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(Ground Test and Flight)

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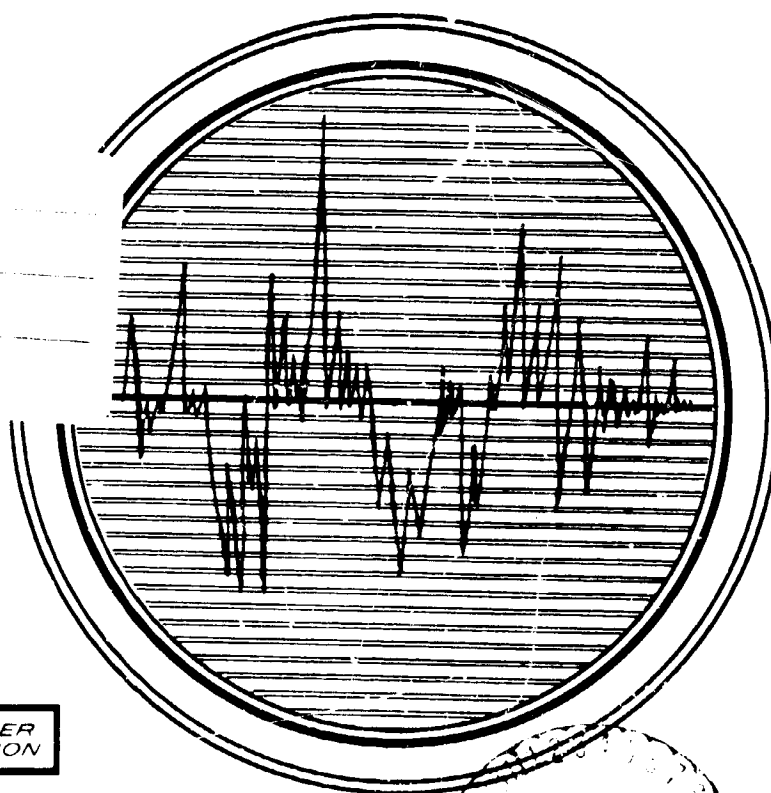
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for

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FINAL REPORT

For

Aerospace Systems Pyrotechnic Shock Data
(Ground Test and Flight)

June 1968 to March 1970

VOLUME III

Contract No.: NAS5-15208

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FOREWORD TO VOLUME III

The pyrotechnic shock data for aerospace systems compiled under Contract NAS5-15208 is contained in two volumes. The two volumes are divided into five divisions and the divisions are further subdivided into parts. The separation of data among the five divisions is as follows:

VOLUME II

Division I - Pyrotechnic shock data associated with structure cutting charges such as mild detonating fuse (MDF) and flexible linear shaped charge (FLSC).

VOLUME III

Division II - Pyrotechnic shock data associated with explosive nuts and bolts.

Division III - Pyrotechnic shock data associated with pressure cartridge actuated devices such as pin pullers and cable cutters.

Division IV - Pyrotechnic shock data associated with extensive test programs on three space vehicles.

Division V - Pyrotechnic shock data from flight events.

The first three divisions are further subdivided into three parts each depending on the type of structure on which the data were measured.

These subdivisions are as follows:

Part A - Data from skin-ring-frame structures.

Part B - Data from truss structures.

Part C - Data from structures other than skin-ring-frame or truss structure.

The separate parts are further divided into sections and each section is a complete unit of data.

Division IV contains shock data from three extensive tests programs on three different space vehicles. Each test program is a separate part of Division IV and contains data from several different types of pyrotechnic devices on the particular vehicle. These data are contained in a separate division for ease in comparing the effects of different pyrotechnic devices on a space vehicle.

Division V contains flight data from four flight programs. Because of the limitations inherent in flight telemetry systems, the quantity and quality of available data is limited.

Each volume of data contains a complete table of contents for all the data. Each of the five divisions contains a table of contents describing the data within that division except Division I, which has a table of contents for each part.

The numbering system used in these data volumes is as follows: each section within a part is given a three character identification. The first character is a Roman Numeral which associates the section with one of the five divisions that make up the two data volumes. The second character is a capital letter (A, B, or C) that associates the section with one of the three Parts in a given Division. The third character is the number of the section in a particular Part. The first section of Part A in Division I would be numbered I.A.1. The tables and figures in a section are identified by the section number followed by the number of the figure or table in the section. For example, the third figure in Section I.B.2 would be cited as Figure I.B.2-3.

The data within a section is presented in such a manner that it can stand by itself. Generally, pertinent information about a Section is presented

in outline form consisting of brief descriptions of the purpose, the test configuration, the pyrotechnic, the structure, and the data acquisition/reduction systems. Additional information and remarks are sometimes included to further describe the data. These discussions are not analyses or conclusions; they are intended to complete the description of the data. The analyses are contained in a separate volume. The descriptive summary is followed by the necessary tables and figures. Finally, the data are presented in the form of shock spectra with their corresponding acceleration time histories.

In some cases the data from a single test program may logically fit at two or more locations within the data volumes. This happens when either a single structure is subjected to more than one type of pyrotechnic device or when the shock from a single explosive device is measured in more than one type of structure. In these cases, the data is presented in one of the logical parts, and reference to it is made in the other logical Part(s).

Under a subcontract to this study Lockheed Missiles and Space Company compiled shock data that summarized their experience in the field of shock testing and analysis. This report

is contained in Volumes IV and V entitled "Compilation of Pyrotechnic Data". Each part in Volume II and III contains a list citing areas of the Lockheed report which would apply to that Part.

The data in each section is presented in the form of shock spectra and the associated time histories when available. Unless otherwise stated the shock spectra in each section are absolute acceleration shock spectra; i.e. the absolute acceleration of a mass when subjected to base acceleration plotted as a function of the natural frequency of the damped single degree of freedom system.

The shock spectra data were analyzed by both analog and digital techniques. The type of analysis for each set of data is stated in the description of data for that section. The majority of spectra were analyzed using a damping factor of $Q = 10$. The damping factor (Q) is stated in the description of data for each section and is not presented on the individual data sheets.

Whenever possible the data is presented in such a manner as to afford a measure of repeatability between similar and/or identical tests.

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LIST OF ABBREVIATIONS

USED IN VOLUME III

APAC	-	Antenna pointing angle change
ATS	-	Applications Technology Satellite
DAC	-	Douglas Aircraft Corporation
EMT	-	Equipment mounting truss
FLSC	-	Flexible linear shaped charge
LES-6	-	Lincoln experimental satellite No. 6
LMSC	-	Lockheed Missiles and Space Company
MDF	-	Mild detonating fuse
mg	-	Milligrams
M-67	-	Mariner 67
OAO	-	Orbiting Astronomical Observatory
OGO	-	Orbiting Geophysical Observatory
OV5-2	-	Orbiting Vehicle No. 5-2
PIPS	-	Post injection propulsion system
POGO	-	Polar Orbiting Geophysical Observatory
SSA	-	Shock spectrum analyzer
JTA	-	Station

DIVISION II

EXPLOSIVE BOLTS AND NUTS

FOREWORD TO DIVISION II

Division II contains pyrotechnic shock data associated with explosive bolts and nuts on skin-ring-frame and truss structures. Cartridge initiated separation nuts were the pyrotechnics associated with much of the test data presented in Division II. However, such a pyrotechnic is effectively an explosive nut rather than a cartridge actuated device. Thus, the data from a test involving a cartridge actuated separation nut is presented in Division II rather than Division III.

A large portion of the data (456 spectra and time histories) in this division is associated with a controlled ground test conducted at Martin Marietta to obtain data for use in this study. Most of the data was obtained on truss structures. Another test containing 202 shock spectra compares the shock levels due to various types of separation hardware. In particular it compares single and dual cartridge separation nuts. A third section compares the shock levels in a light-weight truss structure due to single and multiple charges.

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DIVISION II

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EXPLOSIVE BOLTS AND NUTS

PART II.A

Skin-Ring-Frame Structures

Section	Title	Pyrotechnic Device	Number of Shock Spectra	
II.A.1	POGO Shroud Separation Tests.	Explosive Bolts	13	5
	Location of Additional Data			18

PART II.B

Truss Structures

Section	Title	Pyrotechnic Device	Number of Shock Spectra	
II.B.1	Martin Ground Tests-Task K	Explosive Nuts	456	21
II.B.2	Titan III-M Separation Nut Tests	Explosive Nuts	202	193
II.B.3	Payload Truss Shock Propagation Tests	Explosive Nuts	83	278
	Location of Additional Data			329

PART II.A

PYROTECHNIC SHOCK DATA COMPILED FOR
EXPLOSIVE BOLTS AND NUTS IN SKIN-RING-FRAME
STRUCTURES

SECTION II.A.1

POGO SHROUD SEPARATION TEST

PURPOSE OF TEST

A series of various confidence tests were performed on the Polar Orbiting Geophysical Observatory (POGO). The shock testing phase was conducted to determine the shock loads on the spacecraft and the spacecraft adapter ring due to shroud separation.

DESCRIPTION OF EVENT

Separation is initiated by the detonation of six explosive bolts, four holding the two shroud-band assemblies together, and two at the aft end of the shroud. The nose joint latch mechanism is released when the bands separate, and the separation thruster system, consisting of two springs in the conical section and two springs at the base of the shroud, move the shroud halves in opposite (+Y, -Y) directions, perpendicular to the X axis. Pivot hinge fittings, located on the aft end of each shroud half and the forward end of the vehicle midbody cause the separated shroud halves to pivot and rotate until they disengage from the vehicle and fall free. The test set-up for simulating this event is depicted in Figure II.A.1-1.

DESCRIPTION OF DATA

No. of time histories	0
No. of shock spectra	13
Type of analysis	digital
Frequency range	Table II.A.1-1
Frequency increments	Table II.A.1-2
Damping	Q=10

These shock spectra are presented as Figures II.A.1-4 through II.A.1-10.

DESCRIPTION OF DATA PYROTECHNIC

Six explosive bolts located as discussed in "Description of Event."

