horizontal Bending (LHB), and the Torsional Shear Midship (TSM) stress gages have been plotted against Beaufort Number in Figure 12. These results are from the wave-induced digitized data.

6. Wave Height Radar Data

As part of the continuing effort to obtain accurate information as to the exact nature of the waves incident to the vessel, a wave height radar system was installed aboard the SEA-LAND McLEAN. The output, in the form of a slant range signal, is provided for recording on Channel 3 of Recorder No. 1. The antenna for the device is at the bridge level on the outboard starboard side. The signal, of course, contains components of ship motions. Figure 13 compares the slant range signal with Vertical Bending Stress, Bow Vertical Acceleration, and Roll Sensor outputs.

7. Torsional Response Data

The simultaneous waveforms have been used to develop data plotted in Figure 14, which shows the relationships between strains at the upper corners of the midship transverse girder, and overall midship torsional shear.

8. Simultaneous Comparison of Longitudinal Gages

Figure 15 illustrates the set of instantaneous values from the six longitudinal stress gages as functions of their locations. This figure is designed to be comparable to similar figures presented in the calibration report (Reference 3) for static conditions.

IV. DISCUSSION OF DATA

The following discussion is based on the data presented from the first season. In some cases points are discussed which are the results of observations made during the calibration experiment (Reference 3).

Many relationships can be inferred from the data presented. It is the objective of this discussion to explore some of the more salient features of the ship's response characteristics. No attempt has been made to summarize or correlate all available data. Various forms of data summaries have been used to indicate the behavior of the signals originally recorded on analog tape. Oscillographic display of the magnetic tape data results in time histories from which instantaneous comparisons, waveform analyses, and other manual studies can be performed. The manual studies include a table (IX) of maximum values for Voyage 4. In addition, eight channels of all data from Recorder No. 1 have been digitized, summarized, and parametric studies performed, as mentioned above.

Due to the mass of data collected, it is not possible to publish an all-inclusive summary of results which will not lose some features of the data. Selected analyses

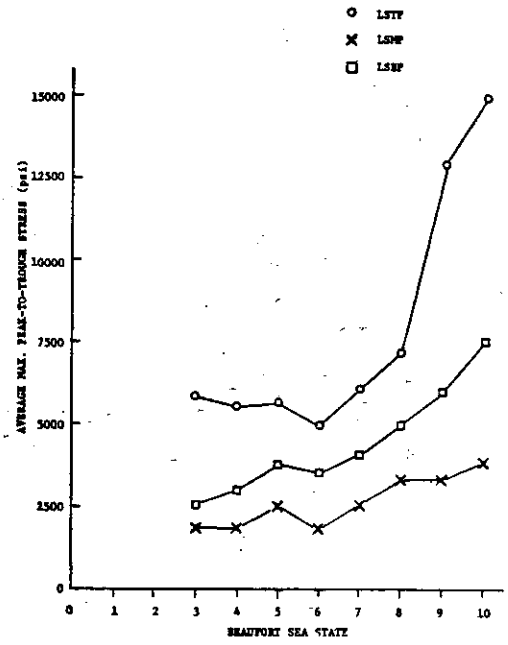


FIGURE 11-A

Port Longitudinal Gages
Average Values - Voyage 4

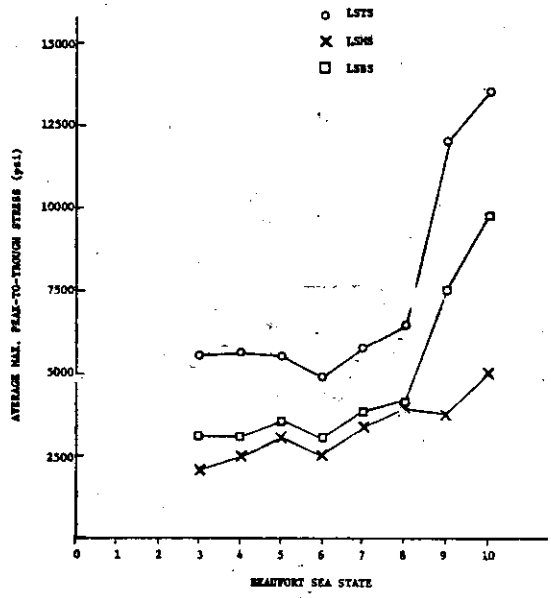


FIGURE 11-B

Starboard Longitudinal Gages
Average Values - Voyage 4

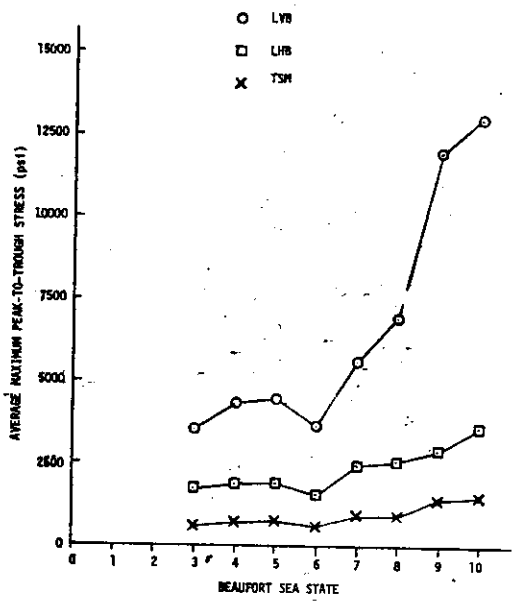
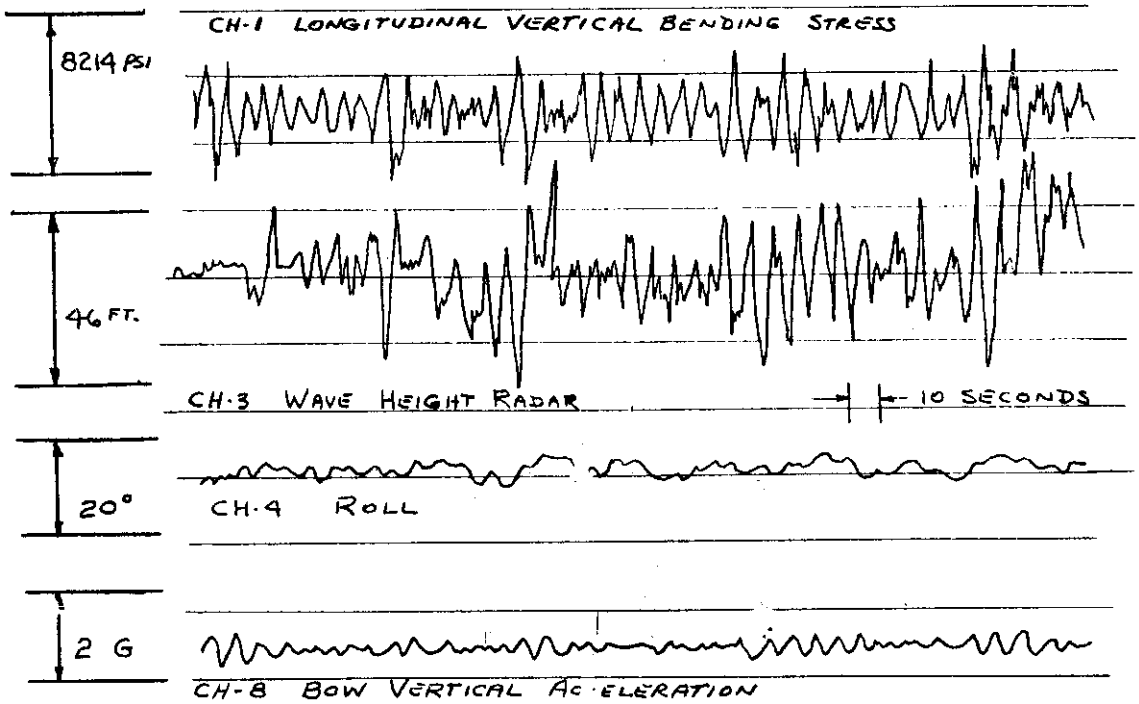


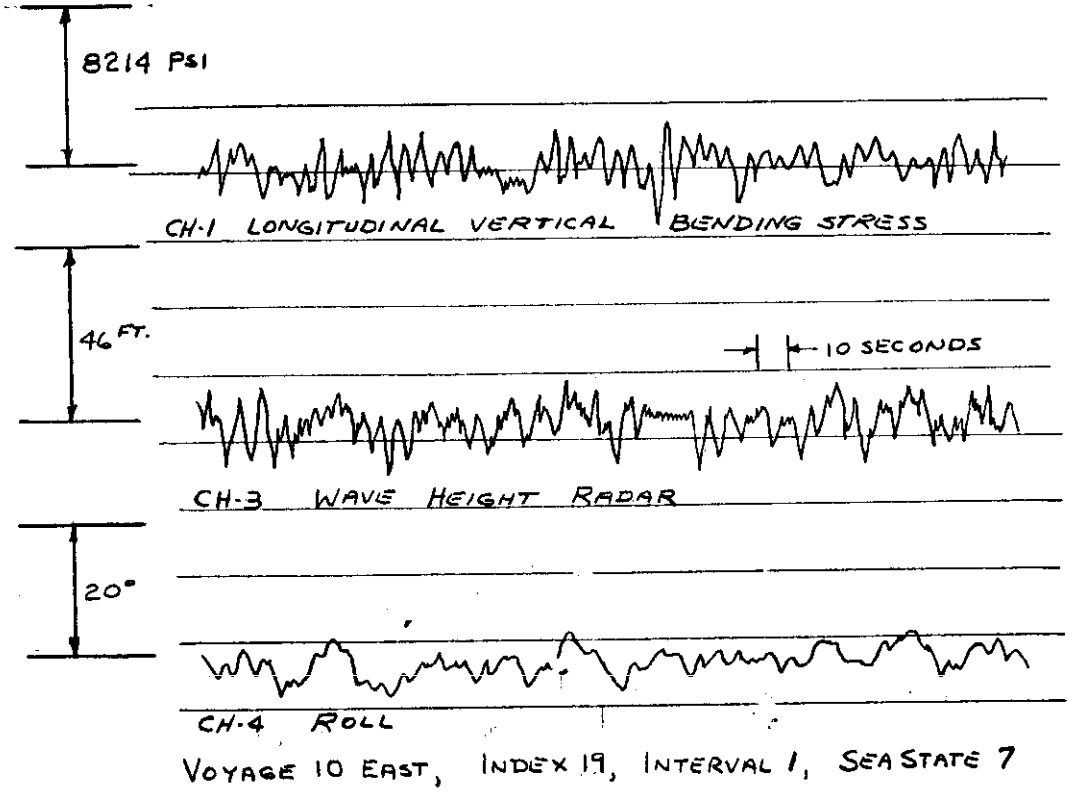
FIGURE 12

AVERAGE MAXIMUM HULL STRESS VALUES
VOYAGE 04



VOYAGE 10 WEST, INDEX 22, INTERVAL 18, SEA STATE 9

Figure 13-A - Sample Wave Height Outputs



VOYAGE 10 EAST, INDEX 19, INTERVAL 1, SEA STATE 7

Figure 13-B - Sample Wave Height Outputs

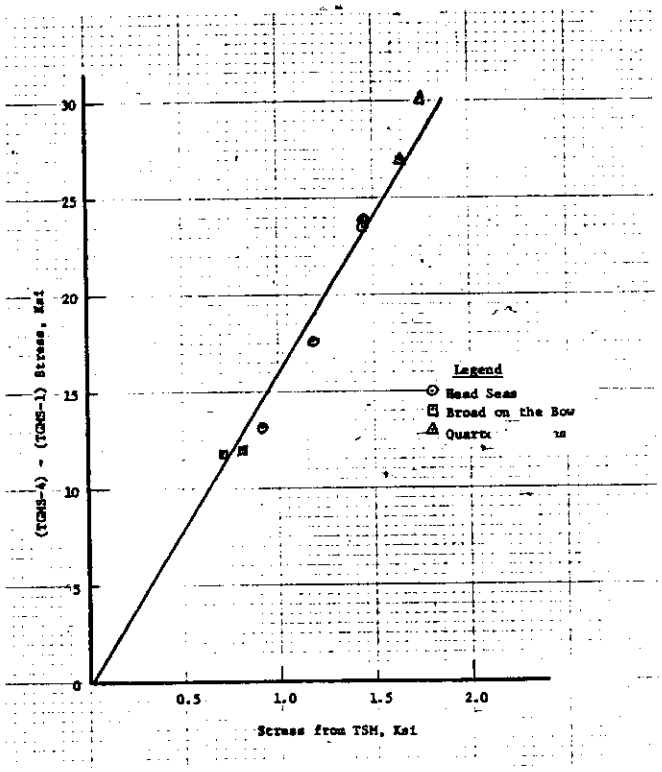


Figure 14 - Comparison Between Midship Torsional Shear and Horizontal Bending of Midship Transverse Girder.

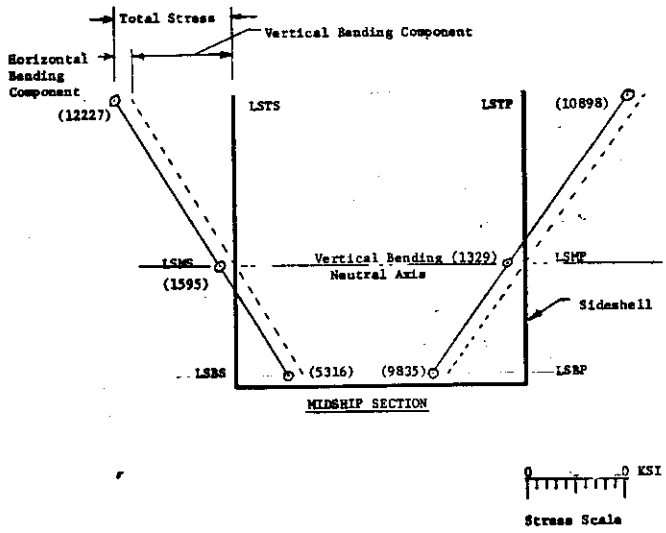


Figure 15 - Instantaneous Seaway Data from Midship Longitudinal Gages.

desired data or format in future reports or, if the need is pressing, to issue appropriate supplemental reports.

A. Voyage 4 Simultaneous Response Data

As indicated by Figure 6, no sea conditions in excess of those corresponding to Beaufort 9 were encountered during eastbound voyages, and only two indexes had Beaufort Numbers of 9. In either direction the most commonly reported Beaufort Number was 4, whereas the median value was 5. During westbound voyages Beaufort Numbers of 9 and 10 were reported about equally. Westbound voyages are, therefore, used for high-sea-state, instantaneous data presentations. Voyage 4 had the highest average and peak sea states. It was, therefore, used to provide simultaneous response data for signals assigned to Tape Recorder No. 2 for Figures 7, 8, 9, and 10.

Figures 7, 8, 9, and 10 present recorded high sea state response data for head, broad-on-the-bow, quartering, and following relative sea conditions. Ship speed is reduced from about 30 knots to about 20 knots in the head and broad-on-the-bow cases.

As expected, the most obvious difference between the four sets of data is the period of the wave-induced (long period, low frequency) responses. In the head or broad-on-the-bow data, the 8-9 second wave encounter period is obvious along with the constant 0.8 Hz first-mode structural frequency. For the quartering or following sea cases, a much larger and less well defined wave-induced stress period is present along with the 0.8 Hz first mode response. The magnitude of the peak-to-trough longitudinal vertical bending stress (LVB) is dependent on and approximately equal for similar sea state numbers.

1. Head Seas

An example of slamming is exhibited during Interval 17 (Mode A) of Tape 25 (head sea). A fairly clean hogging stress is followed by sagging and high first mode stresses. The first mode stresses gradually decrease over a period of 40 seconds. Vertical accelerations at the midship and forward deckhouse accelerometers are also evident and closely follow the vertical bending stress curve. At the same instant there are similarly shaped but opposite longitudinal stresses in the top and bottom hull sideshell gages (LSTP, LSBP, LSTS, LSBS, all on Recorder No. 2, both port and starboard) with virtually no stress exhibited at the vertical bending neutral axis (LSMP and LSMS). The bottom stresses are lower than those measured by the top gages because they are closer to the neutral axis.

The small differences, port to starboard, between the respective midship top, neutral axis (mid) and bottom sideshell gage outputs are due to horizontal longitudinal bending components. This component, along with the longitudinal warping stress, also contributes to the nonzero output of the mid sideshell gages. Neutral axis shear gages (SAP and SAS) show similar responses with the opposite polarity (due to the port and starboard wiring convention).

Another example of slamming is shown near the reference lines of the "B" Mode (Interval 18) of the same tape. In this case the aft rosette responses are monitored on Recorder No. 2. Although AR-1 and AR-2 are located in similar positions but opposite sides, they nevertheless exhibit dissimilar responses in magnitude for the longitudinal and transverse gages (elements A and C, respectively).

In comparing the diagonal gage outputs, however, it should be kept in mind that these elements are parallel to each other and are not symmetric about the ship's longitudinal centerline.

It is interesting to note that although the response period of these gages is similar to that of the longitudinal vertical bending stress gages, their peaks are more rounded and the waveform lags the bending sensor output slightly. The largest output for this gage group is exhibited by the longitudinal element of AR-4 which is located in the starboard longitudinal tunnel top. It reflects the longitudinal bending stress at this location.

Intervals 19 and 20 (Modes "C" and "D" of the same index) present similar sea conditions and similar responses on the respective Recorder No. 1 sensors. The longitudinal element of rosette R1 (located aft of the forward house) exhibited the largest stress of the rosettes in this group. Second largest was the longitudinal element of the similarly placed gage on the opposite (starboard) side. Virtually identical stresses were measured by the diagonal element of this gage and the longitudinal element of the gage located in the tunnel top (R3). A still lower stress was present in the longitudinal element of the outboard tunnel top gage (R4). To summarize, the line load seems to be dropping off towards the outboard sides with the forward house a significant factor in the transmission of bending stresses.

Only moderate stresses were recorded in the mid and aft transverse girder corners (in the transverse direction). It is interesting to note that response exhibited by the mid girder gages are predominantly wave-induced, while the aft responses contain obvious first-mode components. The tensile stresses on the forward plate of the transverse girder, coupled with compressive stresses on the aft (bulkhead) plate, indicate a horizontal bending mode. Notice also that the midship torsional shear sensor indicates some small torsional stresses of a similar shape.

2. Broad-on-the-Bow Seas

On the whole, the major characteristics of ship responses to this condition are similar to that for head seas. Vertical bending stress is somewhat reduced while torsional shear, horizontal bending, and roll are slightly increased. The pronounced first-mode slamming stresses are gone from the sample record.

All of the remaining sensor records are at or below the levels for the head sea conditions. Although both sets of intervals were recorded at Sea State 10, the present set is followed by a Sea State 9, and it is possible that the sea state had, in fact, moderated to a small degree. Other studies of the overall Voyage 4 data indicate that the maximum peak-to-trough stresses are very strong functions of sea state for levels of eight, and above. This may well explain the reduction in stress magnitude. Logbook entries of the observer for this Index indicate spray over the ship but no slamming. This is probably the result of the reduction in sea state and not the change in relative sea direction.

3. Quartering Seas

The most obvious characteristic of the quartering and following sea conditions is the long-period wave-induced responses. Another striking difference is the indicated roll $\pm$ 13 degrees in Interval 13 ("A" Mode). This is accompanied by virtually no pitch or vertical acceleration, but significant transverse acceleration in phase with the roll. In this case the longitudinal neutral axis stress midships is not negligible, but is composed primarily of horizontal bending. Note

the out-of-phase relationship port and starboard, and the similarity to the longitudinal horizontal bending stress sensor output. It should be noted that although torsional stresses may contribute to this signal, the period of the torsional shear sensor output is different from that exhibited by the neutral axis or horizontal bending sensors.

Of the aft rosettes only the diagonal element of AR-1 (port side, near hatch cutout) showed significant strains, probably due to its being aligned with a stress trajectory from the aft house around the hatch opening.

The measured roll period does not correlate to the vertical or horizontal bending or torsion sensors. Roll does, however, correspond generally to the forward hull longitudinal strain sensors (HLSP/T-T/B).

Only small stresses were recorded for mid and aft transverse girders. The forward and aft signals seem to be uniformly out of phase.

4. Following Seas

The sample record presented for the following sea condition has a higher associated sea state than the preceding quartering condition. Many more instances of first-mode excitation are present on all traces. In general, the peak-to-trough stress levels are higher than for the quartering sea case. This is due, however, to the increased sea state rather than the relative sea direction. (A later section in this discussion will present data to affirm this assertion.)

Another characteristic of this data set is the nonperiodic nature of most output traces. This feature makes comparisons of phase behavior among the responses difficult.

The vertical bending sensor shows some evidence of slamming (a relatively clean hogging moment followed by first-mode excitation and an increasing sagging moment.) As would be expected from the following seas, very little torsional shear is present. Roll motions were significant at 20 degrees peak-to-trough. This trace is not a smooth sinusoid as in the case of the quartering sea, but reflects a continuous forcing function application without a steady state or decaying component.

Although virtually no pitch is present, a midship vertical acceleration in excess of 0.1g (peak-to-trough) was present, indicating a heaving translation. A decoupled (i.e., not at the same or harmonic frequency) transverse acceleration component of about 0.4g peak-to-trough was also exhibited. The horizontal bending signal correlates reasonably well with the roll angle. It can also be seen that the forward shear sensors correspond closely to the midship longitudinal stress sensors (available only in the "A" mode) including phase, indicating that these shears are generated mainly by overall vertical bending.

A large (approximately 20 Ksi, peak-to-trough) stress was again present in the diagonal element of the port,aft rosette (AR-1). However, there again was no correspondence between the longitudinal and lateral elements of this gage and the symmetrically placed elements on the starboard side. This may be due to the nature of the cargo loading. If the net load in each hold has a port or starboard component the static and dynamic effect of this offset may be to induce these types of stresses.

Gages located in the longitudinal tunnel exhibit the largest stress in the longitudinal direction both forward (gages R-13 and R-14) and aft (gages AR-3 and AR-4). In all cases these stress outputs closely follow the midship vertical bending sensor output.

B. Extreme Variations with Sea State

All maximum peak-to-trough values (combined wave-induced and vibratory) of the six longitudinal stress sensors have been averaged for each Beaufort Number of Voyage 4 and plotted in Figures 11-A and 11-B. In addition, Figure 12 shows similar averages for the LVB, LHB, and TSM transducers taken from the digitized wave-induced records. In all cases, each average contains all ship speeds and relative wave directions.

Average vertical bending and individual midship longitudinal stresses (port and starboard, top and bottom) all increase with increasing sea state. However, at Beaufort Numbers of eight and above, they increase at a faster rate. This situation does not seem to hold for the Torsional Shear Midship or Longitudinal Horizontal Bending sensors. The midship longitudinal neutral axis gages (port and starboard), which see the combined horizontal bending and restraint-of-torsional-warping stresses, similarly do not exhibit the marked stress increase above Beaufort 8. It is therefore probable that the vertical bending stress increases are real and not due to a systematic error in Beaufort Number estimation.

The stresses measured by the six longitudinal gages include components from vertical, horizontal, and torsional loads. The values for the neutral axis pair (X's in Figures 11-A and 11-B) are relatively insensitive to vertical bending, however, so the moderate increase with increasing Beaufort Number must be an indication of increasing horizontal and/or torsional loads. This is confirmed by inspection of Figure 12, which shows an equally moderate increase in those components. The fact that the individual stresses at the bottom on each side are consistently lower than the comparable deck stresses is because of the location of the neutral axis at about 44% of the depth, measured up from the baseline. The significantly higher values for vertical bending at Beaufort Numbers above eight are probably the result of the existence of waves, or combinations of waves and swells, considerably higher and longer than those observed at the lower sea states. Inspection of the logbook data for Voyage 4 in Appendix 4 shows many intervals of reduced speed operation with pitching and slamming noted.

C. Sample Wave Height Signals

Two intervals of wave height radar outputs are presented in Figure 13. This instrument measures the slant range from a position on the forward house to the ocean surface at a constant relative bearing. A minimum of two corrections are required in order to correlate these data to the wave height. Although the angle between the ship's vertical axis and the radar transmission axis is constant, ship's roll alters the angle between the transmission axis and the ocean surface. This, in turn, changes the slant range. In addition, the vertical height above the ocean changes due to pitching and heaving. This also changes the slant range. Some of the required correction signals are available from the instrumentation system. Roll angle can be utilized directly. A double integration of the forward vertical acceleration signal will yield the change in vertical height of the radar from any reference level.

In reviewing the output traces of the wave height radar some correlation can be seen between the roll and radar output. Although this correlation could be due to the waves affecting the ship's roll, it is probable that the reverse is true; the roll is affecting the measured wave height. A lesser correspondence is seen between the vertical acceleration and the radar output. In some instances, however, the periods of these two signals coincide.

(This discussion has ignored the second-order effect on true wave height from changes in angular relationships due to the accelerometers being mounted in the strap-down configuration.)

D. Torsional Stress Indicators

One of the conclusions of the Calibration Report (see Reference 3), is that the midship transverse girder gages (TGMS) are a more sensitive indicator of torsional loading than the midship torsional shear sensor (TSM). Seaway data provide an additional reinforcement of this assertion. Figure 14 presents a plot of the torsional shear sensor output against a measure of the horizontal bending in the midship transverse girder. Each point represents a randomly-selected peak-to-trough stress reading with ordinate and abscissa values taken at the same instant in time. The data from which these points were drawn represent the higher sea states. The difference between the signals from the upper (fore and aft) corner gages in the transverse girder is taken as the measure of horizontal bending in the girder. Since the output of these gages is 180 degrees out of phase, their algebraic difference results in their absolute values being additive. A pure horizontal bending component is thus generated with twice the sensitivity of a single gage. (This bending results in an "S" curved transverse girder with the ends at each longitudinal tunnel acting as fixed.)

It can be seen from Figure 14 that the horizontal bending stress generated in the transverse girder is higher, by a factor of approximately 16, than the corresponding torsional shear stress for all sea directions.

E. Midship Longitudinal Gages

The odd behavior of the six midship longitudinal stress gages during the calibration experiment (see Reference 3) raised some questions as to the correctness of the instrumentation system with regard to these gages. Seaway data can be used to verify their proper operation under the assumed conditions.

Figure 15 presents a plot of the output from these six midship gages for an instant in time. A head-sea condition was chosen so as to minimize the torsional contribution to longitudinal stress which cannot easily be separated from the horizontal contribution. As shown in the figure, the stresses are well behaved and what one would expect of a vertical bending condition with a small horizontal component. This representation is typical of that which was observed in many instances for the seaway data. It thus affirms the proper operation and configuration of these gages.

F. Parametric Studies (Appendix 3)

To aid in the interpretation of the results of the parametric studies (which are, in effect, a presentation of the entire season's data from eight of the most important transducers), the plots and tables from the Longitudinal Vertical Bending (LVB) stress data will be considered in some detail.

Figure B-1 is a "dot-plot" of the RMS stress value from the LVB transducer by Beaufort Number for the entire season. There are 2,078 points shown. The great scatter in each Beaufort Number is caused by the fact that these points are from all relative wave directions and all ship speeds. Figure B-2 has been plotted from these basic data points analyzed into five classifications of ship speed. The classification nomenclature is given in Table B-II, and in all of the Tables B-III through B-XXXIV at the end of Appendix B. Again, the average values given for each ship speed also contain some range of relative wave direction. Figure B-2 shows that the highest mean values of RMS vertical bending stress were measured at Beaufort 10, at ship speeds between 20 and 25 knots. Note that at the next higher speed range the stresses were lower at the highest Beaufort Numbers, which is probably due to predominantly quartering or following seas. There are no reported cases of operation at full speed at Beaufort Numbers higher than 9.

Figure B-3 is a similar classification of the data by relative wave direction. The values for Beaufort 10 (which contain a range of ship speeds as shown in B-2) indicate that the highest stresses were experienced in head seas, the next highest at relative wave directions from 31 to 60 degrees, and the next highest in quartering seas. Beam seas produced the lowest vertical bending stresses at Beaufort Numbers 8 and above.

Figures B-4 through B-6 are organized in the same way except that they present the distributions of the maximum peak-to-trough stress variations. The stress amplitudes scales are doubled, but the general distributions are the same.

The tables following these figures in Appendix B present the basic data for the figures, and, in addition, the standard deviation of the mean values. These provide a measure of the scatter of the data.

Some brief comments can be made concerning the results of these parametric studies:

1. Horizontal bending stress is much lower than vertical bending stress, and is less sensitive to variations in ship speed and relative wave direction, although quartering seas appear to contribute significantly to higher stresses at Beaufort 10.

2. Torsional Shear Midship is even lower, with less scatter at Beaufort 9 and 10. Quartering seas are a factor at Beaufort 10.

3. Forward Shear Port and Starboard results are essentially the same. The largest shearing stress variations occurred at Beaufort 8, in broad-on-the-bow and quartering seas.

4. The Roll results show more rolling at higher Beaufort Numbers with higher speeds. Quartering and beam seas cause the most rolling. A maximum dynamic roll of $\pm$ 18° was recorded at Beaufort 10.

5. The maximum pitching angle was $\pm$ 2.5 degrees at Beaufort 9. The most pitching occurred at head seas, the least at beam, quartering, and following.

6. The Forward Acceleration (Vertical) showed a maximum of $\pm$ 0.45 g. Highest values were recorded in head seas.

V. POSSIBLE DATA FORMATS

This report presents data in a number of forms, those which seemed most appropriate for an overall survey of the data from the first season. Included are expanded time-histories, logbook tabulations, tabulations of maximum values scaled from compressed time-histories, and plots derived from parametric studies of digitized response and logbook data. Also available, but too voluminous for publication, are tabulations of response and logbook data for each interval, all season, for all eight digitized transducers. As a guide for the consideration of possible expansion, modification, or deletion of these data formats, Figure 16 has been prepared to indicate the various possible data presentation formats.

Of the formats illustrated, all but the spectral computations and manual tabulations of logbook data have been used in this report. From the standpoint of relative cost the manual formats shown at the top of the figure are least costly, but are cumbersome where a number of transducers are to be compared. An expanded time-history is essential for the instantaneous comparisons, since the digital data from different transducers have no common time base once a specific interval is defined.

Digitizing the data is relatively expensive, both in man-hours and in computer costs, but this method has great advantages for rapid tabulations and plots of both logbook and response data. At present the data is filtered so that RMS and maximum values are computed from essentially pure wave-induced response, for comparison with design data derived on the same basis. Vibratory components from slamming or other excitations are retained in the basic digitized record of 12,000 data points from 20 minutes of each 30-minute interval. Spectral computations are made from this record.

In considering decisions on data formats, the basic questions concerning the information desired should be formulated in terms of choice of instantaneous vs. statistical data, a few samples under specified condions vs. the entire season, need for future use of the same data, one transducer or many, and so forth, in order to arrive at a rational decision balancing information desired against cost.

VI. SUMMARY

The first season of data acquisition from the S.S. SEA-LAND McLEAN was a successful one. This report has presented a large amount of data with brief discussions and evaluations. As additional data are acquired during the second season, and the first season data is analyzed more completely, a comprehensive picture of the structural behavior of this unique class of vessel will emerge.

VII. ACKNOWLEDGEMENTS

A program as complex as this can succeed only with the cooperation of many people and organizations. Thanks are due specifically to Mr. John W. Boylston of Sea-Land Service, Inc., and to the officers and crew of the S.S. SEA-LAND McLEAN for all of their efforts to make our part of this work successful. Special thanks also to Teledyne engineers E. T. Booth and H. G. La Montagne for manning the ship and bringing back the data.

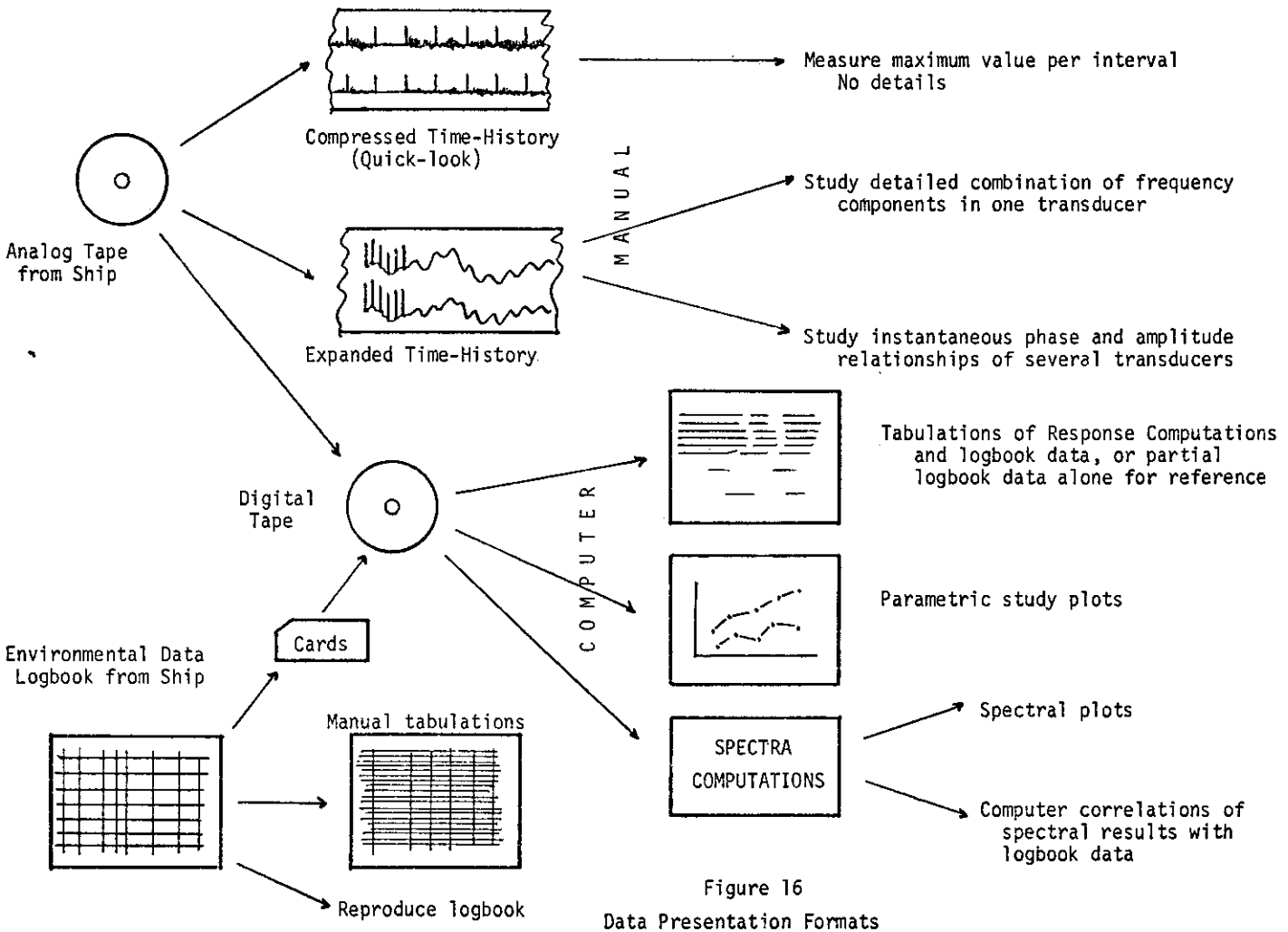


Figure 16
Data Presentation Formats

VIII. REFERENCES

1. Fain, R. A., Design and Installation of a Ship Response Instrumentation System Aboard the SL-7 Class Containership S.S. SEA-LAND McLEAN, Ship Structure Committee Report SSC-238 (SL-7-1), 1973.

2a. Johnson, A. E., Jr., Flaherty, J. A., and Walters, I. J., A Method for Digitizing, Preparing, and Using Library Tapes of Ship Stress and Environment Data, Ship Structure Committee Report SSC-236, 1973.

2b. Johnson, A. E., Jr., Flaherty, J. A., and Walters, I. J., Computer Programs for the Digitizing and Using of Library Tapes of Ship Stress and Environment Data, Ship Structure Committee Report SSC-237, 1973.

3. Boentgen, R. R., and Wheaton, J. W., Static Structural Calibration of Ship Response Instrumentation System Aboard the S.S. SEA-LAND McLEAN, Ship Structure Committee Report SSC-263 (SL-7-7), 1976.