DESCRIPTION OF STRUCTURE

The clamshell shroud consists of two halves of laminar phenolic fiberglass with a fiberglass nose dome structurally attached to one of the halves. See Figures II.A.1-1 through II.A.1-3.

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225
Location: Figures II.A.1-2 and II.A.1-3
Axis of Sensitivity: Table II.A.1-1

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorders: Ampex FR-114 (0-10,000 frequency response)
Amplifiers: Endevco 2614B
Glennite FT2500

TABLE II.A.1-1

FREQUENCY RANGE OF MEASUREMENTS PRESENTED

Accelerometer Number	Sensitive Axis	Frequency Range (Hz)	Figure Number
1	X	20-5,000	II.A.1-4
2	Y	20-5,000	II.A.1-4
3	X	20-2,000	II.A.1-5
4	Y	20-5,000	II.A.1-5
5	X	20-2,000	II.A.1-6
7	Y	20-2,000	II.A.1-6
9	Y	20-2,000	II.A.1-7
10	Z	20-2,000	II.A.1-7
11	X	20-10,000	II.A.1-8
12	Z	20-2,000	II.A.1-8
13	X	20-2,000	II.A.1-9
14	Y	20-2,000	II.A.1-9
PL 20	X	20-2,000	II.A.1-10

TABLE II.A.1-2

FREQUENCY INCREMENTS USED IN VARIOUS FREQUENCY RANGES

<u>Frequency Range (Hz)</u>	<u>Frequency Increment Used in Analysis (Hz)</u>
0- 2,000	20
2,000- 5,000	30
5,000-10,000	50

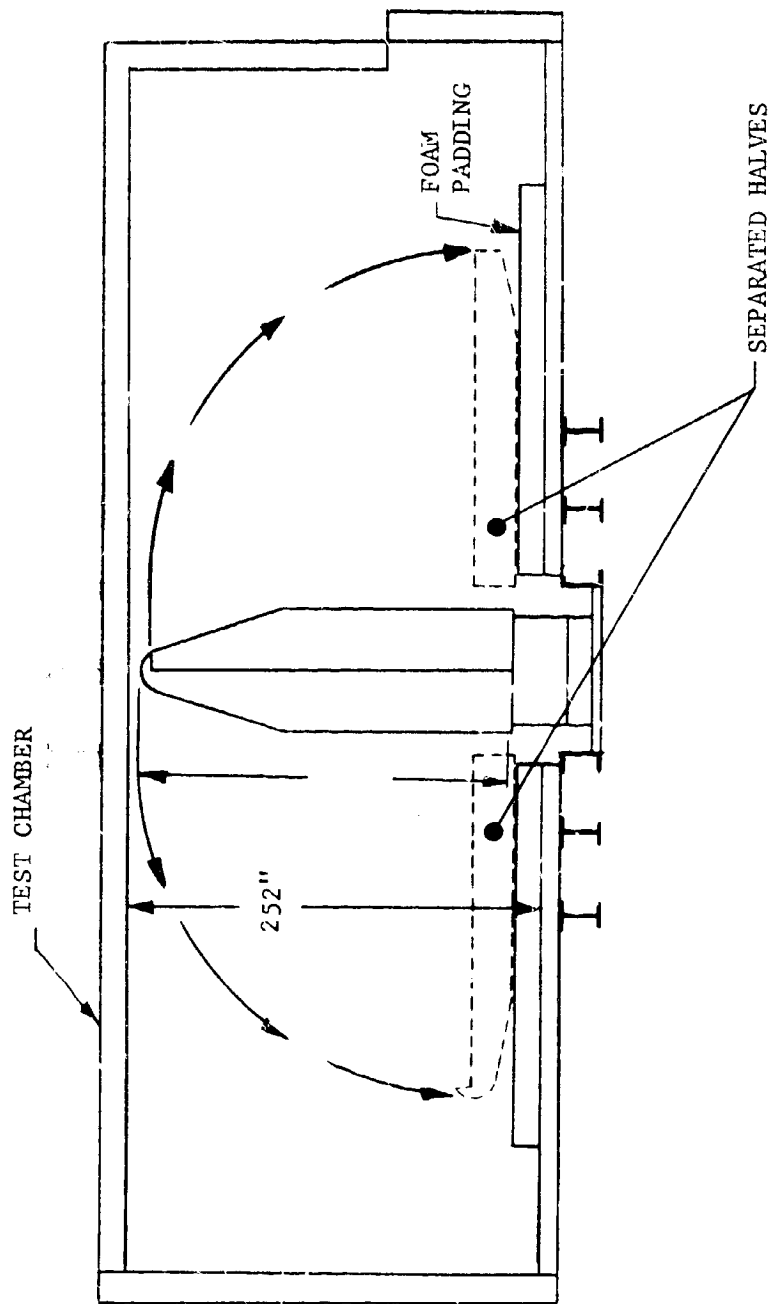


FIGURE II.A.1-1
TEST CONFIGURATION

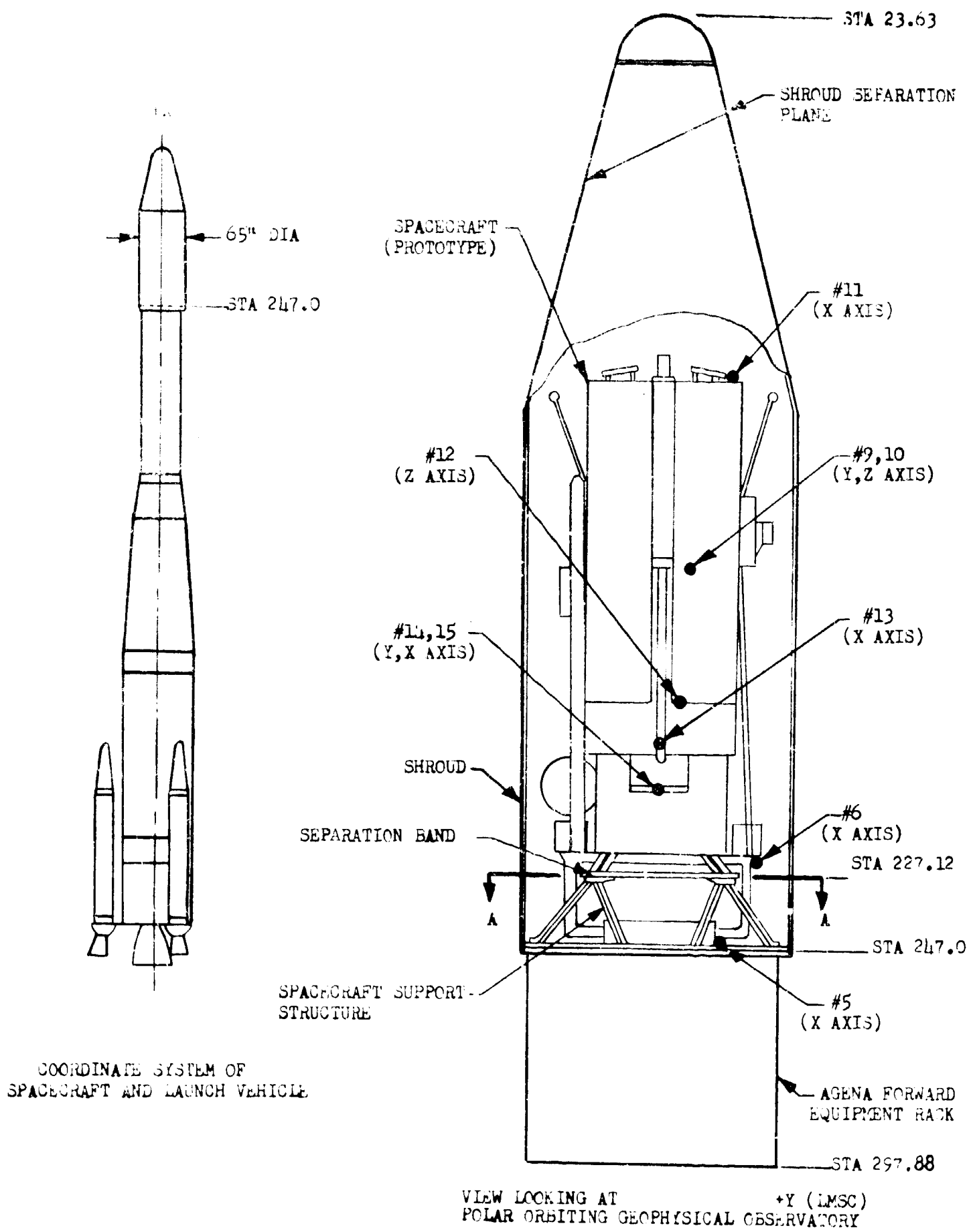


FIGURE II.A.1-2

ACCELEROMETER LOCATIONS FOR POGO SHROUD SEPARATION TESTS

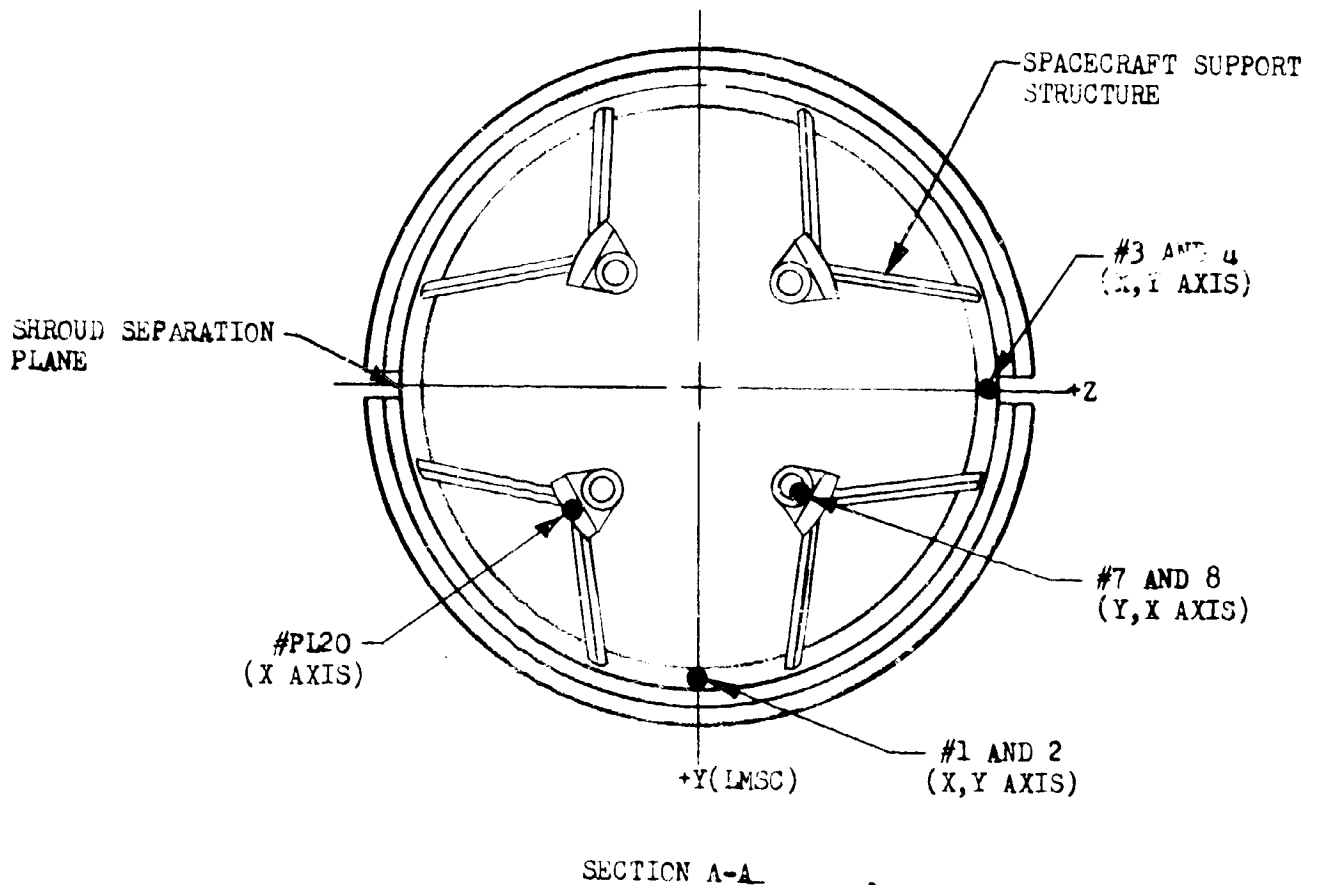
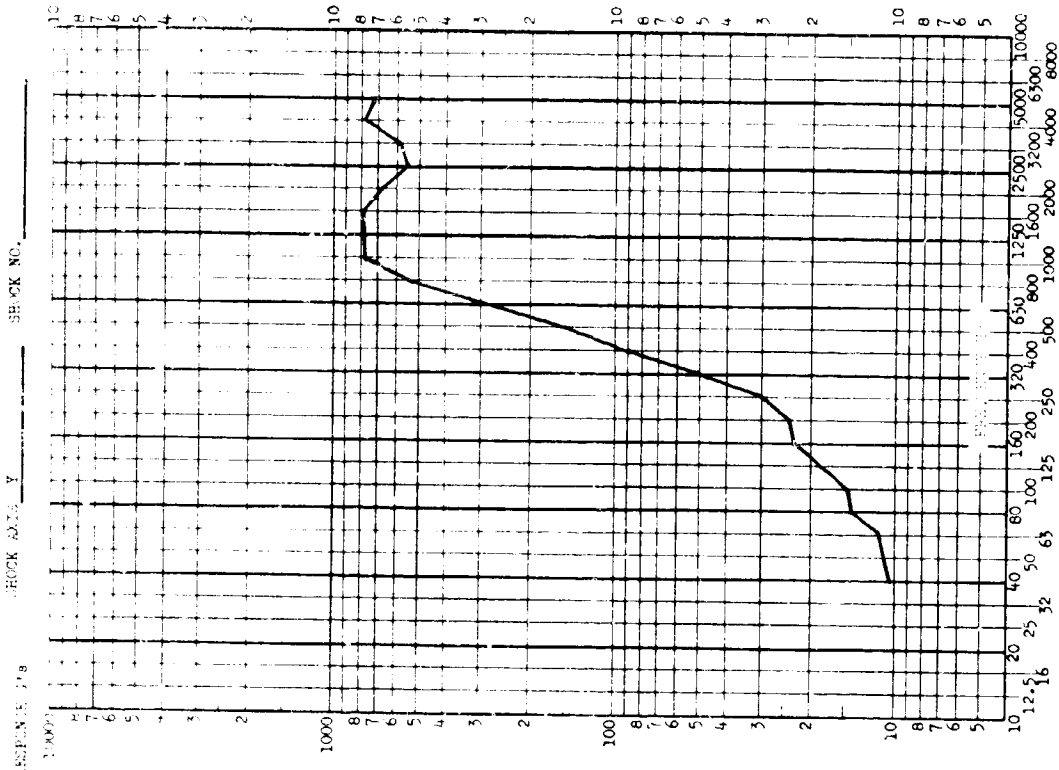


FIGURE 11.A.1-3

ACCELEROMETER LOCATIONS FOR POGO SHROUD SEPARATION TESTS

TEST ITEM: RAMO SHEARD SEPARATION
 TEST DATE: June 1960
 SHOCK AXIS: Y SHOCK NO.:



TEST ITEM: RAMO SHEARD SEPARATION
 TEST DATE: June 1960
 SHOCK AXIS: Y SHOCK NO.:

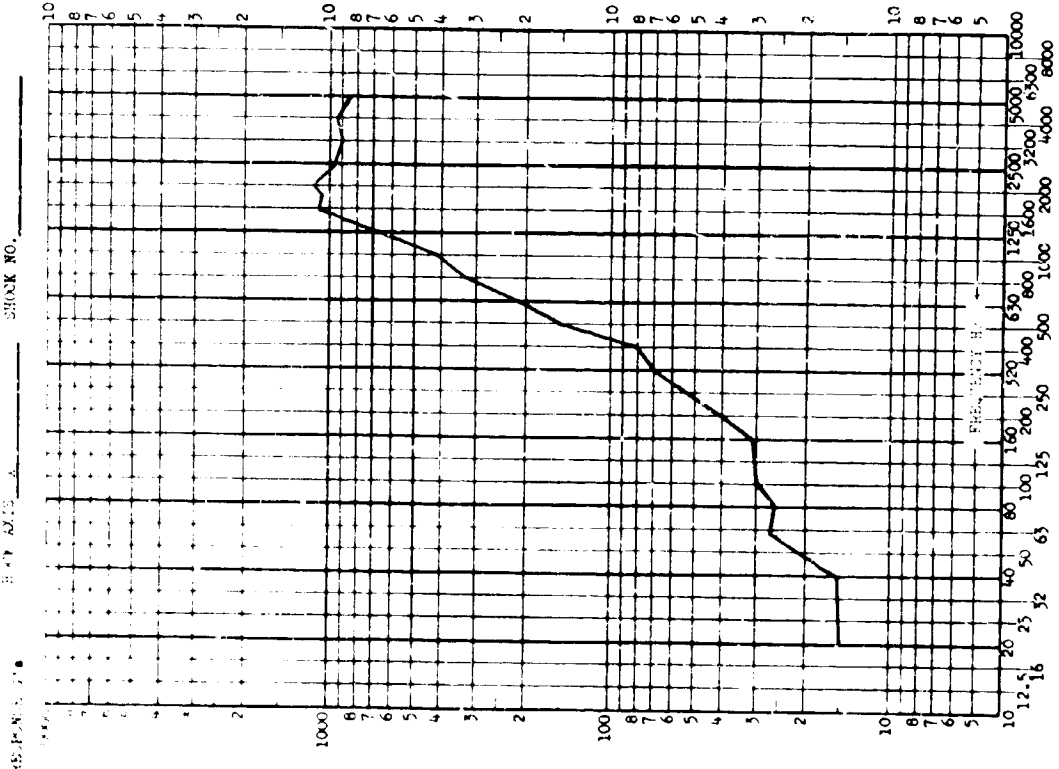
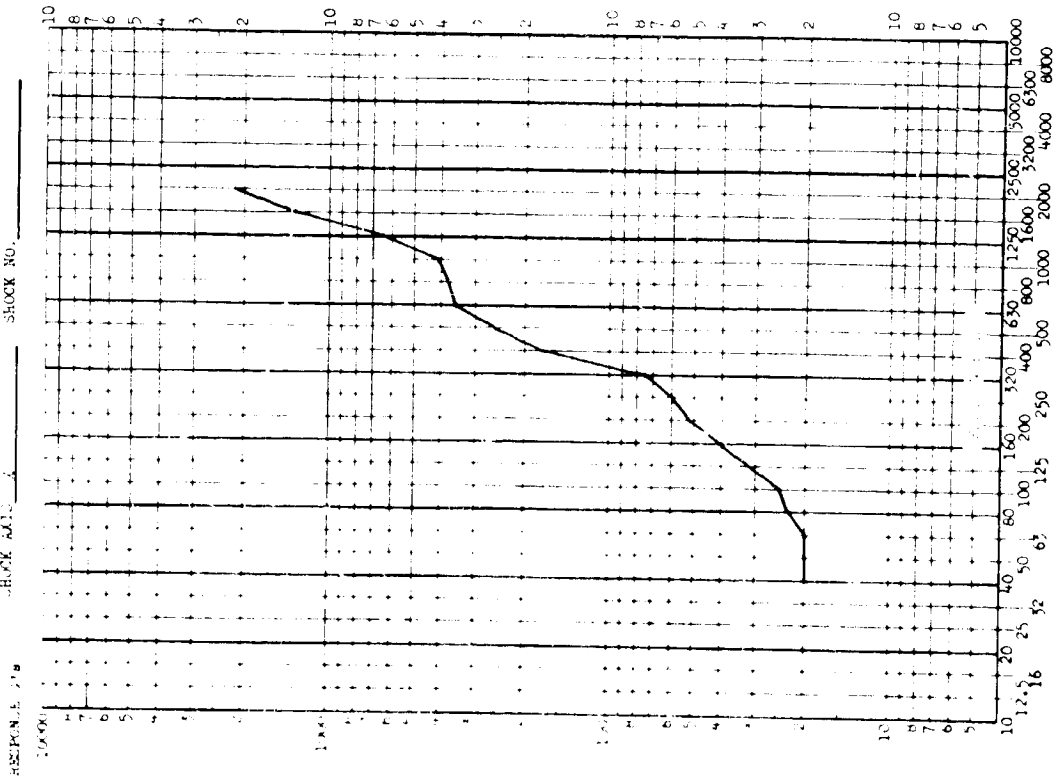