APPENDIX A

Partial Listing of Logbook Data
First Season
S.S. SEA-LAND McLEAN

Nomenclature

VOY = Voyage number, East or West

TP = Analog magnetic tape number

INT = Data interval number

IDX = Logbook index number

DATE = Month/Day/Year

Time = GMT

SPD = Ship speed, knots

BN = Observed Beaufort Number (appearance of sea)

RWVD = Relative Wave Direction (degrees, Port or Stbd)

A-1

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RWVD	WEATHER	COMMENTS
01W	01	001	001	10/08/72	2000		02	052S	OCAST	SLOW SPEED
01W	01	002	001	10/08/72	2000		02	052S	OCAST	SLOW SPEED
01W	01	003	001	10/08/72	2000		02	052S	OCAST	SLOW SPEED
01W	01	004	001	10/08/72	2000		02	052S	OCAST	SLOW SPEED
01W	01	005	002	10/08/72	2400	31.0	02	065S	PTCDY	
01W	01	006	002	10/08/72	2400	31.0	02	065S	PTCDY	
01W	01	007	002	10/08/72	2400	31.0	02	065S	PTCDY	
01W	01	008	002	10/08/72	2400	31.0	02	065S	PTCDY	
01W	01	009	003	10/09/72	0400	31.0	03	075P	PTCDY	
01W	01	010	003	10/09/72	0400	31.0	03	075P	PTCDY	
01W	01	011	003	10/09/72	0400	31.0	03	075P	PTCDY	
01W	01	012	003	10/09/72	0400	31.0	03	075P	PTCDY	
01W	01	013	004	10/09/72	0800	31.0	04	030P	OCAST	
01W	01	014	004	10/09/72	0800	31.0	04	030P	OCAST	
01W	01	015	004	10/09/72	0800	31.0	04	030P	OCAST	
01W	01	016	004	10/09/72	0800	31.0	04	030P	OCAST	
01W	01	017	005	10/09/72	1200	31.0	04	015S	OCAST	SHOWERS
01W	01	018	005	10/09/72	1200	31.0	04	015S	OCAST	SHOWERS
01W	01	019	005	10/09/72	1200	31.0	04	015S	OCAST	SHOWERS
01W	01	020	005	10/09/72	1200	31.0	04	015S	OCAST	SHOWERS
01W	01	021	006	10/09/72	1600	31.0	06	037S	RAIN	ROUGH SEA NNW
01W	01	022	006	10/09/72	1600	31.0	06	037S	RAIN	ROUGH SEA NNW
01W	01	023	006	10/09/72	1600	31.0	06	037S	RAIN	ROUGH SEA NNW
01W	01	024	006	10/09/72	1600	31.0	06	037S	RAIN	ROUGH SEA NNW
01W	01	025	007	10/09/72	2000	31.0	07	036S	CLDY	RAIN ROUGH SEA
01W	01	026	007	10/09/72	2000	31.0	07	036S	CLDY	RAIN ROUGH SEA
01W	01	027	007	10/09/72	2000	31.0	07	036S	CLDY	RAIN ROUGH SEA
01W	01	028	007	10/09/72	2000	31.0	07	036S	CLDY	RAIN ROUGH SEA
01W	01	029	008	10/09/72	2400	28.0	07	059S	PTCLDY	EASING
01W	01	030	008	10/09/72	2400	28.0	07	059S	PTCLDY	EASING
01W	01	031	008	10/09/72	2400	28.0	07	059S	PTCLDY	EASING
01W	01	032	008	10/09/72	2400	28.0	07	059S	PTCLDY	EASING
01W	01	033	009	10/10/72	0400	26.0	05	081S	PTCLDY	LOW SWELL
01W	01	034	009	10/10/72	0400	26.0	05	081S	PTCLDY	LOW SWELL
01W	01	035	009	10/10/72	0400	26.0	05	081S	PTCLDY	LOW SWELL
01W	01	036	009	10/10/72	0400	26.0	05	081S	PTCLDY	LOW SWELL
01W	01	037	010	10/10/72	0800	30.0	03	081S	CLEAR	MOD NNW SEA
01W	01	038	010	10/10/72	0800	30.0	03	081S	CLEAR	MOD NNW SEA
01W	01	039	010	10/10/72	0800	30.0	03	081S	CLEAR	MOD NNW SEA
01W	01	040	010	10/10/72	0800	30.0	03	081S	CLEAR	MOD NNW SEA
01W	01	041	011	10/10/72	1200	31.8	04	059S	PTCDY	
01W	01	042	011	10/10/72	1200	31.8	04	059S	PTCDY	
01W	01	043	011	10/10/72	1200	31.8	04	059S	PTCDY	
01W	01	044	011	10/10/72	1200	31.8	04	059S	PTCDY	
01W	01	045	012	10/10/72	1600	31.8	02	006P	PTCDY	
01W	01	046	012	10/10/72	1600	31.8	02	006P	PTCDY	
01W	01	047	012	10/10/72	1600	31.8	02	006P	PTCDY	
01W	01	048	012	10/10/72	1600	31.8	02	006P	PTCDY	
01W	01	049	013	10/10/72	2000	31.8	02	008P	PTCDY	
01W	01	050	013	10/10/72	2000	31.8	02	008P	PTCDY	

A-2

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RWVD	WEATHER
01W	01	051	013	10/10/72	2000	31.8	02	008P	PTCDY
01W	01	052	013	10/10/72	2000	31.8	02	008P	PTCDY
01W	01	053	014	10/10/72	2400	31.8	04	035P	PTCDY
01W	01	054	014	10/10/72	2400	31.8	04	035P	PTCDY
01W	01	055	014	10/10/72	2400	31.8	04	035P	PTCDY
01W	01	056	014	10/10/72	2400	31.8	04	035P	PTCDY
01W	01	057	015	10/11/72	0400	31.8	06	035P	CLDY RAIN
01W	01	058	015	10/11/72	0400	31.8	06	035P	CLDY RAIN
01W	01	059	015	10/11/72	0400	31.8	06	035P	CLDY RAIN
01W	01	060	015	10/11/72	0400	31.8	06	035P	CLDY RAIN
01W	01	061	016	10/11/72	0800	31.0	07	035P	CLDY RAIN
01W	01	062	016	10/11/72	0800	31.0	07	035P	CLDY RAIN
01W	01	063	016	10/11/72	0800	31.0	07	035P	CLDY RAIN
01W	01	064	016	10/11/72	0800	31.0	07	035P	CLDY RAIN
01W	01	066	017	10/11/72	1200	31.0	07	055S	OCAST
01W	01	067	017	10/11/72	1200	31.0	07	055S	OCAST
01W	01	068	017	10/11/72	1200	31.0	07	055S	OCAST
01W	01	069	018	10/11/72	1600	30.8	07	055S	PTCDY
01W	01	070	018	10/11/72	1600	30.8	07	055S	PTCDY
01W	01	071	018	10/11/72	1600	30.8	07	055S	PTCDY
01W	01	072	018	10/11/72	1600	30.8	07	055S	PTCDY
01W	01	073	019	10/11/72	2000		05	054S	PTCDY
01W	01	074	019	10/11/72	2000		05	054S	PTCDY
01W	01	075	019	10/11/72	2000		05	054S	PTCDY
01W	01	076	019	10/11/72	2000		05	054S	PTCDY
01W	03	001	020	10/11/72	2400		06	056S	PTCDY
01W	03	002	020	10/11/72	2400		06	056S	PTCDY
01W	03	003	020	10/11/72	2400		06	056S	PTCDY
01W	03	004	020	10/11/72	2400		06	056S	PTCDY
01W	03	005	021	10/12/72	0400	28.9	04	033S	PTCDY
01W	03	006	021	10/12/72	0400	28.9	04	033S	PTCDY
01W	03	007	021	10/12/72	0400	28.9	04	033S	PTCDY
01W	03	008	021	10/12/72	0400	28.9	04	033S	PTCDY
01W	03	009	022	10/12/72	0800	28.0	03	079P	CLDY
01W	03	010	022	10/12/72	0800	28.0	03	079P	CLDY
01W	03	011	022	10/12/72	0800	28.0	03	079P	CLDY
01W	03	012	022	10/12/72	0800	28.0	03	079P	CLDY
01W	03	013	023	10/12/72	1200		04	124P	PTCDY
01W	03	014	023	10/12/72	1200		04	124P	PTCDY
01W	03	015	023	10/12/72	1200		04	124P	PTCDY
01W	03	017	025	10/12/72	2000		04	023P	PTCDY
01W	03	018	025	10/12/72	2000		04	023P	PTCDY
01W	03	019	025	10/12/72	2000		04	023P	PTCDY
01W	03	020	025	10/12/72	2000		04	023P	PTCDY
01W	03	021	026	10/12/72	2400		04	022P	PTCDY
01W	03	022	026	10/12/72	2400		04	022P	PTCDY
01W	03	023	026	10/12/72	2400		04	022P	PTCDY
01W	03	024	026	10/12/72	2400		04	022P	PTCDY
01W	03	025	027	10/13/72	0400		04	033P	OCAST
01W	03	026	027	10/13/72	0400		04	033P	OCAST

A-3

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RWVD	WEATHER
01W	03	027	027	10/13/72	0400		04	033P	OCAST
01W	03	028	027	10/13/72	0400		04	033P	OCAST
01W	03	029	028	10/13/72	0800		04	047S	CLEAR
01W	03	030	028	10/13/72	0800		04	047S	CLEAR
01W	03	031	028	10/13/72	0800		04	047S	CLEAR
01W	03	032	028	10/13/72	0800		04	047S	CLEAR
01W	03	033	029	10/13/72	1200		04	047S	PTCDY
01W	03	034	029	10/13/72	1200		04	047S	PTCDY
01W	03	035	029	10/13/72	1200		04	047S	PTCDY
01W	03	036	029	10/13/72	1200		04	047S	PTCDY
02E	05	001	001	10/15/72	0400	28.7	04	086S	PTCDY
02E	05	002	001	10/15/72	0400	28.7	04	086S	PTCDY
02E	05	003	001	10/15/72	0400	28.7	04	086S	PTCDY
02E	05	004	001	10/15/72	0400	28.7	04	086S	PTCDY
02E	05	005	002	10/15/72	0800	28.7	05	136S	CLDY OCAST
02E	05	006	002	10/15/72	0800	28.7	05	136S	CLDY OCAST
02E	05	007	002	10/15/72	0800	28.7	05	136S	CLDY OCAST
02E	05	008	002	10/15/72	0800	28.7	05	136S	CLDY OCAST
02E	05	009	003	10/15/72	1200	31.4	06	134P	CLDY
02E	05	010	003	10/15/72	1200	31.4	06	134P	CLDY
02E	05	011	003	10/15/72	1200	31.4	06	134P	CLDY
02E	05	012	003	10/15/72	1200	31.4	06	134P	CLDY
02E	05	013	004	10/15/72	1600	30.8	06	134P	OCAST
02E	05	014	004	10/15/72	1600	30.8	06	134P	OCAST
02E	05	015	004	10/15/72	1600	30.8	06	134P	OCAST
02E	05	016	004	10/15/72	1600	30.8	06	134P	OCAST
02E	05	017	005	10/15/72	2000	30.9	06	156P	CLDY OCAST
02E	05	018	005	10/15/72	2000	30.9	06	156P	CLDY OCAST
02E	05	019	005	10/15/72	2000	30.9	06	156P	CLDY OCAST
02E	05	020	005	10/15/72	2000	30.9	06	156P	CLDY OCAST
02E	05	021	006	10/15/72	2400	31.8	06	156P	OCAST
02E	05	022	006	10/15/72	2400	31.4	06	156P	OCAST
02E	05	023	006	10/15/72	2400	31.4	06	156P	OCAST
02E	05	024	006	10/15/72	2400	31.4	06	156P	OCAST
02E	05	025	007	10/16/72	0400	31.7	06	156P	OCAST
02E	05	026	007	10/16/72	0400	31.7	06	156P	OCAST
02E	05	027	007	10/16/72	0400	31.7	06	156P	OCAST
02E	05	028	007	10/16/72	0400	31.7	06	156P	OCAST
02E	05	029	008	10/16/72	0800	31.6	07	134P	OCAST
02E	05	030	008	10/16/72	0800	31.6	07	134P	OCAST
02E	05	031	008	10/16/72	0800	31.6	07	134P	OCAST
02E	05	032	008	10/16/72	0800	31.6	07	134P	OCAST
02E	05	033	009	10/16/72	1200	32.2	07	123P	OCAST
02E	05	034	009	10/16/72	1200	32.2	07	123P	OCAST
02E	05	035	009	10/16/72	1200	32.2	07	123P	OCAST
02E	05	036	009	10/16/72	1200	32.2	07	123P	OCAST
02E	05	037	010	10/16/72	1600	32.0	08	100P	OCAST
02E	05	038	010	10/16/72	1600	32.0	08	100P	OCAST
02E	05	039	010	10/16/72	1600	32.0	08	100P	OCAST
02E	05	040	010	10/16/72	1600	32.0	08	100P	OCAST

A-4

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER
02E	05	041	011	10/16/72	2000	32.6	04	078P	CLDY
02E	05	042	011	10/16/72	2000	32.6	04	078P	CLDY
02E	05	043	011	10/16/72	2000	32.6	04	078P	CLDY
02E	05	044	011	10/16/72	2000	32.6	04	078P	CLDY
02E	05	045	012	10/16/72	2400	32.4	03	078P	CLDY
02E	05	046	012	10/16/72	2400	32.4	03	078P	CLDY
02E	05	047	012	10/16/72	2400	32.4	03	078P	CLDY
02E	05	048	012	10/16/72	2400	32.4	03	078P	CLDY
02E	05	049	013	10/17/72	0400	32.3	04	033P	PTCDY
02E	05	050	013	10/17/72	0400	32.3	04	033P	PTCDY
02E	05	051	013	10/17/72	0400	32.3	04	033P	PTCDY
02E	05	052	013	10/17/72	0400	32.3	04	033P	PTCDY
02E	05	053	014	10/17/72	0800	32.0	04	034S	CLDY
02E	05	054	014	10/17/72	0800	32.0	04	034S	CLDY
02E	05	055	014	10/17/72	0800	32.0	04	034S	CLDY
02E	05	056	014	10/17/72	0800	32.0	04	034S	CLDY
02E	07	001	015	10/17/72	1200	32.1	04	034S	PTCDY
02E	07	002	015	10/17/72	1200	32.1	04	034S	PTCDY
02E	07	003	015	10/17/72	1200	32.1	04	034S	PTCDY
02E	07	004	015	10/17/72	1200	32.1	04	034S	PTCDY
02E	07	005	016	10/17/72	1600		04	034S	PTCDY
02E	07	006	016	10/17/72	1600		04	034S	PTCDY
02E	07	007	016	10/17/72	1600		04	034S	PTCDY
02E	07	008	016	10/17/72	1600		04	034S	PTCDY
02E	07	009	017	10/17/72	2000		04	034S	PTCDY
02E	07	010	017	10/17/72	2000		04	034S	PTCDY
02E	07	011	017	10/17/72	2000		04	034S	PTCDY
02E	07	012	017	10/17/72	2000		04	034S	PTCDY
02E	07	013	018	10/17/72	2400		04	010P	PTCDY
02E	07	014	018	10/17/72	2400		04	010P	PTCDY
02E	07	015	018	10/17/72	2400		04	010P	PTCDY
02E	07	016	018	10/17/72	2400		04	010P	PTCDY
02E	07	017	019	10/18/72	0400		04	010P	PTCDY
02E	07	018	019	10/18/72	0400		04	010P	PTCDY
02E	07	019	019	10/18/72	0400		04	010P	PTCDY
02E	07	020	019	10/18/72	0400		04	010P	PTCDY
02E	07	021	020	10/18/72	0800		04	033P	PTCDY
02E	07	022	020	10/18/72	0800		04	033P	PTCDY
02E	07	023	020	10/18/72	0800		04	033P	PTCDY
02E	07	024	020	10/18/72	0800		04	033P	PTCDY
02E	07	025	021	10/18/72	1200		03	033P	OCAST
02E	07	026	021	10/18/72	1200		03	033P	OCAST
02E	07	027	021	10/18/72	1200		03	033P	OCAST
02E	07	028	021	10/18/72	1200		03	033P	OCAST
02E	07	029	022	10/18/72	1600		04	033P	OCAST
02E	07	030	022	10/18/72	1600		04	033P	OCAST
02E	07	031	022	10/18/72	1600		04	033P	OCAST
02E	07	032	022	10/18/72	1600		04	033P	OCAST
02E	07	033	023	10/18/72	2000		05	010P	OCAST
02E	07	034	023	10/18/72	2000		05	010P	OCAST

A-5

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER	COMMENTS
02E	07	035	023	10/18/72	2000		05	010P	OCAST	
02E	07	036	023	10/18/72	2000		05	010P	OCAST	
02E	07	037	024	10/18/72	2400		06	007P	OCAST	
02E	07	038	024	10/18/72	2400		06	007P	OCAST	
02E	07	039	024	10/18/72	2400		06	007P	OCAST	
02E	07	040	024	10/18/72	2400		06	007P	OCAST	
02E	07	041	025	10/19/72	0400		06	007P	OCAST	
02E	07	042	025	10/19/72	0400		06	007P	OCAST	
02E	07	043	025	10/19/72	0400		06	007P	OCAST	
02E	07	044	025	10/19/72	0400		06	007P	OCAST	
02E	07	045	026	10/19/72	0800		06	007P	OCAST	
02E	07	046	026	10/19/72	0800		06	007P	OCAST	
02E	07	047	026	10/19/72	0800		06	007P	OCAST	
02E	07	048	026	10/19/72	0800		06	007P	OCAST	
02E	07	049	027	10/19/72	1200		05	021S	OCAST	
02E	07	050	027	10/19/72	1200		05	021S	OCAST	
02E	07	051	027	10/19/72	1200		05	021S	OCAST	
02E	07	052	027	10/19/72	1200		05	021S	OCAST	
02E	07	053	028	10/19/72	1600		06	016P	PTCDY	
02E	07	054	028	10/19/72	1600		06	016P	PTCDY	
02E	07	055	028	10/19/72	1600		06	016P	PTCDY	
02E	07	056	028	10/19/72	1600		06	016P	PTCDY	
02W	09	001	029	10/23/72	0800	30.1	04	032S	OCAST	
02W	09	002	029	10/23/72	0800	30.1	04	032S	OCAST	
02W	09	003	029	10/23/72	0800	30.1	04	032S	OCAST	
02W	09	004	029	10/23/72	0800	30.1	04	032S	OCAST	
02W	09	005	030	10/23/72	1200	27.9	06	010S	OCAST	
02W	09	007	030	10/23/72	1200	27.9	06	010S	OCAST	
02W	09	008	030	10/23/72	1200	27.9	06	010S	OCAST	
02W	09	009	031	10/23/72	1600	32.1	05	028S	OCAST	
02W	09	010	031	10/23/72	1600	32.1	05	028S	OCAST	
02W	09	011	031	10/23/72	1600	32.1	05	028S	OCAST	
02W	09	012	031	10/23/72	1600	32.1	05	028S	OCAST	
02W	09	013	032	10/23/72	2000	32.1	04	039S	OCAST	
02W	09	014	032	10/23/72	2000	32.1	04	039S	OCAST	
02W	09	015	032	10/23/72	2000	32.1	04	039S	OCAST	
02W	09	016	032	10/23/72	2000	32.1	04	039S	OCAST	
02W	09	017	033	10/23/72	2400	31.8	01		OCAST	LONG LOW SWELLS
02W	09	018	033	10/23/72	2400	31.8	01		OCAST	LONG LOW SWELLS
02W	09	019	033	10/23/72	2400	31.8	01		OCAST	LONG LOW SWELLS
02W	09	020	033	10/23/72	2400	31.8	01		OCAST	LONG LOW SWELLS
02W	09	021	034	10/24/72	0400	32.1	02	140P	OCAST	SHIP ROLLING
02W	09	022	034	10/24/72	0400	32.1	02	140P	OCAST	SHIP ROLLING
02W	09	023	034	10/24/72	0400	32.1	02	140P	OCAST	SHIP ROLLING
02W	09	024	034	10/24/72	0400	32.1	02	140P	OCAST	SHIP ROLLING
02W	09	025	035	10/24/72	0800	32.1	02	140P	OCAST	
02W	09	026	035	10/24/72	0800	32.1	02	140P	OCAST	
02W	09	027	035	10/24/72	0800	32.1	02	140P	OCAST	
02W	09	028	035	10/24/72	0800	32.1	02	140P	OCAST	
02W	09	029	036	10/24/72	1200	32.3	03	140P	OCAST	

A-6

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER
02W	09	030	036	10/24/72	1200	32.3	03	140P	OCAST
02W	09	031	036	10/24/72	1200	32.3	03	140P	OCAST
02W	09	032	036	10/24/72	1200	32.3	03	140P	OCAST
02W	09	033	037	10/24/72	1600	32.4	04	140P	CLDY
02W	09	034	037	10/24/72	1600	32.4	04	140P	CLDY
02W	09	035	037	10/24/72	1600	32.4	04	140P	CLDY
02W	09	036	037	10/24/72	1600	32.4	04	140P	CLDY
02W	09	037	038	10/24/72	2000	32.2	03	145P	CLDY
02W	09	038	038	10/24/72	2000	32.2	03	145P	CLDY
02W	09	039	038	10/24/72	2000	32.2	03	145P	CLDY
02W	09	040	038	10/24/72	2000	32.2	03	145P	CLDY
02W	09	041	039	10/24/72	2400	31.4	06	078P	OCAST
02W	09	042	039	10/24/72	2400	31.4	06	078P	OCAST
02W	09	043	039	10/24/72	2400	31.4	06	078P	OCAST
02W	09	044	039	10/24/72	2400	31.4	06	078P	OCAST
02W	09	045	040	10/25/72	0400	31.7	06	057S	PTCLDY
02W	09	046	040	10/25/72	0400	31.7	06	057S	PTCLDY
02W	09	047	040	10/25/72	0400	31.7	06	057S	PTCLDY
02W	09	048	040	10/25/72	0400	31.7	06	057S	PTCLDY
02W	09	049	041	10/25/72	0800	31.8	06	079S	OCAST
02W	09	050	041	10/25/72	0800	31.8	06	079S	OCAST
02W	09	051	041	10/25/72	0800	31.8	06	079S	OCAST
02W	09	052	041	10/25/72	0800	31.8	06	079S	OCAST
02W	11	001	042	10/25/72	1100	32.0	05	102S	PTCDLY
02W	11	002	042	10/25/72	1100	32.0	05	102S	PTCDLY
02W	11	003	042	10/25/72	1100	32.0	05	102S	PTCDLY
02W	11	004	042	10/25/72	1100	32.0	05	102S	PTCDLY
02W	11	005	043	10/25/72	1300	32.0	05	102S	PTCDLY
02W	11	006	043	10/25/72	1300	32.0	05	102S	PTCDLY
02W	11	007	043	10/25/72	1300	32.0	05	102S	PTCDLY
02W	11	008	043	10/25/72	1300	32.0	05	102S	PTCDLY
02W	11	009	044	10/25/72	1600	32.0	05	102S	PTCLDY
02W	11	010	044	10/25/72	1600	32.0	05	102S	PTCLDY
02W	11	011	044	10/25/72	1600	32.0	05	102S	PTCLDY
02W	11	012	044	10/25/72	1600	32.0	05	102S	PTCLDY
02W	11	013	045	10/25/72	2000	32.1	03	102S	OCAST
02W	11	014	045	10/25/72	2000	32.1	03	102S	OCAST
02W	11	015	045	10/25/72	2000	32.1	03	102S	OCAST
02W	11	016	045	10/25/72	2000	32.1	03	102S	OCAST
02W	11	017	046	10/25/72	2400	32.3	03	147S	PTCLDY
02W	11	018	046	10/25/72	2400	32.3	03	147S	PTCLDY
02W	11	019	046	10/25/72	2400	32.3	03	147S	PTCLDY
02W	11	020	046	10/25/72	2400	32.3	03	147S	PTCLDY
02W	11	021	047	10/26/72	0400	31.6	03	123P	OCAST
02W	11	022	047	10/26/72	0400	31.6	03	123P	OCAST
02W	11	023	047	10/26/72	0400	31.6	03	123P	OCAST
02W	11	024	047	10/26/72	0400	31.6	03	123P	OCAST
02W	11	025	048	10/26/72	0800	32.1	03	043P	CLEAR
02W	11	026	048	10/26/72	0800	32.1	03	043P	CLEAR
02W	11	027	048	10/26/72	0800	32.1	03	043P	CLEAR

A-7

VOY	TP	INT	IOX	DATE	TIME	SPD	BN	RNVD	WEATHER
02W	11	028	048	10/26/72	0800	32.1	03	043P	CLEAR
02W	11	029	049	10/26/72	1200	31.9	04	043P	OCAST
02W	11	030	049	10/26/72	1200	31.9	04	043P	OCAST
02W	11	031	049	10/26/72	1200	31.9	04	043P	OCAST
02W	11	032	049	10/26/72	1200	31.9	04	043P	OCAST
02W	11	033	050	10/26/72	1600		04	071S	OCAST SHOWERS
02W	11	034	050	10/26/72	1600		04	071S	OCAST SHOWERS
02W	11	035	050	10/26/72	1600		04	071S	OCAST SHOWERS
02W	11	036	050	10/26/72	1600		04	071S	OCAST SHOWERS
02W	11	037	051	10/26/72	2000		05	094S	CLDY
02W	11	038	051	10/26/72	2000		05	094S	CLDY
02W	11	039	051	10/26/72	2000		05	094S	CLDY
02W	11	040	051	10/26/72	2000		05	094S	CLDY
02W	11	041	052	10/26/72	2400		04	093S	CLDY
02W	11	042	052	10/26/72	2400		04	093S	CLDY
02W	11	043	052	10/26/72	2400		04	093S	CLDY
02W	11	044	052	10/26/72	2400		04	093S	CLDY
02W	11	045	053	10/27/72	0400		00		CLDY
02W	11	046	053	10/27/72	0400		00		CLDY
02W	11	047	053	10/27/72	0400		00		CLDY
02W	11	048	053	10/27/72	0400		00		CLDY
02W	11	049	054	10/27/72	0800		00		CLEAR
02W	11	050	054	10/27/72	0800		00		CLEAR
02W	11	051	054	10/27/72	0800		00		CLEAR
02W	11	052	054	10/27/72	0800		00		CLEAR
03E	13	017	005	10/29/72	2000	26.6	03	180	DENSE FOG
03E	13	018	005	10/29/72	2000	26.6	03	180	DENSE FOG
03E	13	019	005	10/29/72	2000	26.6	03	180	DENSE FOG
03E	13	020	005	10/29/72	2000	26.6	03	180	DENSE FOG
03E	13	021	006	10/29/72	2400	28.7	04	047S	OCAST SQUALLS
03E	13	022	006	10/29/72	2400	28.7	04	047S	OCAST SQUALLS
03E	13	023	006	10/29/72	2400	28.7	04	047S	OCAST SQUALLS
03E	13	024	006	10/29/72	2400	28.7	04	047S	OCAST SQUALLS
03E	13	025	007	10/30/72	0400	32.9	07	139S	OCAST RAIN
03E	13	026	007	10/30/72	0400	32.9	07	139S	OCAST RAIN
03E	13	027	007	10/30/72	0400	32.9	07	139S	OCAST RAIN
03E	13	028	007	10/30/72	0400	32.9	07	139S	OCAST RAIN
03E	13	029	008	10/30/72	0800	32.0	07	116S	OCAST
03E	13	030	008	10/30/72	0800	32.0	07	116S	OCAST
03E	13	031	008	10/30/72	0800	32.0	07	116S	OCAST
03E	13	032	008	10/30/72	0800	32.0	07	116S	OCAST
03E	13	033	009	10/30/72	1200	32.3	07	094S	CLOUDY ROUGH
03E	13	034	009	10/30/72	1200	32.3	07	094S	CLOUDY ROUGH
03E	13	035	009	10/30/72	1200	32.3	07	094S	CLOUDY ROUGH
03E	13	036	009	10/30/72	1200	32.3	07	094S	CLOUDY ROUGH
03E	13	037	009	10/30/72	1200	32.3	07	094S	CLOUDY ROUGH
03E	13	038	009	10/30/72	1200	32.3	07	094S	CLOUDY ROUGH
03E	13	039	009	10/30/72	1200	32.3	07	094S	CLOUDY ROUGH
03E	13	040	009	10/30/72	1200	32.3	07	094S	CLOUDY ROUGH
03E	13	041	010	10/30/72	1600	31.7	06	090S	PTCLDY

A-8

VOY	TP	INT	IOX	DATE	TIME	SPD	BN	RNVD	WEATHER
03E	13	042	010	10/30/72	1600	31.7	06	090S	PTCLDY
03E	13	043	010	10/30/72	1600	31.7	06	090S	PTCLDY
03E	13	044	010	10/30/72	1600	31.7	06	090S	PTCLDY
03E	13	045	011	10/30/72	2000	31.9	06	094S	PTCLDY
03E	13	046	011	10/30/72	2000	31.9	06	094S	PTCLDY
03E	13	047	011	10/30/72	2000	31.9	06	094S	PTCLDY
03E	13	048	011	10/30/72	2000	31.9	06	094S	PTCLDY
03E	13	049	012	10/30/72	2400	31.7	06	097S	OCAST SQUALL
03E	13	050	012	10/30/72	2400	31.7	06	097S	OCAST SQUALL
03E	13	051	012	10/30/72	2400	31.7	06	097S	OCAST SQUALL
03E	13	052	012	10/30/72	2400	31.7	06	097S	OCAST SQUALL
03E	13	053	013	10/31/72	0400	31.7	06	097S	PTCDY SQUALLS
03E	13	054	013	10/31/72	0400	31.7	06	097S	PTCDY SQUALLS
03E	13	055	013	10/31/72	0400	31.7	06	097S	PTCDY SQUALLS
03E	13	056	013	10/31/72	0400	31.7	06	097S	PTCDY SQUALLS
03E	13	057	014	10/31/72	0800	31.8	06	097S	CLDY
03E	13	058	014	10/31/72	0800	31.8	06	097S	CLDY
03E	13	059	014	10/31/72	0800	31.8	06	097S	CLDY
03E	13	060	014	10/31/72	0800	31.8	06	097S	CLDY
03E	15	001	015	10/31/72	1300	31.8	07	127S	OCAST
03E	15	002	015	10/31/72	1300	31.8	07	127S	OCAST
03E	15	003	015	10/31/72	1300	31.8	07	127S	OCAST
03E	15	004	015	10/31/72	1300	31.8	07	127S	OCAST
03E	15	005	015	10/31/72	1300	31.8	07	127S	OCAST
03E	15	006	015	10/31/72	1300	31.8	07	127S	OCAST
03E	15	007	016	10/31/72	1600	31.9	05	105S	PTCLDY
03E	15	008	016	10/31/72	1600	31.9	05	105S	PTCLDY
03E	15	009	016	10/31/72	1600	31.9	05	105S	PTCLDY
03E	15	010	016	10/31/72	1600	31.9	05	105S	PTCLDY
03E	15	011	016	10/31/72	1600	31.9	05	105S	PTCLDY
03E	15	012	016	10/31/72	1600	31.9	05	105S	PTCLDY
03E	15	013	016	10/31/72	1600	31.9	05	105S	PTCLDY
03E	15	014	016	10/31/72	1600	31.9	05	105S	PTCLDY
03E	15	015	016	10/31/72	1600	31.9	05	105S	PTCLDY
03E	15	016	016	10/31/72	1600	31.9	05	105S	PTCLDY
03E	15	017	017	10/31/72	2100	31.1	06	105S	PTCLDY
03E	15	018	017	10/31/72	2100	31.1	06	105S	PTCLDY
03E	15	019	017	10/31/72	2100	31.1	06	105S	PTCLDY
03E	15	020	017	10/31/72	2100	31.1	06	105S	PTCLDY
03E	15	021	017	10/31/72	2100	31.1	06	105S	PTCLDY
03E	15	022	017	10/31/72	2100	31.1	06	105S	PTCLDY
03E	15	023	018	10/31/72	2400	31.7	05	150S	OCAST
03E	15	024	018	10/31/72	2400	31.7	05	150S	OCAST
03E	15	025	018	10/31/72	2400	31.7	05	150S	OCAST
03E	15	026	018	10/31/72	2400	31.7	05	150S	OCAST
03E	15	027	018	10/31/72	2400	31.7	05	150S	OCAST
03E	15	028	018	10/31/72	2400	31.7	05	150S	OCAST
03E	15	029	018	10/31/72	2400	31.7	05	150S	OCAST
03E	15	030	018	10/31/72	2400	31.7	05	150S	OCAST
03E	15	031	019	11/01/72	0400	31.5	05	150S	CLDY

A-9

VOY	TP	INT	IOX	DATE	TIME	SPD	BN	RNVD	WEATHER
03E	15	032	019	11/01/72	0400	31.5	05	150S	CLDY
03E	15	033	019	11/01/72	0400	31.5	05	150S	CLDY
03E	15	034	019	11/01/72	0400	31.5	05	150S	CLDY
03E	15	035	020	11/01/72	0800	31.9	04	172S	CLDY
03E	15	036	020	11/01/72	0800	31.9	04	172S	CLDY
03E	15	037	020	11/01/72	0800	31.9	04	172S	CLDY
03E	15	038	020	11/01/72	0800	31.9	04	172S	CLDY
03E	15	039	020	11/01/72	0800	31.9	04	172S	CLDY
03E	15	040	020	11/01/72	0800	31.9	04	172S	CLDY
03E	15	041	021	11/01/72	1200	31.9	04	172S	OCAST
03E	15	042	021	11/01/72	1200	31.9	04	172S	OCAST
03E	15	043	021	11/01/72	1200	31.9	04	172S	OCAST
03E	15	044	021	11/01/72	1200	31.9	04	172S	OCAST
03E	15	045	022	11/01/72	1600	31.9	04	166P	PTCDY
03E	15	046	022	11/01/72	1600	31.9	04	166P	PTCDY
03E	15	047	022	11/01/72	1600	31.9	04	166P	PTCDY
03E	15	048	022	11/01/72	1600	31.9	04	166P	PTCDY
03E	15	049	023	11/01/72	2000	31.9	04	143P	CLOUDY
03E	15	050	023	11/01/72	2000	31.9	04	143P	CLOUDY
03E	15	051	023	11/01/72	2000	31.9	04	143P	CLOUDY
03E	15	052	023	11/01/72	2000	31.9	04	143P	CLOUDY
03E	15	053	024	11/01/72	2400	32.0	02	121P	PTCLDY
03E	15	054	024	11/01/72	2400	32.0	02	121P	PTCLDY
03W	17	001	001	11/06/72	1200	30.0	05	022S	OCAST
03W	17	002	001	11/06/72	1200	30.0	05	022S	OCAST
03W	17	003	001	11/06/72	1200	30.0	05	022S	OCAST
03W	17	004	001	11/06/72	1200	30.0	05	022S	OCAST
03W	17	005	002	11/06/72	1600		04	022S	FOG
03W	17	006	002	11/06/72	1600		04	022S	FOG
03W	17	007	002	11/06/72	1600		04	022S	FOG
03W	17	008	002	11/06/72	1600		04	022S	FOG
03W	17	009	003	11/06/72	2000	31.3	04	019S	OCAST
03W	17	010	003	11/06/72	2000	31.3	04	019S	OCAST
03W	17	011	003	11/06/72	2000	31.3	04	019S	OCAST
03W	17	012	003	11/06/72	2000	31.3	04	019S	OCAST
03W	17	013	004	11/06/72	2400	31.9	04	026P	OCAST
03W	17	014	004	11/06/72	2400	31.9	04	026P	OCAST
03W	17	015	004	11/06/72	2400	31.9	04	026P	OCAST
03W	17	016	004	11/06/72	2400	31.9	04	026P	OCAST
03W	17	017	005	11/07/72	0400	32.0	03	026P	CLOUDY
03W	17	018	005	11/07/72	0400	32.0	03	026P	CLOUDY
03W	17	019	005	11/07/72	0400	32.0	03	026P	CLOUDY
03W	17	020	005	11/07/72	0400	32.0	03	026P	CLOUDY
03W	17	021	006	11/07/72	0800	32.0	05	109S	OCAST
03W	17	022	006	11/07/72	0800	32.0	05	109S	OCAST
03W	17	023	006	11/07/72	0800	32.0	05	109S	OCAST
03W	17	024	006	11/07/72	0800	32.0	05	109S	OCAST
03W	17	025	007	11/07/72	1200	31.9	06	131S	OCAST
03W	17	026	007	11/07/72	1200	31.9	06	131S	OCAST
03W	17	027	007	11/07/72	1200	31.9	06	131S	OCAST

A-10

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RWVD	WEATHER
03W	17	028	007	11/07/72	1200	31.9	06	1315	OCAST
03W	17	029	008	11/07/72	1600	32.0	05	1315	CLOUDY
03W	17	030	008	11/07/72	1600	32.0	05	1315	CLOUDY
03W	17	031	008	11/07/72	1600	32.0	05	1315	CLOUDY
03W	17	032	008	11/07/72	1600	32.0	05	1315	CLOUDY
03W	17	033	009	11/07/72	2000	32.1	04	1545	CLOUDY
03W	17	034	009	11/07/72	2000	32.1	04	1545	CLOUDY
03W	17	035	009	11/07/72	2000	32.1	04	1545	CLOUDY
03W	17	036	009	11/07/72	2000	32.1	04	1545	CLOUDY
03W	17	037	010	11/07/72	2400	31.9	03	1165	PTCLOUDY
03W	17	038	010	11/07/72	2400	31.9	03	1165	PTCLOUDY
03W	17	039	010	11/07/72	2400	31.9	03	1165	PTCLOUDY
03W	17	040	010	11/07/72	2400	31.9	03	1165	PTCLOUDY
03W	17	041	011	11/08/72	0400	32.1	03	0605	PTCLOUDY
03W	17	042	011	11/08/72	0400	32.1	03	0605	PTCLOUDY
03W	17	043	011	11/08/72	0400	32.1	03	0605	PTCLOUDY
03W	17	044	011	11/08/72	0400	32.1	03	0605	PTCLOUDY
03W	17	045	012	11/08/72	0800	31.9	06	0835	PTCLOUDY
03W	17	046	012	11/08/72	0800	31.9	06	0835	PTCLOUDY
03W	17	047	012	11/08/72	0800	31.9	06	0835	PTCLOUDY
03W	17	048	012	11/08/72	0800	31.9	06	0835	PTCLOUDY
03W	17	049	013	11/08/72	1200	31.7	06	0675	OCAST
03W	17	050	013	11/08/72	1200	31.7	06	0675	OCAST
03W	17	051	013	11/08/72	1200	31.7	06	0675	OCAST
03W	17	052	013	11/08/72	1200	31.7	06	0675	OCAST
03W	17	053	014	11/08/72	1600	31.8	05	0675	OCAST
03W	17	054	014	11/08/72	1600	31.8	05	0675	OCAST
03W	17	055	014	11/08/72	1600	31.8	05	0675	OCAST
03W	17	056	014	11/08/72	1600	31.8	05	0675	OCAST
03W	17	057	015	11/08/72	2000	31.7	05	0905	OCAST
03W	17	058	015	11/08/72	2000	31.7	05	0905	OCAST
03W	17	059	015	11/08/72	2000	31.7	05	0905	OCAST
03W	17	060	015	11/08/72	2000	31.7	05	0905	OCAST
03W	17	061	015	11/08/72	2400	31.7	05	0905	OCAST
03W	17	062	016	11/08/72	2400	31.7	05	0905	OCAST
03W	17	063	016	11/08/72	2400	31.7	05	0905	OCAST
03W	17	064	016	11/08/72	2400	31.7	05	0905	OCAST
03W	17	065	017	11/09/72	0400	31.9	05	1575	PTCLOUDY
03W	17	066	017	11/09/72	0400	31.9	05	1575	PTCLOUDY
03W	17	067	017	11/09/72	0400	31.9	05	1575	PTCLOUDY
03W	17	068	017	11/09/72	0400	31.9	05	1575	PTCLOUDY
03W	17	069	018	11/09/72	0800	31.9	04	1125	OCAST
03W	17	070	018	11/09/72	0800	31.9	04	1125	OCAST
03W	17	071	018	11/09/72	0800	31.9	04	1125	OCAST
03W	17	072	018	11/09/72	0800	31.9	04	1125	OCAST
03W	17	073	019	11/09/72	1200	32.0	06	1485	OCAST
03W	17	074	019	11/09/72	1200	32.0	06	1485	OCAST
03W	17	075	019	11/09/72	1200	32.0	06	1485	OCAST
03W	17	076	019	11/09/72	1200	32.0	06	1485	OCAST
03W	19	001	020	11/09/72	1600	31.9	07	1575	OCAST

A-11

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RWVD	WEATHER
03W	19	002	020	11/09/72	1600	31.9	07	1575	OCAST
03W	19	003	020	11/09/72	1600	31.9	07	1575	OCAST
03W	19	004	020	11/09/72	1600	31.9	07	1575	OCAST
03W	19	005	020	11/09/72	1600	31.9	07	1575	OCAST
03W	19	006	020	11/09/72	1600	31.9	07	1575	OCAST
03W	19	007	020	11/09/72	1600	31.9	07	1575	OCAST
03W	19	008	020	11/09/72	1600	31.9	07	1575	OCAST
03W	19	009	021	11/09/72	2000	32.2	07	1625	OCAST
03W	19	010	021	11/09/72	2000	32.2	07	1625	OCAST
03W	19	011	021	11/09/72	2000	32.2	07	1625	OCAST
03W	19	012	021	11/09/72	2000	32.2	07	1625	OCAST
03W	19	013	021	11/09/72	2000	32.2	07	1625	OCAST
03W	19	014	021	11/09/72	2000	32.2	07	1625	OCAST
03W	19	015	021	11/09/72	2000	32.2	07	1625	OCAST
03W	19	016	021	11/09/72	2000	32.2	07	1625	OCAST
03W	19	017	022	11/09/72	2400	32.0	07	0925	OCAST
03W	19	018	022	11/09/72	2400	32.0	07	0925	OCAST
03W	19	019	022	11/09/72	2400	32.0	07	0925	OCAST
03W	19	020	022	11/09/72	2400	32.0	07	0925	OCAST
03W	19	021	022	11/09/72	2400	32.0	07	0925	OCAST
03W	19	022	022	11/09/72	2400	32.0	07	0925	OCAST
03W	19	023	022	11/09/72	2400	32.0	07	0925	OCAST
03W	19	024	022	11/09/72	2400	32.0	07	0925	OCAST
03W	19	025	023	11/10/72	0400	31.5	06	0205	PTCLDY
03W	19	026	023	11/10/72	0400	31.5	06	0205	PTCLDY
03W	19	027	023	11/10/72	0400	31.5	06	0205	PTCLDY
03W	19	028	023	11/10/72	0400	31.5	06	0205	PTCLDY
03W	19	029	023	11/10/72	0400	31.5	06	0205	PTCLDY
03W	19	030	023	11/10/72	0400	31.5	06	0205	PTCLDY
03W	19	031	023	11/10/72	0400	31.5	06	0205	PTCLDY
03W	19	032	023	11/10/72	0400	31.5	06	0205	PTCLDY
03W	19	033	024	11/10/72	0800	31.6	08	0695	OCAST
03W	19	034	024	11/10/72	0800	31.6	08	0695	OCAST
03W	19	035	024	11/10/72	0800	31.6	08	0695	OCAST
03W	19	036	024	11/10/72	0800	31.6	08	0695	OCAST
03W	19	037	024	11/10/72	0800	31.6	08	0695	OCAST
03W	19	038	024	11/10/72	0800	31.6	08	0695	OCAST
03W	19	039	024	11/10/72	0800	31.6	08	0695	OCAST
03W	19	040	024	11/10/72	0800	31.6	08	0695	OCAST
03W	19	041	025	11/10/72	1200	31.2	06	0655	OCAST
03W	19	042	025	11/10/72	1200	31.2	06	0655	OCAST
03W	19	043	025	11/10/72	1200	31.2	06	0655	OCAST
03W	19	044	025	11/10/72	1200	31.2	06	0655	OCAST
03W	19	045	025	11/10/72	1200	31.2	06	0655	OCAST
03W	19	046	025	11/10/72	1200	31.2	06	0655	OCAST
03W	19	047	025	11/10/72	1200	31.2	06	0655	OCAST
03W	19	048	025	11/10/72	1200	31.2	06	0655	OCAST
03W	19	049	026	11/10/72	1600	30.1	04	1065	CLEAR
03W	19	050	026	11/10/72	1600	30.1	04	1065	CLEAR
03W	19	051	026	11/10/72	1600	30.1	04	1065	CLEAR