FIGURE 11.A.1-4

TEST ITEM: _____
 TEST DATE: June 1965
 SHOCK AXIS: _____ SHOCK NO.: _____



TEST ITEM: _____
 TEST DATE: June 1965
 SHOCK AXIS: _____ SHOCK NO.: _____

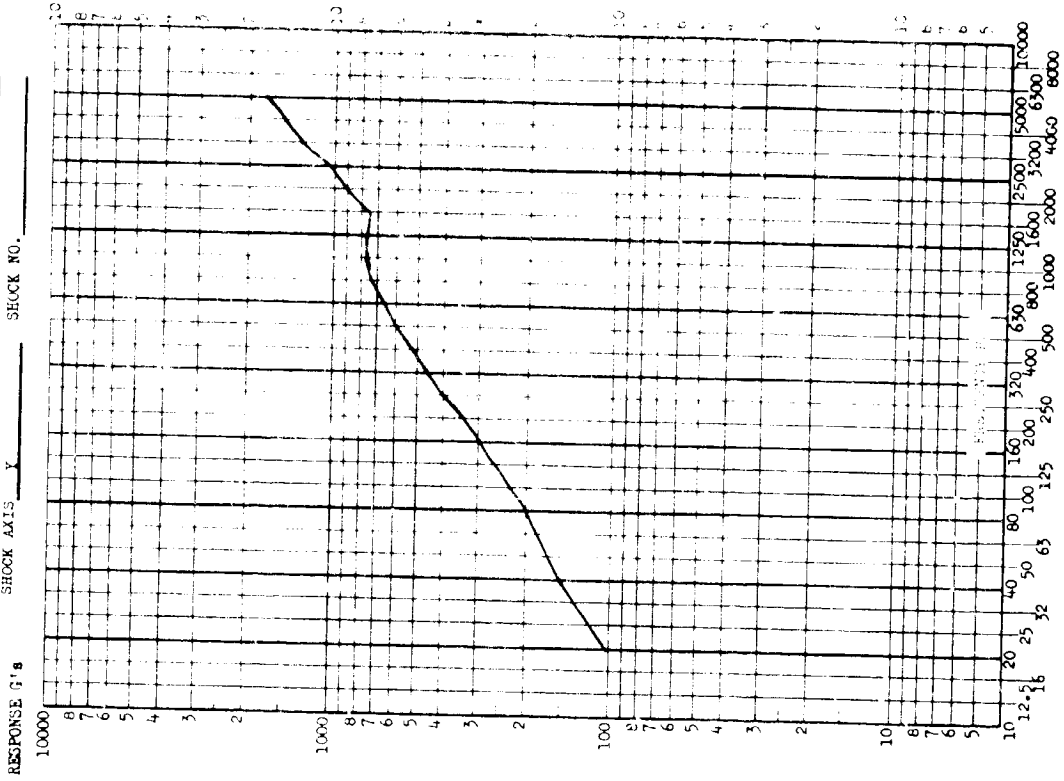
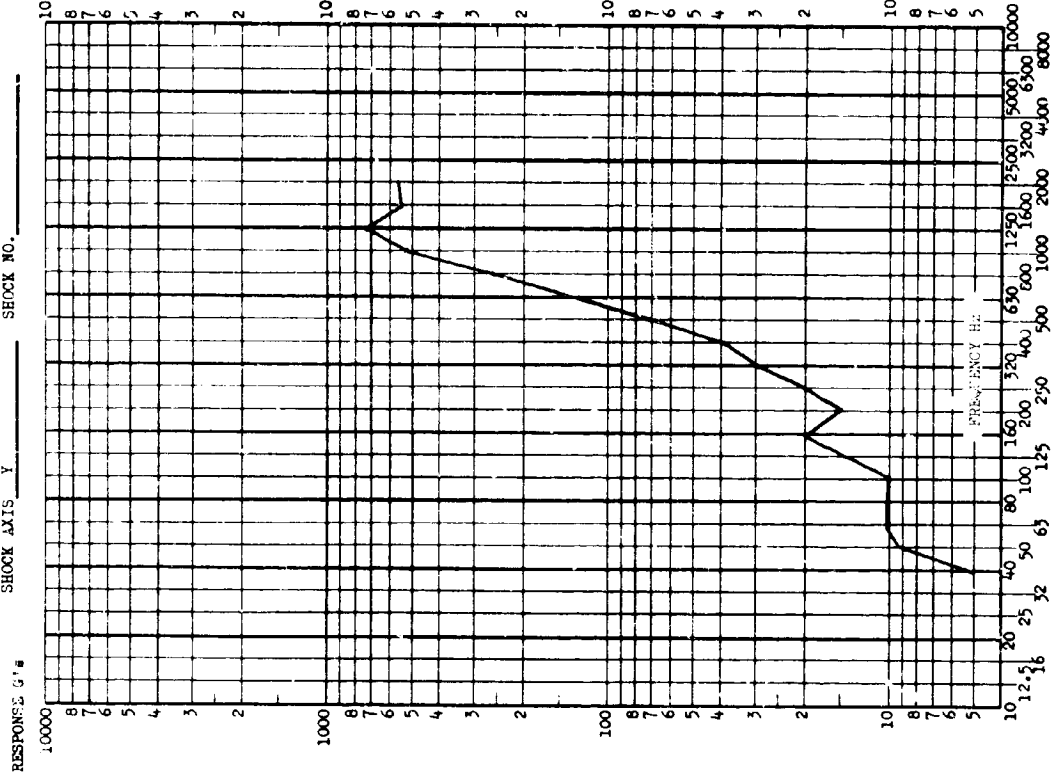


FIGURE II.A.1-5

TEST ITEM: POOR SHROUD SEPARATION
 APP. NO.: 7
 TEST DATE: June 1965
 SHOCK AXIS: Y
 SHOCK NO.:



TEST ITEM: POOR SHROUD SEPARATION
 APP. NO.: X
 TEST DATE: June 1965
 SHOCK AXIS: X
 SHOCK NO.:

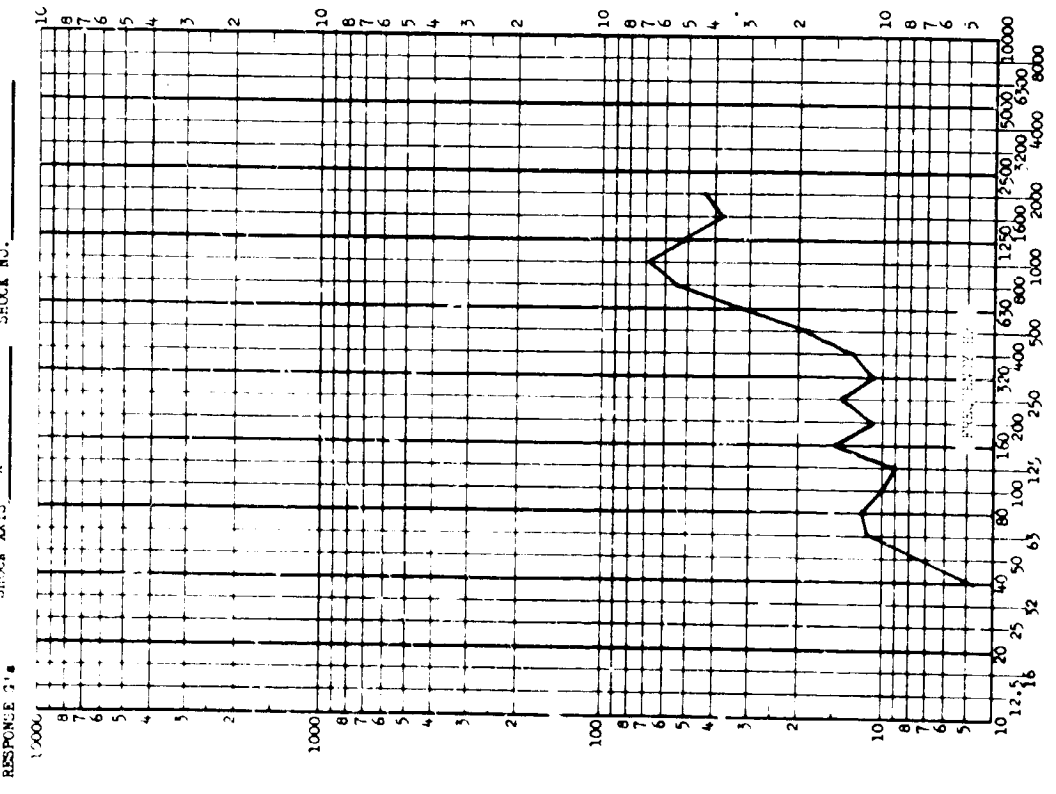
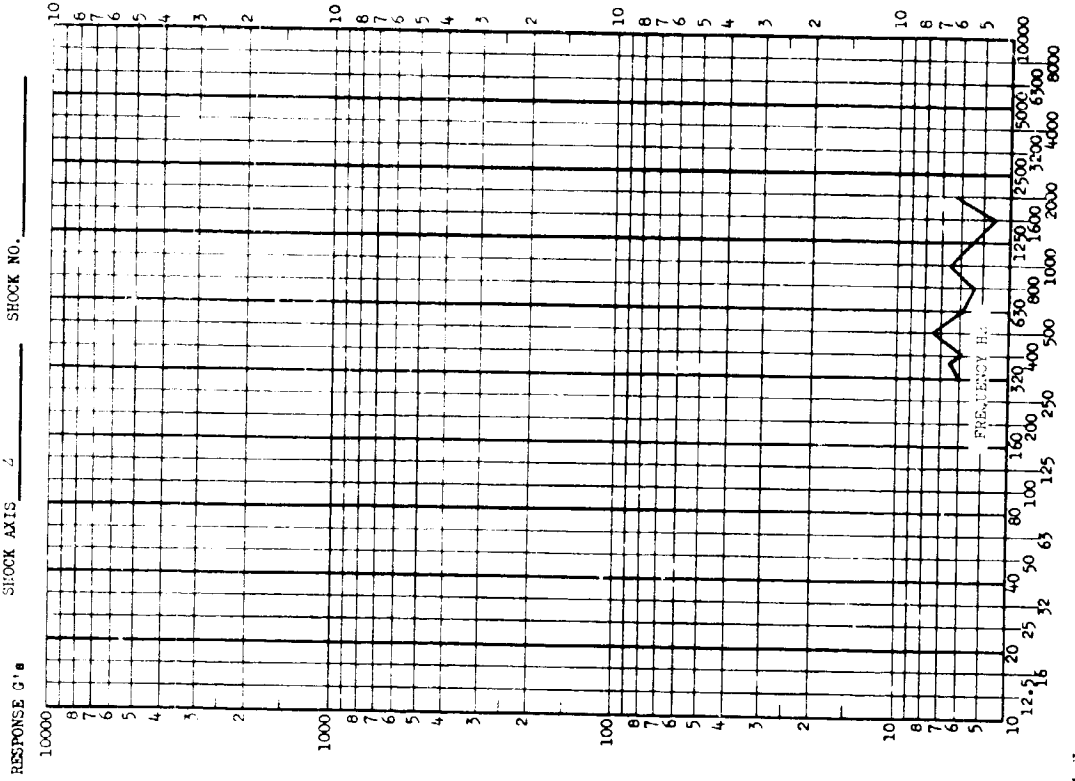


FIGURE 11.A.1-6

TEST ITEM POFO SHIELD SEPARATION
 SER. NO. 10 TEST DATE June 1965
 SHOCK AXIS Z SHOCK NO. 2



TEST ITEM POFO SHIELD SEPARATION
 SER. NO. 10 TEST DATE June 1965
 SHOCK AXIS Y SHOCK NO. 1

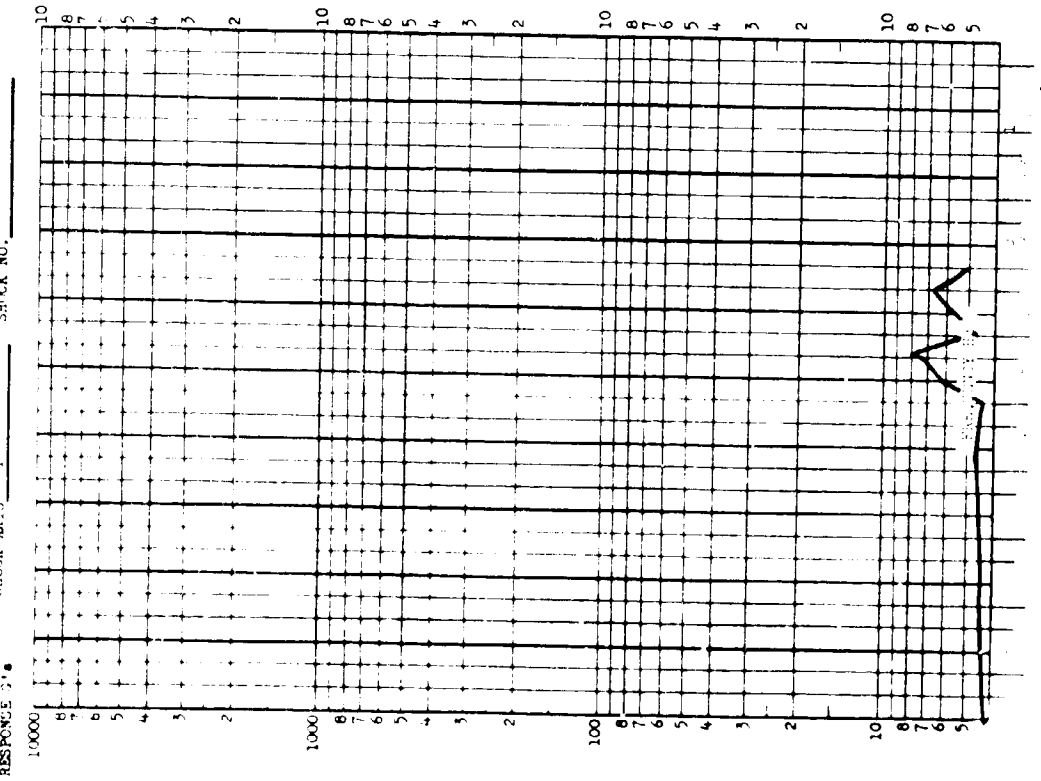
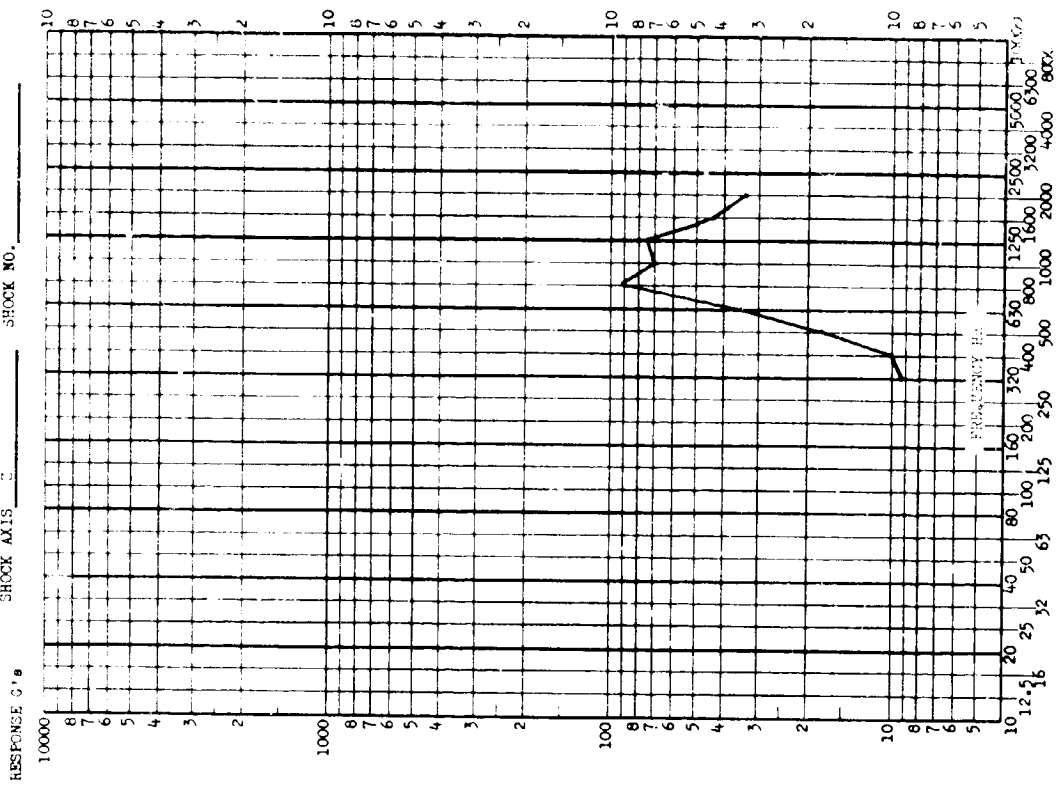