A-12

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RWVD	WEATHER	COMMENTS
03W	19	052	026	11/10/72	1600	30.1	04	1065	CLEAR	
04E	21	001	001	11/12/72	0400	32.8	04	0	CLDY RAIN	
04E	21	002	001	11/12/72	0400	32.8	04	0	CLDY RAIN	
04E	21	003	001	11/12/72	0400	32.8	04	0	CLDY RAIN	
04E	21	004	001	11/12/72	0400	32.8	04	0	CLDY RAIN	
04E	21	005	002	11/12/72	0800	32.0	03	0905	OCAST	
04E	21	006	002	11/12/72	0800	32.0	03	0905	OCAST	
04E	21	007	002	11/12/72	0800	32.0	03	0905	OCAST	
04E	21	008	002	11/12/72	0800	32.0	03	0905	OCAST	
04E	21	009	003	11/12/72	1200	32.0	04	1015	CLDY	
04E	21	010	003	11/12/72	1200	32.0	04	1015	CLDY	
04E	21	011	003	11/12/72	1200	32.0	04	1015	CLDY	
04E	21	012	003	11/12/72	1200	32.0	04	1015	CLDY	
04E	21	013	004	11/12/72	1600	32.0	06	0875	PTCLDY	
04E	21	014	004	11/12/72	1600	32.0	06	0875	PTCLDY	
04E	21	015	004	11/12/72	1600	32.0	06	0875	PTCLDY	
04E	21	016	004	11/12/72	1600	32.0	06	0875	PTCLDY	
04E	21	017	005	11/12/72	2000	32.0	07	0665	OCAST RAIN	SHIP PITCHING IN
04E	21	018	005	11/12/72	2000	32.0	07	0665	OCAST RAIN	SHIP PITCHING IN
04E	21	019	005	11/12/72	2000	32.0	07	0665	OCAST RAIN	SHIP PITCHING IN
04E	21	020	005	11/12/72	2000	32.0	07	0665	OCAST RAIN	SHIP PITCHING IN
04E	21	021	006	11/12/72	2400	32.0	08	0605	OCAST	SPRAY OVER BOW AN
04E	21	022	006	11/12/72	2400	32.0	08	0605	OCAST	SPRAY OVER BOW AN
04E	21	023	006	11/12/72	2400	32.0	08	0605	OCAST	SPRAY OVER BOW AN
04E	21	024	006	11/12/72	2400	32.0	08	0605	OCAST	SPRAY OVER BOW AN
04E	21	025	007	11/13/72	0400	32.0	07	0825	PTCLDY	
04E	21	026	007	11/13/72	0400	32.0	07	0825	PTCLDY	
04E	21	027	007	11/13/72	0400	32.0	07	0825	PTCLDY	
04E	21	028	007	11/13/72	0400	32.0	07	0825	PTCLDY	
04E	21	029	008	11/13/72	0800	32.0	07	1385	CLDY	PITCH AND SLIGHT
04E	21	030	008	11/13/72	0800	32.0	07	1385	CLDY	PITCH AND SLIGHT
04E	21	031	008	11/13/72	0800	32.0	07	1385	CLDY	PITCH AND SLIGHT
04E	21	032	008	11/13/72	0800	32.0	07	1385	CLDY	PITCH AND SLIGHT
04E	21	033	009	11/13/72	1200	32.0	06	1455	CLDY	
04E	21	034	009	11/13/72	1200	32.0	06	1455	CLDY	
04E	21	035	009	11/13/72	1200	32.0	06	1455	CLDY	
04E	21	036	009	11/13/72	1200	32.0	06	1455	CLDY	
04E	21	037	010	11/13/72	1600	32.0	07	1665	OCAST	
04E	21	038	010	11/13/72	1600	32.0	07	1665	OCAST	
04E	21	039	010	11/13/72	1600	32.0	07	1665	OCAST	
04E	21	040	010	11/13/72	1600	32.0	07	1665	OCAST	
04E	21	041	011	11/13/72	2000	32.0	07	1495	CLDY	
04E	21	042	011	11/13/72	2000	32.0	07	1495	CLDY	
04E	21	043	011	11/13/72	2000	32.0	07	1495	CLDY	
04E	21	044	011	11/13/72	2000	32.0	07	1495	CLDY	
04E	21	045	012	11/13/72	2400	32.0	06	1495	CLDY	
04E	21	046	012	11/13/72	2400	32.0	06	1495	CLDY	
04E	21	047	012	11/13/72	2400	32.0	06	1495	CLDY	
04E	21	048	012	11/13/72	2400	32.0	06	1495	CLDY	
04E	21	049	013	11/14/72	0400	32.0	05	1495	PTCLDY	

A-13

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RWVD	WEATHER	COMMENTS
04E	21	050	013	11/14/72	0400	32.0	05	1498	PTCLDY	
04E	21	051	013	11/14/72	0400	32.0	05	1498	PTCLDY	
04E	21	052	013	11/14/72	0400	32.0	05	1498	PTCLDY	
04E	23	001	014	11/14/72	0800	32.0	05	1158	PTCLDY	
04E	23	002	014	11/14/72	0800	32.0	05	1158	PTCLDY	
04E	23	003	014	11/14/72	0800	32.0	05	1158	PTCLDY	
04E	23	004	014	11/14/72	0800	32.0	05	1158	PTCLDY	
04E	23	005	015	11/14/72	1200	32.0	05	1258	OCAST	
04E	23	006	015	11/14/72	1200	32.0	05	1258	OCAST	
04E	23	007	015	11/14/72	1200	32.0	05	1258	OCAST	
04E	23	008	015	11/14/72	1200	32.0	05	1258	OCAST	
04E	23	009	016	11/14/72	1600	32.0	05	1038	OCAST RAIN	
04E	23	010	016	11/14/72	1600	32.0	05	1038	OCAST RAIN	
04E	23	011	016	11/14/72	1600	32.0	05	1038	OCAST RAIN	
04E	23	012	016	11/14/72	1600	32.0	05	1038	OCAST RAIN	
04E	23	013	017	11/14/72	2000	32.0	05	1478	OCAST RAIN	
04E	23	014	017	11/14/72	2000	32.0	05	1478	OCAST RAIN	
04E	23	015	017	11/14/72	2000	32.0	05	1478	OCAST RAIN	
04E	23	016	017	11/14/72	2000	32.0	05	1478	OCAST RAIN	
04E	23	017	018	11/14/72	2400	32.0	04	1478	OCAST RAIN	
04E	23	018	018	11/14/72	2400	32.0	04	1478	OCAST RAIN	
04E	23	019	018	11/14/72	2400	32.0	04	1478	OCAST RAIN	
04E	23	020	018	11/14/72	2400	32.0	04	1478	OCAST RAIN	
04E	23	021	019	11/15/72	0400	32.0	04	1028	OCAST RAIN	
04E	23	022	019	11/15/72	0400	32.0	04	1028	OCAST RAIN	
04E	23	023	019	11/15/72	0400	32.0	04	1028	OCAST RAIN	
04E	23	024	019	11/15/72	0400	32.0	04	1028	OCAST RAIN	
04E	23	025	020	11/15/72	0800	32.0	05	1028	OCAST RAIN	LOW SWELL RIDING
04E	23	026	020	11/15/72	0800	32.0	05	1028	OCAST RAIN	LOW SWELL RIDING
04E	23	027	020	11/15/72	0800	32.0	05	1028	OCAST RAIN	LOW SWELL RIDING
04E	23	028	020	11/15/72	0800	32.0	05	1028	OCAST RAIN	LOW SWELL RIDING
04E	23	029	021	11/15/72	1200	32.0	06	1028	OCAST RAIN	
04E	23	030	021	11/15/72	1200	32.0	06	1028	OCAST RAIN	
04E	23	031	021	11/15/72	1200	32.0	06	1028	OCAST RAIN	
04E	23	032	021	11/15/72	1200	32.0	06	1028	OCAST RAIN	
04E	23	033	022	11/15/72	1600	32.0	06	0578	OCAST RAIN	
04E	23	034	022	11/15/72	1600	32.0	06	0578	OCAST RAIN	
04E	23	035	022	11/15/72	1600	32.0	06	0578	OCAST RAIN	
04E	23	036	022	11/15/72	1600	32.0	06	0578	OCAST RAIN	
04E	23	037	023	11/15/72	2000	32.0	05	1288	OCAST RAIN	
04E	23	038	023	11/15/72	2000	32.0	05	1288	OCAST RAIN	
04E	23	039	023	11/15/72	2000	32.0	05	1288	OCAST RAIN	
04E	23	040	023	11/15/72	2000	32.0	05	1288	OCAST RAIN	
04E	23	041	024	11/15/72	2400	32.0	06	1068	OCAST RAIN	
04E	23	042	024	11/15/72	2400	32.0	06	1068	OCAST RAIN	
04E	23	043	024	11/15/72	2400	32.0	06	1068	OCAST RAIN	
04E	23	044	024	11/15/72	2400	32.0	06	1068	OCAST RAIN	
04E	23	045	025	11/16/72	0400	32.0	06	0788	OCAST RAIN	
04E	23	046	025	11/16/72	0400	32.0	06	0788	OCAST RAIN	
04E	23	047	025	11/16/72	0400	32.0	06	0788	OCAST RAIN	

A-14

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RWVD	WEATHER	COMMENTS
04E	23	048	025	11/16/72	0400	32.0	06	078S	OCAST RAIN	
04E	23	049	026	11/16/72	0800		06	120S	OCAST RAIN	
04E	23	050	026	11/16/72	0800		06	120S	OCAST RAIN	
04E	23	051	026	11/16/72	0800		06	120S	OCAST RAIN	
04E	23	052	026	11/16/72	0800		06	120S	OCAST RAIN	
04E	23	053	027	11/16/72	1200		05	120S	OCAST	
04E	23	054	027	11/16/72	1200		05	120S	OCAST	
04E	23	055	027	11/16/72	1200		05	120S	OCAST	
04E	23	056	027	11/16/72	1200		05	120S	OCAST	
04W	25	001	001	11/19/72	2400	29.0	07	050P	OCAST RAIN	
04W	25	002	001	11/19/72	2400	29.0	07	050P	OCAST RAIN	
04W	25	003	001	11/19/72	2400	29.0	07	050P	OCAST RAIN	
04W	25	004	001	11/19/72	2400	29.0	07	050P	OCAST RAIN	
04W	25	005	002	11/20/72	0400	29.0	07	050P	OCAST RAIN	
04W	25	006	002	11/20/72	0400	29.0	07	050P	OCAST RAIN	
04W	25	007	002	11/20/72	0400	29.0	07	050P	OCAST RAIN	
04W	25	008	002	11/20/72	0400	29.0	07	050P	OCAST RAIN	
04W	25	009	003	11/20/72	0800	29.0	08	0	CLDY	SWELLS ON BOW SPR
04W	25	010	003	11/20/72	0800	29.0	08	0	CLDY	SWELLS ON BOW SPR
04W	25	011	003	11/20/72	0800	29.0	08	0	CLDY	SWELLS ON BOW SPR
04W	25	012	003	11/20/72	0800	29.0	08	0	CLDY	SWELLS ON BOW SPR
04W	25	013	004	11/20/72	1200	25.0	09	000P	PTCLDY	SPEED REDUCED
04W	25	014	004	11/20/72	1200	25.0	09	000P	PTCLDY	SPEED REDUCED
04W	25	015	004	11/20/72	1200	25.0	09	000P	PTCLDY	SPEED REDUCED
04W	25	016	004	11/20/72	1200	25.0	09	000P	PTCLDY	SPEED REDUCED
04W	25	017	005	11/20/72	1400	21.0	10	020S	PTCLDY	PITCHING SLAM RED
04W	25	018	005	11/20/72	1400	21.0	10	020S	PTCLDY	PITCHING SLAM RED
04W	25	019	005	11/20/72	1400	21.0	10	020S	PTCLDY	PITCHING SLAM RED
04W	25	020	005	11/20/72	1400	21.0	10	020S	PTCLDY	PITCHING SLAM RED
04W	25	021	006	11/20/72	1600	23.0	10	031S	PTCLDY	
04W	25	022	006	11/20/72	1600	23.0	10	031S	PTCLDY	
04W	25	023	006	11/20/72	1600	23.0	10	031S	PTCLDY	
04W	25	024	006	11/20/72	1600	23.0	10	031S	PTCLDY	
04W	25	025	007	11/20/72	1600	21.0	10	042S	PTCLDY	PITCH HEAVY SPRAY
04W	25	026	007	11/20/72	1600	21.0	10	042S	PTCLDY	PITCH HEAVY SPRAY
04W	25	027	007	11/20/72	1600	21.0	10	042S	PTCLDY	PITCH HEAVY SPRAY
04W	25	028	007	11/20/72	1600	21.0	10	042S	PTCLDY	PITCH HEAVY SPRAY
04W	25	029	008	11/20/72	2000	19.0	10	042S	PTCLDY	PITCH HEAVY SPRAY
04W	25	030	008	11/20/72	2000	19.0	10	042S	PTCLDY	PITCH HEAVY SPRAY
04W	25	031	008	11/20/72	2000	19.0	10	042S	PTCLDY	PITCH HEAVY SPRAY
04W	25	032	008	11/20/72	2000	19.0	10	042S	PTCLDY	PITCH HEAVY SPRAY
04W	25	033	009	11/20/72	2400	26.0	09	042S	PTCLDY	EASING OCCAS. SPR
04W	25	034	009	11/20/72	2400	26.0	09	042S	PTCLDY	EASING OCCAS. SPR
04W	25	035	009	11/20/72	2400	26.0	09	042S	PTCLDY	EASING OCCAS. SPR
04W	25	036	009	11/20/72	2400	26.0	09	042S	PTCLDY	EASING OCCAS. SPR
04W	25	037	010	11/21/72	0400	27.0	05	042S	OCAST	
04W	25	038	010	11/21/72	0400	27.0	05	042S	OCAST	
04W	25	039	010	11/21/72	0400	27.0	05	042S	OCAST	
04W	25	040	010	11/21/72	0400	27.0	05	042S	OCAST	
04W	25	041	011	11/21/72	0800	29.0	04	067S	CLDY	ROLLING 5 DEG IN

A-15

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RHVD	WEATHER	COMMENTS
04W	25	042	011	11/21/72	0800	29.0	04	0673	CLDY	ROLLING 5 DEG IN
04W	25	043	011	11/21/72	0800	29.0	04	0673	CLDY	ROLLING 5 DEG IN
04W	25	044	011	11/21/72	0800	29.0	04	0673	CLDY	ROLLING 5 DEG IN
04W	25	045	012	11/21/72	1200	30.0	05	1553	OCAST LT RAIN	
04W	25	046	012	11/21/72	1200	30.0	05	1553	OCAST LT RAIN	
04W	25	047	012	11/21/72	1200	30.0	05	1553	OCAST LT RAIN	
04W	25	048	012	11/21/72	1200	30.0	05	1553	OCAST LT RAIN	
04W	25	049	013	11/21/72	1600	29.0	07	1553	OCAST	
04W	25	050	013	11/21/72	1600	29.0	07	1553	OCAST	
04W	25	051	013	11/21/72	1600	29.0	07	1553	OCAST	
04W	25	052	013	11/21/72	1600	29.0	07	1553	OCAST	
04W	25	053	014	11/21/72	2000	29.0	07	1553	CLDY	ROLLING IN SWELL
04W	25	054	014	11/21/72	2000	29.0	07	1553	CLDY	ROLLING IN SWELL
04W	25	055	014	11/21/72	2000	29.0	07	1553	CLDY	ROLLING IN SWELL
04W	25	056	014	11/21/72	2000	29.0	07	1553	CLDY	ROLLING IN SWELL
04W	25	057	015	11/21/72	2400	29.0	08	1553	OCAST	
04W	25	058	015	11/21/72	2400	29.0	08	1553	OCAST	
04W	25	059	015	11/21/72	2400	29.0	08	1553	OCAST	
04W	25	060	015	11/21/72	2400	29.0	08	1553	OCAST	
04W	25	061	016	11/22/72	0400	29.0	07	1553	OCAST	
04W	25	062	016	11/22/72	0400	29.0	07	1553	OCAST	
04W	25	063	016	11/22/72	0400	29.0	07	1553	OCAST	
04W	25	064	016	11/22/72	0400	29.0	07	1553	OCAST	
04W	25	065	017	11/22/72	0800	29.0	07	1553	PTCDY	
04W	25	066	017	11/22/72	0800	29.0	07	1553	PTCDY	
04W	25	067	017	11/22/72	0800	29.0	07	1553	PTCDY	
04W	25	068	017	11/22/72	0800	29.0	07	1553	PTCDY	
04W	27	001	018	11/22/72	1200	29.0	07	177P	CLEAR	
04W	27	002	018	11/22/72	1200	29.0	07	177P	CLEAR	
04W	27	003	018	11/22/72	1200	29.0	07	177P	CLEAR	
04W	27	004	018	11/22/72	1200	29.0	07	177P	CLEAR	
04W	27	005	019	11/22/72	1600	29.0	07	076P	OCAST	
04W	27	009	020	11/22/72	2000	30.0	07	0255	CLDY	
04W	27	010	020	11/22/72	2000	30.0	07	0255	CLDY	
04W	27	011	020	11/22/72	2000	30.0	07	0255	CLDY	
04W	27	012	020	11/22/72	2000	30.0	07	0255	CLDY	
04W	27	013	021	11/22/72	2400	30.0	05	0705	OCAST	
04W	27	014	021	11/22/72	2400	30.0	05	0705	OCAST	
04W	27	015	021	11/22/72	2400	30.0	05	0705	OCAST	
04W	27	016	021	11/22/72	2400	30.0	05	0705	OCAST	
04W	27	017	022	11/23/72	0400	30.0	04	0255	OCAST	
04W	27	018	022	11/23/72	0400	30.0	04	0255	OCAST	
04W	27	019	022	11/23/72	0400	30.0	04	0255	OCAST	
04W	27	020	022	11/23/72	0400	30.0	04	0255	OCAST	
04W	27	021	023	11/23/72	0800	29.0	03	0255	OCAST	
04W	27	022	023	11/23/72	0800	29.0	03	0255	OCAST	
04W	27	023	023	11/23/72	0800	29.0	03	0255	OCAST	
04W	27	024	023	11/23/72	0800	29.0	03	0255	OCAST	
04W	27	025	024	11/23/72	1200	29.0	07	177P	OCAST	FORCE 7 WEATHER 0
04W	27	026	024	11/23/72	1200	29.0	07	177P	OCAST	FORCE 7 WEATHER 0

A-16

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RHVD	WEATHER	COMMENTS
04W	27	027	024	11/23/72	1200	29.0	07	177P	OCAST	FORCE 7 WEATHER 0
04W	27	028	024	11/23/72	1200	29.0	07	177P	OCAST	FORCE 7 WEATHER 0
04W	27	029	025	11/23/72	1600	30.0	09	177P	OCAST RAIN	RIDING EASY WEATH
04W	27	030	025	11/23/72	1600	30.0	09	177P	OCAST RAIN	RIDING EASY WEATH
04W	27	031	025	11/23/72	1600	30.0	09	177P	OCAST RAIN	RIDING EASY WEATH
04W	27	032	025	11/23/72	1600	30.0	09	177P	OCAST RAIN	RIDING EASY WEATH
04W	27	034	026	11/23/72	1800	29.0	09	177P	OCAST RAIN	ROLLING HEAVY 15-
04W	27	035	026	11/23/72	1800	29.0	09	177P	OCAST RAIN	ROLLING HEAVY 15-
04W	27	036	026	11/23/72	1800	29.0	09	177P	OCAST RAIN	ROLLING HEAVY 15-
04W	27	037	027	11/23/72	2000	29.0	10	1385	OCAST RAIN	ROLLING HEAVY
04W	27	038	027	11/23/72	2000	29.0	10	1385	OCAST RAIN	ROLLING HEAVY
04W	27	039	027	11/23/72	2000	29.0	10	1385	OCAST RAIN	ROLLING HEAVY
04W	27	040	027	11/23/72	2000	29.0	10	1385	OCAST RAIN	ROLLING HEAVY
04W	27	041	028	11/23/72	2200	28.0	10	0935	OCAST RAIN	ROLLING HEAVY
04W	27	042	028	11/23/72	2200	28.0	10	0935	OCAST RAIN	ROLLING HEAVY
04W	27	043	028	11/23/72	2200	28.0	10	0935	OCAST RAIN	ROLLING HEAVY
04W	27	044	028	11/23/72	2200	28.0	10	0935	OCAST RAIN	ROLLING HEAVY
04W	27	045	029	11/23/72	2400	28.0	10	0735	OCAST RAIN	MODERATE ROLL
04W	27	046	029	11/23/72	2400	28.0	10	0735	OCAST RAIN	MODERATE ROLL
04W	27	047	029	11/23/72	2400	28.0	10	0735	OCAST RAIN	MODERATE ROLL
04W	27	048	029	11/23/72	2400	28.0	10	0735	OCAST RAIN	MODERATE ROLL
04W	27	049	030	11/24/72	0400	29.0	08	0735	OCAST RAIN	RIDING EASY
04W	27	050	030	11/24/72	0400	29.0	08	0735	OCAST RAIN	RIDING EASY
04W	27	051	030	11/24/72	0400	29.0	08	0735	OCAST RAIN	RIDING EASY
04W	27	052	030	11/24/72	0400	29.0	08	0735	OCAST RAIN	RIDING EASY
04W	27	053	031	11/24/72	0800	28.0	05	0485	CLDY	
04W	27	054	031	11/24/72	0800	28.0	05	0485	CLDY	
04W	27	055	031	11/24/72	0800	28.0	05	0485	CLDY	
04W	27	056	031	11/24/72	0800	28.0	05	0485	CLDY	
04W	27	057	032	11/24/72	1200	28.0	05	0235	CLDY	
04W	27	058	032	11/24/72	1200	28.0	05	0235	CLDY	
04W	27	059	032	11/24/72	1200	28.0	05	0235	CLDY	
04W	27	060	032	11/24/72	1200	28.0	05	0235	CLDY	
05E	29	001	001	11/26/72	0400		03	180	OCAST RAIN	
05E	29	002	001	11/26/72	0400		03	180	OCAST RAIN	
05E	29	003	001	11/26/72	0400		03	180	OCAST RAIN	
05E	29	004	001	11/26/72	0400		03	180	OCAST RAIN	
05E	29	005	002	11/26/72	0800	26.0	04	0465	OCAST RAIN	
05E	29	006	002	11/26/72	0800	26.0	04	0465	OCAST RAIN	
05E	29	007	002	11/26/72	0800	26.0	04	0465	OCAST RAIN	
05E	29	008	002	11/26/72	0800	26.0	04	0465	OCAST RAIN	
05E	29	009	003	11/26/72	1200	30.0	07	077S	OCAST RAIN	
05E	29	010	003	11/26/72	1200	30.0	07	077S	OCAST RAIN	
05E	29	011	003	11/26/72	1200	30.0	07	077S	OCAST RAIN	
05E	29	012	003	11/26/72	1200	30.0	07	077S	OCAST RAIN	
05E	29	013	004	11/26/72	1600	30.0	07	100S	OCAST RAIN	
05E	29	014	004	11/26/72	1600	30.0	07	100S	OCAST RAIN	
05E	29	015	004	11/26/72	1600	30.0	07	100S	OCAST RAIN	
05E	29	016	004	11/26/72	1600	30.0	07	100S	OCAST RAIN	
05E	29	017	005	11/26/72	2000	30.0	09	090S	OCAST RAIN	ROLLING HEAVY

A-17

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER	COMMENTS
05E	29	018	005	11/26/72	2000	30,0	09	0903	OCAST RAIN	ROLLING HEAVY
05E	29	019	005	11/26/72	2000	30,0	09	0903	OCAST RAIN	ROLLING HEAVY
05E	29	020	005	11/26/72	2000	30,0	09	0903	OCAST RAIN	ROLLING HEAVY
05E	29	021	006	11/26/72	2200	30,0	09	0885	OCAST RAIN	ROLLING HEAVY
05E	29	022	006	11/26/72	2200	30,0	09	0885	OCAST RAIN	ROLLING HEAVY
05E	29	023	006	11/26/72	2200	30,0	09	0885	OCAST RAIN	ROLLING HEAVY
05E	29	024	006	11/26/72	2200	30,0	09	0885	OCAST RAIN	ROLLING HEAVY
05E	29	025	007	11/26/72	2400	30,0	08	0755	OCAST RAIN	EASING
05E	29	026	007	11/26/72	2400	30,0	08	0755	OCAST RAIN	EASING
05E	29	027	007	11/26/72	2400	30,0	08	0755	OCAST RAIN	EASING
05E	29	028	007	11/26/72	2400	30,0	08	0755	OCAST RAIN	EASING
05E	29	029	008	11/27/72	0400	30,0	07	0755	OCAST RAIN	
05E	29	030	008	11/27/72	0400	30,0	07	0755	OCAST RAIN	
05E	29	031	008	11/27/72	0400	30,0	07	0758	OCAST RAIN	
05E	29	032	008	11/27/72	0400	30,0	07	0758	OCAST RAIN	
05E	29	033	009	11/27/72	0800	30,0	05	0305	OCAST	
05E	29	034	009	11/27/72	0800	30,0	05	0305	OCAST	
05E	29	035	009	11/27/72	0800	30,0	05	0305	OCAST	
05E	29	036	009	11/27/72	0800	30,0	05	0305	OCAST	
05E	29	037	010	11/27/72	1200	30,0	05	0758	OCAST	
05E	29	038	010	11/27/72	1200	30,0	05	0758	OCAST	
05E	29	039	010	11/27/72	1200	30,0	05	0758	OCAST	
05E	29	040	010	11/27/72	1200	30,0	05	0758	OCAST	
05E	29	041	011	11/27/72	1600	0	04	0755	PTCLDY	MOVE TO
05E	29	042	011	11/27/72	1600	0	04	0755	PTCLDY	MOVE TO
05E	29	043	011	11/27/72	1600	0	04	0755	PTCLDY	MOVE TO
05E	29	044	011	11/27/72	1600	0	04	0755	PTCLDY	MOVE TO
05E	29	045	012	11/27/72	2000	0	06	0985	OCAST	MOVE TO
05E	29	046	012	11/27/72	2000	0	06	0985	OCAST	MOVE TO
05E	29	047	012	11/27/72	2000	0	06	0985	OCAST	MOVE TO
05E	29	048	012	11/27/72	2000	0	06	0985	OCAST	MOVE TO
05E	29	049	013	11/27/72	2400	0	06	0985	OCAST	MOVE TO
05E	29	050	013	11/27/72	2400	0	06	0985	OCAST	MOVE TO
05E	29	051	013	11/27/72	2400	0	06	0985	OCAST	MOVE TO
05E	29	052	013	11/27/72	2400	0	06	0985	OCAST	MOVE TO
05E	29	053	014	11/28/72	0400	0	05	1435	OCAST	START-STOP
05E	29	054	014	11/28/72	0400	0	05	1435	OCAST	START-STOP
05E	29	055	014	11/28/72	0400	0	05	1435	OCAST	START-STOP
05E	29	056	014	11/28/72	0400	0	05	1435	OCAST	START-STOP
05E	29	057	015	11/28/72	0800	0	05	1655	OCAST	MOVE TO
05E	29	058	015	11/28/72	0800	0	05	1655	OCAST	MOVE TO
05E	29	059	015	11/28/72	0800	0	05	1655	OCAST	MOVE TO
05E	29	060	015	11/28/72	0800	0	05	1655	OCAST	MOVE TO
05E	29	061	016	11/28/72	1200	0	04	1655	CLEAR	MOVE TO
05E	29	062	016	11/28/72	1200	0	04	1655	CLEAR	MOVE TO
05E	29	063	016	11/28/72	1200	0	04	1655	CLEAR	MOVE TO
05E	29	064	016	11/28/72	1200	0	04	1655	CLEAR	MOVE TO
05E	31	001	017	11/28/72	1600	0	04	1435	CLEAR	MOVE TO START 9 K
05E	31	002	017	11/28/72	1600	0	04	1435	CLEAR	MOVE TO START 9 K
05E	31	003	017	11/28/72	1600	0	04	1435	CLEAR	MOVE TO START 9 K
05E	31	004	017	11/28/72	1600	0	04	1435	CLEAR	MOVE TO START 9 K

A-18

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER	COMMENTS
05E	31	005	018	11/28/72	2000	09,0	04	1435	CLEAR	9 KTS STBD ENGINE
05E	31	006	018	11/28/72	2000	09,0	04	1435	CLEAR	9 KTS STBD ENGINE
05E	31	007	018	11/28/72	2000	09,0	04	1435	CLEAR	9 KTS STBD ENGINE
05E	31	008	018	11/28/72	2000	09,0	04	1435	CLEAR	9 KTS STBD ENGINE
05E	31	009	019	11/28/72	2400	13,0	05	1655	CLEAR	13 KTS STBD ONLY
05E	31	010	019	11/28/72	2400	13,0	05	1655	CLEAR	13 KTS STBD ONLY
05E	31	011	019	11/28/72	2400	13,0	05	1655	CLEAR	13 KTS STBD ONLY
05E	31	012	019	11/28/72	2400	13,0	05	1655	CLEAR	13 KTS STBD ONLY
05E	31	013	020	11/29/72	0400	13,0	05	1705	CLEAR	STBD ENGINE ONLY
05E	31	014	020	11/29/72	0400	13,0	05	1705	CLEAR	STBD ENGINE ONLY
05E	31	015	020	11/29/72	0400	13,0	05	1705	CLEAR	STBD ENGINE ONLY
05E	31	016	020	11/29/72	0400	13,0	05	1705	CLEAR	STBD ENGINE ONLY
05E	31	017	021	11/29/72	0800	13,0	04	1647	CLEAR	STBD ENGINE ONLY
05E	31	018	021	11/29/72	0800	13,0	04	1647	CLEAR	STBD ENGINE ONLY
05E	31	019	021	11/29/72	0800	13,0	04	1647	CLEAR	STBD ENGINE ONLY
05E	31	020	021	11/29/72	0800	13,0	04	1647	CLEAR	STBD ENGINE ONLY
05E	31	021	022	11/29/72	1200	13,0	04	1647	CLEAR	STBD ENGINE ONLY
05E	31	022	022	11/29/72	1200	13,0	04	1647	CLEAR	STBD ENGINE ONLY
05E	31	023	022	11/29/72	1200	13,0	04	1647	CLEAR	STBD ENGINE ONLY
05E	31	024	022	11/29/72	1200	13,0	04	1647	CLEAR	STBD ENGINE ONLY
05E	31	025	023	11/29/72	1600	13,0	04	1647	CLEAR	STBD ENGINE ONLY
05E	31	026	023	11/29/72	1600	13,0	04	1647	CLEAR	STBD ENGINE ONLY
05E	31	027	023	11/29/72	1600	13,0	04	1647	CLEAR	STBD ENGINE ONLY
05E	31	028	023	11/29/72	1600	13,0	04	1647	CLEAR	STBD ENGINE ONLY
05E	31	029	024	11/29/72	2000	13,0	04	1675	PTCLDY	STBD ENGINE ONLY
05E	31	030	024	11/29/72	2000	13,0	04	1675	PTCLDY	STBD ENGINE ONLY
05E	31	031	024	11/29/72	2000	13,0	04	1675	PTCLDY	STBD ENGINE ONLY
05E	31	032	024	11/29/72	2000	13,0	04	1675	PTCLDY	STBD ENGINE ONLY
05E	31	033	025	11/29/72	2400	13,0	05	1455	PTCLDY	STBD ENGINE ONLY
05E	31	034	025	11/29/72	2400	13,0	05	1455	PTCLDY	STBD ENGINE ONLY
05E	31	035	025	11/29/72	2400	13,0	05	1455	PTCLDY	STBD ENGINE ONLY
05E	31	036	025	11/29/72	2400	13,0	05	1455	PTCLDY	STBD ENGINE ONLY
05E	31	037	026	11/30/72	0400	13,0	06	1115	OCAST RAIN	STBD ENGINE ONLY
05E	31	038	026	11/30/72	0400	13,0	06	1115	OCAST RAIN	ENGINE ONL
05E	31	039	026	11/30/72	0400	13,0	06	1115	OCAST RAIN	STBD ENGINE ONLY
05E	31	040	026	11/30/72	0400	13,0	06	1115	OCAST RAIN	STBD ENGINE ONLY
05E	31	041	027	11/30/72	0800	13,0	06	1675	OCAST RAIN	STBD ENGINE ONLY
05E	31	042	027	11/30/72	0800	13,0	06	1675	OCAST RAIN	STBD ENGINE ONLY
05E	31	043	027	11/30/72	0800	13,0	06	1675	OCAST RAIN	STBD ENGINE ONLY
05E	31	044	027	11/30/72	0800	13,0	06	1675	OCAST RAIN	STBD ENGINE ONLY
05E	31	045	028	11/30/72	1200	13,0	06	1675	OCAST	STBD ENGINE ONLY
05E	31	046	028	11/30/72	1200	13,0	06	1675	OCAST	STBD ENGINE ONLY
05E	31	047	028	11/30/72	1200	13,0	06	1675	OCAST	STBD ENGINE ONLY
05E	31	048	028	11/30/72	1200	13,0	06	1675	OCAST	STBD ENGINE ONLY
05E	33	001	034	12/01/72	1200	13,0	07	1215	PTCLDY	STBD ENGINE ONLY
05E	33	002	034	12/01/72	1200	13,0	07	1215	PTCLDY	STBD ENGINE ONLY
05E	33	003	034	12/01/72	1200	13,0	07	1215	PTCLDY	STBD ENGINE ONLY
05E	33	004	034	12/01/72	1200	13,0	07	1215	PTCLDY	STBD ENGINE ONLY
05E	33	005	035	12/01/72	1600	13,0	07	1075	OCAST	STBD ENGINE ONLY
05E	33	006	035	12/01/72	1600	13,0	07	1075	OCAST	STBD ENGINE ONLY

A-19

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER	COMMENTS
05E	33	007	035	12/01/72	1600	13.0	07	107P	OCAST	STBD ENGINE ONLY
05E	33	008	035	12/01/72	1600	13.0	07	107P	OCAST	STBD ENGINE ONLY
05E	33	009	036	12/01/72	2000	13.0	07	095P	OCAST	STBD ENGINE ONLY
05E	33	010	036	12/01/72	2000	13.0	07	095P	OCAST	STBD ENGINE ONLY
05E	33	011	036	12/01/72	2000	13.0	07	095P	OCAST	STBD ENGINE ONLY
05E	33	012	036	12/01/72	2000	13.0	07	095P	OCAST	STBD ENGINE ONLY
05E	33	013	037	12/01/72	2400	13.0	07	094P	PTCLDY	STBD ENGINE ONLY
05E	33	014	037	12/01/72	2400	13.0	07	094P	PTCLDY	STBD ENGINE ONLY
05E	33	015	037	12/01/72	2400	13.0	07	094P	PTCLDY	STBD ENGINE ONLY
05E	33	016	037	12/01/72	2400	13.0	07	094P	PTCLDY	STBD ENGINE ONLY
05E	33	017	038	12/02/72	0400	13.0	07	094P	PTCLDY	STBD ENGINE ONLY
05E	33	018	038	12/02/72	0400	13.0	07	094P	PTCLDY	STBD ENGINE ONLY
05E	33	019	038	12/02/72	0400	13.0	07	094P	PTCLDY	STBD ENGINE ONLY
05E	33	020	038	12/02/72	0400	13.0	07	094P	PTCLDY	STBD ENGINE ONLY
05E	33	021	039	12/02/72	0800	13.0	07	094P	PTCLDY	STBD ENGINE ONLY
05E	33	022	039	12/02/72	0800	13.0	07	094P	PTCLDY	STBD ENGINE ONLY
05E	33	023	039	12/02/72	0800	13.0	07	094P	PTCLDY	STBD ENGINE ONLY
05E	33	024	039	12/02/72	0800	13.0	07	094P	PTCLDY	STBD ENGINE ONLY
05E	33	025	040	12/02/72	1200	13.0	07	115P	PTCLDY	STBD ENGINE ONLY
05E	33	026	040	12/02/72	1200	13.0	07	115P	PTCLDY	STBD ENGINE ONLY
05E	33	027	040	12/02/72	1200	13.0	07	115P	PTCLDY	STBD ENGINE ONLY
05E	33	028	040	12/02/72	1200	13.0	07	115P	PTCLDY	STBD ENGINE ONLY
05E	33	029	041	12/02/72	1600	14.0	07	115P	PTCLDY	STBD ENGINE ONLY
05E	33	030	041	12/02/72	1600	14.0	07	115P	PTCLDY	STBD ENGINE ONLY
05E	33	031	041	12/02/72	1600	14.0	07	115P	PTCLDY	STBD ENGINE ONLY
05E	33	032	041	12/02/72	1600	14.0	07	115P	PTCLDY	STBD ENGINE ONLY
05E	33	033	042	12/02/72	2000	14.0	05	120P	OCAST	STBD ENGINE ONLY
05E	33	034	042	12/02/72	2000	14.0	05	120P	OCAST	STBD ENGINE ONLY
05E	33	035	042	12/02/72	2000	14.0	05	120P	OCAST	STBD ENGINE ONLY
05E	33	036	042	12/02/72	2000	14.0	05	120P	OCAST	STBD ENGINE ONLY
05E	33	037	043	12/02/72	2400	14.0	05	144P	OCAST	STBD ENGINE ONLY
05E	33	038	043	12/02/72	2400	14.0	05	144P	OCAST	STBD ENGINE ONLY
05E	33	039	043	12/02/72	2400	14.0	05	144P	OCAST	STBD ENGINE ONLY
05E	33	040	043	12/02/72	2400	14.0	05	144P	OCAST	STBD ENGINE ONLY
05E	33	041	044	12/03/72	0400	14.0	05	144P	PTCLDY	ENGINE ONLY
05E	33	042	044	12/03/72	0400	14.0	05	144P	PTCLDY	STBD ENGINE ONLY
05E	33	043	044	12/03/72	0400	14.0	05	144P	PTCLDY	STBD ENGINE ONLY
05E	33	044	044	12/03/72	0400	14.0	05	144P	PTCLDY	STBD ENGINE ONLY
05E	33	045	045	12/03/72	0800	14.0	04	167P	CLDY	STBD ENGINE ONLY
05E	33	046	045	12/03/72	0800	14.0	04	167P	CLDY	STBD ENGINE ONLY
05E	33	047	045	12/03/72	0800	14.0	04	167P	CLDY	STBD ENGINE ONLY
08E	47	001	001	01/30/73	2400				CLEAR	
08E	47	002	001	01/30/73	2400				CLEAR	
08E	47	003	001	01/30/73	2400				CLEAR	
08E	47	004	001	01/30/73	2400				CLEAR	
08E	47	005	002	01/31/73	0400	24.6	05	001P	CLEAR	
08E	47	006	002	01/31/73	0400	24.6	05	001P	CLEAR	
08E	47	007	002	01/31/73	0400	24.6	05	001P	CLEAR	
08E	47	008	002	01/31/73	0400	24.6	05	001P	CLEAR	
08E	47	009	003	01/31/73	0800	24.6	06	134P	CLDY	

A-20

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER
08E	47	010	003	01/31/73	0800	24.6	06	134P	CLDY
08E	47	011	003	01/31/73	0800	24.6	06	134P	CLDY
08E	47	012	003	01/31/73	0800	24.6	06	134P	CLDY
08E	47	013	004	01/31/73	1200	24.6	07	179P	PTCLDY
08E	47	014	004	01/31/73	1200	24.6	07	179P	PTCLDY
08E	47	015	004	01/31/73	1200	24.6	07	179P	PTCLDY
08E	47	016	004	01/31/73	1200	24.6	07	179P	PTCLDY
08E	47	017	005	01/31/73	1600	24.6	07	157P	SNOW
08E	47	018	005	01/31/73	1600	24.6	07	157P	SNOW
08E	47	019	005	01/31/73	1600	24.6	07	157P	SNOW
08E	47	020	005	01/31/73	1600	24.6	07	157P	SNOW
08E	47	021	006	01/31/73	2000	24.6	08	157P	SNOW
08E	47	022	006	01/31/73	2000	24.6	08	157P	SNOW
08E	47	023	006	01/31/73	2000	24.6	08	157P	SNOW
08E	47	024	006	01/31/73	2000	24.6	08	157P	SNOW
08E	47	025	007	01/31/73	2400	24.6	08	131P	SNOW SH
08E	47	026	007	01/31/73	2400	24.6	08	131P	SNOW
08E	47	027	007	01/31/73	2400	24.6	08	131P	SNOW
08E	47	028	007	01/31/73	2400	24.6	08	131P	SNOW
08E	47	029	008	02/01/73	0400	24.6	08	131P	SNOW
08E	47	030	008	02/01/73	0400	24.6	08	131P	SNOW
08E	47	031	008	02/01/73	0400	24.6	08	131P	SNOW
08E	47	032	008	02/01/73	0400	24.6	08	131P	SNOW
08E	47	033	009	02/01/73	0800	24.6	08	131P	SNOW
08E	47	034	009	02/01/73	0800	24.6	08	131P	SNOW
08E	47	035	009	02/01/73	0800	24.6	08	131P	SNOW
08E	47	036	009	02/01/73	0800	24.6	08	131P	SNOW
08E	47	037	010	02/01/73	1200	24.6	08	131P	SNOW
08E	47	038	010	02/01/73	1200	24.6	08	131P	SNOW
08E	47	039	010	02/01/73	1200	24.6	08	131P	SNOW
08E	47	040	010	02/01/73	1200	24.6	08	131P	SNOW
08E	47	041	011	02/01/73	1600	24.6	08	129P	SNOW
08E	47	042	011	02/01/73	1600	24.6	08	129P	SNOW
08E	47	043	011	02/01/73	1600	24.6	08	129P	SNOW
08E	47	044	011	02/01/73	1600	24.6	08	129P	SNOW
08E	47	045	012	02/01/73	2000	25.0	08	129P	SNOW
08E	47	046	012	02/01/73	2000	25.0	08	129P	SNOW
08E	47	047	012	02/01/73	2000	25.0	08	129P	SNOW
08E	47	048	012	02/01/73	2000	25.0	08	129P	SNOW
08E	47	049	013	02/01/73	2400	25.0	08	119P	SNOW
08E	47	050	013	02/01/73	2400	25.0	08	119P	SNOW
08E	47	051	013	02/01/73	2400	25.0	08	119P	SNOW
08E	47	052	013	02/01/73	2400	25.0	08	119P	SNOW
08W	51	002	031	02/08/73	0800	24.8	06	020P	PT CLDY
08W	51	003	031	02/08/73	0800	24.8	06	020P	PT CLDY
08W	51	004	031	02/08/73	0800	24.8	06	020P	PT CLDY
08W	51	005	032	02/08/73	1200	24.8	06	002P	PT CLDY
08W	51	006	032	02/08/73	1200	24.8	06	002P	PT CLDY
08W	51	007	032	02/08/73	1200	24.8	06	002P	PT CLDY
08W	51	008	032	02/08/73	1200	24.8	06	002P	PT CLDY

A-21

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER
08W	51	009	033	02/08/73	1600	24.8	06	025P	PT CLDY
08W	51	010	033	02/08/73	1600	24.8	06	025P	PT CLDY
08W	51	011	033	02/08/73	1600	24.8	06	025P	PT CLDY
08W	51	012	033	02/08/73	1600	24.8	06	025P	PT CLDY
08W	51	013	034	02/08/73	2000	24.8	06	012S	PT CLDY
08W	51	014	034	02/08/73	2000	24.8	06	012S	PT CLDY
08W	51	015	034	02/08/73	2000	24.8	06	012S	PT CLDY
08W	51	016	034	02/08/73	2000	24.8	06	012S	PT CLDY
08W	51	017	035	02/08/73	2400	24.8	05	065S	PT CLDY
08W	51	018	035	02/08/73	2400	24.8	05	065S	PT CLDY
08W	51	019	035	02/08/73	2400	24.8	05	065S	PT CLDY
08W	51	020	035	02/08/73	2400	24.8	05	065S	PT CLDY
08W	51	021	036	02/09/73	0400	24.8	05	065S	PT CLDY
08W	51	022	036	02/09/73	0400	24.8	05	065S	PT CLDY
08W	51	023	036	02/09/73	0400	24.8	05	065S	PT CLDY
08W	51	024	036	02/09/73	0400	24.8	05	065S	PT CLDY
08W	51	025	037	02/09/73	0800	24.8	05	065S	PT CLDY
08W	51	026	037	02/09/73	0800	24.8	05	065S	PT CLDY
08W	51	027	037	02/09/73	0800	24.8	05	065S	PT CLDY
08W	51	028	037	02/09/73	0800	24.8	05	065S	PT CLDY
08W	51	029	038	02/09/73	1200	24.9	05	110S	PT CLDY
08W	51	030	038	02/09/73	1200	24.9	05	110S	PT CLDY
08W	51	031	038	02/09/73	1200	24.9	05	110S	PT CLDY
08W	51	032	038	02/09/73	1200	24.9	05	110S	PT CLDY
08W	51	033	039	02/09/73	1600	24.9	05	110S	PT CLDY
08W	51	034	039	02/09/73	1600	24.9	05	110S	PT CLDY
08W	51	035	039	02/09/73	1600	24.9	05	110S	PT CLDY
08W	51	036	039	02/09/73	1600	24.9	05	110S	PT CLDY
08W	51	037	040	02/09/73	2000	24.9	04	132S	PT CLDY
08W	51	038	040	02/09/73	2000	24.9	04	132S	PT CLDY
08W	51	039	040	02/09/73	2000	24.9	04	132S	PT CLDY
08W	51	040	040	02/09/73	2000	24.9	04	132S	PT CLDY
08W	51	041	041	02/09/73	2400	24.9	04	143S	PT CLDY
08W	51	042	041	02/09/73	2400	24.9	04	143S	PT CLDY
08W	51	043	041	02/09/73	2400	24.9	04	143S	PT CLDY
08W	51	044	041	02/09/73	2400	24.9	04	143S	PT CLDY
08W	51	045	042	02/10/73	0400	24.9	05	059P	PT CLDY
08W	51	046	042	02/10/73	0400	24.9	05	059P	PT CLDY
08W	51	047	042	02/10/73	0400	24.9	05	059P	PT CLDY
08W	51	048	042	02/10/73	0400	24.9	05	059P	PT CLDY
08W	51	049	043	02/10/73	0800	24.9	04	104P	PT CLDY
08W	51	050	043	02/10/73	0800	24.9	04	104P	PT CLDY
08W	51	051	043	02/10/73	0800	24.9	04	104P	PT CLDY
08W	51	052	043	02/10/73	0800	24.9	04	104P	PT CLDY
08W	51	053	044	02/10/73	1200	24.9	06	082P	PT CLDY
08W	51	054	044	02/10/73	1200	24.9	06	082P	PT CLDY
08W	51	055	044	02/10/73	1200	24.9	06	082P	PT CLDY
08W	51	056	044	02/10/73	1200	24.9	06	082P	PT CLDY
08W	51	057	045	02/10/73	1600	25.0	06	082P	CLDY
08W	51	058	045	02/10/73	1600	25.0	06	082P	CLDY

A-22

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RWVD	WEATHER
08W	51	059	045	02/10/73	1600	25.0	06	082P	CLDY
08W	51	060	045	02/10/73	1600	25.0	06	082P	CLDY
08W	51	061	046	02/10/73	2000	25.0	06	037P	CLDY
08W	51	062	046	02/10/73	2000	25.0	06	037P	CLDY
08W	51	063	046	02/10/73	2000	25.0	06	037P	CLDY
08W	51	064	046	02/10/73	2000	25.0	06	037P	CLDY
08W	51	065	047	02/10/73	2400	25.0	05	037P	CLDY
08W	51	066	047	02/10/73	2400	25.0	05	037P	CLDY
08W	51	067	047	02/10/73	2400	25.0	05	037P	CLDY
08W	51	068	047	02/10/73	2400	25.0	05	037P	CLDY
08W	53	001	048	02/11/73	0400	25.0	04	082P	CLDY
08W	53	002	048	02/11/73	0400	25.0	04	082P	CLDY
08W	53	003	048	02/11/73	0400	25.0	04	082P	CLDY
08W	53	004	048	02/11/73	0400	25.0	04	082P	CLDY
08W	53	005	049	02/11/73	0800	25.0	04	082P	CLDY
08W	53	006	049	02/11/73	0800	25.0	04	082P	CLDY
08W	53	007	049	02/11/73	0800	25.0	04	082P	CLDY
08W	53	008	049	02/11/73	0800	25.0	04	082P	CLDY
08W	53	009	050	02/11/73	1200	25.0	02	082P	CLDY
08W	53	010	050	02/11/73	1200	25.0	02	082P	CLDY
08W	53	011	050	02/11/73	1200	25.0	02	082P	CLDY
08W	53	012	050	02/11/73	1200	25.0	02	082P	CLDY
08W	53	013	051	02/11/73	1600	20.0	04	082P	FOG DENSE
08W	53	014	051	02/11/73	1600	20.0	04	082P	FOG DENSE
08W	53	015	051	02/11/73	1600	20.0	04	082P	FOG DENSE
08W	53	016	051	02/11/73	1600	20.0	04	082P	FOG DENSE
08W	53	017	052	02/11/73	2000	20.0	03	104P	FOG
08W	53	018	052	02/11/73	2000	20.0	03	104P	FOG
08W	53	019	052	02/11/73	2000	20.0	03	104P	FOG
08W	53	020	052	02/11/73	2000	20.0	03	104P	FOG
08W	53	021	053	02/11/73	2400	20.0	03	127P	FOG
08W	53	022	053	02/11/73	2400	20.0	03	127P	FOG
08W	53	023	053	02/11/73	2400	20.0	03	127P	FOG
08W	53	024	053	02/11/73	2400	20.0	03	127P	FOG
08W	53	025	054	02/12/73	0400	24.9	03	127P	FOG LIFTING
08W	53	026	054	02/12/73	0400	24.9	03	127P	FOG LIFTING
08W	53	027	054	02/12/73	0400	24.9	03	127P	FOG LIFTING
08W	53	028	054	02/12/73	0400	24.9	03	127P	FOG LIFTING
08W	53	029	055	02/12/73	0800	24.9	04	082P	PT CLDY
08W	53	030	055	02/12/73	0800	24.9	04	082P	PT CLDY
08W	53	031	055	02/12/73	0800	24.9	04	082P	PT CLDY
08W	53	032	055	02/12/73	0800	24.9	04	082P	PT CLDY
08W	53	033	056	02/12/73	1200	24.9	06	150P	PT CLDY
08W	53	034	056	02/12/73	1200	24.9	06	150P	PT CLDY
08W	53	035	056	02/12/73	1200	24.9	06	150P	PT CLDY
08W	53	036	056	02/12/73	1200	24.9	06	150P	PT CLDY
08W	53	037	057	02/12/73	1600	24.9	06	150P	PT CLDY
08W	53	038	057	02/12/73	1600	24.9	06	150P	PT CLDY
08W	53	039	057	02/12/73	1600	24.9	06	150P	PT CLDY
08W	53	040	057	02/12/73	1600	24.9	06	150P	PT CLDY

A-23

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RWVD	WEATHER	COMMENTS
08W	53	041	058	02/12/73	2000	24.9	05	120S	FOG MIST	
08W	53	042	058	02/12/73	2000	24.9	05	120S	FOG MIST	
08W	53	043	058	02/12/73	2000	24.9	05	120S	FOG MIST	
08W	53	044	058	02/12/73	2000	24.9	05	120S	FOG MIST	
08W	53	045	059	02/12/73	2400	24.9	05	097S	FOG MIST	
08W	53	046	059	02/12/73	2400	24.9	05	097S	FOG MIST	
08W	53	047	059	02/12/73	2400	24.9	05	097S	FOG MIST	
08W	53	048	059	02/12/73	2400	24.9	05	097S	FOG MIST	
08W	53	049	060	02/13/73	0400	24.9	05	097S	PT CLDY	
08W	53	050	060	02/13/73	0400	24.9	05	097S	PT CLDY	
08W	53	051	060	02/13/73	0400	24.9	05	097S	PT CLDY	
08W	53	052	060	02/13/73	0400	24.9	05	097S	PT CLDY	
08W	53	053	061	02/13/73	0800	24.9	04	075S	PT CLDY	
08W	53	054	061	02/13/73	0800	24.9	04	075S	PT CLDY	
08W	53	055	061	02/13/73	0800	24.9	04	075S	PT CLDY	
08W	53	056	061	02/13/73	0800	24.9	04	075S	PT CLDY	
08W	53	057	062	02/13/73	1200	24.9	04	046S	PT CLDY	
08W	53	058	062	02/13/73	1200	24.9	04	046S	PT CLDY	
08W	53	059	062	02/13/73	1200	24.9	04	046S	PT CLDY	
08W	53	060	062	02/13/73	1200	24.9	04	046S	PT CLDY	
09E	55	001	001	02/15/73	1600	25.0	07	102S	OCAST	
09E	55	002	001	02/15/73	1600	25.0	07	102S	OCAST	
09E	55	003	001	02/15/73	1600	25.0	07	102S	OCAST	
09E	55	004	001	02/15/73	1600	25.0	07	102S	OCAST	
09E	55	005	002	02/15/73	2000	24.0	07	113S	OCAST	
09E	55	006	002	02/15/73	2000	24.0	07	113S	OCAST	
09E	55	007	002	02/15/73	2000	24.0	07	113S	OCAST	
09E	55	008	002	02/15/73	2000	24.0	07	113S	OCAST	
09E	55	009	003	02/15/73	2400	24.0	07	124S	OCAST	
09E	55	010	003	02/15/73	2400	24.0	07	124S	OCAST	
09E	55	011	003	02/15/73	2400	24.0	07	124S	OCAST	
09E	55	012	003	02/15/73	2400	24.0	07	124S	OCAST	
09E	55	013	004	02/16/73	0400	25.0	07	124S	OCAST	
09E	55	014	004	02/16/73	0400	25.0	07	124S	OCAST	
09E	55	015	004	02/16/73	0400	25.0	07	124S	OCAST	
09E	55	016	004	02/16/73	0400	25.0	07	124S	OCAST	
09E	55	017	005	02/16/73	0800	25.0	07	079S	OCAST	
09E	55	018	005	02/16/73	0800	25.0	07	079S	OCAST	
09E	55	019	005	02/16/73	0800	25.0	07	079S	OCAST	
09E	55	020	005	02/16/73	0800	25.0	07	079S	OCAST	
09E	55	021	006	02/16/73	1200	25.0	07	102S	OCAST	
09E	55	022	006	02/16/73	1200	25.0	07	102S	OCAST	
09E	55	023	006	02/16/73	1200	25.0	07	102S	OCAST	
09E	55	024	006	02/16/73	1200	25.0	07	102S	OCAST	
09E	55	025	007	02/16/73	1600	24.0	07	102S	OCAST	
09E	55	026	007	02/16/73	1600	24.0	07	102S	OCAST	
09E	55	027	007	02/16/73	1600	24.0	07	102S	OCAST	
09E	55	028	007	02/16/73	1600	24.0	07	102S	OCAST	
09E	55	029	008	02/16/73	2000	24.0	07	102S	OCAST	SPRAY OVER STBD R
09E	55	030	008	02/16/73	2000	24.0	07	102S	OCAST	SPRAY OVER STBD R

A-24

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RWYD	WEATHER	COMMENTS
09E	55	031	008	02/16/73	2000	24.0	07	1025	OCAST	SPRAY OVER STBD R
09E	55	032	008	02/16/73	2000	24.0	07	1025	OCAST	SPRAY OVER STBD R
09E	55	033	009	02/16/73	2400	24.0	05	1025	OCAST FOG	
09E	55	034	009	02/16/73	2400	24.0	05	1025	OCAST FOG	
09E	55	035	009	02/16/73	2400	24.0	05	1025	OCAST FOG	
09E	55	036	009	02/16/73	2400	24.0	05	1025	OCAST FOG	
09E	55	037	010	02/17/73	0400	23.0	05	1025	OCAST	
09E	55	038	010	02/17/73	0400	23.0	05	1025	OCAST	
09E	55	039	010	02/17/73	0400	23.0	05	1025	OCAST	
09E	55	040	010	02/17/73	0400	23.0	05	1025	OCAST	
09E	55	041	011	02/17/73	0800	23.0	04	0575	CLEAR	ROLLING EASILY
09E	55	042	011	02/17/73	0800	23.0	04	0575	CLEAR	ROLLING EASILY
09E	55	043	011	02/17/73	0800	23.0	04	0575	CLEAR	ROLLING EASILY
09E	55	044	011	02/17/73	0800	23.0	04	0575	CLEAR	ROLLING EASILY
09E	55	045	012	02/17/73	1200	23.0	04	1025	PT CLDY	
09E	55	046	012	02/17/73	1200	23.0	04	1025	PT CLDY	
09E	55	047	012	02/17/73	1200	23.0	04	1025	PT CLDY	
09E	55	048	012	02/17/73	1200	23.0	04	1025	PT CLDY	
09E	55	049	013	02/17/73	1600	24.0	06	1025	OCAST	
09E	55	050	013	02/17/73	1600	24.0	06	1025	OCAST	
09E	55	051	013	02/17/73	1600	24.0	06	1025	OCAST	
09E	55	052	013	02/17/73	1600	24.0	06	1025	OCAST	
09E	55	055	014	02/17/73	2000	24.0	06	1105	CLDY	
09E	55	056	014	02/17/73	2000	24.0	06	1105	CLDY	
09E	57	001	015	02/17/73	2400	24.0	06	1275	OCAST	
09E	57	002	015	02/17/73	2400	24.0	06	1275	OCAST	
09E	57	003	015	02/17/73	2400	24.0	06	1275	OCAST	
09E	57	004	015	02/17/73	2400	24.0	06	1275	OCAST	
09E	57	005	016	02/18/73	0400	24.0	04	1275	PT CLDY	
09E	57	006	016	02/18/73	0400	24.0	04	1275	PT CLDY	
09E	57	007	016	02/18/73	0400	24.0	04	1275	PT CLDY	
09E	57	008	016	02/18/73	0400	24.0	04	1275	PT CLDY	
09E	57	009	017	02/18/73	0800	24.0	04	0995	CLDY	
09E	57	010	017	02/18/73	0800	24.0	04	0995	CLDY	
09E	57	011	017	02/18/73	0800	24.0	04	0995	CLDY	
09E	57	012	017	02/18/73	0800	24.0	04	0995	CLDY	
09E	57	013	018	02/18/73	1200	24.0	05	0995	PT CLDY	
09E	57	014	018	02/18/73	1200	24.0	05	0995	PT CLDY	
09E	57	015	018	02/18/73	1200	24.0	05	0995	PT CLDY	
09E	57	016	018	02/18/73	1200	24.0	05	0995	PT CLDY	
09E	57	017	019	02/18/73	1600	23.0	04	0995	CLDY	
09E	57	018	019	02/18/73	1600	23.0	04	0995	CLDY	
09E	57	019	019	02/18/73	1600	23.0	04	0995	CLDY	
09E	57	020	019	02/18/73	1600	23.0	04	0995	CLDY	
09E	57	021	020	02/18/73	2000	23.0	04	0995	CLDY	
09E	57	022	020	02/18/73	2000	23.0	04	0995	CLDY	
09E	57	023	020	02/18/73	2000	23.0	04	0995	CLDY	
09E	57	024	020	02/18/73	2000	23.0	04	0995	CLDY	
09E	57	025	021	02/18/73	2400	23.0	03	1445	OCAST	
09E	57	026	021	02/18/73	2400	23.0	03	1445	OCAST	

A-25

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RWYD	WEATHER
09E	57	027	021	02/18/73	2400	23.0	03	1445	OCAST
09E	57	028	021	02/18/73	2400	23.0	03	1445	OCAST
09E	57	029	022	02/19/73	0400	23.0	03	1395	OCAST
09E	57	030	022	02/19/73	0400	23.0	03	1395	OCAST
09E	57	031	022	02/19/73	0400	23.0	03	1395	OCAST
09E	57	032	022	02/19/73	0400	23.0	03	1395	OCAST
09E	57	033	023	02/19/73	0800	23.0	02	1755	OCAST
09E	57	034	023	02/19/73	0800	23.0	02	1755	OCAST
09E	57	035	023	02/19/73	0800	23.0	02	1755	OCAST
09E	57	036	023	02/19/73	0800	23.0	02	1755	OCAST
09E	57	037	024	02/19/73	1200	23.0	04	1555	OCAST
09E	57	038	024	02/19/73	1200	23.0	04	1555	OCAST
09E	57	039	024	02/19/73	1200	23.0	04	1555	OCAST
09E	57	040	024	02/19/73	1200	23.0	04	1555	OCAST
09E	57	041	025	02/19/73	1600	23.0	04	1335	PT CLDY
09E	57	042	025	02/19/73	1600	23.0	04	1335	PT CLDY
09E	57	043	025	02/19/73	1600	23.0	04	1335	PT CLDY
09E	57	044	025	02/19/73	1600	23.0	04	1335	PT CLDY
09E	57	045	026	02/19/73	2000	25.0	04	1245	PT CLDY
09E	57	046	026	02/19/73	2000	25.0	04	1245	PT CLDY
09E	57	047	026	02/19/73	2000	25.0	04	1245	PT CLDY
09E	57	048	026	02/19/73	2000	25.0	04	1245	PT CLDY
09E	57	049	027	02/19/73	2400	24.0	04	1245	OCAST
09E	57	050	027	02/19/73	2400	24.0	04	1245	OCAST
09E	57	051	027	02/19/73	2400	24.0	04	1245	OCAST
09E	57	052	027	02/19/73	2400	24.0	04	1245	OCAST
09E	57	053	028	02/20/73	0400	24.0	04	0985	CLDY
09E	57	054	028	02/20/73	0400	24.0	04	0985	CLDY
09E	57	055	028	02/20/73	0400	24.0	04	0985	CLDY
09E	57	056	028	02/20/73	0400	24.0	04	0985	CLDY
09E	57	057	029	02/20/73	0800	24.0			OCAST
09E	57	058	029	02/20/73	0800	24.0			OCAST
09E	57	059	029	02/20/73	0800	24.0			OCAST
09E	57	060	029	02/20/73	08 0	24.0			OCAST
09W	59	001	030	02/24/73	1600	22.0	04	1335	CLDY
09W	59	002	030	02/24/73	1600	22.0	04	1335	CLDY
09W	59	003	030	02/24/73	1600	22.0	04	1335	CLDY
09W	59	004	030	02/24/73	1600	22.0	04	1335	CLDY
09W	59	005	031	02/24/73	2000	24.0	05	1115	CLDY
09W	59	006	031	02/24/73	2000	24.0	05	1115	CLDY
09W	59	007	031	02/24/73	2000	24.0	05	1115	CLDY
09W	59	008	031	02/24/73	2000	24.0	05	1115	CLDY
09W	59	009	032	02/24/73	2400	24.0	05	1565	OCAST
09W	59	010	032	02/24/73	2400	24.0	05	1565	OCAST
09W	59	011	032	02/24/73	2400	24.0	05	1565	OCAST
09W	59	012	032	02/24/73	2400	24.0	05	1565	OCAST
09W	59	013	033	02/25/73	0400	25.0	04	024P	CLDY
09W	59	014	033	02/25/73	0400	25.0	04	024P	CLDY
09W	59	015	033	02/25/73	0400	25.0	04	024P	CLDY
09W	59	016	033	02/25/73	0400	25.0	04	024P	CLDY

A-26

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RWYD	WEATHER
09W	59	017	034	02/25/73	0800	24.0	06	0215	OCAST
09W	59	018	034	02/25/73	0800	24.0	06	0215	OCAST
09W	59	019	034	02/25/73	0800	24.0	06	0215	OCAST
09W	59	020	034	02/25/73	0800	24.0	06	0215	OCAST
09W	59	021	035	02/25/73	1200	24.0	07	045P	PT CLDY
09W	59	022	035	02/25/73	1200	24.0	07	045P	PT CLDY
09W	59	023	035	02/25/73	1200	24.0	07	045P	PT CLDY
09W	59	024	035	02/25/73	1200	24.0	07	045P	PT CLDY
09W	59	025	036	02/25/73	1600	25.0	07	021S	PT CLDY
09W	59	026	036	02/25/73	1600	25.0	07	021S	PT CLDY
09W	59	027	036	02/25/73	1600	25.0	07	021S	PT CLDY
09W	59	028	036	02/25/73	1600	25.0	07	021S	PT CLDY
09W	59	029	037	02/25/73	2000	25.0	07	021S	OCAST
09W	59	030	037	02/25/73	2000	25.0	07	021S	OCAST
09W	59	031	037	02/25/73	2000	25.0	07	021S	OCAST
09W	59	032	037	02/25/73	2000	25.0	07	021S	OCAST
09W	59	033	038	02/25/73	2400	25.0	05	001P	PT CLDY
09W	59	034	038	02/25/73	2400	25.0	05	001P	PT CLDY
09W	59	035	038	02/25/73	2400	25.0	05	001P	PT CLDY
09W	59	036	038	02/25/73	2400	25.0	05	001P	PT CLDY
09W	59	037	039	02/26/73	0400	25.0	05	024P	PT CLDY
09W	59	038	039	02/26/73	0400	25.0	05	024P	PT CLDY
09W	59	039	039	02/26/73	0400	25.0	05	024P	PT CLDY
09W	59	040	039	02/26/73	0400	25.0	05	024P	PT CLDY
09W	59	041	040	02/26/73	0800	25.0	05	024P	70CAST
09W	59	042	040	02/26/73	0800	25.0	05	024P	70CAST
09W	59	043	040	02/26/73	0800	25.0	05	024P	70CAST
09W	59	044	040	02/26/73	0800	25.0	05	024P	70CAST
09W	59	045	041	02/26/73	1200	25.0	06	024P	OCAST
09W	59	046	041	02/26/73	1200	25.0	06	024P	OCAST
09W	59	047	041	02/26/73	1200	25.0	06	024P	OCAST
09W	59	048	041	02/26/73	1200	25.0	06	024P	OCAST
09W	59	049	042	02/26/73	1600	25.0	06	062P	OCAST
09W	59	050	042	02/26/73	1600	25.0	06	062P	OCAST
09W	59	051	042	02/26/73	1600	25.0	06	062P	OCAST
09W	59	052	042	02/26/73	1600	25.0	06	062P	OCAST
09W	61	001	043	02/26/73	2000	25.0	06	0055	OCAST
09W	61	002	043	02/26/73	2000	25.0	06	0055	OCAST
09W	61	003	043	02/26/73	2000	25.0	06	0055	OCAST
09W	61	004	043	02/26/73	2000	25.0	06	0055	OCAST
09W	61	005	044	02/26/73	2400	25.0	04	0955	PT CLDY
09W	61	006	044	02/26/73	2400	25.0	04	0955	PT CLDY
09W	61	007	044	02/26/73	2400	25.0	04	0955	PT CLDY
09W	61	008	044	02/26/73	2400	25.0	04	0955	PT CLDY
09W	61	009	045	02/27/73	0400	25.0	04	0955	OCAST
09W	61	010	045	02/27/73	0400	25.0	04	0955	OCAST
09W	61	011	045	02/27/73	0400	25.0	04	0955	OCAST
09W	61	012	045	02/27/73	0400	25.0	04	0955	OCAST
09W	61	013	046	02/27/73	0800	25.0	04	0955	OCAST
09W	61	014	046	02/27/73	0800	25.0	04	0955	OCAST

A-27

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER
09W	61	015	046	02/27/73	0800	25.0	04	0958	OCAST
09W	61	016	046	02/27/73	0800	25.0	04	0958	OCAST
09W	61	017	047	02/27/73	1200	25.0	03	005P	CLDY
09W	61	018	047	02/27/73	1200	25.0	03	005P	CLDY
09W	61	019	047	02/27/73	1200	25.0	03	005P	CLDY
09W	61	020	047	02/27/73	1200	25.0	03	005P	CLDY
09W	61	021	048	02/27/73	1600	23.0	05	045P	PT CLDY
09W	61	022	048	02/27/73	1600	23.0	05	045P	PT CLDY
09W	61	023	048	02/27/73	1600	23.0	05	045P	PT CLDY
09W	61	024	048	02/27/73	1600	23.0	05	045P	PT CLDY
09W	61	025	049	02/27/73	2000	25.0	07	067P	CLDY
09W	61	026	049	02/27/73	2000	25.0	07	067P	CLDY
09W	61	027	049	02/27/73	2000	25.0	07	067P	CLDY
09W	61	028	049	02/27/73	2000	25.0	07	067P	CLDY
09W	61	029	050	02/27/73	2400	25.0	07	045S	CLDY
09W	61	030	050	02/27/73	2400	25.0	07	045S	CLDY
09W	61	031	050	02/27/73	2400	25.0	07	045S	CLDY
09W	61	032	050	02/27/73	2400	25.0	07	045S	CLDY
09W	61	033	051	02/28/73	0400	25.0	04	045S	PT CLDY
09W	61	034	051	02/28/73	0400	25.0	04	045S	PT CLDY
09W	61	035	051	02/28/73	0400	25.0	04	045S	PT CLDY
09W	61	036	051	02/28/73	0400	25.0	04	045S	PT CLDY
09W	61	037	052	02/28/73	0800	25.0	04	067S	RAIN
09W	61	038	052	02/28/73	0800	25.0	04	067S	RAIN
09W	61	039	052	02/28/73	0800	25.0	04	067S	RAIN
09W	61	040	052	02/28/73	0800	25.0	04	067S	RAIN
09W	61	041	053	02/28/73	1200	25.0	08	145S	OCAST
09W	61	042	053	02/28/73	1200	25.0	08	145S	OCAST
09W	61	043	053	02/28/73	1200	25.0	08	145S	OCAST
09W	61	044	053	02/28/73	1200	25.0	08	145S	OCAST
09W	61	045	054	02/28/73	1600	25.0	08	145S	OCAST
09W	61	046	054	02/28/73	1600	25.0	08	145S	OCAST
09W	61	047	054	02/28/73	1600	25.0	08	145S	OCAST
09W	61	048	054	02/28/73	1600	25.0	08	145S	OCAST
09W	61	049	055	02/28/73	2000	25.0	08	145S	OCAST
09W	61	050	055	02/28/73	2000	25.0	08	145S	OCAST
09W	61	051	055	02/28/73	2000	25.0	08	145S	OCAST
09W	61	052	055	02/28/73	2000	25.0	08	145S	OCAST
09W	61	053	056	02/28/73	2400	25.0	08	145S	CLDY
09W	61	054	056	02/28/73	2400	25.0	08	145S	CLDY
09W	61	055	056	02/28/73	2400	25.0	08	145S	CLDY
09W	61	056	056	02/28/73	2400	25.0	08	145S	CLDY
09W	61	057	057	03/01/73	0400	25.0	06	145S	PT CLDY
09W	61	058	057	03/01/73	0400	25.0	06	145S	PT CLDY
09W	61	059	057	03/01/73	0400	25.0	06	145S	PT CLDY
09W	61	060	057	03/01/73	0400	25.0	06	145S	PT CLDY
09W	61	061	058	03/01/73	0800	25.0	05	100S	CLEAR
09W	61	062	058	03/01/73	0800	25.0	05	100S	CLEAR
09W	61	063	058	03/01/73	0800	25.0	05	100S	CLEAR
09W	61	064	058	03/01/73	0800	25.0	05	100S	CLEAR

A-28

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER
09W	61	065	059	03/01/73	1200	25.0	03	133P	CLEAR
09W	61	066	059	03/01/73	1200	25.0	03	133P	CLEAR
09W	61	067	059	03/01/73	1200	25.0	03	133P	CLEAR
09W	61	068	059	03/01/73	1200	25.0	03	133P	CLEAR
09W	61	069	060	03/01/73	1600	25.0	05	042P	PT CLDY
09W	61	070	060	03/01/73	1600	25.0	05	042P	PT CLDY
09W	61	071	060	03/01/73	1600	25.0	05	042P	PT CLDY
09W	61	072	060	03/01/73	1600	25.0	05	042P	PT CLDY
10E	63	001	001	03/03/73	2400	24.6	04	046S	OCAST
10E	63	002	001	03/03/73	2400	24.6	04	046S	OCAST
10E	63	003	001	03/03/73	2400	24.6	04	046S	OCAST
10E	63	004	001	03/03/73	2400	24.6	04	046S	OCAST
10E	63	005	002	03/04/73	0400	29.5	04	045S	OCAST
10E	63	006	002	03/04/73	0400	29.5	04	045S	OCAST
10E	63	007	002	03/04/73	0400	29.5	04	045S	OCAST
10E	63	008	002	03/04/73	0400	29.5	04	045S	OCAST
10E	63	009	003	03/04/73	0800	29.6	04	075S	OCAST
10E	63	010	003	03/04/73	0800	29.6	04	075S	OCAST
10E	63	011	003	03/04/73	0800	29.6	04	075S	OCAST
10E	63	012	003	03/04/73	0800	29.6	04	075S	OCAST
10E	63	013	004	03/04/73	1200	29.6	05	051S	CLDY
10E	63	014	004	03/04/73	1200	29.6	05	051S	CLDY
10E	63	015	004	03/04/73	1200	29.6	05	051S	CLDY
10E	63	016	004	03/04/73	1200	29.6	05	051S	CLDY
10E	63	017	005	03/04/73	1600	29.7	05	078S	CLDY
10E	63	018	005	03/04/73	1600	29.7	05	078S	PT CLDY
10E	63	019	005	03/04/73	1600	29.7	05	078S	PT CLDY
10E	63	020	005	03/04/73	1600	29.7	05	078S	PT CLDY
10E	63	021	006	03/04/73	2000	29.7	04	079S	PT CLDY
10E	63	022	006	03/04/73	2000	29.7	04	079S	PT CLDY
10E	63	023	006	03/04/73	2000	29.7	04	079S	PT CLDY
10E	63	024	006	03/04/73	2000	29.7	04	079S	PT CLDY
10E	63	025	007	03/04/73	2400	29.3	04	079S	PT CLDY
10E	63	026	007	03/04/73	2400	29.3	04	079S	PT CLDY
10E	63	027	007	03/04/73	2400	29.3	04	079S	PT CLDY
10E	63	028	007	03/04/73	2400	29.3	04	079S	PT CLDY
10E	63	029	008	03/05/73	0400	28.8	03	079S	FOG
10E	63	030	008	03/05/73	0400	28.8	03	079S	FOG
10E	63	031	008	03/05/73	0400	28.8	03	079S	FOG
10E	63	032	008	03/05/73	0400	28.8	03	079S	FOG
10E	63	033	009	03/05/73	0800	29.1	04	079S	PT CLDY
10E	63	034	009	03/05/73	0800	29.1	04	079S	PT CLDY
10E	63	035	009	03/05/73	0800	29.1	04	079S	PT CLDY
10E	63	036	009	03/05/73	0800	29.1	04	079S	PT CLDY
10E	63	037	010	03/05/73	1200	28.9	04	102S	PT CLDY
10E	63	038	010	03/05/73	1200	28.9	04	102S	PT CLDY
10E	63	039	010	03/05/73	1200	28.9	04	102S	PT CLDY
10E	63	040	010	03/05/73	1200	28.9	04	102S	PT CLDY
10E	63	041	011	03/05/73	1600	28.9	04	102S	PT CLDY
10E	63	042	011	03/05/73	1600	28.9	04	102S	PT CLDY

A-29

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER	COMMENTS
10E	63	043	011	03/05/73	1600	28.9	04	102S	PT CLDY	
10E	63	044	011	03/05/73	1600	28.9	04	102S	PT CLDY	
10E	63	045	012	03/05/73	2000	29.0	06	102S	PT CLDY	
10E	63	046	012	03/05/73	2000	29.0	06	102S	PT CLDY	
10E	63	047	012	03/05/73	2000	29.0	06	102S	PT CLDY	
10E	63	048	012	03/05/73	2000	29.0	06	102S	PT CLDY	
10E	63	049	013	03/05/73	2400	28.9	05	102S	PT CLDY	
10E	63	050	013	03/05/73	2400	28.9	05	102S	PT CLDY	
10E	63	051	013	03/05/73	2400	28.9	05	102S	PT CLDY	
10E	63	052	013	03/05/73	2400	28.9	05	102S	PT CLDY	
10E	63	053	014	03/06/73	0400	28.9	05	124S	PT CLDY	
10E	63	054	014	03/06/73	0400	28.9	05	124S	PT CLDY	
10E	63	055	014	03/06/73	0400	28.9	05	124S	PT CLDY	
10E	63	056	014	03/06/73	0400	28.9	05	124S	PT CLDY	
10E	63	057	015	03/06/73	0800	28.9	05	124S	PT CLDY	
10E	63	058	015	03/06/73	0800	28.9	05	124S	PT CLDY	
10E	63	059	015	03/06/73	0800	28.9	05	124S	PT CLDY	
10E	63	060	015	03/06/73	0800	28.9	05	124S	PT CLDY	
10E	63	061	016	03/06/73	1200	28.8	05	057S	OCAST	
10E	63	062	016	03/06/73	1200	28.8	05	057S	OCAST	
10E	63	063	016	03/06/73	1200	28.8	05	057S	OCAST	
10E	63	064	016	03/06/73	1200	28.8	05	057S	OCAST	
10E	63	065	017	03/06/73	1600	28.7	05	057S	OCAST	
10E	63	066	017	03/06/73	1600	28.7	05	057S	OCAST	
10E	63	067	017	03/06/73	1600	28.7	05	057S	OCAST	
10E	63	068	017	03/06/73	1600	28.7	05	057S	OCAST	
10E	63	069	018	03/06/73	2000	28.6	07	057S	OCAST	
10E	63	070	018	03/06/73	2000	28.6	07	057S	OCAST	
10E	63	071	018	03/06/73	2000	28.6	07	057S	OCAST	
10E	63	072	018	03/06/73	2000	28.6	07	057S	OCAST	
10E	65	001	019	03/06/73	2400	28.6	07	079S	OCAST	
10E	65	002	019	03/06/73	2400	28.6	07	079S	OCAST	
10E	65	003	019	03/06/73	2400	28.6	07	079S	OCAST	
10E	65	004	019	03/06/73	2400	28.6	07	079S	OCAST	
10E	65	005	020	03/07/73	0400	28.6	06	034S	OCAST	
10E	65	006	020	03/07/73	0400	28.6	06	034S	OCAST	
10E	65	007	020	03/07/73	0400	28.6	06	034S	OCAST	
10E	65	008	020	03/07/73	0400	28.6	06	034S	OCAST	
10E	65	009	021	03/07/73	0800	28.7	08	100S	OCAST	
10E	65	010	021	03/07/73	0800	28.7	08	100S	OCAST	
10E	65	011	021	03/07/73	0800	28.7	08	100S	OCAST	
10E	65	012	012	03/07/73	0800	28.7	08	100S	OCAST	
10E	65	013	022	03/07/73	1000				OCAST	
10E	65	014	022	03/07/73	1000				OCAST	
10E	65	015	022	03/07/73	1000				OCAST	
10E	65	016	022	03/07/73	1000				OCAST	
10E	65	017	023	03/07/73	1200	28.6	08	100S	OCAST	PORT LIST
10E	65	018	023	03/07/73	1200	28.6	08	100S	OCAST	PORT LIST
10E	65	019	023	03/07/73	1200	28.6	08	100S	OCAST	PORT LIST
10E	65	020	023	03/07/73	1200	28.6	08	100S	OCAST	PORT LIST

A-30

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER	COMMENTS
10E	65	021	024	03/07/73	1400				OCAST	PORT LIST
10E	65	022	024	03/07/73	1400				OCAST	PORT LIST
10E	65	023	024	03/07/73	1400				OCAST	PORT LIST
10E	65	024	024	03/07/73	1400				OCAST	PORT LIST
10E	65	025	025	03/07/73	1600	28,5	06	077S	OCAST	
10E	65	026	025	03/07/73	1600	28,5	06	077S	OCAST	
10E	65	027	025	03/07/73	1600	28,5	06	077S	OCAST	
10E	65	028	025	03/07/73	1600	28,5	06	077S	OCAST	
10E	65	029	026	03/07/73	2000	28,6	06	077S	LDY	
10E	65	030	026	03/07/73	2000	28,6	06	077S	LDY	
10E	65	031	026	03/07/73	2000	28,6	06	077S	LDY	
10E	65	032	026	03/07/73	2000	28,6	06	077S	LDY	
10E	65	033	027	03/07/73	2400	28,8	05	055S	PT CLDY	
10E	65	034	027	03/07/73	2400	28,8	05	055S	PT CLDY	
10E	65	035	027	03/07/73	2400	28,8	05	055S	PT CLDY	
10E	65	036	027	03/07/73	2400	28,8	05	055S	PT CLDY	
10E	65	037	028	03/08/73	0400	28,8	04	033S	CLEAR	
10E	65	038	028	03/08/73	0400	28,8	04	033S	CLEAR	
10E	65	039	028	03/08/73	0400	28,8	04	033S	CLEAR	
10E	65	040	028	03/08/73	0400	28,8	04	033S	CLEAR	
10E	65	041	029	03/08/73	0800	28,9	02	030S	CLEAR	
10E	65	042	029	03/08/73	0800	28,9	02	030S	CLEAR	
10E	65	043	029	03/08/73	0800	28,9	02	030S	CLEAR	
10E	65	044	029	03/08/73	0800	28,9	02	030S	CLEAR	
10W	67	001	001	03/11/73	1600		03	125P	OCAST	
10W	67	002	001	03/11/73	1600		03	125P	OCAST	
10W	67	003	001	03/11/73	1600		03	125P	OCAST	
10W	67	004	001	03/11/73	1600		03	125P	OCAST	
10W	67	005	002	03/11/73	2000	28,3	03	164P	OCAST	
10W	67	006	002	03/11/73	2000	28,3	03	164P	OCAST	
10W	67	007	002	03/11/73	2000	28,3	03	164P	OCAST	
10W	67	008	002	03/11/73	2000	28,3	03	164P	OCAST	
10W	67	009	003	03/11/73	2400	28,9	04	141P	CLEAR	
10W	67	010	003	03/11/73	2400	28,9	04	141P	CLEAR	
10W	67	011	003	03/11/73	2400	28,9	04	141P	CLEAR	
10W	67	012	003	03/11/73	2400	28,9	04	141P	CLEAR	
10W	67	013	004	03/12/73	0400	28,8	05	074P	PT CLDY	
10W	67	014	004	03/12/73	0400	28,8	05	074P	PT CLDY	
10W	67	015	004	03/12/73	0400	28,8	05	074P	PT CLDY	
10W	67	016	004	03/12/73	0400	28,8	05	074P	PT CLDY	
10W	67	017	005	03/12/73	0800	28,6	06	119P	PT CLDY	
10W	67	018	005	03/12/73	0800	28,6	06	119P	PT CLDY	
10W	67	019	005	03/12/73	0800	28,6	06	119P	PT CLDY	
10W	67	020	005	03/12/73	0800	28,6	06	119P	PT CLDY	
10W	67	021	006	03/12/73	1200	28,7	06	096P	PT CLDY	
10W	67	022	006	03/12/73	1200	28,7	06	096P	PT CLDY	
10W	67	023	006	03/12/73	1200	28,7	06	096P	PT CLDY	
10W	67	024	006	03/12/73	1200	28,7	06	096P	PT CLDY	
10W	67	025	007	03/12/73	1600	28,6	05	119P	PT CLDY	
10W	67	026	007	03/12/73	1600	28,6	05	119P	PT CLDY	