FIGURE II.A.1-7

TEST ITEM: 1000 GHR IN. DEFORMATION
 TEST NO.: 11
 TEST DATE: June 1967
 SHOCK AXIS: C
 SHOCK NO.: 1



TEST ITEM: 1000 GHR IN. DEFORMATION
 TEST NO.: 11
 TEST DATE: June 1967
 SHOCK AXIS: C
 SHOCK NO.: 1

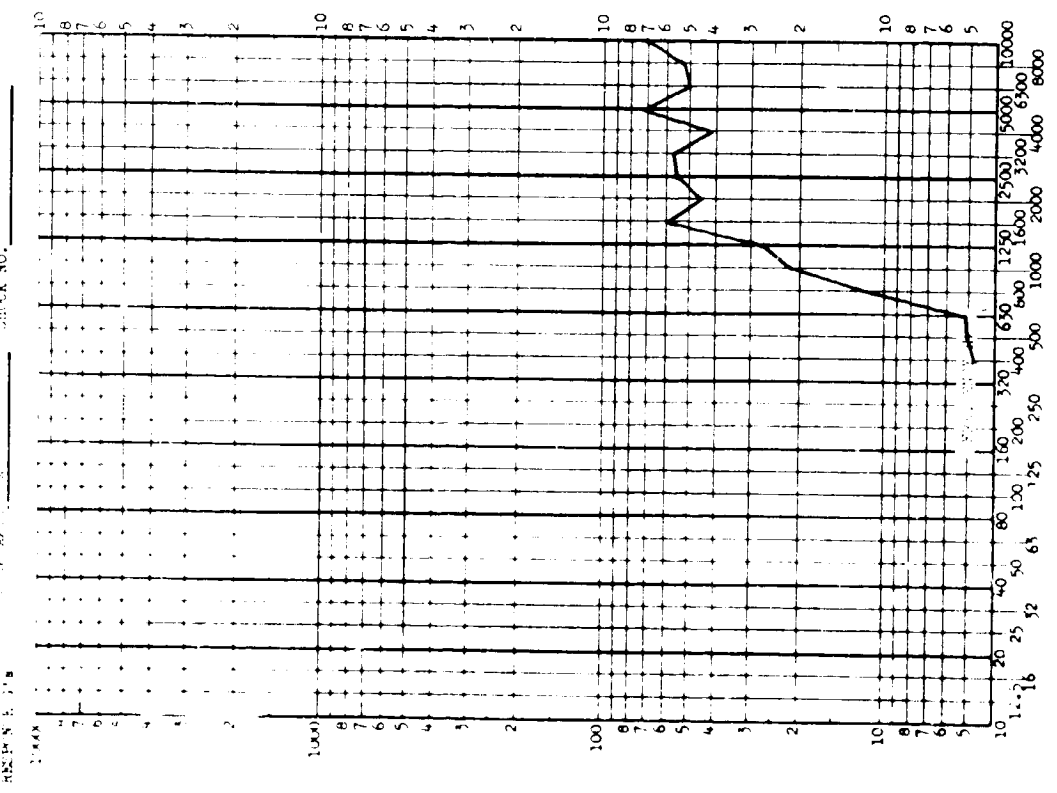
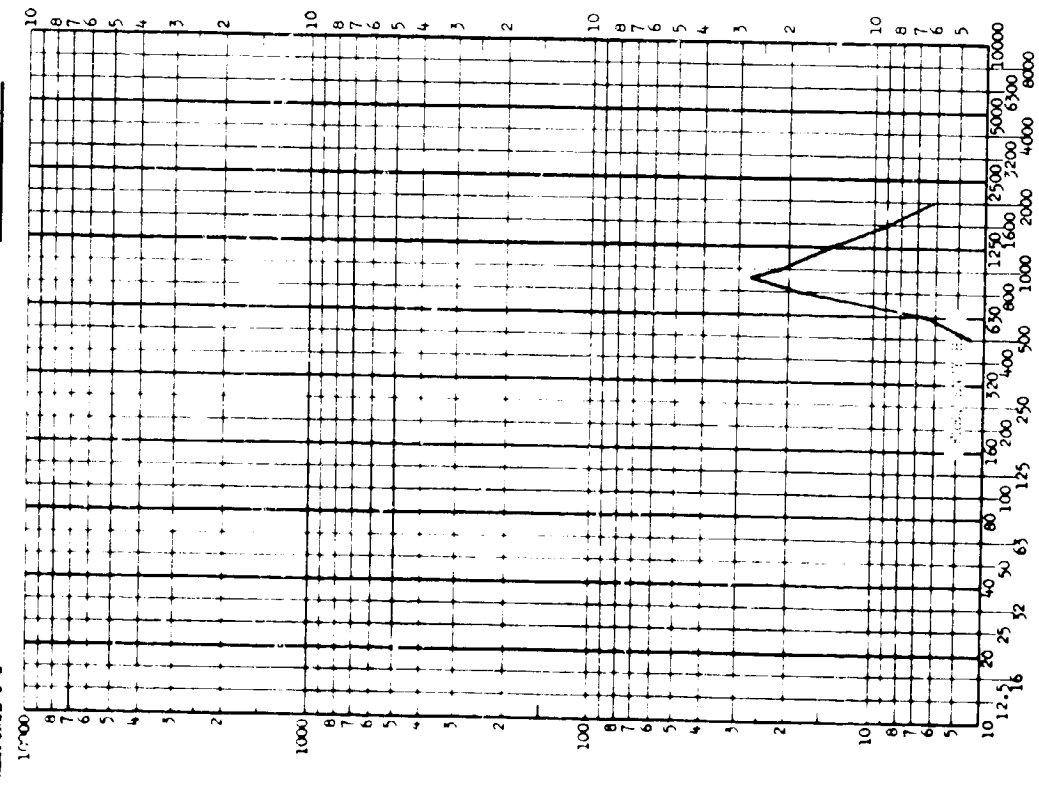


FIGURE II.A.1-8

TEST ITEM POGO SHROUD SEPARATION
 A.I. NO. 14 TEST DATE June 1965
 SHOCK AXIS X SHOCK NO. _____



TEST ITEM POGO SHROUD SEPARATION
 A.I. NO. 14 TEST DATE June 1965
 SHOCK AXIS Y SHOCK NO. _____

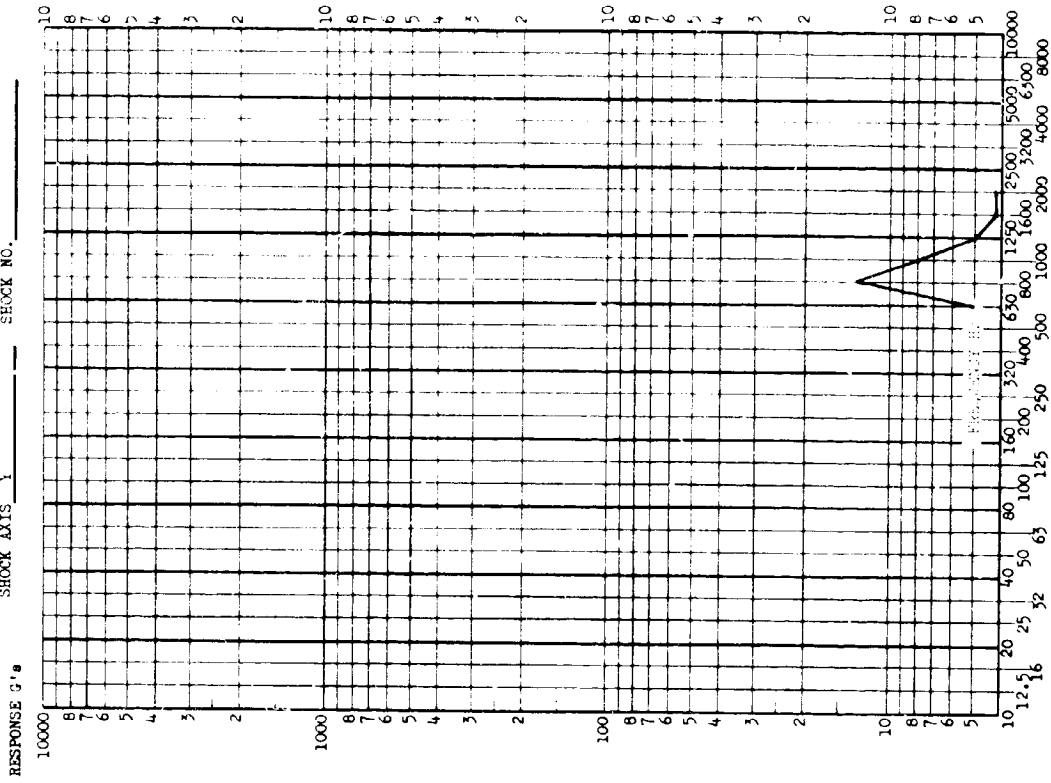


FIGURE II.A.11-9

TEST ITEM POSS SHROUD SEPARATION
 SERIAL NO. 11-20 TEST DATE June 1965
 SHOCK AXIS X SHOCK NO. _____

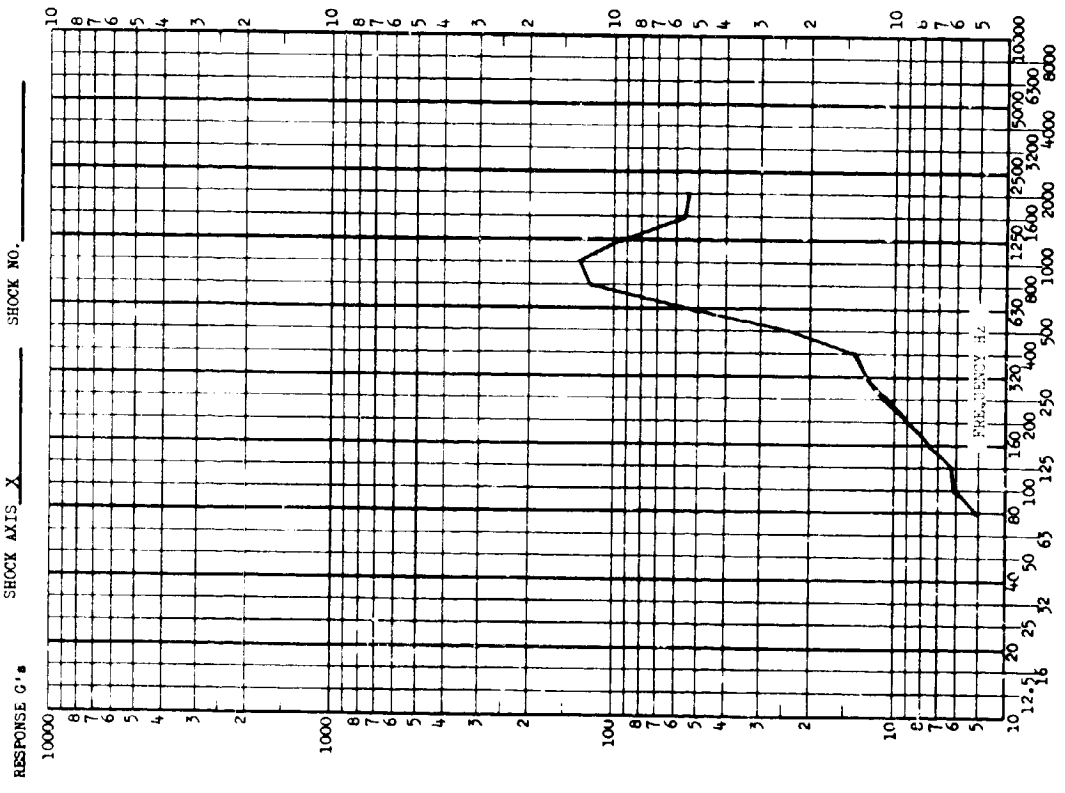


FIGURE II.A.1-10

LOCATION OF ADDITIONAL DATA

Additional pyrotechnic shock data compiled for explosive nuts and bolts with propagation in skin-ring-frame structure may be found in the following sections of this data volume:

II.B.1 Figures 38 through 61

II.B.2 Data for accelerometers 1, 2, 3 and 16 through
24

V.2 Figures 3, 4, and 5

V.3 Entire section

V.4 Engine section

LOCATION OF RELATED LOCKHEED DATA

Additional pyrotechnic shock data for explosive nuts with propagation in skin-ring-frame structures may be found in the following sections of the Lockheed data compilation:

II.A.4

II.B.3

PART II.B

PYROTECHNIC SHOCK DATA COMPILED FOR
EXPLOSIVE BOLTS AND NUTS IN TRUSS
STRUCTURES

SECTION II.B.1

MARLIN GROUND TESTS --- TASK K

PURPOSE OF TESTS

Full scale Titan III components were utilized in the performance of a controlled pyrotechnic shock test program performed to determine:

- 1) The repeatability of pyrotechnic shock measurements.
- 2) The influence of intervening structure on shock propagation and attenuation characteristics.
- 3) The collection of information to aid in the determination of structural simulation requirements for pyrotechnic shock systems.