A-31

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER
10W	67	027	007	03/12/73	1600	28,6	05	119P	PT CLDY
10W	67	028	007	03/12/73	1600	28,6	05	119P	PT CLDY
10W	67	029	008	03/12/73	2000	28,6	05	006P	PT CLDY
10W	67	030	008	03/12/73	2000	28,6	05	006P	PT CLDY
10W	67	031	008	03/12/73	2000	28,6	05	006P	PT CLDY
10W	67	032	008	03/12/73	2000	28,6	05	006P	PT CLDY
10W	67	033	009	03/12/73	2400	28,5	05	029P	PT CLDY
10W	67	034	009	03/12/73	2400	28,5	05	029P	PT CLDY
10W	67	035	009	03/12/73	2400	28,5	05	029P	PT CLDY
10W	67	036	009	03/12/73	2400	28,5	05	029P	PT CLDY
10W	67	037	010	03/13/73	0400	28,5	05	029P	RAIN
10W	67	038	010	03/13/73	0400	28,5	05	029P	RAIN
10W	67	039	010	03/13/73	0400	28,5	05	029P	RAIN
10W	67	040	010	03/13/73	0400	28,5	05	029P	RAIN
10W	67	041	011	03/13/73	0800	28,5	04	026P	OCAST
10W	67	042	011	03/13/73	0800	28,5	04	026P	OCAST
10W	67	043	011	03/13/73	0800	28,5	04	026P	OCAST
10W	67	044	011	03/13/73	0800	28,5	04	026P	OCAST
10W	67	045	012	03/13/73	1200	28,7	04	064S	PT CLDY
10W	67	046	012	03/13/73	1200	28,7	04	064S	PT CLDY
10W	67	047	012	03/13/73	1200	28,7	04	064S	PT CLDY
10W	67	048	012	03/13/73	1200	28,7	04	064S	PT CLDY
10W	67	049	013	03/13/73	1600	28,6	04	048S	PT CLDY
10W	67	050	013	03/13/73	1600	28,6	04	048S	PT CLDY
10W	67	051	013	03/13/73	1600	28,6	04	048S	PT CLDY
10W	67	052	013	03/13/73	1600	28,6	04	048S	PT CLDY
10W	67	053	014	03/13/73	2000	28,8	07	041P	OCAST
10W	67	054	014	03/13/73	2000	28,8	07	041P	OCAST
10W	67	055	014	03/13/73	2000	28,8	07	041P	OCAST
10W	67	056	014	03/13/73	2000	28,8	07	041P	OCAST
10W	67	057	015	03/13/73	2400	28,5	08	041P	OCAST
10W	67	058	015	03/13/73	2400	28,5	08	041P	OCAST
10W	67	059	015	03/13/73	2400	28,5	08	041P	OCAST
10W	67	060	015	03/13/73	2400	28,5	08	041P	OCAST
10W	67	061	016	03/14/73	0400	25,1	09	019P	
10W	67	062	016	03/14/73	0400	25,1	09	019P	
10W	67	063	016	03/14/73	0400	25,1	09	019P	
10W	67	064	016	03/14/73	0400	25,1	09	019P	
10W	67	065	017	03/14/73	0800	21,4	08	019P	RAIN
10W	67	066	017	03/14/73	0800	21,4	08	019P	RAIN
10W	67	067	017	03/14/73	0800	21,4	08	019P	RAIN
10W	67	068	017	03/14/73	0800	21,4	08	019P	RAIN
10W	69	001	018	03/14/73	1200	23,4	07	021S	PT CLDY
10W	69	002	018	03/14/73	1200	23,4	07	021S	PT CLDY
10W	69	003	018	03/14/73	1200	23,4	07	021S	PT CLDY
10W	69	004	018	03/14/73	1200	23,4	07	021S	PT CLDY
10W	69	005	019	03/14/73	1400	23,4	07	021S	PT CLDY
10W	69	006	019	03/14/73	1400	23,4	07	021S	PT CLDY
10W	69	007	019	03/14/73	1400	23,4	07	021S	PT CLDY
10W	69	008	019	03/14/73	1400	23,4	07	021S	PT CLDY

A-32

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER	COMMENTS
10W	69	009	020	03/14/73	1600	29,4	10	001P	OCAST	
10W	69	010	020	03/14/73	1600	29,4	10	001P	OCAST	
10W	69	011	020	03/14/73	1600	29,4	10	001P	OCAST	
10W	69	012	020	03/14/73	1600	29,4	10	001P	OCAST	
10W	69	013	021	03/14/73	1800	29,4	10	001P	OCAST	
10W	69	014	021	03/14/73	1800	29,4	10	001P	OCAST	
10W	69	015	021	03/14/73	1800	29,4	10	001P	OCAST	
10W	69	016	021	03/14/73	1800	29,4	10	001P	OCAST	
10W	69	017	022	03/14/73	2000	29,4	09	001P	CLDY	
10W	69	018	022	03/14/73	2000	29,4	09	001P	CLDY	
10W	69	019	022	03/14/73	2000	29,4	09	001P	CLDY	
10W	69	020	022	03/14/73	2000	29,4	09	001P	CLDY	
10W	69	021	023	03/14/73	2200	29,4	09	001P	CLDY	
10W	69	022	023	03/14/73	2200	29,4	09	001P	CLDY	
10W	69	023	023	03/14/73	2200	29,4	09	001P	CLDY	
10W	69	024	023	03/14/73	2200	29,4	09	001P	CLDY	
10W	69	025	024	03/14/73	2400	22,2	09	044S	CLDY	PITCHING
10W	69	026	024	03/14/73	2400	22,2	09	044S	CLDY	PITCHING
10W	69	027	024	03/14/73	2400	22,2	09	044S	CLDY	PITCHING
10W	69	028	024	03/14/73	2400	22,2	09	044S	CLDY	PITCHING
10W	69	029	024	03/14/73	2400	22,2	09	044S	CLDY	PITCHING
10W	69	030	024	03/14/73	2400	22,2	09	044S	CLDY	PITCHING
10W	69	031	024	03/14/73	2400	22,2	09	044S	CLDY	PITCHING
10W	69	032	024	03/14/73	2400	22,2	09	044S	CLDY	PITCHING
10W	69	033	025	03/15/73	0400	19,8	08	044S	PT CLDY	
10W	69	034	025	03/15/73	0400	19,8	08	044S	PT CLDY	
10W	69	035	025	03/15/73	0400	19,8	08	044S	PT CLDY	
10W	69	036	025	03/15/73	0400	19,8	08	044S	PT CLDY	
10W	69	037	025	03/15/73	0400	19,8	08	044S	PT CLDY	
10W	69	038	025	03/15/73	0400	19,8	08	044S	PT CLDY	
10W	69	039	025	03/15/73	0400	19,8	08	044S	PT CLDY	
10W	69	040	025	03/15/73	0400	19,8	08	044S	PT CLDY	
10W	69	041	026	03/15/73	0800	20,4	08	044S	PT CLDY	
10W	69	042	026	03/15/73	0800	20,4	08	044S	PT CLDY	
10W	69	043	026	03/15/73	0800	20,4	08	044S	PT CLDY	
10W	69	044	026	03/15/73	0800	20,4	08	044S	PT CLDY	
10W	69	045	026	03/15/73	0800	20,4	08	044S	PT CLDY	
10W	69	046	026	03/15/73	0800	20,4	08	044S	PT CLDY	
10W	69	047	026	03/15/73	0800	20,4	08	044S	PT CLDY	
10W	69	048	026	03/15/73	0800	20,4	08	044S	PT CLDY	
10W	69	049	027	03/15/73	1200	26,5	07	044S	PT CLDY	4-5 DEG, PORT LIS
10W	69	050	027	03/15/73	1200	26,5	07	044S	PT CLDY	4-5 DEG, PORT LIS
10W	69	051	027	03/15/73	1200	26,5	07	044S	PT CLDY	4-5 DEG, PORT LIS
10W	69	052	027	03/15/73	1200	26,5	07	044S	PT CLDY	4-5 DEG, PORT LIS
10W	69	053	028	03/15/73	1600	29,9	06	044S	OCAST	
10W	69	054	028	03/15/73	1600	29,9	06	044S	OCAST	
10W	69	055	028	03/15/73	1600	29,9	06	044S	OCAST	
10W	69	056	028	03/15/73	1600	29,9	06	044S	OCAST	
10W	69	057	029	03/15/73	2000	29,8	02	136P	OCAST	
10W	69	058	029	03/15/73	2000	29,8	02	136P	OCAST	

A-33

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RHVD	WEATHER
10W	69	059	029	03/15/73	2000	29,8	02	136P	OCAST
10W	69	060	029	03/15/73	2000	29,8	02	136P	OCAST
11E	71	001	001	03/19/73	1200	28,9	07	124P	OCAST
11E	71	002	001	03/19/73	1200	28,9	07	124P	OCAST
11E	71	003	001	03/19/73	1200	28,9	07	124P	OCAST
11E	71	004	001	03/19/73	1200	28,9	07	124P	OCAST
11E	71	005	002	03/19/73	1400				OCAST
11E	71	006	002	03/19/73	1400				OCAST
11E	71	007	002	03/19/73	1400				OCAST
11E	71	008	002	03/19/73	1400				OCAST
11E	71	009	003	03/19/73	1600	29,3	04	146P	OCAST
11E	71	010	003	03/19/73	1600	29,3	04	146P	OCAST
11E	71	011	003	03/19/73	1600	29,3	04	146P	OCAST
11E	71	012	003	03/19/73	1600	29,3	04	146P	OCAST
11E	71	013	004	03/19/73	1600				OCAST
11E	71	014	004	03/19/73	1600				OCAST
11E	71	015	004	03/19/73	1600				OCAST
11E	71	016	004	03/19/73	1600				OCAST
11E	71	017	005	03/19/73	2000	29,6	08	146P	OCAST
11E	71	018	005	03/19/73	2000	29,6	08	146P	OCAST
11E	71	019	005	03/19/73	2000	29,6	08	146P	OCAST
11E	71	020	005	03/19/73	2000	29,6	08	146P	OCAST
11E	71	021	006	03/19/73	2400	29,4	08	135P	OCAST
11E	71	022	006	03/19/73	2400	29,4	08	135P	OCAST
11E	71	023	006	03/19/73	2400	29,4	08	135P	OCAST
11E	71	024	006	03/19/73	2400	29,4	08	135P	OCAST
11E	71	025	007	03/20/73	0400	28,8	05	135S	OCAST
11E	71	026	007	03/20/73	0400	28,8	05	135S	OCAST
11E	71	027	007	03/20/73	0400	28,8	05	135S	OCAST
11E	71	028	007	03/20/73	0400	28,8	05	135S	OCAST
11E	71	029	008	03/20/73	0400	28,8	04	157P	CLDY
11E	71	030	008	03/20/73	0800	28,8	04	157P	CLDY
11E	71	031	008	03/20/73	0800	28,8	04	157P	CLDY
11E	71	032	008	03/20/73	0800	28,8	04	157P	CLDY
11E	71	033	009	03/20/73	1200	28,8	04	135P	CLDY
11E	71	034	009	03/20/73	1200	28,8	04	135P	CLDY
11E	71	035	009	03/20/73	1200	28,8	04	135P	CLDY
11E	71	036	009	03/20/73	1200	28,8	04	135P	CLDY
11E	71	037	010	03/20/73	1600	28,7	05	157S	PT CLDY
11E	71	038	010	03/20/73	1600	28,7	05	157S	PT CLDY
11E	71	039	010	03/20/73	1600	28,7	05	157S	PT CLDY
11E	71	040	010	03/20/73	1600	28,7	05	157S	PT CLDY
11E	71	041	011	03/20/73	2000	28,7	05	135S	PT CLDY
11E	71	042	011	03/20/73	2000	28,7	05	135S	PT CLDY
11E	71	043	011	03/20/73	2000	28,7	05	135S	PT CLDY
11E	71	044	011	03/20/73	2000	28,7	05	135S	PT CLDY
11E	71	045	012	03/20/73	2400	28,6	04	135S	PT CLDY
11E	71	046	012	03/20/73	2400	28,6	04	135S	PT CLDY
11E	71	047	012	03/20/73	2400	28,6	04	135S	PT CLDY
11E	71	048	012	03/20/73	2400	28,6	04	135S	PT CLDY

A-34

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RHVD	WEATHER
11E	71	049	013	03/21/73	0400	29,7	04	128S	PT CLDY
11E	71	050	013	03/21/73	0400	29,7	04	128S	PT CLDY
11E	71	051	013	03/21/73	0400	29,7	04	128S	PT CLDY
11E	71	052	013	03/21/73	0400	29,7	04	128S	PT CLDY
11E	71	053	014	03/21/73	0800	28,5	05	128S	CLDY
11E	71	054	014	03/21/73	0800	28,5	05	128S	CLDY
11E	71	055	014	03/21/73	0800	28,5	05	128S	CLDY
11E	71	056	014	03/21/73	0800	28,5	05	128S	CLDY
11E	71	057	015	03/21/73	1200	28,7	06	128S	CLDY
11E	71	058	015	03/21/73	1200	28,7	06	128S	CLEAR
11E	71	059	015	03/21/73	1200	28,7	06	128S	CLEAR
11E	71	060	015	03/21/73	1200	28,7	06	128S	CLEAR
11E	71	061	016	03/21/73	1600	28,9	05	151S	PTCLDY
11E	71	062	016	03/21/73	1600	28,9	05	151S	PTCLDY
11E	71	063	016	03/21/73	1600	28,9	05	151S	PTCLDY
11E	71	064	016	03/21/73	1600	28,9	05	151S	PTCLDY
11E	71	065	017	03/21/73	2000	29,0	06	151S	CLDY
11E	71	066	017	03/21/73	2000	29,0	06	151S	CLDY
11E	71	067	017	03/21/73	2000	29,0	06	151S	CLDY
11E	71	068	017	03/21/73	2000	29,0	06	151S	CLDY
11E	71	069	018	03/21/73	2400	28,8	04	151S	OCAST
11F	71	070	018	03/21/73	2400	28,8	04	151S	OCAST
11E	71	071	018	03/21/73	2400	28,8	04	151S	OCAST
11E	71	072	018	03/21/73	2400	28,8	04	151S	OCAST
11E	71	073	019	03/22/73	0400	28,9	03	151S	OCAST
11E	71	074	019	03/22/73	0400	28,9	03	151S	OCAST
11E	71	075	019	03/22/73	0400	28,9	03	151S	OCAST
11E	71	076	019	03/22/73	0400	28,9	03	151S	OCAST
11F	73	002	020	03/22/73	0800	28,9	04	151S	OCAST
11E	73	003	020	03/22/73	0800	28,9	04	151S	OCAST
11E	73	004	020	03/22/73	0800	28,9	04	151S	OCAST
11E	73	005	021	03/22/73	1200	28,9	04	151S	FOG
11E	73	006	021	03/22/73	1200	28,9	04	151S	FOG
11E	73	007	021	03/22/73	1200	28,9	04	151S	FOG
11F	73	008	02,	03/22/73	1200	28,9	04	151S	FOG
11E	73	009	022	03/22/73	1600	28,8	04	106S	FOG
11E	73	010	022	03/22/73	1600	28,8	04	106S	FOG
11E	73	011	022	03/22/73	1600	28,8	04	106S	FOG
11F	73	012	022	03/22/73	1600	28,8	04	106S	FOG
11E	73	013	023	03/22/73	2000	28,8	04	106S	OCAST
11E	73	014	023	03/22/73	2000	28,8	04	106S	OCAST
11E	73	015	023	03/22/73	2000	28,8	04	106S	OCAST
11F	73	016	023	03/22/73	2000	28,8	04	106S	OCAST
11E	73	017	024	03/22/73	2400	28,8	04	106S	OCAST
11E	73	018	024	03/22/73	2400	28,8	04	106S	OCAST
11E	73	019	024	03/22/73	2400	28,8	04	106S	OCAST
11E	73	020	024	03/22/73	2400	28,8	04	106S	OCAST
11E	73	021	025	03/23/73	0400	28,8	03	106S	PT CLDY
11E	73	022	025	03/23/73	0400	28,8	03	106S	PT CLDY
11E	73	023	025	03/23/73	0400	28,8	03	106S	PT CLDY

A-35

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RHVD	WEATHER
11E	73	024	025	03/23/73	0400	28,8	03	106S	PT CLDY
11E	73	025	026	03/23/73	0800	28,8	04	061S	PT CLDY
11E	73	026	026	03/23/73	0800	28,8	04	061S	PT CLDY
11E	73	027	026	03/23/73	0800	28,8	04	061S	PT CLDY
11E	73	028	026	03/23/73	0800	28,8	04	061S	PT CLDY
11E	73	029	027	03/23/73	1200	28,8	05	106S	PT CLDY
11E	73	030	027	03/23/73	1200	28,8	05	106S	PT CLDY
11E	73	031	027	03/23/73	1200	28,8	05	106S	PT CLDY
11E	73	032	027	03/23/73	1200	28,8	05	106S	PT CLDY
11E	73	033	028	03/23/73	1600	28,8	05	106S	PT CLDY
11E	73	034	028	03/23/73	1600	28,8	05	106S	PT CLDY
11E	73	035	028	03/23/73	1600	28,8	05	106S	PT CLDY
11E	73	036	028	03/23/73	1600	28,8	05	106S	PT CLDY
11E	73	037	029	03/23/73	2000	28,8	05	106S	PT CLDY
11E	73	038	029	03/23/73	2000	28,8	05	106S	PT CLDY
11E	73	039	029	03/23/73	2000	28,8	05	106S	PT CLDY
11E	73	040	029	03/23/73	2000	28,8	05	106S	PT CLDY
11E	73	041	030	03/23/73	2400	28,5	03		PT CLDY
11E	73	042	030	03/23/73	2400	28,5	03		PT CLDY
11E	73	043	030	03/23/73	2400	28,5	03		PT CLDY
11E	73	044	030	03/23/73	2400	28,5	03		PT CLDY
11E	73	045	031	03/24/73	0400	26,0	02		CLEAR
11E	73	046	031	03/24/73	0400	26,0	02		CLEAR
11E	73	047	031	03/24/73	0400	26,0	02		CLEAR
11E	73	048	031	03/24/73	0400	26,0	02		CLEAR
11W	75	001	001	03/26/73	1200	26,8	03		PT CLDY
11W	75	002	001	03/26/73	1200	26,8	03		PT CLDY
11W	75	003	001	03/26/73	1200	26,8	03		PT CLDY
11W	75	004	001	03/26/73	1200	26,8	03		PT CLDY
11W	75	005	002	03/26/73	1600	26,7	03	025P	PT CLDY
11W	75	006	002	03/26/73	1600	26,7	03	025P	PT CLDY
11W	75	007	002	03/26/73	1600	26,7	03	025P	PT CLDY
11W	75	008	002	03/26/73	1600	26,7	03	025P	PT CLDY
11W	75	009	003	03/26/73	2000	28,5	05	044P	OCAST
11W	75	010	003	03/26/73	2000	28,5	05	044P	OCAST
11W	75	011	003	03/26/73	2000	28,5	05	044P	OCAST
11W	75	012	003	03/26/73	2000	28,5	05	044P	OCAST
11W	75	013	004	03/26/73	2400	28,5	05	044P	OCAST
11W	75	014	004	03/26/73	2400	28,5	05	044P	OCAST
11W	75	015	004	03/26/73	2400	28,5	05	044P	OCAST
11W	75	016	004	03/26/73	2400	28,5	05	044P	OCAST
11W	75	017	005	03/27/73	0400	28,8	03	022P	CLDY
11W	75	018	005	03/27/73	0400	28,8	03	022P	CLDY
11W	75	019	005	03/27/73	0400	28,8	03	022P	CLDY
11W	75	020	005	03/27/73	0400	28,8	03	022P	CLDY
11W	75	021	006	03/27/73	0800	28,8	05	022S	OCAST
11W	75	022	006	03/27/73	0800	28,8	05	022S	OCAST
11W	75	023	006	03/27/73	0800	28,8	05	022S	OCAST
11W	75	024	006	03/27/73	0800	28,8	05	022S	OCAST
11W	75	025	007	03/27/73	1200	28,8	05	022S	OCAST DRIZZLE

A-36

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER
11W	75	026	007	03/27/73	1200	28,8	05	0228	OCAST DRIZZLE
11W	75	027	007	03/27/73	1200	28,8	05	0228	OCAST DRIZZLE
11W	75	028	007	03/27/73	1200	28,8	05	0228	OCAST DRIZZLE
11W	75	029	008	03/27/73	1600	28,0	04	0238	OCAST
11W	75	030	008	03/27/73	1600	28,0	04	0238	OCAST
11W	75	031	008	03/27/73	1600	28,0	04	0238	OCAST
11W	75	032	008	03/27/73	1600	28,0	04	0238	OCAST
11W	75	033	009	03/27/73	2000	29,2	03	0238	OCAST
11W	75	034	009	03/27/73	2000	29,2	03	0238	OCAST
11W	75	035	009	03/27/73	2000	29,2	03	0238	OCAST
11W	75	036	009	03/27/73	2000	29,2	03	0238	OCAST
11W	75	037	010	03/27/73	2400	29,3	03	022P	THIN FOG
11W	75	038	010	03/27/73	2400	29,3	03	022P	THIN FOG
11W	75	039	010	03/27/73	2400	29,3	03	022P	THIN FOG
11W	75	040	010	03/27/73	2400	29,3	03	022P	THIN FOG
11W	75	041	011	03/28/73	0400	29,7	05	022P	OCAST
11W	75	042	011	03/28/73	0400	29,7	05	022P	OCAST
11W	75	043	011	03/28/73	0400	29,7	05	022P	OCAST
11W	75	044	011	03/28/73	0400	29,7	05	022P	OCAST
11W	75	045	012	03/28/73	0800	29,6	04	089P	CLDY
11W	75	046	012	03/28/73	0800	29,6	04	089P	CLDY
11W	75	047	012	03/28/73	0800	29,6	04	089P	CLDY
11W	75	048	012	03/28/73	0800	29,6	04	089P	CLDY
11W	75	049	013	03/28/73	1200	29,7	05	089P	OCAST
11W	75	050	013	03/28/73	1200	29,7	05	089P	OCAST
11W	75	051	013	03/28/73	1200	29,7	05	089P	OCAST
11W	75	052	013	03/28/73	1200	29,7	05	089P	OCAST
11W	75	053	014	03/28/73	1600	29,7	05	089P	CLDY
11W	75	054	014	03/28/73	1600	29,7	05	089P	CLDY
11W	75	055	014	03/28/73	1600	29,7	05	089P	CLDY
11W	75	056	014	03/28/73	1600	29,7	05	089P	CLDY
11W	75	057	015	03/28/73	2000	29,3	06	089P	OCAST
11W	75	058	015	03/28/73	2000	29,3	06	089P	OCAST
11W	75	059	015	03/28/73	2000	29,3	06	089P	OCAST
11W	75	060	015	03/28/73	2000	29,3	06	089P	OCAST
11W	75	061	016	03/28/73	2400	29,2	05	066P	OCAST
11W	75	062	016	03/28/73	2400	29,2	05	066P	OCAS;
11W	75	063	016	03/28/73	2400	29,2	05	066P	OCAST
11W	75	064	016	03/28/73	2400	29,2	05	066P	OCAST
11W	75	070	018	03/29/73	0800	29,4	07	1358	OCAST
11W	75	071	018	03/29/73	0800	29,4	07	1358	OCAST
11W	75	072	018	03/29/73	0800	29,4	07	1358	OCAST
11W	77	001	019	03/29/73	1000		07		OCAST
11W	77	002	019	03/29/73	1000		07		OCAST
11W	77	003	019	03/29/73	1000		07		OCAST
11W	77	004	019	03/29/73	1000		07		OCAST
11W	77	005	020	03/29/73	1200	29,7	08	1578	OCAST
11W	77	006	020	03/29/73	1200	29,7	08	1578	OCAST
11W	77	007	020	03/29/73	1200	29,7	08	1578	OCAST
11W	77	008	020	03/29/73	1200	29,7	08	1578	OCAST

A-37

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER
11W	77	009	021	03/29/73	1400		08		OCAST
11W	77	010	021	03/29/73	1400		08		OCAST
11W	77	011	021	03/29/73	1400		08		OCAST
11W	77	012	021	03/29/73	1400		08		OCAST
11W	77	013	022	03/29/73	1600	28,6	08	1358	OCAST
11W	77	014	022	03/29/73	1600	28,6	08	1358	OCAST
11W	77	015	022	03/29/73	1600	28,6	08	1358	OCAST
11W	77	016	022	03/29/73	1600	28,6	08	1358	OCAST
11W	77	017	023	03/29/73	1800		08		OCAST
11W	77	018	023	03/29/73	1800		08		OCAST
11W	77	019	023	03/29/73	1800		08		OCAST
11W	77	020	023	03/29/73	1800		08		OCAST
11W	77	021	024	03/29/73	2000	29,6	08	1418	OCAST
11W	77	022	024	03/29/73	2000	29,6	08	1418	OCAST
11W	77	023	024	03/29/73	2000	29,6	08	1418	OCAST
11W	77	024	024	03/29/73	2000	29,6	08	1418	OCAST
11W	77	025	025	03/29/73	2200		08		OCAST
11W	77	026	025	03/29/73	2200		08		OCAST
11W	77	027	025	03/29/73	2200		08		OCAST
11W	77	028	025	03/29/73	2200		08		OCAST
11W	77	029	026	03/29/73	2200	29,7	08	1418	OCAST
11W	77	030	026	03/29/73	2200	29,7	08	1418	OCAST
11W	77	031	026	03/29/73	2200	29,7	08	1418	OCAST
11W	77	032	026	03/29/73	2200	29,7	08	1418	OCAST
11W	77	033	027	03/30/73	0200		06		OCAST
11W	77	034	027	03/30/73	0200		06		OCAST
11W	77	035	027	03/30/73	0200		06		OCAST
11W	77	036	027	03/30/73	0200		06		OCAST
11W	77	037	028	03/30/73	0400	29,7	05	1188	PT CLDY
11W	77	038	028	03/30/73	0400	29,7	05	1188	PT CLDY
11W	77	039	028	03/30/73	0400	29,7	05	1188	PT CLDY
11W	77	040	028	03/30/73	0400	29,7	05	1188	PT CLDY
11W	77	041	029	03/30/73	0600		05		PT CLDY
11W	77	042	029	03/30/73	0600		05		PT CLDY
11W	77	043	029	03/30/73	0600		05		PT CLDY
11W	77	044	029	03/30/73	0600		05		PT CLDY
11W	77	045	030	03/30/73	0800	29,4	05	1188	CLEAR
11W	77	046	030	03/30/73	0800	29,4	05	1188	CLEAR
11W	77	047	030	03/30/73	0800	29,4	05	1188	CLEAR
11W	77	048	030	03/30/73	0800	29,4	05	1188	CLEAR
11W	77	049	031	03/30/73	1200	29,6	04	1188	OCAST
11W	77	050	031	03/30/73	1200	29,6	04	1188	OCAST
11W	77	051	031	03/30/73	1200	29,6	04	1188	OCAST
11W	77	052	031	03/30/73	1200	29,6	04	1188	OCAST
12E	79	001	001	04/01/73	1600	24,8	04	000	OCAST
12E	79	002	001	04/01/73	1600	24,8	04	000	OCAST
12E	79	003	001	04/01/73	1600	24,8	04	000	OCAST
12E	79	004	001	04/01/73	1600	24,8	04	000	OCAST
12E	79	005	002	04/01/73	2000	24,8	06	0238	OCAST
12E	79	006	002	04/01/73	2000	24,8	06	0238	OCAST

A-38

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER
12E	79	007	002	04/01/73	2000	24,8	06	0238	OCAST
12E	79	008	002	04/01/73	2000	24,8	06	0238	OCAST
12E	79	009	003	04/01/73	2400	25,6	05	0458	CLDY
12E	79	010	003	04/01/73	2400	25,6	05	0458	CLDY
12E	79	011	003	04/01/73	2400	25,6	05	0458	CLDY
12E	79	012	003	04/01/73	2400	25,6	05	0458	CLDY
12E	79	013	004	04/02/73	0400	25,4	05	0458	OCAST
12E	79	014	004	04/02/73	0400	25,4	05	0458	OCAST
12E	79	015	004	04/02/73	0400	25,4	05	0458	OCAST
12E	79	016	004	04/02/73	0400	25,4	05	0458	OCAST
12E	79	017	005	04/02/73	0800	25,6	03	023P	CLDY
12E	79	018	005	04/02/73	0800	25,6	03	023P	CLDY
12E	79	019	005	04/02/73	0800	25,6	03	023P	CLDY
12E	79	020	005	04/02/73	0800	25,6	03	023P	CLDY
12E	79	021	006	04/02/73	1200	25,3	03	032P	CLDY
12E	79	022	006	04/02/73	1200	25,3	03	032P	CLDY
12E	79	023	006	04/02/73	1200	25,3	03	032P	CLDY
12E	79	024	006	04/02/73	1200	25,3	03	032P	CLDY
12E	79	025	007	04/02/73	1600	24,7	05	058P	OCAST
12E	79	026	007	04/02/73	1600	24,7	05	058P	OCAST
12E	79	027	007	04/02/73	1600	24,7	05	058P	OCAST
12E	79	028	007	04/02/73	1600	24,7	05	058P	OCAST
12E	79	029	008	04/02/73	2000	24,7	05	031P	OCAST
12E	79	030	008	04/02/73	2000	24,7	05	031P	OCAST
12E	79	031	008	04/02/73	2000	24,7	05	031P	OCAST
12E	79	032	008	04/02/73	2000	24,7	05	031P	OCAST
12E	79	033	009	04/02/73	2400	24,7	05	031P	OCAST
12E	79	034	009	04/02/73	2400	24,7	05	031P	OCAST
12E	79	035	009	04/02/73	2400	24,7	05	031P	OCAST
12E	79	036	009	04/02/73	2400	24,7	05	031P	OCAST
12E	79	037	010	04/03/73	0400	24,6	05	076P	PT CLDY
12E	79	038	010	04/03/73	0400	24,6	05	076P	PT CLDY
12E	79	039	010	04/03/73	0400	24,6	05	076P	PT CLDY
12E	79	040	010	04/03/73	0400	24,6	05	076P	PT CLDY
12E	79	041	011	04/03/73	0800	24,8	05	054P	PT CLDY
12E	79	042	011	04/03/73	0800	24,8	05	054P	PT CLDY
12E	79	043	011	04/03/73	0800	24,8	05	054P	PT CLDY
12E	79	044	011	04/03/73	0800	24,8	05	054P	PT CLDY
12E	79	045	012	04/03/73	1200	24,8	04	076P	OCAST
12E	79	046	012	04/03/73	1200	24,8	04	076P	OCAST
12E	79	047	012	04/03/73	1200	24,8	04	076P	OCAST
12E	79	048	012	04/03/73	1200	24,8	04	076P	OCAST
12E	79	049	013	04/03/73	1600	24,9	05	059S	OCAST
12E	79	050	013	04/03/73	1600	24,9	05	059S	OCAST
12E	79	051	013	04/03/73	1600	24,9	05	059S	OCAST
12E	79	052	013	04/03/73	1600	24,9	05	059S	OCAST
12E	79	053	014	04/03/73	2000	25,0	03	121P	OCAST
12E	79	054	014	04/03/73	2000	25,0	03	121P	OCAST
12E	79	055	014	04/03/73	2000	25,0	03	121P	OCAST
12E	79	056	014	04/03/73	2000	25,0	03	121P	OCAST

A-39

VOY	TP	INT	IDX	DATE	TIME	SPD	BN	RNVD	WEATHER
12E	79	057	015	04/03/73	2400	24,9	03	104S	OCAST
12E	79	058	015	04/03/73	2400	24,9	03	104S	OCAST
12E	79	059	015	04/03/73	2400	24,9	03	104S	OCAST
12E	79	060	015	04/03/73	2400	24,9	03	104S	OCAST
12E	79	061	016	04/04/73	0400	24,9	03	104S	OCAST
12E	79	062	016	04/04/73	0400	24,9	03	104S	OCAST
12E	79	063	016	04/04/73	0400	24,9	03	104S	OCAST
12E	79	064	016	04/04/73	0400	24,9	03	104S	OCAST
12E	79	065	017	04/04/73	0800	24,9	04	104S	OCAST
12E	79	066	017	04/04/73	0800	24,9	04	104S	OCAST
12E	79	067	017	04/04/73	0800	24,9	04	104S	OCAST
12E	79	068	017	04/04/73	0800	24,9	04	104S	OCAST
12E	79	069	018	04/04/73	1200	24,9	05	104S	OCAST
12E	79	070	018	04/04/73	1200	24,9	05	104S	OCAST
12E	79	071	018	04/04/73	1200	24,9	05	104S	OCAST
12E	79	072	018	04/04/73	1200	24,9	05	104S	OCAST

APPENDIX B

PARAMETRIC STUDIES

This appendix contains the plots and tabulated summaries resulting from the parametric studies program, designated "SPLOT". Each plot presents either a five-curve family of various ship speeds or a five-curve family of relative wave direction groups for a transducer output against Beaufort Number. Within each Beaufort Number, the magnitude of a particular point is determined by calculating the mean of the appropriate data. A superscribed note on each plot designates which value is applicable. The measured data set is composed of the maximum wave-induced peak-to-trough value within each 30-minute data interval, or the RMS value determined for that interval. The graph title notes which characterization is applicable. Eight measurements, all from Recorder No. 1, were selected for study:

1. Longitudinal Vertical Bending Stress
2. Longitudinal Horizontal Bending Stress
3. Torsional Shear Midship Stress
4. Forward Shearing Stress-Port
5. Forward Shearing Stress-Starboard
6. Roll Angle
7. Pitch Angle
8. Forward Hull Vertical Acceleration

Each tabulated summary (Tables III-XXXIV) presents a listing of all plotted points along with the number of data points comprising each plotted mean point and its standard deviation.

Table B-I provides an index for all parametric plots and summaries.

Table B-II gives the code for the ship speed or relative sea direction curve families as used in the plots.

TABLE B-I

Figure and Table Index for Parametric Studies

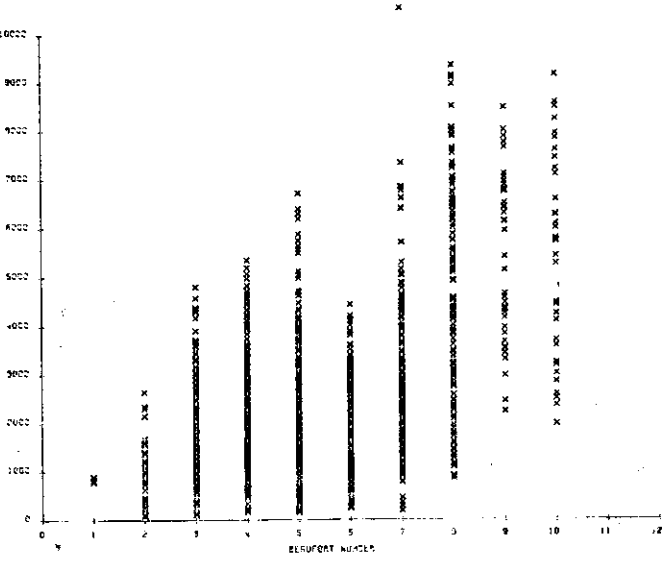
For value within each 30-minute interval of: / For values within each Beaufort No. Set		For Sensor*															
		LVB		LWB		TSM		SFP		SFS		ROLL		PITCH		FAV	
		RMS	Max	RMS	Max	RMS	Max	RMS	Max	RMS	Max.	RMS	Max	RMS	Max	RMS	Max
All Data Points		1	4	7	10	13	16	19	22	25	28	31	34	37	40	43	46
Mean of All Data Points	by Ship Speed	2	5	8	11	14	17	20	23	26	29	32	35	38	41	44	47
	by Relative Wave Direction	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48
Summary Listing	by Ship Speed	III	V	VII	IX	XI	XIII	XV	XVII	XIX	XXI	XXIII	XXV	XXVII	XXIX	XXXI	XXXII
	by Relative Wave Direction	IV	VI	VIII	X	XII	XIV	XVI	XVIII	XX	XXII	XXIV	XXVI	XXVII	XXX	XXXII	XXXIV

Note: Arabic numbers are Figure Numbers B-1, etc.
Roman numberals are Table Numbers B-III, etc.
*See Table III for definition of Sensor Abbreviations

TABLE B-II

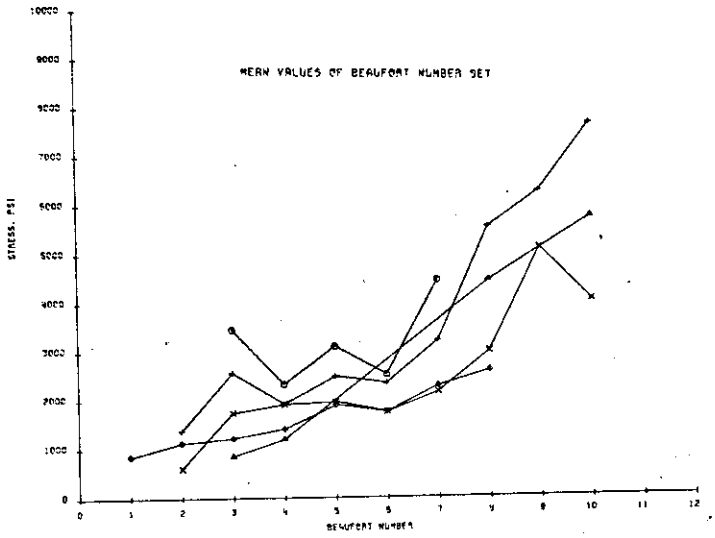
LEGEND FOR PARAMETRIC STUDIES

SYMBOL	Ship's Speed, Knots	Relative Sea Direction, Deg. P or S
⬡	1-15	0-30
△	15-20	31-60
+	20-25	61-120
×	25-30	121-150
◇	30-35	151-180



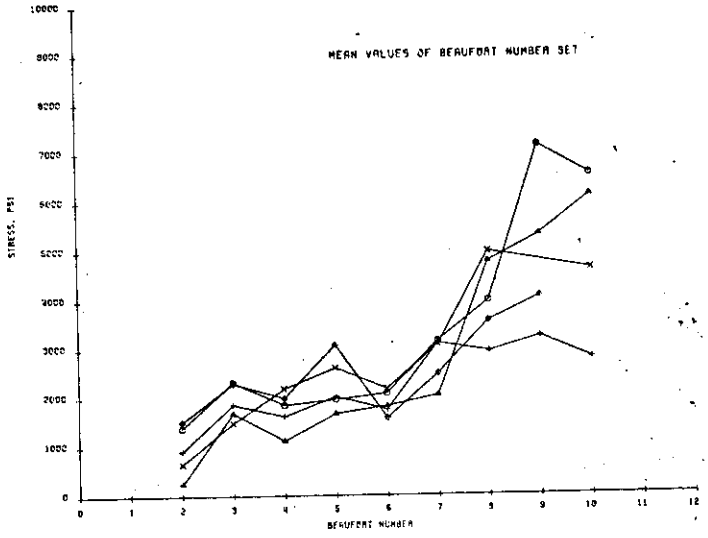
RMS LONGITUDINAL VERTICAL BENDING STRESS VS BEAUFORT NUMBER

B-1 All Data



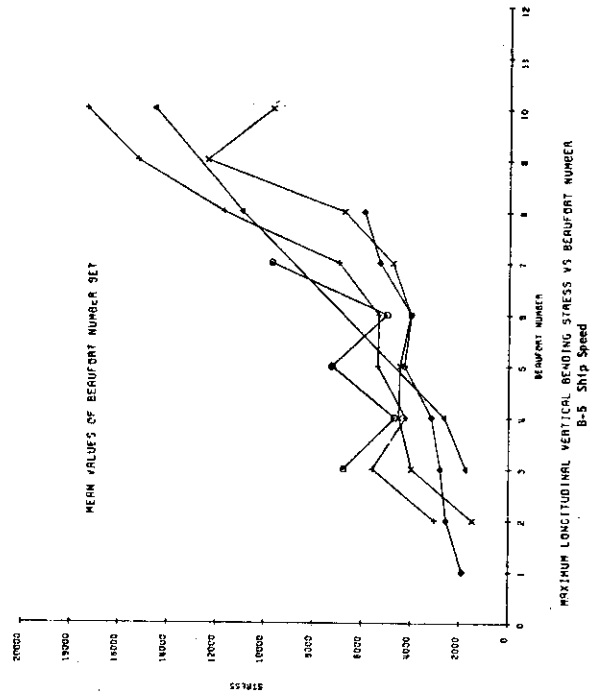
RMS LONGITUDINAL VERTICAL BENDING STRESS VS BEAUFORT NUMBER

B-2 Ship Speed

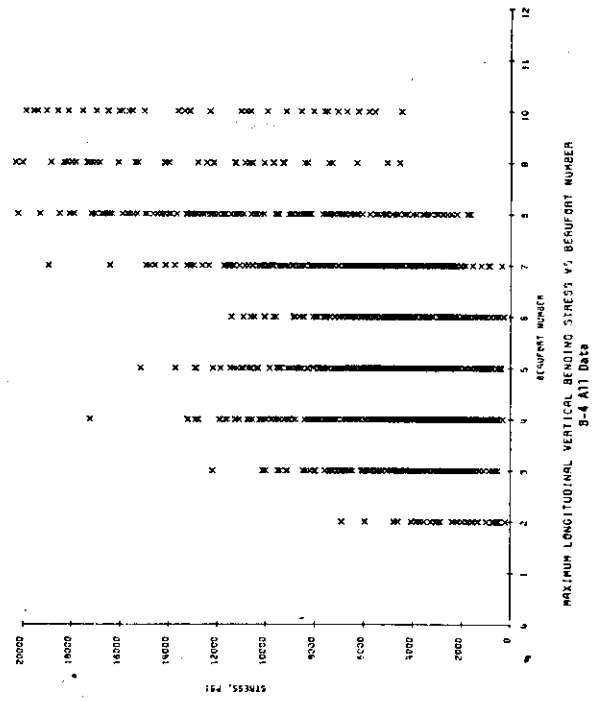


RMS LONGITUDINAL VERTICAL BENDING STRESS VS BEAUFORT NUMBER

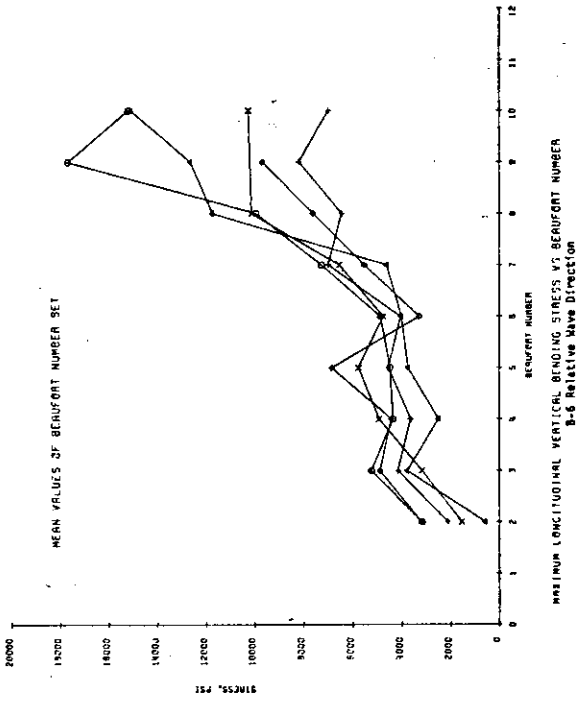
B-3 Relative Wave Direction



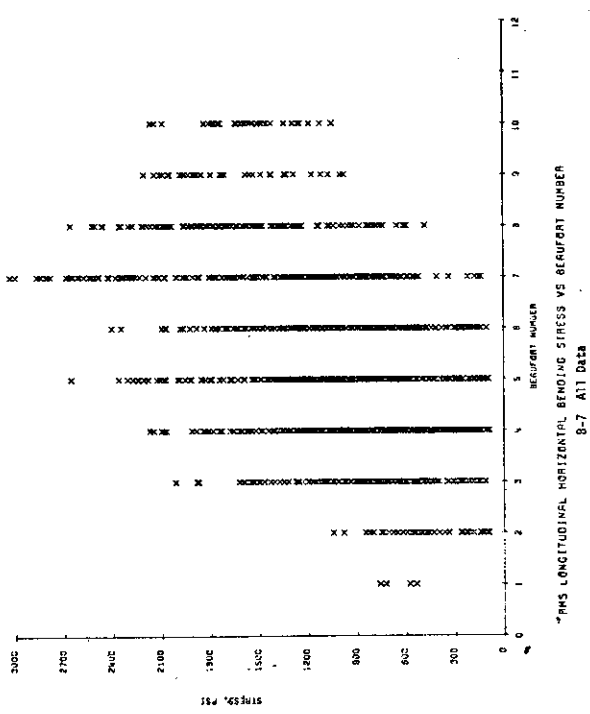
MAXIMUM LONGITUDINAL VERTICAL BENDING STRESS VS BEAUFORT NUMBER
B-5 Ship Speed



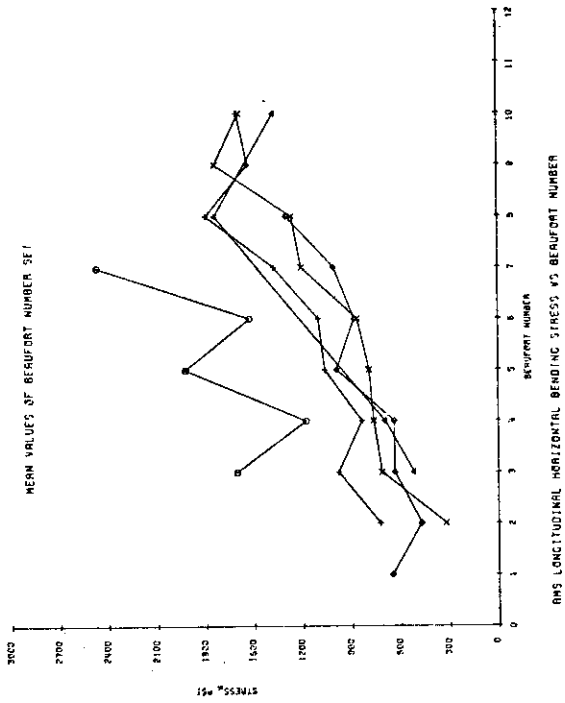
MAXIMUM LONGITUDINAL VERTICAL BENDING STRESS VS BEAUFORT NUMBER
B-4 All Data



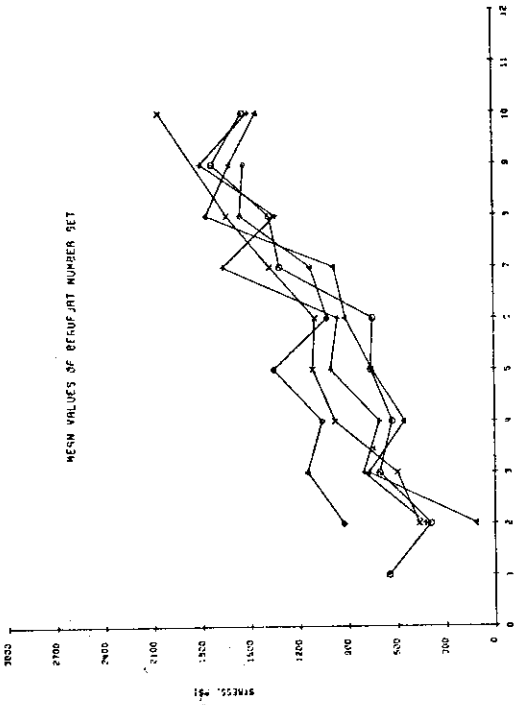
MAXIMUM LONGITUDINAL VERTICAL BENDING STRESS VS BEAUFORT NUMBER
B-6 Relative Wave Direction



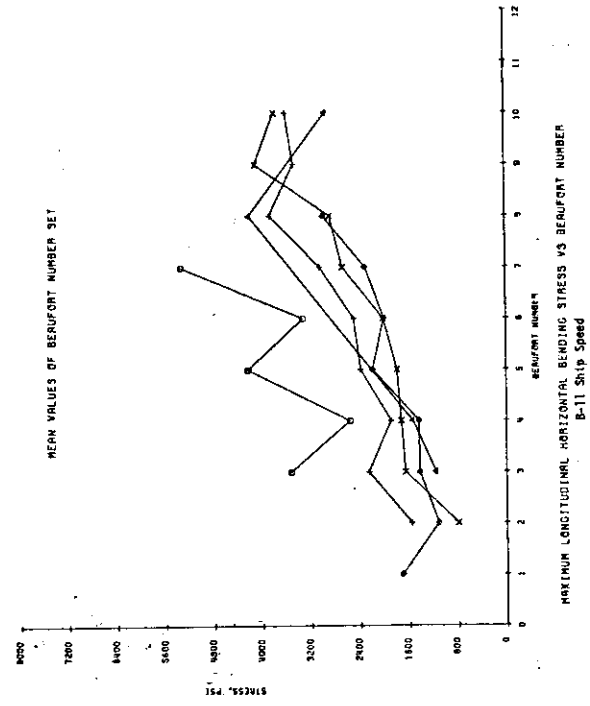
RMS LONGITUDINAL HORIZONTAL BENDING STRESS VS BEAUFORT NUMBER
B-7 All Data



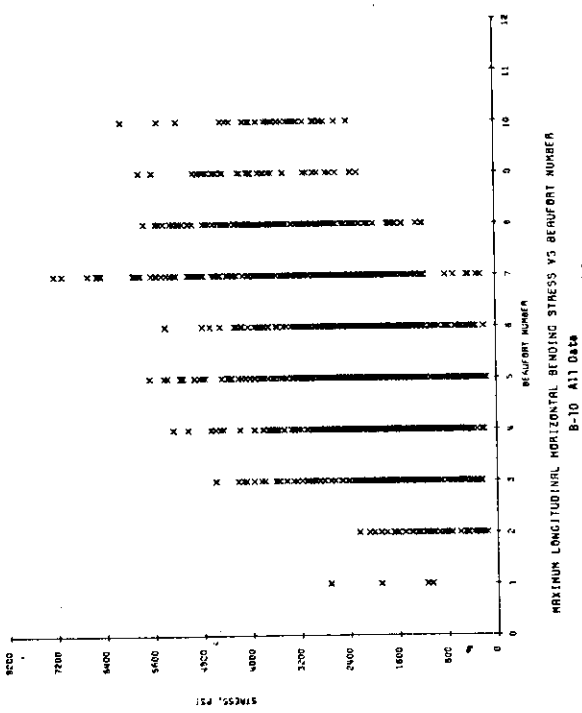
RMS LONGITUDINAL HORIZONTAL BENDING STRESS VS BEAUFORT NUMBER
B-8 Ship Speed



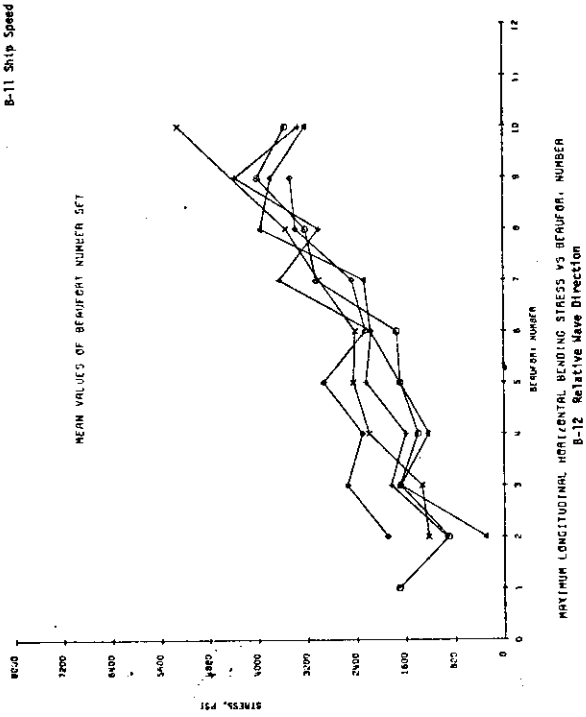
RMS LONGITUDINAL HORIZONTAL BENDING STRESS VS BEAUFORT NUMBER
B-9 Relative Wave Direction



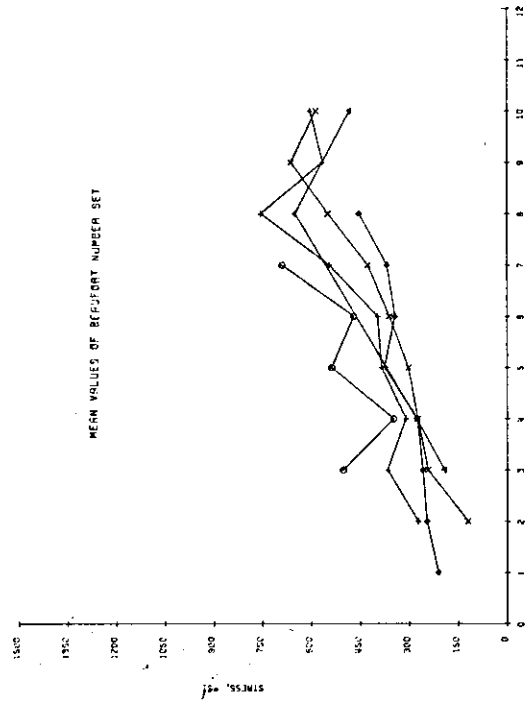
MAXIMUM LONGITUDINAL HORIZONTAL BENDING STRESS VS BEAUFORT NUMBER
B-11 Ship Speed



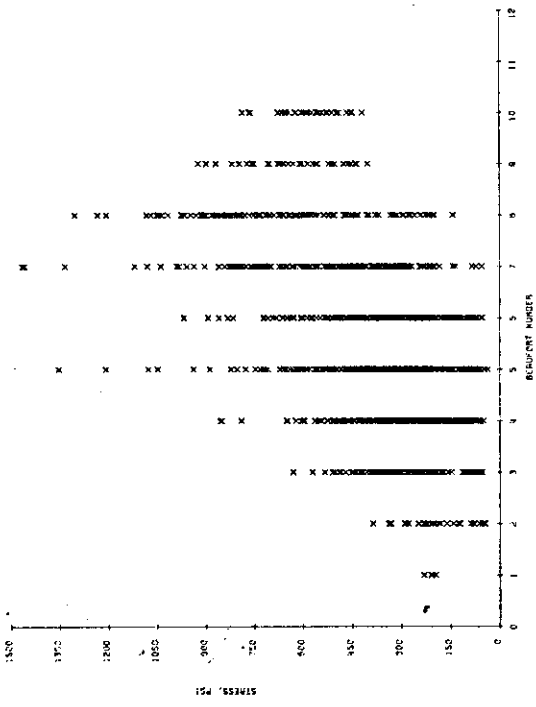
MAXIMUM LONGITUDINAL HORIZONTAL BENDING STRESS VS BEAUFORT NUMBER
B-10 All Data



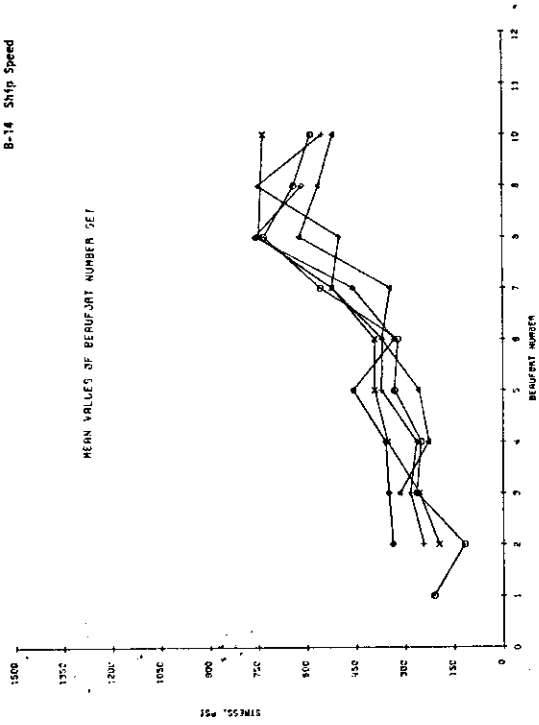
MAXIMUM LONGITUDINAL HORIZONTAL BENDING STRESS VS BEAUFORT NUMBER
B-12 Relative Wave Direction



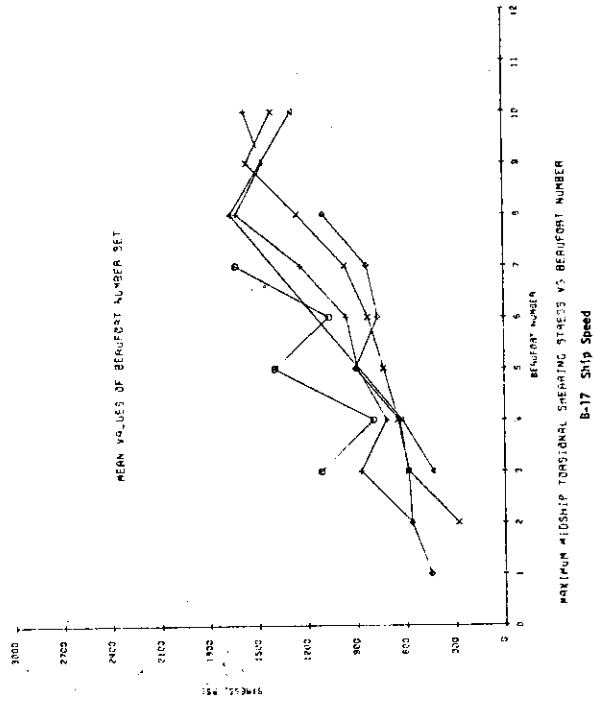
RMS MIDSHIP TORSIONAL SHEARING STRESS VS BEAUFORT NUMBER
B-14 Ship Speed



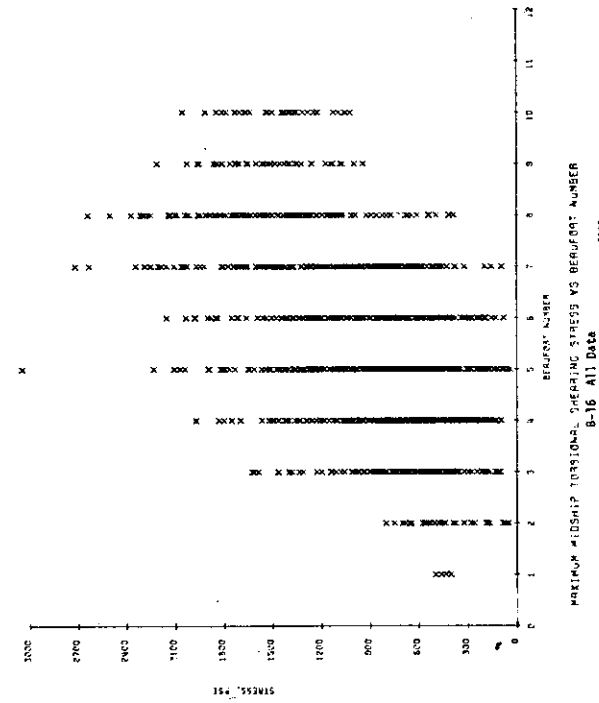
RMS MIDSHIP TORSIONAL SHEARING STRESS VS BEAUFORT NUMBER
B-13 All Data



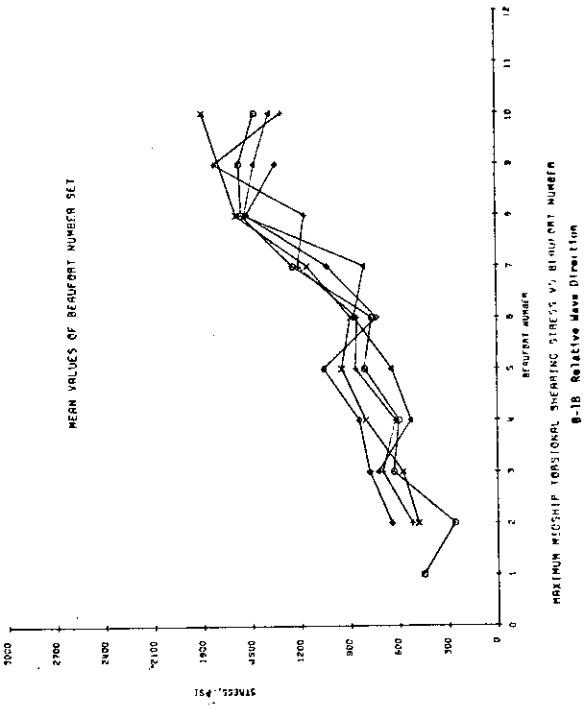
RMS MIDSHIP TORSIONAL SHEARING STRESS VS BEAUFORT NUMBER
B-15 Relative Wave Direction



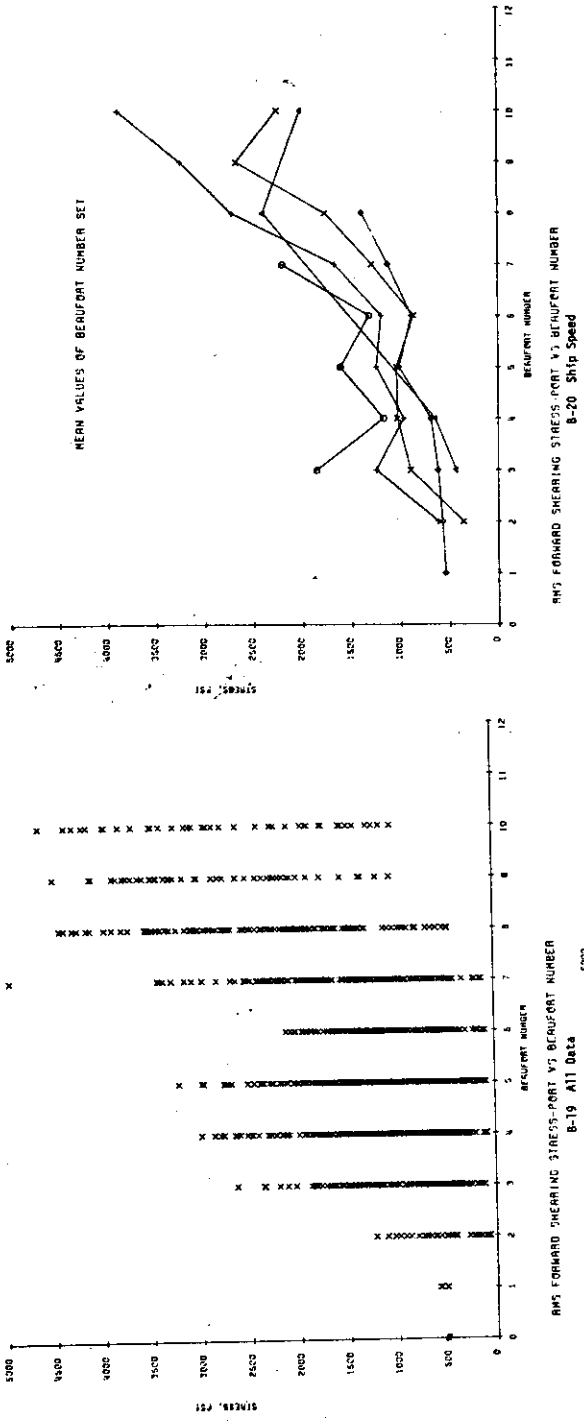
B-17 Ship Speed



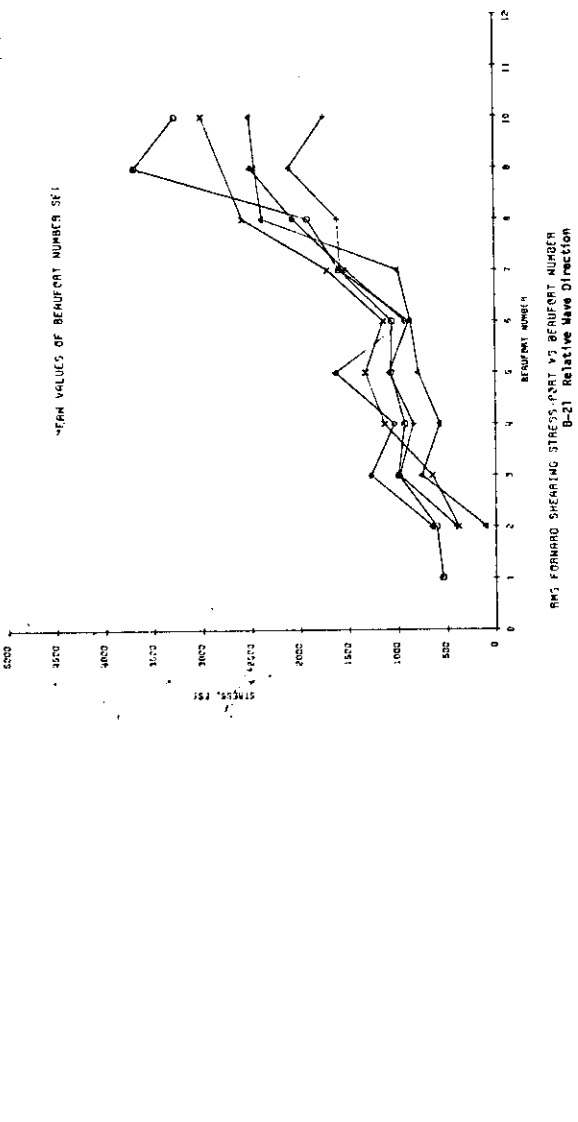
B-16 All Data

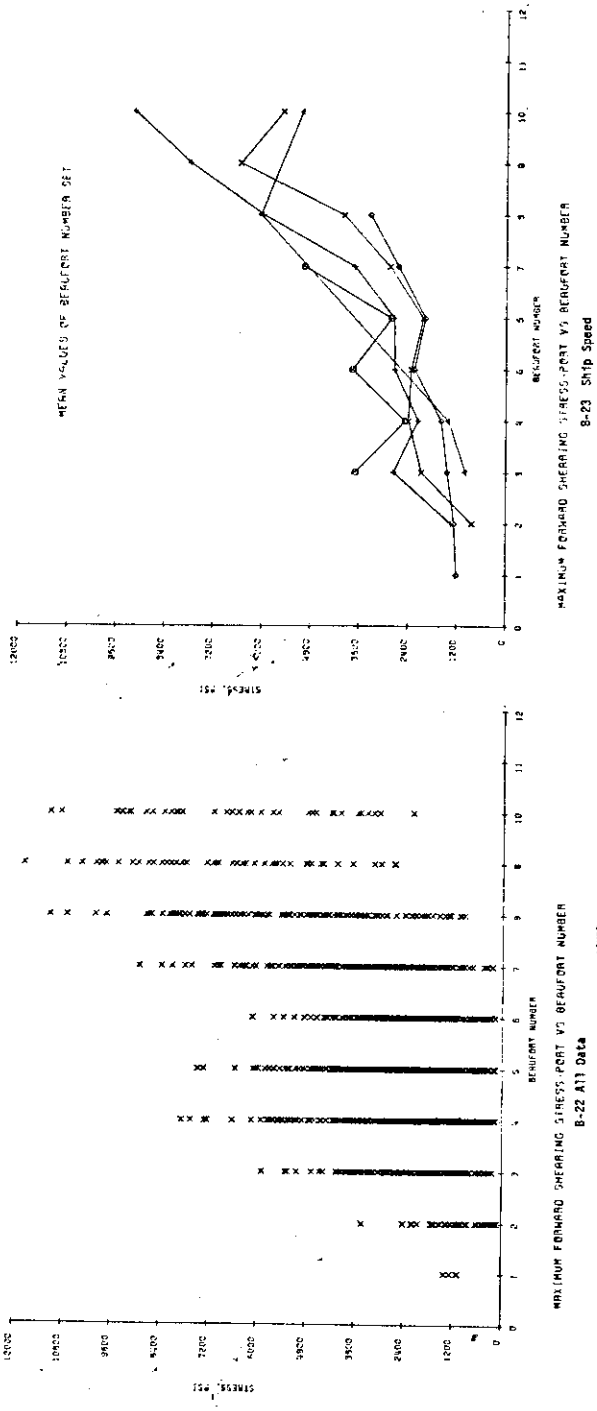


B-18 Relative Wave Direction


RMS FORWARD SHEARING STRESS-PORT VS BEAUFORT NUMBER
B-19 All Data
STRESS, PSI
BEAUFORT NUMBER

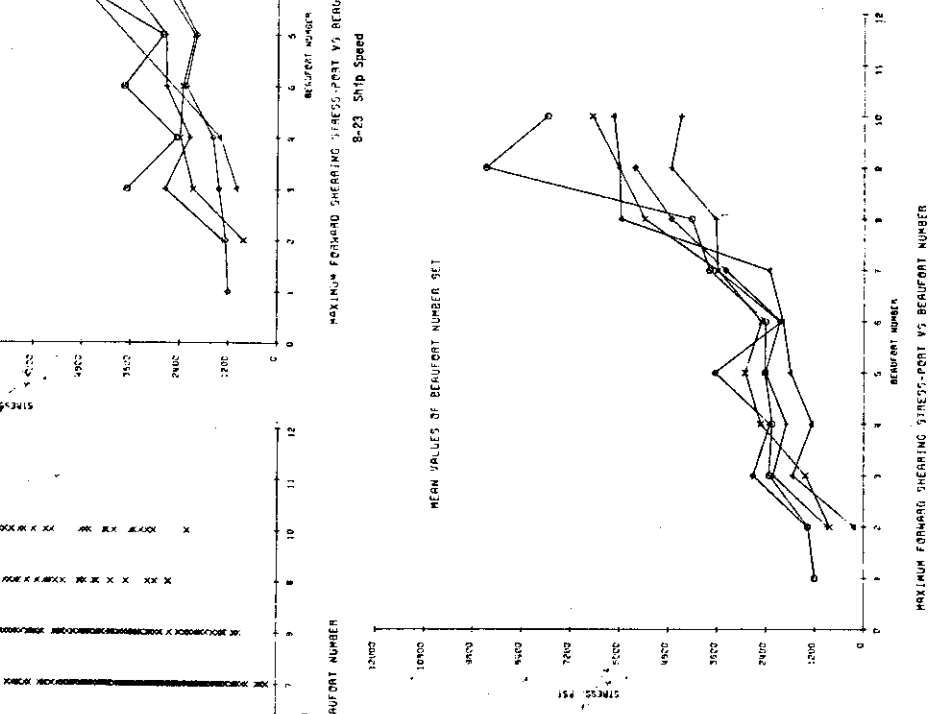
MEAN VALUES OF BEAUFORT NUMBER SET
RMS FORWARD SHEARING STRESS-PORT VS BEAUFORT NUMBER
B-20 Ship Speed
STRESS, PSI
BEAUFORT NUMBER


MEAN VALUES OF BEAUFORT NUMBER SET
RMS FORWARD SHEARING STRESS-PORT VS BEAUFORT NUMBER
B-21 Relative Wave Direction
STRESS, PSI
BEAUFORT NUMBER

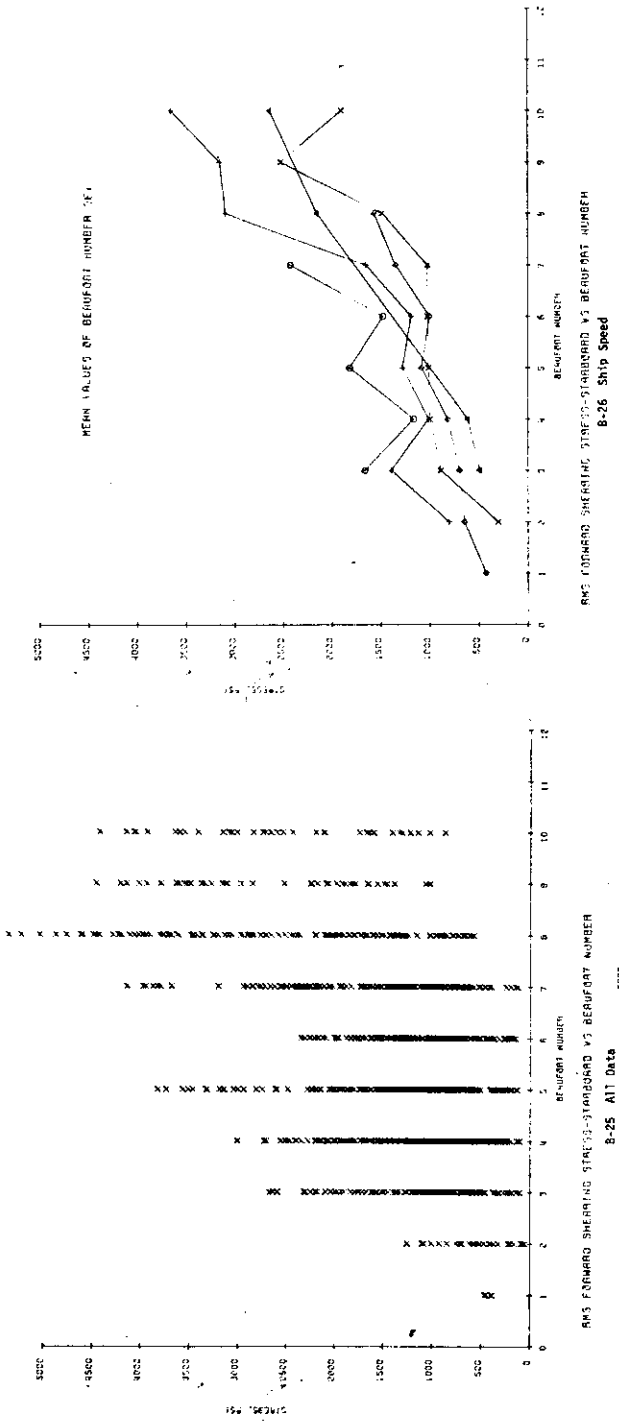


B-22 All Data

B-23 Ship Speed

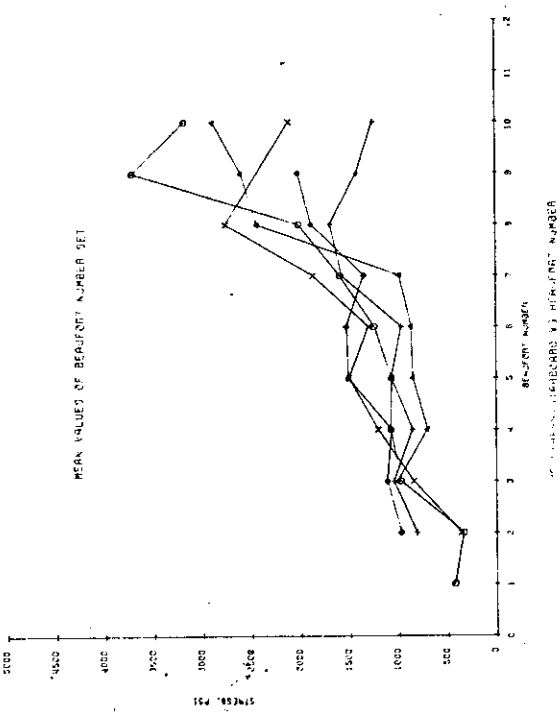


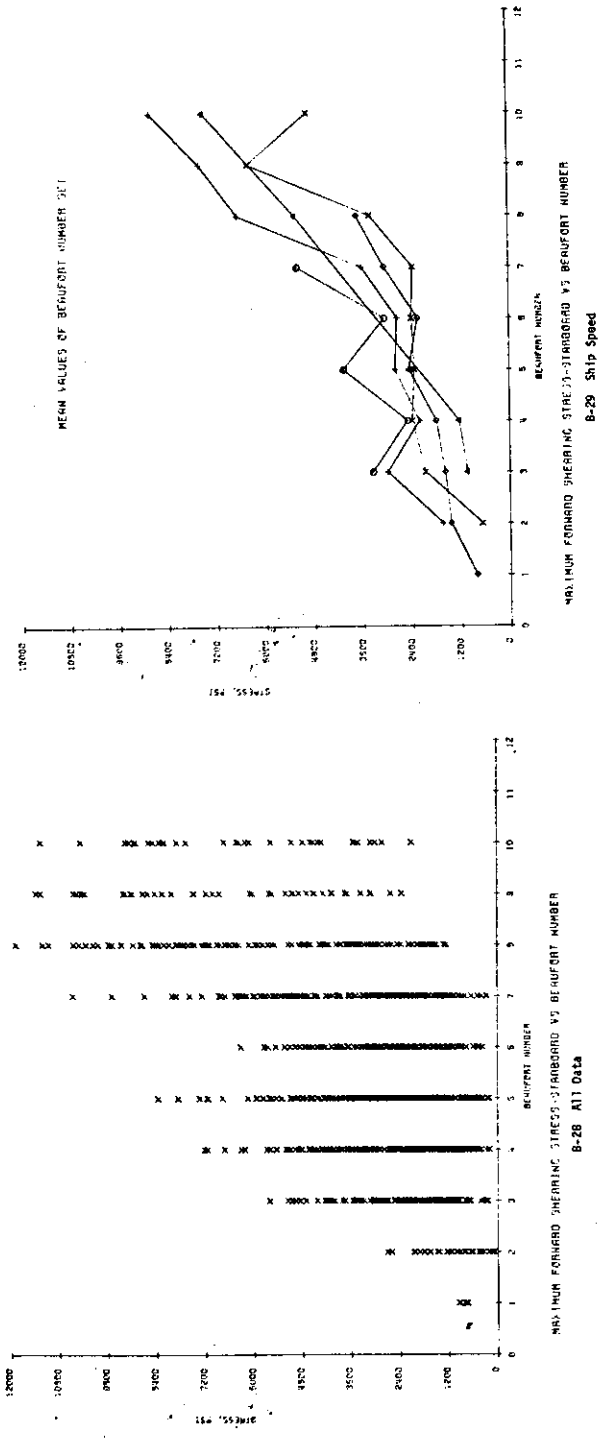
B-24 Relative Wave Direction



B-25 All Data

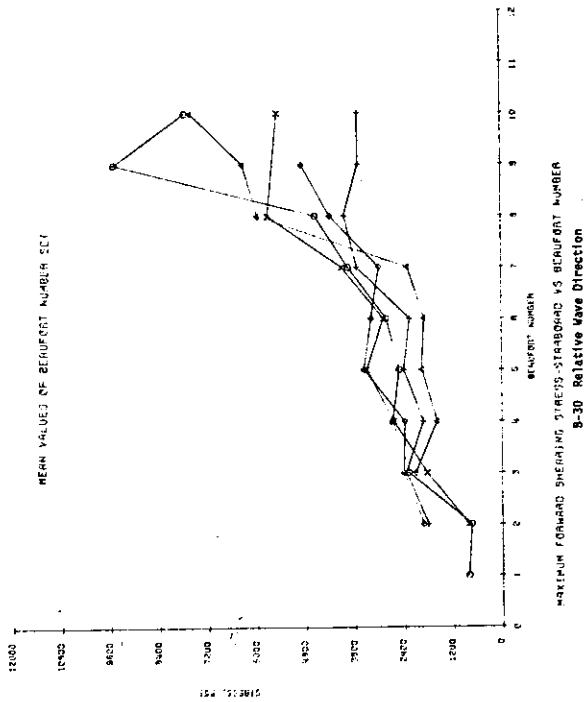
B-26 Ship Speed



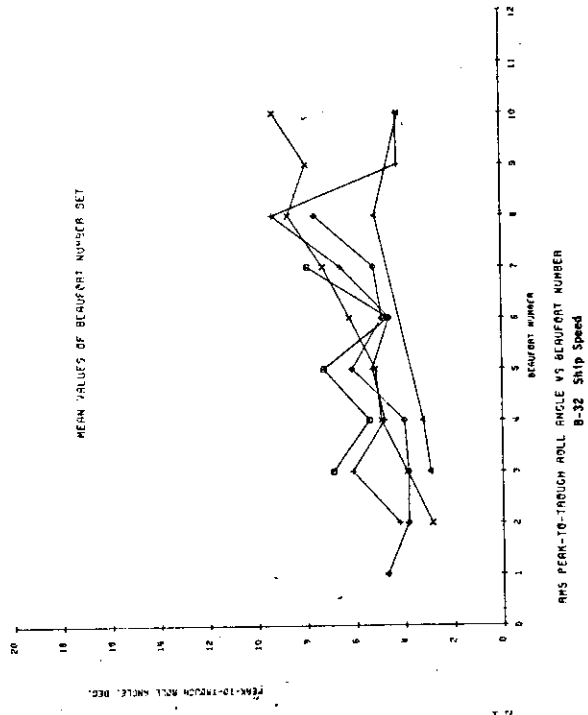


B-28 All Data

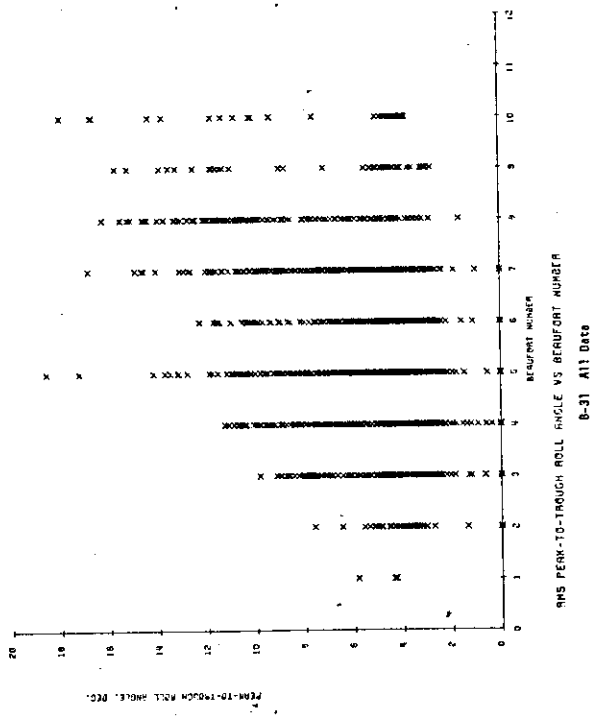
B-29 Ship Speed



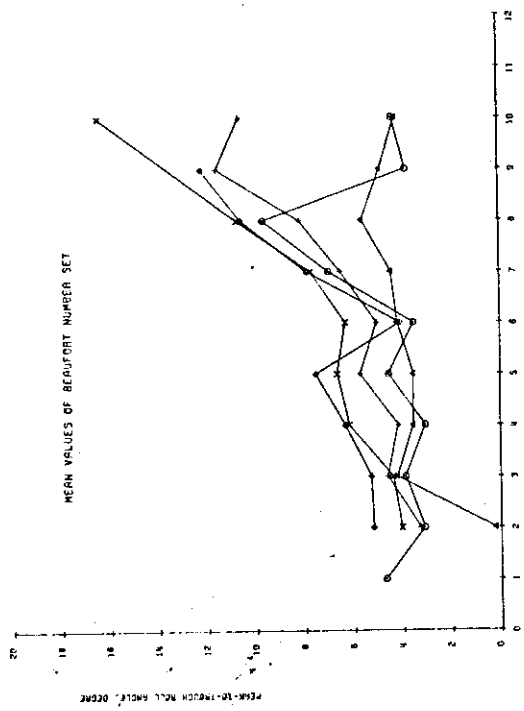
B-30 Relative Wave Direction



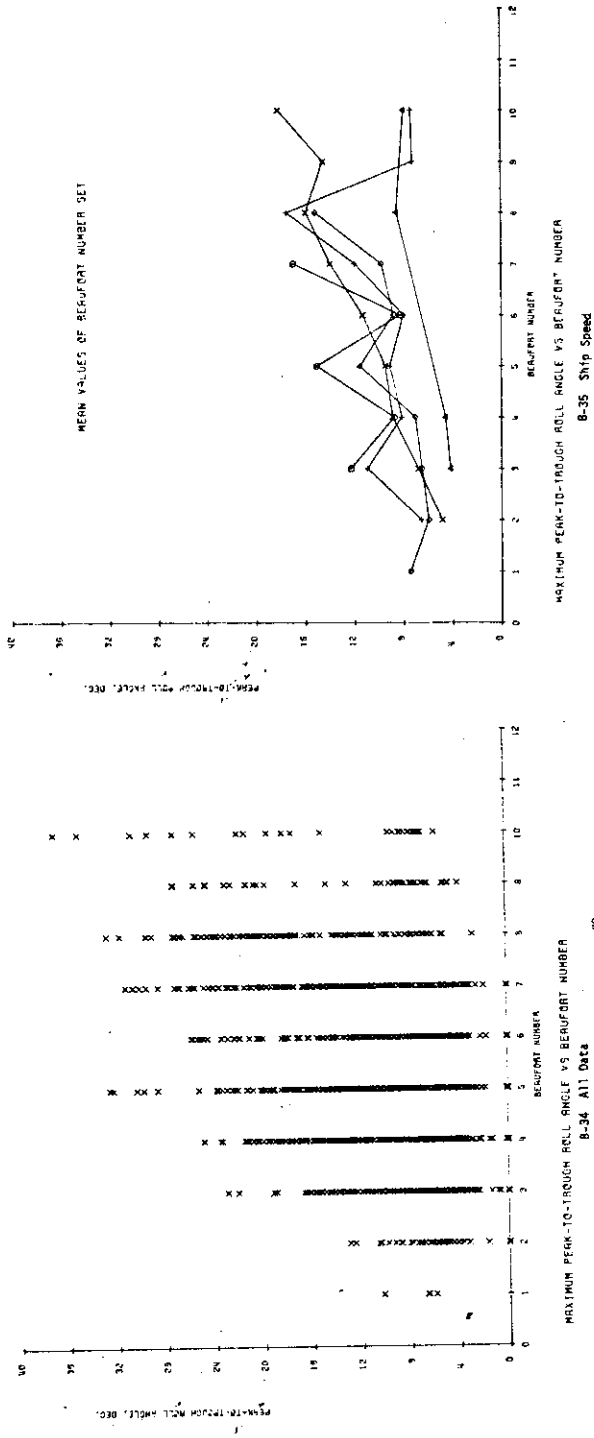
RMS PEAK-TO-TROUGH ROLL ANGLE VS BEAUFORT NUMBER
B-32 Ship Speed