DESCRIPTION OF EVENT

A total of nineteen (19) tests were conducted on four different configurations of the Titan III Payload Truss (Figures II.B.1-1 and II.B.1-2) as follows:

- Configuration I - Payload Truss installed on transtage skirt
- Configuration IIa - Payload Truss freely suspended
- Configuration IIb - Payload Truss freely suspended with dummy satellites installed

Configuration III - Payload Truss installed on hydrostatic test tool (rigid fixture).

Configuration IV - Payload Truss installed on channel adapter simulating longitudinal stiffness of transtage skirt

These four mounting configurations are depicted in Figures II.B.1-3 through II.B.1-6, respectively. Dummy satellites (Figures II.B.1-7 and II.B.1-8) were mounted in all configurations except IIa.

For each test one separation nut was detonated, and that nut was always located at the truss attach point indicated in Figure II.B.1-1. The separation nut employed was of the gas pressure cartridge actuated variety: the nut separates into four segments following the build-up of pressure in the nut supplied by the cartridge. Figures II.B.1-9 and II.B.1-10 illustrates the nut/pressure cartridge configuration.

DESCRIPTION OF DATA

No. of time histories	456
No. of shock spectra	456
Type of analysis	analog
Analog machine	Ling SSA-100

Frequency range	50-10,000 Hz
Frequency increment	3 points per octave
Damping	Q=10

These shock spectra are presented along with their corresponding time histories as Figures II.B.1-14 through II.B.1-157 as indexed in Table II.B.1-1. The data are presented by configuration in order of measurement number. See also Table II.B.1-4

DESCRIPTION OF PYROTECHNIC

Pressure cartridge actuated separation nut. A description of the pressure cartridge charge follows:

Prime charge: 90 mg pressed zirconium

Base charge: 346 mg boron and potassium nitrate

Booster charge: 86 mg boron and potassium nitrate

Sustainer charge: 193 mg ammonium nitrate and rubber

Location: Figures II.B.1-1 through II.B.1-7 indicate nut orientation for the various test configurations.

Figures II.B.1-9 and II.B.1-10 depict the nut/pressure cartridge assembly.

DESCRIPTION OF STRUCTURE

Payload truss tubular members of various diameter

Transtage skirt

Skin: aluminum, 0.028 inch thick

Longeron: aluminum section, see Figure II.B.1-11

Ring-frame: aluminum section, see Figure II.B.1-11.

See also Figures II.B.1-1 through II.B.1-8

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225

Locations: Table II.B.1-2 and Figures II.B.1-1,
II.B.1-2, II.B.1-12, and II.B.1-13

Axis of Sensitivity: Table II.B.1-3

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape Recorders: Ampex ES-100 (0-20,000 Hz frequency
response)

Amplifiers: Kistler 504A (0-100,000 Hz frequency
response)

Galvanometers: CEC Type 7-362

COMMENTS

The accelerometer instrumentation equated volts RMS
to g's peak and thus the acceleration data is valid to a
level of 1.414 greater than the noted calibration level.

TABLE II.B.1-1

INDEX OF DATA PRESENTED

<u>Figure No</u>	<u>Test Configuration</u>	<u>Shock No(s)</u>	<u>Accelerometer Location</u>	<u>Sensitive Axis</u>
II.B.1-14	I	7,8,11,12	1	longitudinal
-15	I	7,8,11,12	1	lateral
-16	I	7,8,11,12	1	vertical
-17	I	7,8	2	longitudinal
-18	I	7,8	2	lateral
-19	I	7,8	2	vertical
-20	I	7,8,12	3	longitudinal
-21	I	7,8,12	3	lateral
-22	I	7,8,12	3	vertical
-23	I	7,8	4	longitudinal
-24	I	7,8	4	lateral
-25	I	7,8	4	vertical
-26	I	7,8	5	longitudinal
-27	I	7,8	5	lateral
-28	I	7,8	5	vertical
-29	I	7,8,12	6	longitudinal
-30	I	7,8,12	6	lateral
-31	I	7,8,12	6	vertical
-32	I	7,8	7	longitudinal
-33	I	7,8	7	lateral

TABLE II.B.1-1 (continued)

INDEX OF DATA PRESENTED

<u>Figure No</u>	<u>Test Configuration</u>	<u>Shock No(s)</u>	<u>Accelerometer Location</u>	<u>Sensitive Axis</u>
II.B.1-34	I	7,8	7	vertical
-35	I	7,8,12	8	longitudinal
-36	I	7,8,12	8	lateral
-37	I	7,8,12	8	vertical
-38	I	9,10	11	longitudinal
-39	I	9,10	11	tangential
-40	I	9,10	11	radial
-41	I	9,10,11	12	longitudinal
-42	I	9,10,11	12	tangential
-43	I	9,10,11	12	radial
-44	I	9,10,11,12	13	longitudinal
-45	I	9,10,11,12	13	tangential
-46	I	9,10,11,12	13	radial
-47	I	9,10,11,12	14	longitudinal
-48	I	9,10,11,12	14	tangential
-49	I	9,10,11,12	14	radial
-50	I	9,10,11,12	15	longitudinal
-51	I	9,10,11,12	15	tangential
-52	I	9,10,11,12	15	radial
-53	I	9,10,11	16	longitudinal

TABLE II.B.1-1 (continued)

INDEX OF DATA PRESENTED

<u>Figure No</u>	<u>Test Configuration</u>	<u>Shock No(s)</u>	<u>Accelerometer Location</u>	<u>Sensitive Axis</u>
II.B.1-54	I	9,10,11	16	tangential
-55	I	9,10,11	16	radial
-56	I	9,10,11,12	17	longitudinal
-57	I	9,10,11,12	17	tangential
-58	I	9,10,11,12	17	radial
-59	I	9,10,11	18	longitudinal
-60	I	9,10,11	18	tangential
-61	I	9,10,11	18	radial
-62	IIa	1,2,3	1	longitudinal
-63	IIa	1,2,3	1	lateral
-64	IIa	1,2,3	1	vertical
-65	IIa	1,2,3	2	longitudinal
-66	IIa	1,2,3	2	lateral
-67	IIa	1,2,3	2	vertical
-68	IIa	1,2,3	3	longitudinal
-69	IIa	1,2,3	3	lateral
-70	IIa	1,2,3	3	vertical
-71	IIa	1,2,3	4	longitudinal
-72	IIa	1,2,3	4	lateral
-73	IIa	1,2,3	4	vertical

TABLE II.B.1-1 (continued)

INDEX OF DATA PRESENTED

<u>Figure No</u>	<u>Test Configuration</u>	<u>Shock No(s)</u>	<u>Accelerometer Location</u>	<u>Sensitive Axis</u>
II.B.1-74	IIa	1,2,3	5	longitudinal
-75	IIa	1,2,3	5	lateral
-76	IIa	1,2,3	5	vertical
-77	IIa	1,2,3	6	longitudinal
-78	IIa	1,2,3	6	lateral
-79	IIa	1,2,3	6	vertical
-80	IIa	1,2,3	7	longitudinal
-81	IIa	1,2,3	7	lateral
-82	IIa	1,2,3	7	vertical
-83	IIa	1,2,3	8	longitudinal
-84	IIa	1,2,3	8	lateral
-85	IIa	1,2,3	8	vertical
-86	IIb	4,5,6	1	longitudinal
-87	IIb	4,5,6	1	lateral
-88	IIb	4,5,6	1	vertical
-89	IIb	4,5,6	2	longitudinal
-90	IIb	4,5,6	2	lateral
-91	IIb	4,5,6	2	vertical
-92	IIb	4,5,6	3	longitudinal
-93	IIb	4,5,6	3	lateral

TABLE II.B.1-1 (continued)

INDEX OF DATA PRESENTED

<u>Figure No.</u>	<u>Test Configuration</u>	<u>Shock No(s)</u>	<u>Accelerometer Location</u>	<u>Sensitive Axis</u>
II.B.1-94	IIb	4,5,6	3	vertical
-95	IIb	4,5,6	4	longitudinal
-96	IIb	4,5,6	4	lateral
-97	IIb	4,5,6	4	vertical
-98	IIb	4,5,6	5	longitudinal
-99	IIb	4,5,6	5	lateral
-100	IIb	4,5,6	5	vertical
-101	IIb	4,5,6	6	longitudinal
-102	IIb	4,5,6	6	lateral
-103	IIb	4,5,6	6	vertical
-104	IIb	4,5,6	7	longitudinal
-105	IIb	4,5,6	7	lateral
-106	IIb	4,5,6	7	vertical
-107	IIb	4,5,6	8	longitudinal
-108	IIb	4,5,6	8	lateral
-109	IIb	4,5,6	8	vertical
-110	III	13,14,15	1	longitudinal
-111	III	13,14,15	1	lateral
-112	III	13,14,15	1	vertical