RMS PEAK-TO-TROUGH ROLL ANGLE VS BEAUFORT NUMBER
B-31 All Data

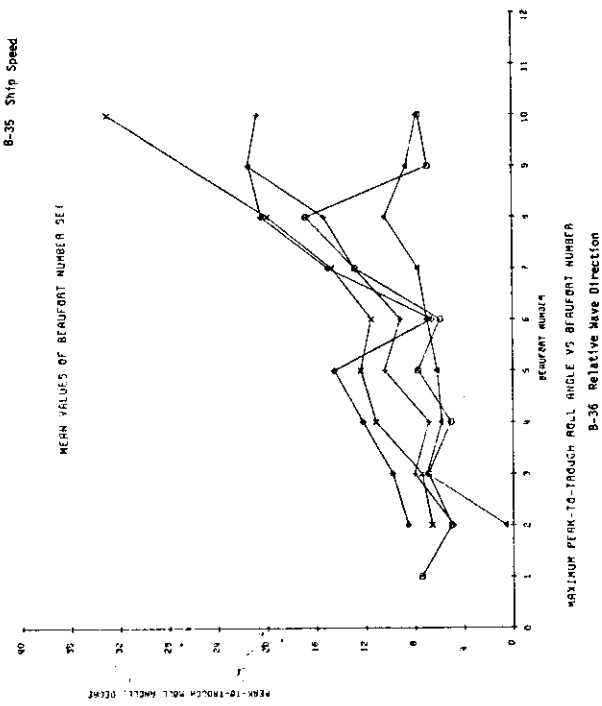


RMS PEAK-TO-TROUGH ROLL ANGLE VS BEAUFORT NUMBER
B-33 Relative Wave Direction

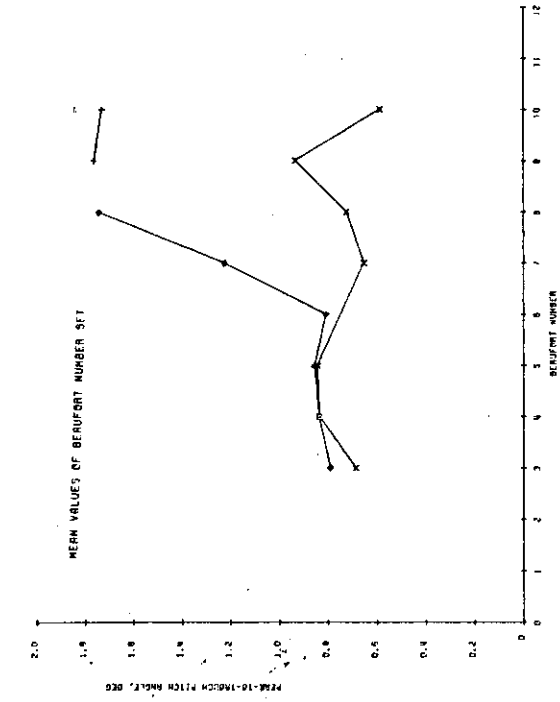


B-34 All Data

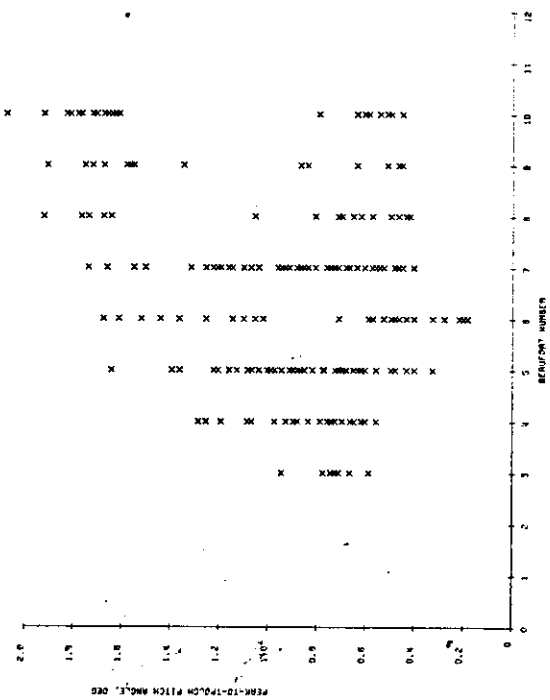
B-35 Ship Speed



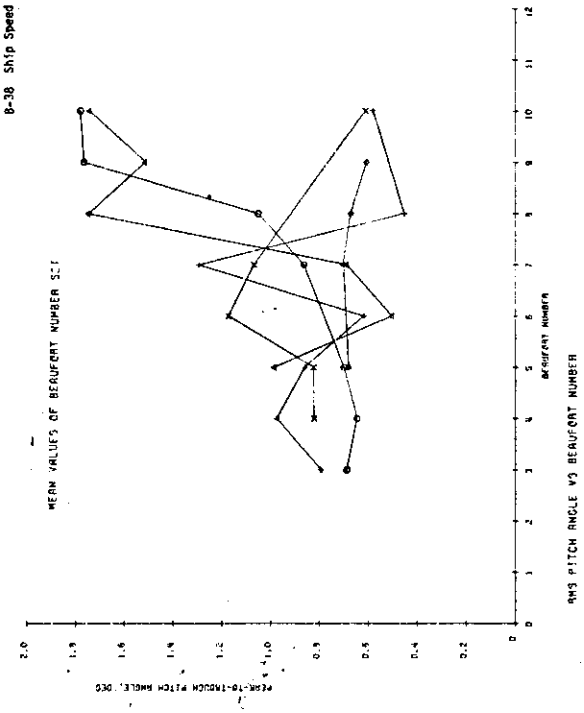
B-36 Relative Wave Direction



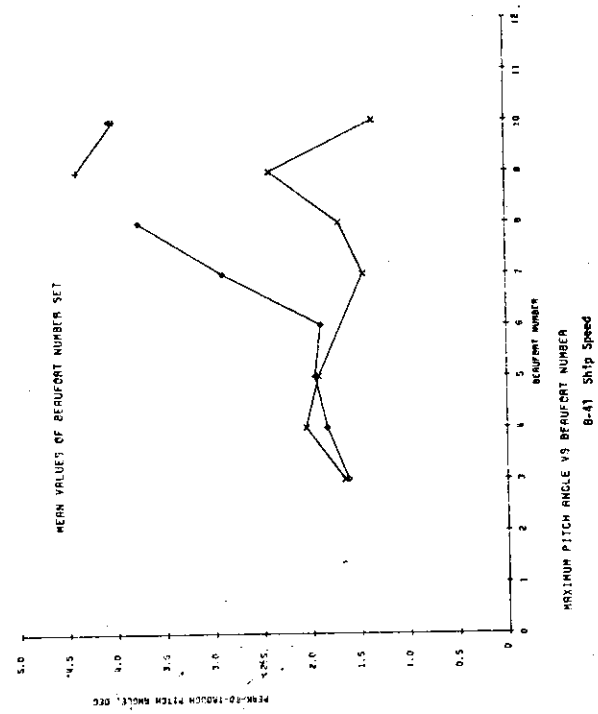
B-38 Ship Speed



B-37 All Data

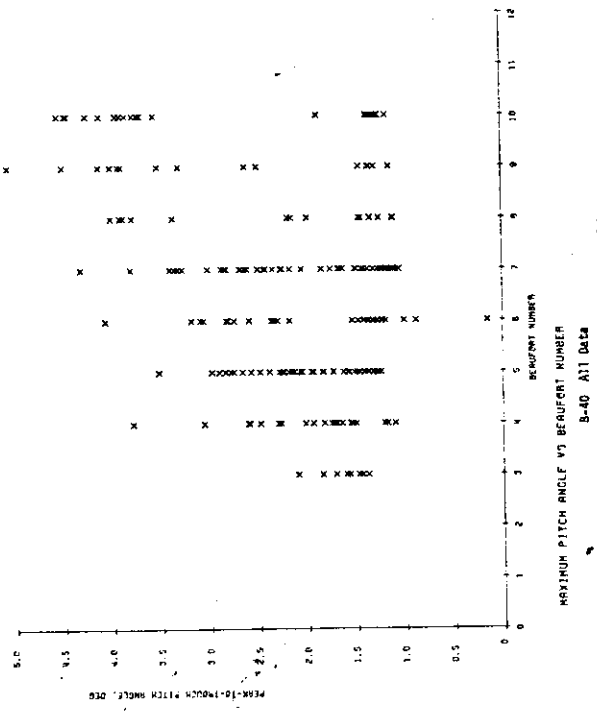


B-39 Relative Wave Direction



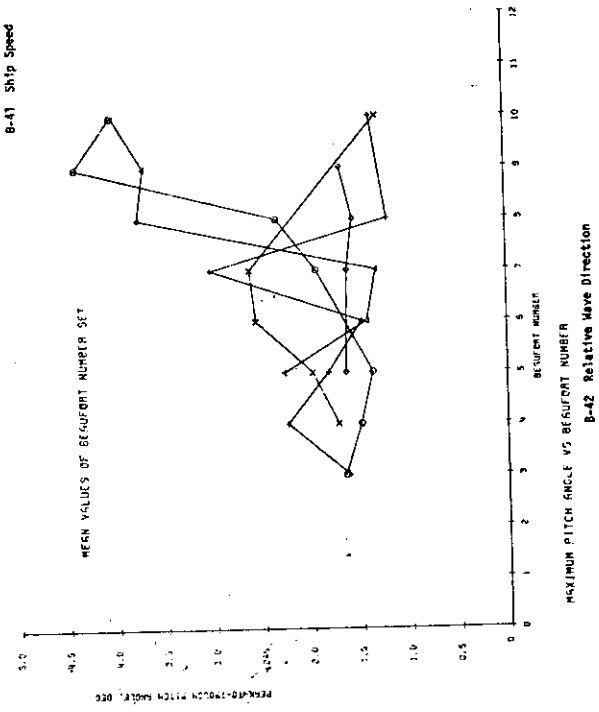
MAXIMUM PITCH ANGLE VS BEAUFORT NUMBER

B-41 Ship Speed



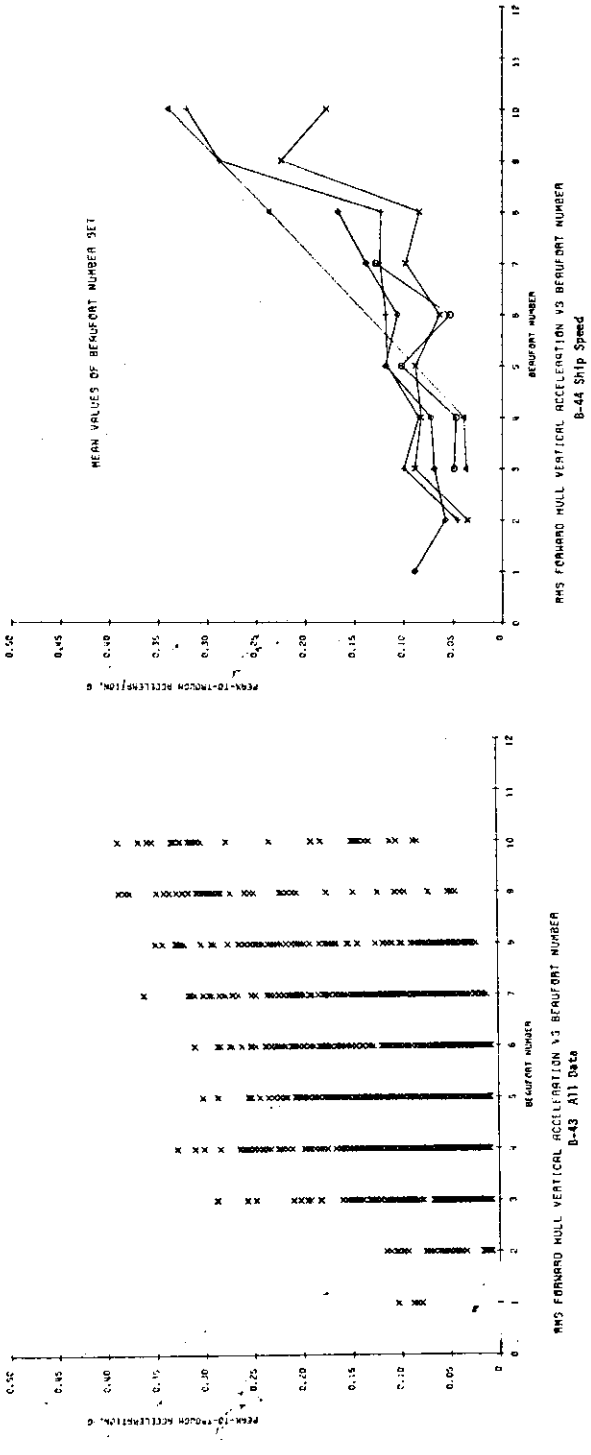
MAXIMUM PITCH ANGLE VS BEAUFORT NUMBER

B-40 All Data

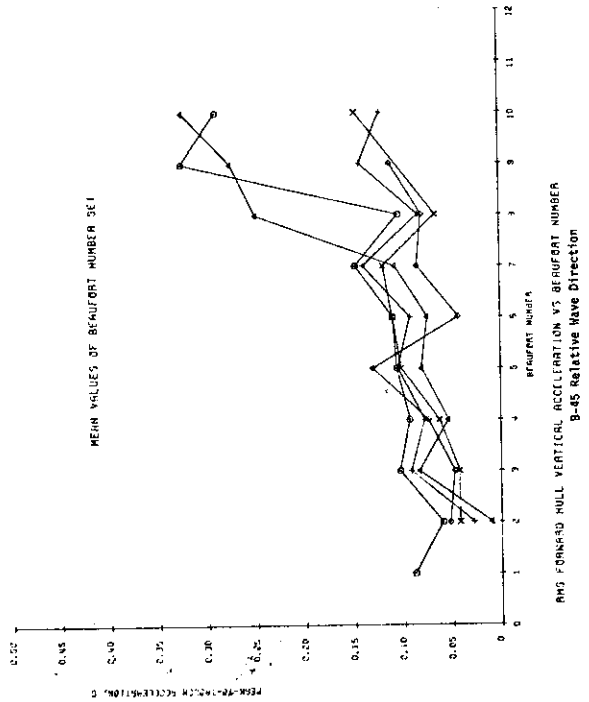


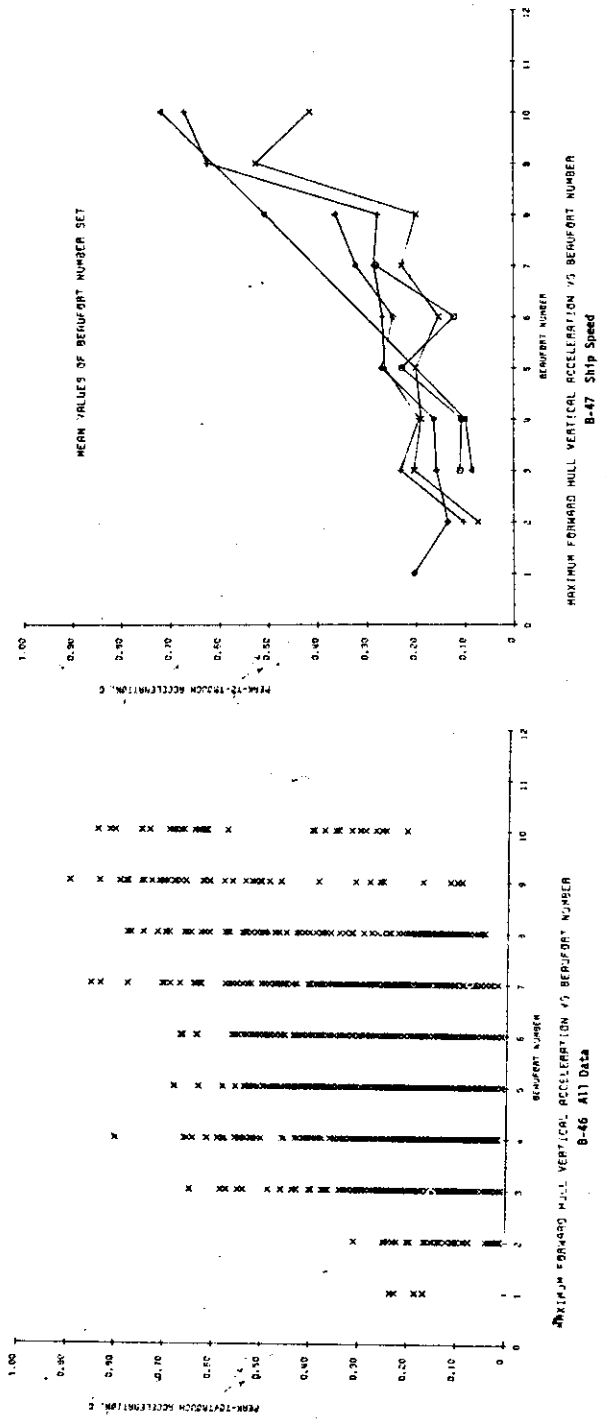
MAXIMUM PITCH ANGLE VS BEAUFORT NUMBER

B-42 Relative Wave Direction


RMS FORWARD HULL VERTICAL ACCELERATION VS BEAUFORT NUMBER
B-43 All Data
BEAUFORT NUMBER
PEAK-TO-TROUGH ACCELERATION, G

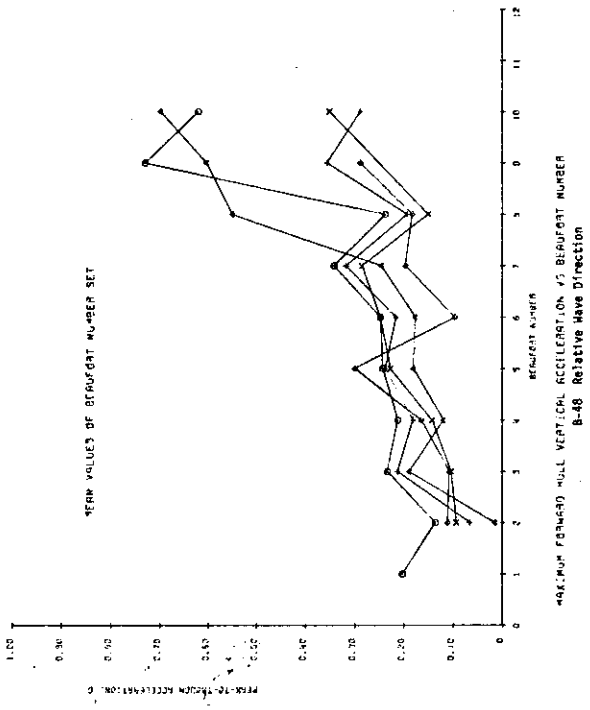
RMS FORWARD HULL VERTICAL ACCELERATION VS BEAUFORT NUMBER
B-44 Ship Speed
MEAN VALUES OF BEAUFORT NUMBER SET
BEAUFORT NUMBER
PEAK-TO-TROUGH ACCELERATION, G


RMS FORWARD HULL VERTICAL ACCELERATION VS BEAUFORT NUMBER
B-45 Relative Wave Direction
MEAN VALUES OF BEAUFORT NUMBER SET
BEAUFORT NUMBER
PEAK-TO-TROUGH ACCELERATION, G



B-46 All Data

B-47 Ship Speed



B-48 Relative Wave Direction

RMS LONGITUDINAL VERTICAL BENDING STRESS VS BEAUFORT NUMBER

III

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	3455.	3488.	477.
4	23	2211.	2371.	856.
5	16	3216.	3355.	957.
6	12	2478.	2496.	300.
7	30	4427.	4450.	450.
8	0			
9	0			
10	0			
11	0			
12	0			

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	856.	856.	35.
4	4	1192.	1193.	64.
5	0			
6	0			
7	0			
8	8	4420.	4432.	330.
9	0			
10	4	5689.	5695.	266.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	1372.	1389.	216.
3	56	2560.	2768.	1051.
4	155	1919.	2182.	1039.
5	139	2473.	2781.	1272.
6	77	2332.	2494.	884.
7	80	3189.	3605.	1681.
8	78	5508.	5847.	1962.
9	12	6213.	6279.	903.
10	12	7573.	7636.	968.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	16	604.	832.	572.
3	80	1744.	1929.	823.
4	162	1907.	2263.	1220.
5	176	1947.	2288.	1200.
6	43	1741.	1849.	732.
7	74	2142.	2268.	744.
8	52	2969.	3319.	1484.
9	31	5064.	5363.	1766.
10	20	4002.	4249.	1427.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	851.	852.	49.
2	22	1121.	1314.	684.
3	48	1213.	1289.	436.
4	99	1397.	1518.	594.
5	90	1887.	1972.	572.
6	126	1750.	1997.	963.
7	87	2265.	2504.	1068.
8	16	2572.	2872.	1278.
9	0			
10	0			
11	0			
12	0			

RMS LONGITUDINAL VERTICAL BENDING STRESS VS BEAUFORT NUMBER

IV

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	16	1372.	1551.	723.
3	40	2312.	2370.	519.
4	87	1839.	2204.	1215.
5	68	1951.	2286.	1113.
6	57	2069.	2406.	1227.
7	20	3131.	3185.	581.
8	8	3958.	4306.	1698.
9	16	7115.	7181.	606.
10	16	6522.	6805.	1941.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	1	253.	257.	43.
3	24	1673.	1907.	916.
4	110	1111.	1321.	715.
5	75	1657.	1835.	788.
6	32	1810.	1937.	689.
7	50	2027.	2231.	932.
8	32	4755.	4886.	1124.
9	12	5301.	5377.	902.
10	8	6098.	6130.	620.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	10	912.	1061.	583.
3	72	1849.	2158.	1112.
4	179	1612.	1933.	1067.
5	190	2010.	2241.	992.
6	128	1733.	1939.	870.
7	108	3090.	3370.	1346.
8	35	2915.	3821.	2470.
9	8	3215.	3263.	563.
10	8	2771.	2818.	510.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	12	653.	688.	215.
3	45	1476.	1716.	876.
4	96	2176.	2406.	1025.
5	92	2598.	2980.	1460.
6	52	2161.	2381.	902.
7	47	3068.	3726.	2114.
8	67	4955.	5386.	2109.
9	0			
10	4	4597.	4623.	493.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	1499.	1502.	102.
3	20	2283.	2551.	1139.
4	42	1985.	2199.	947.
5	28	3064.	3315.	1264.
6	20	1555.	1788.	883.
7	52	2466.	2585.	777.
8	12	3554.	3674.	932.
9	7	4052.	4081.	486.
10	8			
11	0			
12	0			

MAXIMUM LONGITUDINAL VERTICAL BENDING STRESS VS BEAUFORT NUMBER

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	4763.	4801.	722.
4	23	4692.	5061.	1899.
5	16	7255.	7582.	2204.
6	12	5003.	5039.	602.
7	36	9722.	9844.	1543.
8	8			
9	0			
10	0			
11	0			
12	0			

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	1757.	1760.	116.
4	4	2640.	2691.	525.
5	0			
6	0			
7	0			
8	8	10950.	11065.	1587.
9	0			
10	4	14559.	14617.	1303.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	3034.	3074.	495.
3	56	5589.	6062.	2348.
4	155	4236.	4871.	2405.
5	139	5386.	5991.	2623.
6	77	5149.	5782.	2204.
7	80	6975.	7758.	3394.
8	76	11730.	12405.	4036.
9	12	15264.	15567.	3160.
10	12	17374.	17507.	2150.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	16	1484.	2016.	1364.
3	80	3979.	4463.	2021.
4	162	4518.	5500.	3136.
5	176	4473.	5275.	2795.
6	83	4036.	4428.	1823.
7	76	4790.	5065.	1646.
8	52	6766.	7754.	3788.
9	31	12404.	13162.	4400.
10	20	9697.	10323.	3540.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	1903.	1905.	91.
2	22	2553.	3060.	1686.
3	48	2608.	2966.	955.
4	99	3169.	3471.	1417.
5	90	4287.	4501.	1372.
6	126	3993.	4587.	2258.
7	87	5308.	6015.	2829.
8	16	5946.	6720.	3132.
9	0			
10	0			
11	0			
12	0			

MAXIMUM LONGITUDINAL VERTICAL BENDING STRESS VS BEAUFORT NUMBER

VI

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	16	3161.	3630.	1825.
3	40	5231.	5428.	1451.
4	87	4353.	5332.	3080.
5	48	4077.	5180.	2525.
6	57	4861.	5897.	2972.
7	20	7271.	7935.	1976.
8	8	9900.	10811.	4293.
9	16	17677.	17730.	1377.
10	16	15190.	15752.	4149.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	3	585.	587.	56.
3	24	3770.	4266.	1997.
4	110	2683.	2961.	1612.
5	75	3747.	4228.	1959.
6	32	4020.	4304.	1543.
7	50	4609.	5092.	2166.
8	32	11755.	12210.	3302.
9	12	12652.	13882.	5422.
10	6	15081.	15229.	2118.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	10	2110.	2469.	1261.
3	72	4154.	4861.	2526.
4	179	3630.	4428.	2538.
5	190	4543.	5094.	2303.
6	128	4053.	4820.	2218.
7	108	6486.	7699.	3236.
8	35	6440.	8350.	5319.
9	8	8172.	8599.	2678.
10	8	6987.	7211.	1784.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	12	1545.	1601.	420.
3	45	3173.	3594.	1688.
4	96	4914.	5516.	2504.
5	92	5764.	6495.	2993.
6	52	4745.	5109.	1694.
7	47	6929.	7699.	4081.
8	47	10109.	10898.	4071.
9	0			
10	4	10246.	10272.	736.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	3207.	3220.	291.
3	20	4881.	5356.	2204.
4	42	6410.	6975.	2303.
5	24	6682.	7410.	2845.
6	20	3283.	3656.	1610.
7	52	5520.	5766.	1664.
8	12	7798.	7798.	1743.
9	7	9667.	9805.	1638.
10	0			
11	0			
12	0			

RMS LONGITUDINAL HORIZONTAL BENDING STRESS VS BEAUFORT NUMBER

VII

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	1606.	1620.	215.
4	23	1177.	1281.	507.
5	16	1926.	2003.	542.
6	12	1526.	1536.	174.
7	36	2469.	2483.	261.
8	0			
9	0			
10	0			
11	0			
12	0			

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	520.	521.	29.
4	4	695.	696.	22.
5	0			
6	0			
7	0			
8	8	1740.	1758.	224.
9	0			
10	4	1374.	1375.	63.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	729.	759.	211.
3	54	981.	1028.	309.
4	157	839.	914.	364.
5	138	1062.	1127.	376.
6	75	1103.	1200.	473.
7	79	1375.	1480.	546.
8	78	1796.	1833.	364.
9	12	1531.	1575.	366.
10	12	1600.	1603.	101.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	16	325.	401.	235.
3	79	714.	808.	377.
4	161	765.	861.	395.
5	171	793.	889.	403.
6	42	866.	932.	344.
7	74	1204.	1286.	450.
8	52	1265.	1316.	360.
9	31	1736.	1766.	321.
10	20	1586.	1617.	316.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	653.	660.	95.
2	22	475.	504.	168.
3	47	637.	665.	190.
4	100	640.	702.	288.
5	90	991.	1019.	240.
6	125	883.	956.	367.
7	87	1008.	1036.	237.
8	16	1297.	1386.	489.
9	0			
10	0			
11	0			
12	0			

VIII

RMS LONGITUDINAL HORIZONTAL BENDING STRESS VS BEAUFORT NUMBER

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGO

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	653.	680.	95.
2	20	395.	450.	216.
3	48	708.	787.	344.
4	88	629.	705.	318.
5	71	758.	846.	376.
6	58	746.	859.	426.
7	23	1314.	1380.	425.
8	20	1378.	1450.	457.
9	14	1730.	1775.	399.
10	16	1537.	1550.	200.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	113.	116.	15.
3	25	773.	815.	260.
4	108	554.	685.	403.
5	72	750.	798.	271.
6	32	911.	970.	334.
7	48	980.	1067.	422.
8	32	1765.	1801.	362.
9	12	1618.	1639.	259.
10	6	1450.	1453.	94.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	10	427.	480.	219.
3	70	805.	904.	410.
4	179	708.	786.	340.
5	189	1003.	1110.	477.
6	128	956.	1045.	420.
7	108	1663.	1808.	709.
8	35	1335.	1450.	564.
9	8	1799.	1818.	262.
10	8	1502.	1529.	229.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	12	867.	895.	162.
3	47	600.	640.	223.
4	96	977.	1065.	422.
5	91	1111.	1214.	489.
6	52	1097.	1212.	516.
7	49	1372.	1469.	526.
8	67	1637.	1678.	371.
9	0			
10	4	2054.	2058.	131.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	927.	931.	91.
3	20	1147.	1265.	533.
4	45	1058.	1150.	451.
5	24	1352.	1371.	229.
6	20	1023.	1132.	485.
7	52	1124.	1162.	293.
8	12	1553.	1565.	194.
9	7	1530.	1572.	301.
10	0			
11	0			
12	0			

IX

MAXIMUM LONGITUDINAL HORIZONTAL BENDING STRESS VS BEAUFORT NUMBER

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	3520.	3552.	478.
4	25	2548.	2738.	1001.
5	16	4221.	4403.	1253.
6	12	3316.	3354.	510.
7	36	5328.	5393.	858.
8	0			
9	0			
10	0			
11	0			
12	0			

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	1154.	1155.	62.
4	4	1530.	1533.	93.
5	0			
6	0			
7	0			
8	8	4193.	4297.	943.
9	0			
10	4	2932.	2933.	43.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	1554.	1598.	370.
3	54	2248.	2378.	773.
4	157	1881.	2044.	800.
5	138	2371.	2536.	900.
6	75	2479.	2686.	1033.
7	79	3033.	3252.	1173.
8	78	3853.	3927.	760.
9	12	3461.	3579.	913.
10	12	3584.	3599.	328.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	16	792.	921.	471.
3	79	1645.	1873.	895.
4	161	1715.	1933.	891.
5	171	1781.	1999.	908.
6	42	2000.	2157.	808.
7	74	2641.	2849.	1018.
8	52	2866.	2977.	805.
9	31	4087.	4170.	829.
10	20	3771.	3892.	964.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0	1709.	1835.	670.
2	22	1116.	1213.	475.
3	47	1417.	1680.	420.
4	100	1429.	1569.	648.
5	90	2175.	2265.	634.
6	125	1966.	2159.	848.
7	87	2296.	2376.	612.
8	16	2976.	3239.	1278.
9	0			
10	0			
11	0			
12	0			

MAXIMUM LONGITUDINAL HORIZONTAL BENDING STRESS VS BEAUFORT NUMBER

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	1709.	1835.	670.
2	70	903.	1006.	443.
3	48	1687.	1888.	887.
4	88	1402.	1579.	776.
5	71	1685.	1898.	865.
6	58	1737.	1989.	969.
7	23	3043.	3225.	1070.
8	20	3218.	3382.	1039.
9	16	3997.	4119.	999.
10	16	3540.	3575.	496.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	293.	312.	107.
3	23	1681.	1768.	588.
4	108	1229.	1520.	902.
5	72	1697.	1820.	659.
6	32	2166.	2315.	817.
7	48	2267.	2477.	993.
8	32	3937.	4018.	800.
9	12	3769.	3824.	650.
10	8	3212.	3233.	376.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	10	932.	1046.	478.
3	70	1831.	2080.	987.
4	179	1599.	1759.	731.
5	189	2241.	2487.	1077.
6	128	2155.	2359.	960.
7	108	3640.	3950.	1532.
8	35	2997.	3235.	1219.
9	8	4355.	4414.	725.
10	8	3328.	3370.	527.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	12	1225.	1315.	475.
3	47	1343.	1443.	528.
4	96	2195.	2411.	997.
5	91	2489.	2693.	1121.
6	52	2412.	2675.	1158.
7	49	3001.	3229.	1193.
8	67	3534.	3626.	811.
9	0			
10	4	5300.	5336.	622.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	1895.	1902.	182.
3	20	2547.	2806.	1177.
4	45	2302.	2480.	922.
5	24	2936.	2998.	608.
6	20	2244.	2500.	1101.
7	52	2469.	2561.	679.
8	12	3372.	3423.	589.
9	7	3460.	3588.	935.
10	0			
11	0			
12	0			

RMS MIDSHIP TORSIONAL SHEARING STRESS VS BEAUFORT NUMBER

XI

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	501.	507.	63.
4	22	348.	372.	133.
5	6	534.	555.	137.
6	12	471.	474.	60.
7	55	669.	690.	83.
8	0			
9	0			
10	0			
11	0			
12	0			

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	192.	193.	17.
4	4	277.	277.	5.
5	0			
6	0			
7	0			
8	8	649.	655.	63.
9	0			
10	4	483.	484.	30.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	273.	282.	70.
3	53	366.	376.	86.
4	156	310.	334.	122.
5	133	386.	409.	137.
6	75	398.	426.	151.
7	77	545.	588.	221.
8	78	753.	773.	172.
9	12	565.	574.	97.
10	12	603.	605.	51.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	16	120.	138.	67.
3	73	242.	265.	108.
4	159	274.	317.	159.
5	169	302.	363.	202.
6	93	361.	437.	287.
7	73	427.	477.	213.
8	52	549.	599.	238.
9	31	661.	675.	136.
10	20	984.	993.	98.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	211.	212.	13.
2	10	246.	249.	40.
3	44	259.	267.	69.
4	85	275.	297.	112.
5	90	374.	386.	88.
6	118	300.	378.	156.
7	74	349.	377.	98.
8	16	454.	462.	161.
9	0			
10	0			
11	0			
12	0			

RMS MIDSHIP TORSIONAL SHEARING STRESS VS BEAUFORT NUMBER

XII

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	211.	212.	13.
2	12	117.	139.	76.
3	45	266.	281.	96.
4	79	250.	270.	104.
5	70	331.	378.	176.
6	61	321.	359.	162.
7	23	557.	645.	325.
8	20	729.	797.	321.
9	16	639.	651.	125.
10	16	588.	589.	66.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	24	315.	321.	60.
4	97	226.	250.	109.
5	71	257.	275.	99.
6	24	370.	405.	165.
7	31	384.	378.	157.
8	32	621.	629.	101.
9	12	563.	571.	94.
10	6	517.	519.	42.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	6	243.	249.	58.
3	63	283.	313.	133.
4	177	283.	297.	137.
5	178	372.	422.	200.
6	127	369.	412.	183.
7	110	522.	560.	202.
8	35	500.	566.	266.
9	8	749.	763.	148.
10	8	592.	596.	74.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	12	197.	204.	53.
3	65	257.	273.	92.
4	96	353.	387.	158.
5	91	392.	419.	148.
6	52	392.	433.	182.
7	48	523.	591.	276.
8	67	745.	769.	188.
9	0			
10	4	732.	735.	69.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	337.	339.	35.
3	20	349.	388.	169.
4	48	358.	379.	111.
5	26	456.	470.	108.
6	20	331.	368.	147.
7	51	459.	476.	120.
8	12	756.	774.	165.
9	7	614.	622.	97.
10	0			
11	0			
12	0			

MAXIMUM MIDSHIP TORSIONAL SHEARING STRESS VS BEAUFORT NUMBER

XIII

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	1114.	1130.	191.
4	22	798.	857.	311.
5	16	1399.	1409.	450.
6	12	1069.	1081.	187.
7	39	1639.	1665.	315.
8	0			
9	0			
10	0			
11	0			
12	0			

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	436.	449.	107.
4	4	623.	624.	41.
5	0			
6	0			
7	0			
8	8	1666.	1692.	296.
9	0			
10	4	1287.	1295.	148.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	562.	572.	105.
3	53	874.	922.	287.
4	156	718.	782.	309.
5	133	893.	952.	320.
6	75	960.	1041.	402.
7	77	1237.	1332.	492.
8	78	1631.	1672.	369.
9	12	1468.	1487.	238.
10	12	1581.	1598.	231.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	16	282.	339.	188.
3	73	584.	651.	288.
4	159	667.	749.	377.
5	169	735.	871.	468.
6	43	831.	986.	530.
7	73	970.	1073.	458.
8	52	1258.	1351.	498.
9	31	1565.	1597.	321.
10	20	1613.	1639.	251.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	450.	451.	38.
2	10	568.	582.	134.
3	48	585.	607.	159.
4	85	691.	707.	209.
5	98	7904.	900.	259.
6	118	770.	852.	336.
7	74	837.	867.	229.
8	16	1101.	1160.	428.
9	0			
10	0			
11	0			
12	0			

MAXIMUM MIDSHIP TORSIONAL SHEARING STRESS VS BEAUFORT NUMBER

XIV

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	450.	491.	34.
2	12	264.	330.	199.
3	45	631.	677.	246.
4	79	599.	665.	291.
5	70	809.	921.	439.
6	61	763.	859.	395.
7	21	1245.	1411.	668.
8	20	1558.	1672.	607.
9	16	1572.	1597.	282.
10	16	1476.	1498.	256.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	24	725.	781.	152.
4	97	525.	597.	284.
5	71	642.	711.	305.
6	24	872.	955.	389.
7	31	808.	891.	375.
8	32	1539.	1571.	318.
9	12	1478.	1501.	260.
10	8	1382.	1398.	194.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	6	520.	526.	81.
3	63	696.	797.	387.
4	177	621.	711.	345.
5	178	865.	973.	445.
6	127	852.	955.	432.
7	110	1213.	1311.	499.
8	35	1172.	1301.	565.
9	8	1725.	1751.	299.
10	8	1313.	1326.	183.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	12	484.	515.	177.
3	45	579.	621.	236.
4	96	803.	879.	358.
5	91	947.	1028.	400.
6	52	892.	999.	450.
7	48	1158.	1367.	606.
8	47	1592.	1648.	410.
9	0			
10	4	1797.	1799.	85.
11	6			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	646.	689.	61.
3	20	780.	867.	379.
4	48	842.	890.	289.
5	20	1058.	1091.	264.
6	20	734.	819.	368.
7	41	1036.	1070.	266.
8	12	1524.	1559.	327.
9	7	1348.	1378.	286.
10	0			
11	0			
12	0			

RMS FORWARD SHEARING STRESS-POINT VS BEAUFORT NUMBER

XV

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	1852.	1884.	205.
4	23	1170.	1249.	437.
5	16	1609.	1663.	422.
6	12	1317.	1324.	133.
7	36	2202.	2215.	239.
8	0			
9	0			
10	0			
11	0			
12	0			

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	435.	436.	29.
4	8	643.	643.	23.
5	0			
6	0			
7	0			
8	8	2398.	2403.	149.
9	0			
10	7	2015.	2158.	775.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	619.	620.	85.
3	56	1245.	1342.	500.
4	161	968.	1092.	506.
5	140	1243.	1370.	576.
6	77	1191.	1267.	430.
7	77	1668.	1843.	784.
8	78	2719.	2850.	856.
9	12	3248.	3272.	395.
10	12	3868.	3917.	474.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 50.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	16	363.	485.	322.
3	80	895.	994.	432.
4	167	1030.	1295.	698.
5	182	1037.	1224.	652.
6	93	861.	933.	358.
7	83	1269.	1386.	509.
8	51	1768.	1955.	835.
9	35	2472.	2822.	910.
10	20	2252.	2360.	704.
11	0			
12	0			

SHIP SPEED BETWEEN 50.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	545.	586.	34.
2	22	574.	652.	310.
3	48	617.	652.	210.
4	102	687.	761.	327.
5	86	1011.	1064.	334.
6	117	882.	989.	448.
7	79	1128.	1245.	537.
8	15	1393.	1508.	576.
9	0			
10	8			
11	0			
12	0			

XVI

RMS FORE-AND SHEARING STRESS-PORT VS REAUPORT NUMBER

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL

REAUPORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	545.	546.	34.
2	20	609.	724.	392.
3	48	994.	1063.	379.
4	68	928.	1139.	660.
5	71	1066.	1216.	585.
6	61	1054.	1218.	598.
7	23	1568.	1627.	354.
8	20	1911.	2001.	592.
9	16	3688.	3702.	323.
10	16	3271.	3431.	1036.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

REAUPORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	102.	104.	18.
3	24	753.	833.	357.
4	111	572.	676.	360.
5	60	788.	861.	347.
6	32	865.	896.	238.
7	51	993.	1105.	483.
8	32	2377.	2438.	584.
9	16	2452.	2582.	811.
10	11	2504.	2667.	917.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

REAUPORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	10	401.	461.	229.
3	72	981.	1136.	578.
4	183	842.	1002.	544.
5	190	1082.	1199.	516.
6	127	885.	984.	429.
7	110	1580.	1702.	632.
8	33	1603.	1997.	1191.
9	8	2098.	2140.	421.
10	8	1741.	1768.	309.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

REAUPORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	12	382.	401.	122.
3	48	652.	746.	362.
4	97	1130.	1277.	587.
5	87	1324.	1525.	756.
6	44	1141.	1233.	468.
7	41	1710.	2013.	1061.
8	67	2581.	2728.	882.
9	0			
10	4	2996.	3018.	365.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

REAUPORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	652.	653.	37.
3	20	1270.	1420.	635.
4	49	1034.	1209.	626.
5	28	1451.	1689.	840.
6	20	922.	997.	380.
7	52	1521.	1579.	425.
8	12	2062.	2077.	246.
9	7	2495.	2525.	392.
10	0			
11	0			
12	0			

XVII

MAXIMUM BOW-AND SHEARING STRESS-PORT VS BEAUFORT NUMBER

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	3701.	3721.	386.
4	23	2885.	2889.	918.
5	16	3769.	3913.	1050.
6	12	2816.	2836.	329.
7	36	4984.	5028.	800.
8	0			
9	0			
10	0			
11	0			
12	0			

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	994.	1001.	118.
4	8	1415.	1425.	164.
5	0			
6	0			
7	0			
8	8	6037.	6105.	910.
9	0			
10	7	5023.	5003.	1991.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	1353.	1372.	230.
3	56	2764.	2980.	1113.
4	161	2158.	2471.	1205.
5	140	2745.	3002.	1217.
6	77	2740.	2988.	1117.
7	77	3724.	4065.	1631.
8	78	5977.	6261.	1866.
9	12	7785.	7877.	1205.
10	12	9159.	9231.	1150.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	16	827.	1132.	774.
3	80	2081.	2345.	1081.
4	167	2394.	2924.	1676.
5	182	2333.	2774.	1500.
6	93	2042.	2280.	922.
7	83	2865.	3087.	1151.
8	51	3988.	4516.	2118.
9	35	6534.	7003.	2515.
10	20	5495.	5723.	1599.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	1205.	1213.	133.
2	22	1271.	1479.	756.
3	48	1440.	1580.	544.
4	102	1590.	1759.	752.
5	86	2254.	2390.	795.
6	117	1969.	2226.	1000.
7	77	2654.	2984.	1365.
8	15	3340.	3670.	1519.
9	0			
10	0			
11	0			
12	0			

XVIII

MAXIMUM FORWARD SHEARING STRESS-PORT VS BEAUFORT NUMBER

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	1205.	1213.	133.
2	20	1372.	1674.	959.
3	48	2317.	2498.	922.
4	86	2251.	2790.	1647.
5	71	2430.	2758.	1306.
6	61	2421.	2797.	1481.
7	23	3804.	3904.	881.
8	20	4239.	4514.	1551.
9	16	9281.	9359.	1137.
10	16	7782.	8138.	2379.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	233.	233.	13.
3	24	1742.	1924.	817.
4	111	1270.	1509.	806.
5	80	1800.	1986.	838.
6	32	1997.	2066.	528.
7	51	2330.	2588.	1126.
8	32	5978.	6216.	1710.
9	16	6021.	6318.	1916.
10	11	6161.	6571.	2285.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	10	891.	1026.	509.
3	72	2225.	2592.	1331.
4	183	1902.	2306.	1304.
5	190	2415.	2713.	1236.
6	127	2065.	2307.	1114.
7	110	3603.	3913.	1527.
8	33	3651.	4570.	2748.
9	8	4741.	4880.	1140.
10	8	4498.	4592.	935.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	12	845.	883.	257.
3	48	1434.	1613.	740.
4	97	2529.	2887.	1307.
5	87	2922.	3381.	1621.
6	44	2518.	2708.	1001.
7	41	3601.	4225.	2210.
8	47	5387.	5692.	1838.
9	0			
10	4	6688.	6686.	288.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	1378.	1390.	180.
3	20	2712.	3080.	1283.
4	49	2302.	2681.	1375.
5	28	3660.	3814.	1072.
6	20	2043.	2192.	795.
7	52	3405.	3537.	958.
8	12	4728.	4807.	871.
9	7	5631.	5767.	1247.
10	0			
11	0			
12	0			

XIX

RMS FORWARD SHEARING STRESS-STARBOARD VS BEAUFORT NUMBER

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	1661.	1674.	208.
4	23	1161.	1245.	451.
5	16	1816.	1885.	504.
6	12	1473.	1479.	137.
7	36	2421.	2433.	235.
8	0			
9	0			
10	0			
11	0			
12	0			

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	490.	491.	30.
4	4	612.	612.	19.
5	0			
6	0			
7	0			
8	8	2149.	2155.	154.
9	0			
10	8	2634.	2639.	145.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	805.	827.	193.
3	58	1391.	1533.	643.
4	159	1012.	1173.	592.
5	138	1278.	1487.	764.
6	76	1189.	1266.	437.
7	77	1651.	1982.	1028.
8	78	3095.	3314.	1176.
9	12	3154.	3185.	446.
10	12	3653.	3684.	477.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	16	303.	386.	240.
3	70	887.	971.	396.
4	155	997.	1152.	577.
5	166	1018.	1176.	596.
6	43	1020.	1157.	585.
7	73	1021.	1060.	350.
8	52	1485.	1643.	702.
9	31	2522.	2727.	1039.
10	20	1899.	2037.	738.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	427.	428.	32.
2	8	648.	719.	311.
3	39	696.	724.	207.
4	68	815.	902.	388.
5	88	1084.	1125.	300.
6	96	1001.	1121.	504.
7	65	1305.	1461.	571.
8	12	1566.	1700.	661.
9	0			
10	0			
11	0			
12	0			

RMS FORWARD SHEARING STRESS-STARBOARD VS BEAUFORT NUMBER

XX

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	8	427.	678.	32.
2	12	336.	830.	269.
3	87	973.	1069.	632.
4	44	1075.	1206.	547.
5	63	1068.	1215.	578.
6	85	1244.	1392.	530.
7	25	1499.	1602.	386.
8	20	2012.	2110.	657.
9	16	3711.	3726.	340.
10	16	3178.	3308.	919.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	19	1010.	1203.	653.
4	58	761.	885.	539.
5	71	850.	926.	366.
6	19	867.	920.	306.
7	32	987.	1149.	589.
8	32	2436.	2535.	700.
9	12	2600.	2663.	575.
10	8	2886.	2903.	336.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	6	815.	858.	269.
3	55	1046.	1213.	615.
4	169	855.	1030.	578.
5	182	1067.	1198.	536.
6	127	968.	1082.	490.
7	110	1577.	1760.	782.
8	31	1690.	2273.	1519.
9	8	1416.	1435.	231.
10	8	1249.	1270.	230.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	10	368.	391.	143.
3	46	847.	1003.	537.
4	93	1206.	1305.	500.
5	88	1498.	1688.	779.
6	44	1299.	1368.	428.
7	34	1867.	2236.	1258.
8	67	2760.	3026.	1241.
9	0			
10	8	2110.	2136.	337.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	971.	978.	93.
3	26	1113.	1232.	530.
4	47	1068.	1138.	386.
5	26	1509.	1727.	840.
6	4	1524.	1529.	129.
7	52	1345.	1403.	396.
8	12	1882.	1994.	658.
9	7	2018.	2028.	163.
10	0			
11	0			
12	0			

XXI

MAXIMUM FORWARD SHEARING STRESS=STARBOARD VS BEAUFORT NUMBER

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	3352.	3371.	355.
4	23	2894.	2859.	918.
5	16	8062.	4241.	1218.
6	12	3052.	3076.	367.
7	36	5189.	5238.	713.
8	0			
9	0			
10	0			
11	0			
12	0			

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	1047.	1048.	66.
4	4	1237.	1239.	77.
5	0			
6	0			
7	0			
8	8	5251.	5311.	795.
9	0			
10	8	7504.	7577.	1047.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	1652.	1690.	357.
3	48	2948.	3240.	1263.
4	158	2218.	2560.	1285.
5	138	2801.	3174.	1892.
6	76	2735.	2986.	1147.
7	77	3595.	4158.	2089.
8	78	6658.	7099.	2064.
9	12	7592.	7738.	1495.
10	12	8809.	8895.	1228.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	14	682.	808.	568.
3	70	2070.	2296.	992.
4	155	2382.	2812.	1484.
5	166	2331.	2718.	1398.
6	43	2386.	2698.	1259.
7	73	2352.	2487.	808.
8	52	3386.	3866.	1865.
9	31	6194.	6999.	2886.
10	20	8926.	9281.	1805.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	821.	824.	81.
2	8	1851.	1615.	709.
3	39	1592.	1688.	548.
4	68	1808.	2012.	891.
5	88	2458.	2559.	709.
6	96	2235.	2522.	1169.
7	65	3058.	3405.	1506.
8	12	3721.	4045.	1586.
9	0			
10	0			
11	0			
12	0			

XXII

MAXIMUM FORWARD SHEARING STRESS-STARBOARD VS BEAUFORT NUMBER

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	821.	826.	81.
2	12	709.	984.	659.
3	87	2282.	2517.	1063.
4	68	2661.	3049.	1489.
5	63	2499.	2835.	1338.
6	45	2818.	3065.	1213.
7	25	3727.	3910.	1183.
8	20	4531.	4778.	1515.
9	16	9883.	9587.	1108.
10	16	7736.	8050.	2251.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	19	2110.	2820.	1188.
4	58	1582.	2026.	1265.
5	71	1906.	2165.	948.
6	19	1893.	1987.	604.
7	32	2292.	2665.	1360.
8	32	5958.	6296.	1921.
9	12	6308.	6478.	1466.
10	8	7581.	7651.	1032.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	6	1808.	1921.	698.
3	55	2339.	2695.	1339.
4	149	1918.	2324.	1312.
5	182	2390.	2682.	1210.
6	127	2238.	2566.	1254.
7	110	3523.	3948.	1742.
8	31	3823.	5058.	3311.
9	8	3883.	3588.	841.
10	8	3401.	3586.	829.
11	8			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	10	821.	877.	308.
3	86	1831.	2113.	1056.
4	93	2637.	2848.	1075.
5	86	3286.	3621.	1522.
6	44	2862.	3048.	966.
7	38	3879.	4539.	2357.
8	67	5690.	6228.	2521.
9	0			
10	4	5853.	5886.	601.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	1921.	1927.	157.
3	28	2397.	2610.	1033.
4	47	2372.	2550.	936.
5	28	3360.	3743.	1730.
6	8	3177.	3198.	369.
7	92	2977.	3118.	915.
8	12	4167.	4430.	1505.
9	7	4862.	4962.	991.
10	0			
11	0			
12	0			

XXIII

RMS PEAK-TO-TROUGH ROLL ANGLE VS BEAUFORT NUMBER

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	0	6898.	6965.	818.
4	25	5823.	5923.	1828.
5	16	7271.	7603.	2221.
6	12	4619.	4655.	385.
7	34	7910.	8006.	1237.
8	0			
9	0			
10	0			
11	0			
12	0			

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	2930.	2961.	429.
4	8	3215.	3220.	181.
5	0			
6	0			
7	0			
8	8	5108.	5230.	950.
9	0			
10	4	6141.	6148.	168.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	4210.	4351.	1016.
3	56	4111.	4375.	1815.
4	154	4801.	5295.	2233.
5	140	5261.	5778.	2345.
6	77	4588.	5200.	2550.
7	78	6567.	7258.	3091.
8	78	9339.	9748.	2933.
9	12	4200.	4302.	928.
10	12	4250.	4259.	209.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	16	2890.	3389.	1769.
3	80	3888.	4031.	2125.
4	142	4920.	5636.	2715.
5	176	5168.	6130.	3296.
6	93	6197.	6830.	2882.
7	76	7290.	7987.	3244.
8	51	8491.	9408.	3598.
9	31	7928.	8937.	4176.
10	20	9288.	10395.	4675.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	4722.	4767.	652.
2	27	3805.	4196.	1686.
3	48	3836.	4191.	1686.
4	102	3983.	4694.	2484.
5	90	6494.	6329.	1711.
6	126	4879.	5298.	2067.
7	89	5221.	5520.	1791.
8	16	7597.	8077.	3761.
9	0			
10	0			
11	0			
12	0			

XXIV

RMS PEAK-TO-TROUGH ROLL ANGLE VS BEAUFORT NUMBER

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	4722.	4767.	652.
2	20	3110.	3525.	1654.
3	47	5888.	8459.	2151.
4	87	3069.	3662.	2003.
5	72	4552.	9370.	2849.
6	42	3519.	8992.	2951.
7	22	6976.	8161.	4235.
8	20	9646.	10847.	4960.
9	16	3785.	3885.	677.
10	16	4336.	4369.	384.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	229.	458.	397.
3	20	4223.	4600.	1826.
4	111	3557.	4192.	2142.
5	76	3535.	3979.	1828.
6	32	4182.	4448.	1504.
7	91	4432.	4777.	1782.
8	32	5620.	5957.	1975.
9	12	4836.	4889.	390.
10	8	4193.	4196.	156.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	10	3288.	4088.	2361.
3	72	4419.	5206.	2888.
4	177	4160.	4750.	2294.
5	190	5711.	6361.	2800.
6	128	5034.	5502.	2219.
7	149	6508.	6856.	2198.
8	58	8173.	8934.	3608.
9	8	11500.	11797.	2650.
10	8	10599.	10733.	1695.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	12	4049.	4086.	550.
3	88	4395.	4728.	1743.
4	98	6168.	6608.	2382.
5	92	6657.	7125.	2539.
6	52	6312.	6848.	2605.
7	89	7713.	8590.	3689.
8	67	10741.	10910.	1918.
9	0			
10	8	16397.	16489.	1309.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	5809.	5814.	237.
3	20	5302.	5824.	2412.
4	44	6327.	6600.	1880.
5	24	7532.	7750.	1856.
6	20	8071.	8121.	683.
7	52	7872.	8286.	2585.
8	12	10563.	10610.	2193.
9	7	12180.	12339.	1972.
10	0			
11	0			
12	0			

MAXIMUM PEAK-TO-TROUGH ROLL ANGLE VS BEAUFORT NUMBER

XXV

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	12271.	12456.	2132.
4	23	8738.	9617.	4016.
5	16	15032.	16138.	5870.
6	12	8242.	8340.	1271.
7	36	16922.	17463.	4313.
8	0			
9	0			
10	0			
11	0			
12	0			

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	4163.	4212.	646.
4	8	4552.	4639.	894.
5	0			
6	0			
7	0			
8	4	8521.	8762.	2043.
9	0			
10	4	7947.	8001.	923.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	6564.	6888.	2086.
3	55	10944.	11681.	4085.
4	156	8196.	9502.	4889.
5	140	9100.	10399.	5034.
6	77	7981.	9614.	5360.
7	78	11944.	13723.	6760.
8	78	17478.	18474.	5985.
9	12	7224.	7525.	2110.
10	12	7383.	7422.	754.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	16	4872.	6010.	3520.
3	80	6790.	8276.	4731.
4	162	8873.	10548.	5701.
5	176	9461.	11516.	6568.
6	93	11307.	13244.	6896.
7	76	13938.	15535.	6862.
8	51	15886.	17359.	6998.
9	31	14507.	16273.	7373.
10	20	18117.	20588.	9781.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	7438.	7627.	1689.
2	22	5970.	6706.	3053.
3	48	6512.	7593.	3395.
4	102	7027.	8764.	5237.
5	90	11523.	12148.	3848.
6	124	8802.	10000.	4747.
7	89	9771.	10681.	4314.
8	16	15133.	17309.	8401.
9	0			
10	0			
11	0			
12	0			

XXVI

MAXIMUM PEAK-TO-TROUGH ROLL ANGLE VS BEAUFORT NUMBER

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	20	5011.	5908.	3128.
3	47	6870.	8079.	4971.
4	87	9026.	6860.	4028.
5	72	7701.	9510.	5593.
6	62	5893.	8361.	5931.
7	22	12827.	15009.	7793.
8	20	16801.	19096.	9077.
9	16	6916.	7114.	1668.
10	16	7676.	7722.	902.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0	568.	1137.	984.
3	20	6978.	8022.	3958.
4	111	5771.	7311.	4889.
5	76	6126.	7228.	3619.
6	32	6979.	7678.	3201.
7	91	7698.	8642.	3935.
8	32	10813.	11147.	4034.
9	12	8626.	8702.	1148.
10	8	7764.	7810.	855.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	10	4824.	6286.	3967.
3	72	8069.	9502.	5125.
4	177	6821.	8520.	4758.
5	190	10480.	12037.	5990.
6	128	9134.	10556.	5295.
7	109	12454.	14035.	5635.
8	50	15314.	17251.	7958.
9	8	21510.	21954.	4377.
10	8	20782.	21093.	3827.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	12	6404.	6863.	1868.
3	88	7908.	8208.	3536.
4	98	11119.	12207.	5133.
5	92	12380.	13688.	5153.
6	52	11516.	12810.	5611.
7	89	14702.	14507.	7507.
8	67	19935.	20359.	4133.
9	0			
10	4	32991.	33141.	3183.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	8527.	8579.	949.
3	20	9788.	10829.	4853.
4	44	12191.	13609.	4482.
5	28	14506.	15022.	3901.
6	20	6558.	6830.	1920.
7	52	15007.	16090.	5814.
8	12	20418.	20816.	4049.
9	7	21845.	21760.	3688.
10	0			
11	0			
12	0			

RMS PITCH ANGLE VS BEAUFORT NUMBER

XXVII

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION

NO DATA POINTS

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	0			
4	0			
5	0			
6	0			
7	0			
8	0			
9	0			
10	4	1646.	1651.	142.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	0			
4	0			
5	0			
6	0			
7	0			
8	0			
9	4	1765.	1767.	87.
10	12	1732.	1735.	108.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	4	687.	690.	65.
4	8	837.	851.	149.
5	20	848.	899.	310.
6	0			
7	4	453.	471.	155.
8	12	725.	809.	358.
9	11	935.	1042.	460.
10	11	586.	594.	86.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	4	791.	797.	92.
4	16	839.	872.	237.
5	28	855.	890.	247.
6	28	808.	924.	448.
7	20	1225.	1245.	222.
8	4	1746.	1749.	108.
9	0			
10	0			
11	0			
12	0			

RMS PITCH ANGLE VS BEAUFORT NUMBER

XXVIII

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	687.	696.	65.
4	8	646.	649.	44.
5	4	698.	701.	58.
6	0			
7	4	861.	864.	73.
8	4	1051.	1142.	448.
9	4	1765.	1767.	87.
10	8	1780.	1783.	103.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	0			
4	0			
5	8	983.	1076.	439.
6	4	503.	507.	67.
7	8	686.	692.	68.
8	4	1746.	1749.	108.
9	4	1512.	1515.	95.
10	8	1741.	1747.	145.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	4	791.	797.	92.
4	12	973.	994.	203.
5	20	858.	877.	185.
6	20	617.	775.	469.
7	9	1293.	1345.	370.
8	4	454.	454.	30.
9	0			
10	8	580.	588.	99.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	0			
4	4	820.	825.	92.
5	16	821.	862.	263.
6	8	1172.	1186.	182.
7	8	1067.	1072.	101.
8	0			
9	0			
10	3	610.	610.	20.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	0			
4	0			
5	4	678.	679.	28.
6	0			
7	27	701.	744.	251.
8	4	671.	672.	37.
9	7	605.	628.	166.
10	0			
11	0			
12	0			

MAXIMUM PITCH ANGLE VS BEAUFORT NUMBER

XIX

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

NO DATA POINTS

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	0			
4	0			
5	0			
6	0			
7	0			
8	0			
9	0			
10	4	4049.	4058.	270.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	0			
4	0			
5	0			
6	0			
7	0			
8	0			
9	4	4395.	4414.	440.
10	12	4005.	4018.	324.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	4	1657.	1680.	281.
4	8	2050.	2084.	377.
5	20	1917.	2016.	631.
6	0			
7	36	1858.	1893.	521.
8	12	1704.	1867.	765.
9	11	2409.	2691.	1081.
10	11	1351.	1363.	176.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	4	1622.	1627.	138.
4	16	1833.	1967.	714.
5	28	1954.	2016.	494.
6	28	1893.	2087.	880.
7	20	2499.	2946.	521.
8	6	3760.	3768.	239.
9	0			
10	0			
11	0			
12	0			

MAXIMUM PITCH ANGLE VS BEAUFORT NUMBER

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL XXX

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	4	1657.	1680.	281.
4	8	1490.	1536.	376.
5	8	1370.	1371.	69.
6	0			
7	4	1906.	1971.	326.
8	4	2342.	2548.	1002.
9	4	4395.	4414.	480.
10	8	4026.	4038.	320.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	0			
4	0			
5	8	2267.	2398.	768.
6	8	1828.	1828.	81.
7	8	1328.	1335.	137.
8	4	3760.	3768.	239.
9	4	3688.	3700.	287.
10	8	4006.	4018.	363.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	4	1622.	1627.	136.
4	12	2242.	2383.	679.
5	20	1819.	1870.	433.
6	20	1881.	1779.	977.
7	9	3023.	3127.	600.
8	4	1214.	1214.	99.
9	0			
10	8	1370.	1383.	195.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	4			
4	4	1726.	1727.	70.
5	16	1982.	2054.	539.
6	8	2561.	2580.	316.
7	8	2621.	2680.	319.
8	0			
9	0			
10	3	1303.	1306.	89.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	0			
4	0			
5	4	1688.	1680.	363.
6	0			
7	27	1626.	1724.	571.
8	4	1559.	1579.	250.
9	7	1478.	1771.	566.
10	0			
11	0			
12	0			

XXXI

RMS FORWARD HULL VERTICAL ACCELERATION VS BEAUFORT NUMBER

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	7	494.	496.	42.
4	22	471.	506.	186.
5	15	1023.	1071.	314.
6	12	533.	534.	37.
7	35	1291.	1323.	287.
8	0			
9	0			
10	0			
11	0			
12	0			

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	8	368.	371.	50.
4	4	391.	391.	25.
5	0			
6	0			
7	0			
8	6	2365.	2371.	169.
9	0			
10	4	3404.	3407.	152.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	8	457.	480.	77.
3	40	999.	1236.	676.
4	138	850.	1051.	620.
5	119	1169.	1298.	565.
6	72	1188.	1351.	643.
7	67	1245.	1367.	564.
8	67	1238.	1506.	858.
9	12	2865.	2910.	382.
10	12	3217.	3221.	171.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	.			
2	16	355.	547.	417.
3	78	886.	1032.	550.
4	157	824.	1076.	692.
5	164	882.	1087.	637.
6	43	639.	704.	296.
7	73	962.	1093.	480.
8	51	847.	1091.	686.
9	31	2248.	2488.	1065.
10	20	1790.	1974.	831.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0	889.	894.	90.
2	22	579.	643.	280.
3	47	692.	802.	406.
4	100	724.	865.	474.
5	89	1187.	1335.	610.
6	121	1069.	1317.	769.
7	87	1386.	1652.	862.
8	15	1670.	1949.	1042.
9	0			
10	0			
11	0			
12	0			

XXXII

RMS P-IRRAND HULL VERTICAL ACCELERATION VS BEAUFORT NUMBER

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	849.	849.	90.
2	20	600.	735.	425.
3	46	1037.	1133.	456.
4	83	935.	1202.	758.
5	67	1062.	1233.	626.
6	57	1101.	1376.	826.
7	22	1481.	1559.	487.
8	20	1039.	1429.	981.
9	16	3252.	3268.	317.
10	16	2902.	2989.	717.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	98.	101.	24.
3	20	836.	931.	410.
4	109	539.	732.	496.
5	74	808.	1000.	590.
6	32	746.	787.	249.
7	48	1079.	1278.	684.
8	32	2496.	2559.	562.
9	12	2751.	2767.	299.
10	8	3247.	3253.	190.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	10	288.	309.	122.
3	68	920.	1151.	692.
4	164	783.	1015.	646.
5	183	1050.	1231.	642.
6	125	926.	1098.	590.
7	108	1400.	1545.	649.
8	30	838.	928.	402.
9	8	1428.	1517.	510.
10	8	1215.	1254.	308.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	12	426.	476.	211.
3	45	430.	460.	163.
4	91	629.	736.	382.
5	78	1016.	1159.	557.
6	50	1102.	1393.	853.
7	38	1197.	1323.	563.
8	59	660.	783.	342.
9	0			
10	4	1470.	1470.	21.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	928.	585.	83.
3	19	480.	509.	159.
4	45	741.	863.	442.
5	16	1306.	1365.	397.
6	20	829.	837.	78.
7	50	850.	1017.	558.
8	12	802.	848.	276.
9	7	1119.	1327.	714.
10	0			
11	0			
12	0			

MAXIMUM FORWARD HULL VERTICAL ACCELERATION VS REALIFORT NUMBER

XXXIII

SHIP SPEED BETWEEN 1.0 AND 15.0 PLOT SYMBOL OCTAGONAL

REALIFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	7	1101.	1123.	219.
4	22	1067.	1159.	451.
5	15	2261.	2403.	753.
6	12	1219.	1222.	134.
7	35	2809.	2876.	614.
8	0			
9	0			
10	0			
11	0			
12	0			

SHIP SPEED BETWEEN 15.0 AND 20.0 PLOT SYMBOL TRIANGLE

REALIFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	0			
3	2	851.	863.	142.
4	0	989.	1018.	243.
5	0			
6	0			
7	0			
8	2	5065.	5100.	590.
9	0			
10	4	7191.	7198.	324.
11	0			
12	0			

SHIP SPEED BETWEEN 20.0 AND 25.0 PLOT SYMBOL PLUS

REALIFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	3	1032.	1046.	171.
3	40	2309.	2745.	1485.
4	138	1932.	2397.	1418.
5	119	2632.	2919.	1262.
6	72	2687.	3062.	1470.
7	67	2849.	3130.	1304.
8	47	2777.	3350.	1875.
9	12	6241.	6303.	881.
10	12	6717.	6741.	567.
11	0			
12	0			

SHIP SPEED BETWEEN 25.0 AND 30.0 PLOT SYMBOL X

REALIFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	16	730.	1188.	937.
3	78	2036.	2403.	1277.
4	157	1891.	2285.	1615.
5	166	2001.	2280.	1464.
6	93	1536.	1742.	821.
7	73	2286.	2541.	1158.
8	51	1998.	2636.	1724.
9	31	5250.	5749.	2333.
10	20	4105.	4531.	1830.
11	0			
12	0			

SHIP SPEED BETWEEN 30.0 AND 35.0 PLOT SYMBOL DIAMOND

REALIFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	2031.	2050.	279.
2	22	1354.	1575.	725.
3	87	1583.	1816.	889.
4	100	1631.	1950.	1069.
5	89	2491.	3015.	1340.
6	121	2458.	3012.	1741.
7	87	3215.	3819.	2061.
8	15	3627.	4153.	2021.
9	0			
10	0			
11	0			
12	0			

XXXIV

MAXIMUM FORE AND AFT VERTICAL ACCELERATION VS BEAUFORT NUMBER

RELATIVE WAVE DIRECTION BETWEEN 0.0 AND 31.0 PLOT SYMBOL OCTAGONAL

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	4	2031.	2050.	279.
2	20	1364.	1717.	1044.
3	46	2335.	2555.	1038.
4	83	2125.	2734.	1723.
5	67	2429.	2849.	1489.
6	57	2475.	3106.	1877.
7	22	3414.	3621.	1208.
8	20	2378.	3242.	2188.
9	14	7298.	7337.	756.
10	16	6201.	6387.	1531.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 31.0 AND 61.0 PLOT SYMBOL TRIANGLE

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	165.	179.	71.
3	20	1891.	2104.	925.
4	109	1701.	1841.	1118.
5	78	1812.	2230.	1300.
6	32	1767.	1899.	695.
7	68	2858.	2903.	1505.
8	32	5501.	5637.	1232.
9	12	6031.	6078.	755.
10	8	6984.	6997.	823.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 61.0 AND 121.0 PLOT SYMBOL PLUS

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	10	668.	733.	302.
3	80	2123.	2638.	1565.
4	164	1815.	2363.	1513.
5	183	2375.	2787.	1457.
6	125	2160.	2965.	1383.
7	104	3178.	3536.	1559.
8	30	1933.	2140.	919.
9	8	3557.	3713.	1064.
10	8	2493.	2937.	508.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 121.0 AND 151.0 PLOT SYMBOL X

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	12	942.	1067.	502.
3	43	1050.	1208.	668.
4	91	1438.	1698.	908.
5	78	2275.	2575.	1205.
6	50	2082.	3116.	1883.
7	38	2850.	3179.	1810.
8	59	1504.	1718.	822.
9	0			
10	8	3507.	3523.	333.
11	0			
12	0			

RELATIVE WAVE DIRECTION BETWEEN 151.0 AND 180.0 PLOT SYMBOL DIAMOND

BEAUFORT NUMBER	NO. OF DATA POINTS	MEAN	RMS	ST. DEVIATION
1	0			
2	4	1117.	1132.	181.
3	19	1079.	1153.	406.
4	45	1649.	1923.	988.
5	14	2994.	3109.	966.
6	20	968.	993.	217.
7	50	1965.	2348.	1516.
8	12	1829.	1926.	615.
9	7	2881.	3510.	2005.
10	0			
11	0			
12	0			

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER SSC-264	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* FIRST SEASON RESULTS FROM SHIP RESPONSE INSTRUMENTATION ABOARD THE SL-7 CLASS CONTAINERSHIP S.S. SEA-LAND McLEAN IN NORTH ATLANTIC SERVICE		5. TYPE OF REPORT & PERIOD COVERED Technical Report 10/8/72 - 4/5/73 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR*(s)* R. R. Boentgen, R. A. Fain, and J. W. Wheaton		8. CONTRACT OR GRANT NUMBER*(s)* N00024-73-C-5059
9. PERFORMING ORGANIZATION NAME AND ADDRESS Teledyne Materials Research Inc. Waltham, MA. 02154		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS SR-211
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Ship Engineering Center Department of the Navy Washington, D.C. 20364		12. REPORT DATE September 1976 13. NUMBER OF PAGES 182
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)* Ship Research Committee National Academy of Sciences Washington, D.C. 20418		15. SECURITY CLASS. *(of this report)* Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

This document has been approved for public release and sale; its distribution is unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

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

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report contains data, with appropriate evaluation and discussions, collected during the first season on board the S.S. SEA-LAND McLEAN. Data collection began with westbound Voyage 1 on October 8, 1972 and terminated with the eastbound passage of Voyage 12 on April 5, 1973. A total of 80 data tapes were recorded containing in excess of 50,000 separate data intervals from more than 100 transducers.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-014-6601 |

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: SSC-264	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE *(and Subtitle)*: FIRST SEASON RESULTS FROM SHIP RESPONSE INSTRUMENTATION ABOARD THE SL-7 CLASS CONTAINERSHIP S.S. SEA-LAND McLEAN IN NORTH ATLANTIC SERVICE	5. TYPE OF REPORT & PERIOD COVERED: Technical Report 10/8/72 - 4/5/73
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): R. R. Boentgen, R. A. Fain, and J. W. Wheaton	8. CONTRACT OR GRANT NUMBER(s): N00024-73-C-5059
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Teledyne Materials Research Inc. Waltham, MA. 02154	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: SR-211
11. CONTROLLING OFFICE NAME AND ADDRESS: Naval Ship Engineering Center Department of the Navy Washington, D.C. 20364	12. REPORT DATE: September 1976
	13. NUMBER OF PAGES: 182
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*: Ship Research Committee National Academy of Sciences Washington, D.C. 20418	15. SECURITY CLASS. *(of this report)*: Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

This document has been approved for public release and sale; its distribution is unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

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

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report contains data, with appropriate evaluation and discussions, collected during the first season on board the S.S. SEA-LAND McLEAN. Data collection began with westbound Voyage 1 on October 8, 1972 and terminated with the eastbound passage of Voyage 12 on April 5, 1973. A total of 80 data tapes were recorded containing in excess of 50,000 separate data intervals from more than 100 transducers.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

20. ABSTRACT (Cont'd).

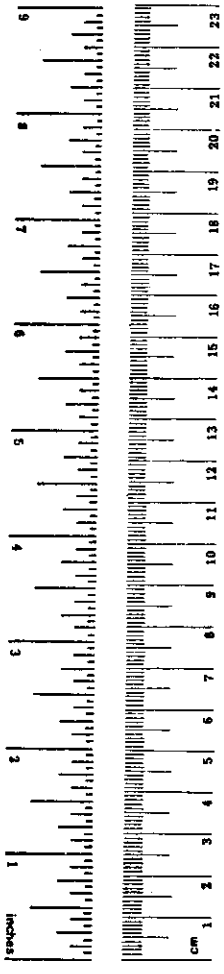
Discussions include a description of the digitized data, comparisons of stresses with sea state, simultaneous response data from all transducers during selected portions of a rough voyage, and a consideration of torsional responses.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

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

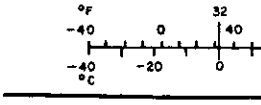
*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conv

Symbol	When You Know
mm	millimeters
cm	centimeters
m	meters
m	meters
km	kilometers
cm^2	square centimeters
m^2	square meters
km^2	square kilometers
ha	hectares (10,000 m^2
g	grams
kg	kilograms
t	tonnes (1000 kg)
ml	milliliters
l	liters
l	liters
l	liters
m^3	cubic meters
m^3	cubic meters
°C	Celsius temperature

TEMI



SHIP RESEARCH COMMITTEE
Maritime Transportation Research Board
National Academy of Sciences-National Research Council

The Ship Research Committee has technical cognizance of the interagency Ship Structure Committee's research program:

PROF. J. E. GOLDBERG, Chairman, *Professor Emeritus, Purdue University*
MR. D. P. COURTSAL, *General Manager, Engrg. Works Division, BRAVO Corp.*
MR. E. S. DILLON, *Consultant, Silver Spring, Md.*
DEAN D. C. DRUCKER, *College of Engineering, University of Illinois*
MR. G. E. KAMPSCHAEFER, Jr., *Manager, Technical Services, ARMCO Steel Corp.*
PROF. L. LANDWEBER, *Inst. of Hydraulic Research, The University of Iowa*
MR. O. H. OAKLEY, *Consultant, McLean, Virginia*
MR. D. P. ROSEMAN, *Chief Naval Architect, Hydronautics, Inc.*
DEAN R. D. STOUT, *Graduate School, Lehigh University*
MR. R. W. RUMKE, *Executive Secretary, Ship Research Committee*

The Ship Design, Response, and Load Criteria Advisory Group prepared the project prospectus and evaluated the proposals for this project:

MR. D. P. ROSEMAN, Chairman, *Chief Naval Architect, Hydronautics, Inc.*
MR. M. D. BURKHART, *Head, Marine Science Affairs, Dept. of Navy*
DR. D. D. KANA, *Manager, Structural Dynamics & Acoustics, S.W. Res. Inst.*
MR. W. J. LANE, *Structural Engineer, Bethlehem Steel Corp.*
DR. M. K. OCHI, *Research Scientist, Naval Ship Research & Dev. Center*
PROF. W. D. PILKEY, *Department of Mechanics, University of Virginia*
PROF. J. C. SAMUELS, *Dept. of Electrical Engineering, Howard University*
PROF. M. SHINOZUKA, *Dept. of Civil Engineering, Columbia University*
MR. H. S. TOWNSEND, *Consultant, Westport, Conn.*
PROF. G. A. WEMPNER, *School of Engrg. Science & Mechanics. Georgia Inst. of Technology*

The SL-7 Program Advisory Committee provided the liaison technical guidance, and reviewed the project reports with the investigator:

MR. R. C. STRASSER, Chairman, *Consultant, Newport News, Va.*
MR. E. R. ASHEY, *Asst. for Advanced Technology, Naval Ship Engrg. Center*
PROF. J. E. GOLDBERG, *Professor Emeritus, Purdue University*
PROF. E. V. LEWIS, *Director of Research, Webb Inst. of Naval Architecture*
MR. J. H. ROBINSON, *Staff Naval Architect, Naval Ship Res. & Dev. Center*
MR. D. P. ROSEMAN, *Chief Naval Architect, Hydronautics, Inc.*
PROF. R. A. YAGLE, *Dept. of Naval Architecture, University of Michigan*

SHIP STRUCTURE COMMITTEE PUBLICATIONS

These documents are distributed by the National Technical Information Service, Springfield, Va. 22161. These documents have been announced in the Clearinghouse journal U.S. Government Research & Development Reports (USGRDR) under the individual AD numbers.

SL-7 PUBLICATIONS TO DATE

SL-7-1, (SSC-238) - *Design and Installation of a Ship Response Instrumentation System Aboard the SL-7 Class Containership S.S. SEA-LAND McLEAN* by R. A. Fain. 1974. AD 780000.

SL-7-2, (SSC-239) - *Wave Loads in a Model of the SL-7 Containership Running at Oblique Headings in Regular Waves* by J. F. Dalzell and M. J. Chiocco. 1974. AD 780065.

SL-7-3, (SSC-243) - *Structural Analysis of SL-7 Containership Under Combined Loading of Vertical, Lateral and Torsional Moments Using Finite Element Techniques* by A. M. Elbatouti, D. Liu, and H. Y. Jan. 1974. AD-A002620

SL-7-4, (SSC-246) - *Theoretical Estimates of Wave Loads on the SL-7 Containership in Regular and Irregular Seas* by P. Kaplan, T. P. Sargent, and J. Cilmi. 1974. AD-A004554.

SL-7-5, (SSC-257) - *SL-7 Instrumentation Program Background and Research Plan* by W. J. Siekierka, R. A. Johnson, and CDR C. S. Loosmore, USCG. 1976. AD-A021337.

SL-7-6, (SSC-259) - *Verification of the Rigid Vinyl Modeling Techniques: The SL-7 Structure* by J. L. Rodd. 1976. AD-A025717.

SL-7-7, (SSC-263) - *Static Structural Calibration of Ship Response Instrumentation System Aboard the SEA-LAND McLEAN* by R. R. Boentgen and J. W. Wheaton. 1976. AD-A031527.

SL-7-8, (SSC-264) - *First Season Results from Ship Response Instrumentation Aboard the SL-7 Class Containership S.S. SEA-LAND McLEAN in North Atlantic Service* by R. R. Boentgen, R. A. Fain, and J. W. Wheaton. 1976.

SL-7-9, *Second Season Results from Ship Response Instrumentation Aboard the SL-7 Class Containership S.S. Sea-Land McLean in North Atlantic Service* by J. W. Wheaton and R. R. Boentgen. 1976. AD-A034162.

SL-7-10, *Third Season Results from Ship Response Instrumentation Aboard the SL-7 Class Containership S.S. Sea-Land McLean in North Atlantic Service* by R. R. Boentgen. 1976. AD-A034175.