TABLE II.B.1-1 (continued)

INDEX OF DATA PRESENTED

<u>Figure No</u>	<u>Test Configuration</u>	<u>Shock No(s)</u>	<u>Accelerometer Location</u>	<u>Sensitive Axis</u>
II.B.1-113	III	13,14,15	2	longitudinal
-114	III	13,14,15	2	lateral
-115	III	13,14,15	2	vertical
-116	III	13,14,15	3	longitudinal
-117	III	13,14,15	3	lateral
-118	III	13,14,15	3	vertical
-119	III	13,14,15	4	longitudinal
-120	III	13,14,15	4	lateral
-121	III	13,14,15	4	vertical
-122	III	13,14,15	5	longitudinal
-123	III	13,14,15	5	lateral
-124	III	13,14,15	5	vertical
-125	III	13,14,15	6	longitudinal
-126	III	13,14,15	6	lateral
-127	III	13,14,15	6	vertical
-128	III	13,14,15	7	longitudinal
-129	III	13,14,15	7	lateral
-130	III	13,14,15	7	vertical
-131	III	13,14,15	8	longitudinal
-132	III	13,14,15	8	lateral

TABLE II.B.1-1 (continued)

INDEX OF DATA PRESENTED

<u>Figure No</u>	<u>Test Configuration</u>	<u>Shock No(s)</u>	<u>Accelerometer Location</u>	<u>Sensitive Axis</u>
II.B.1-133	III	13,14,15	8	vertical
-134	IV	16,17,18,19	1	longitudinal
-135	IV	16,17,18,19	1	lateral
-136	IV	16,17,18,19	1	vertical
-137	IV	16,17,18,19	2	longitudinal
-138	IV	16,17,18,19	2	lateral
-139	IV	16,17,18,19	2	vertical
-140	IV	16,17,18,19	3	longitudinal
-141	IV	16,17,18,19	3	lateral
-142	IV	16,17,18,19	3	vertical
-143	IV	16,17,18,19	4	longitudinal
-144	IV	16,17,18,19	4	lateral
-145	IV	16,17,18,19	4	vertical
-146	IV	16,17,18,19	5	longitudinal
-147	IV	16,17,18,19	5	lateral
-148	IV	16,17,18,19	5	vertical
-149	IV	16,17,18,19	6	longitudinal
-150	IV	16,17,18,19	6	lateral
-151	IV	16,17,18,19	6	vertical
-152	IV	16,17,18,19	7	longitudinal

TABLE II.B.1-1 (continued)

INDEX OF DATA PRESENTED

<u>Figure No</u>	<u>Test Configuration</u>	<u>Shock No(s)</u>	<u>Accelerometer Location</u>	<u>Sensitive Axis</u>
II.B.1-153	IV	16,17,18,19	7	lateral
-154	IV	16,17,18,19	7	vertical
-155	IV	16,17,18,19	8	longitudinal
-156	IV	16,17,18,19	8	lateral
-157	IV	16,17,18,19	8	vertical

TABLE F.I.B.1-2

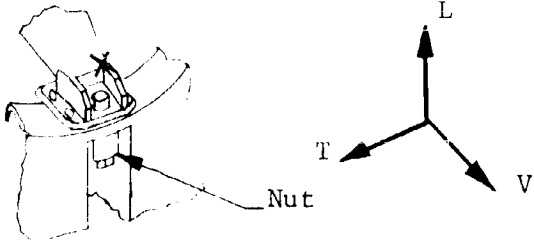
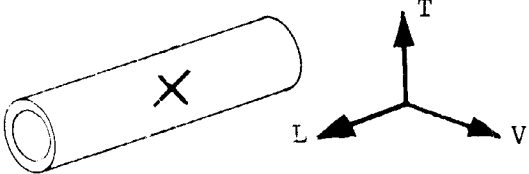
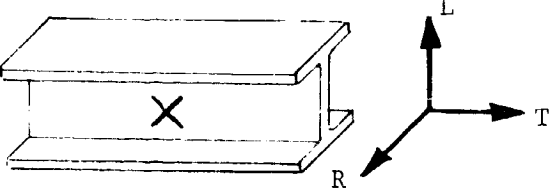
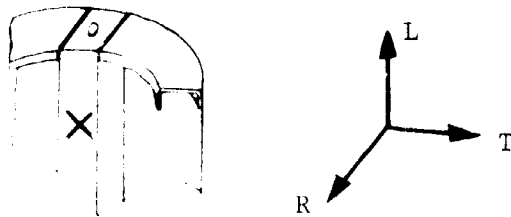
ACCELEROMETER LOCATIONS

<u>Payload Truss Locations</u>	<u>Distance From Shock Sources (Inches)</u>	<u>Transtage Skirt Locations</u>	<u>Distance From* Shock Source (Inches)</u>
1	3	11	3
2	35	12	18
3	65	13	36
4	104	14	55
5	114	15	68
6	38	16	102
7	57	17	160
8	76	18	216

*These distances were determined based on shock propagation through the longerous and ring-frames and not the skin.

TABLE II.B.1-3

DIRECTIONS OF ACCELEROMETER SENSITIVITY

Accelerometer Locations	Directions Monitored	Description of Directions
1	longitudinal (L) lateral (T) vertical (V)	
2,3,4,5,6	longitudinal (L) lateral (T) vertical (V)	Oriented with axes of truss member 
7,8	longitudinal (L) lateral (T) vertical (V)	Oriented with vehicle axes 
11,12,13,14 15,16,17,18	longitudinal (L) tangential (T) radial (R)	

ACCELEROMETER LOCATION	TEST NUMBER																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	IIa	IIa	IIa	IIb	IIb	IIb	I	I	I	I	I	I	III	III	III	IV	IV	IV	IV	
2																				
3																				
4																				
5																				
6																				
7																				
8																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				

TEST CONFIGURATIONS

- I - Truss on Transtage Skirt
- IIa- Truss freely suspended
- IIb- Truss freely suspended with dummy satellites
- III- Truss on test tool
- IV - Truss on channel adaptors

TABLE II.B.1-4

MATRIX SHOWING TEST CONFIGURATION FOR ACCELEROMETER LOCATION AND TEST NUMBER

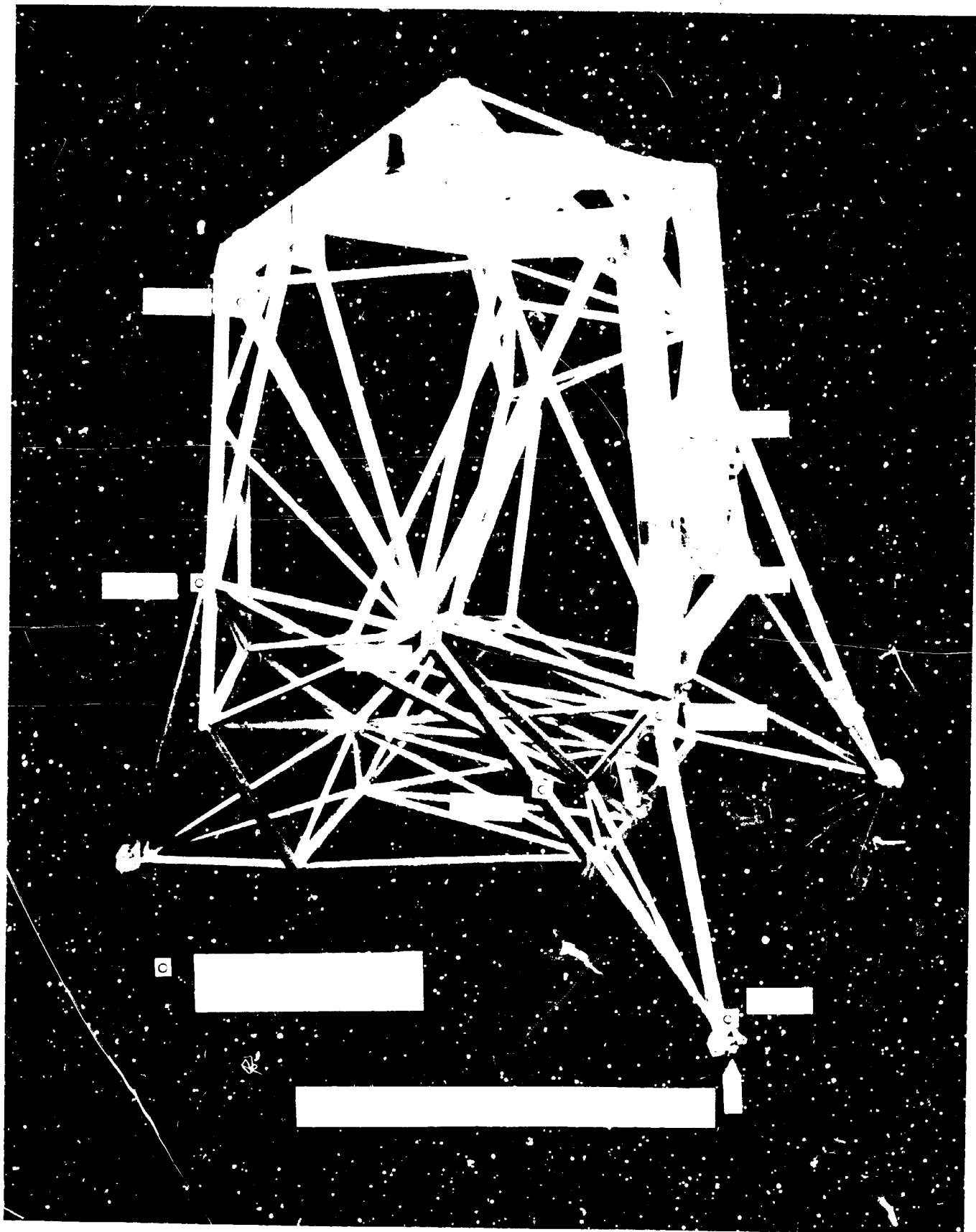


FIGURE 11.B.1-1
PHOTOGRAPH OF MODEL TRUSS

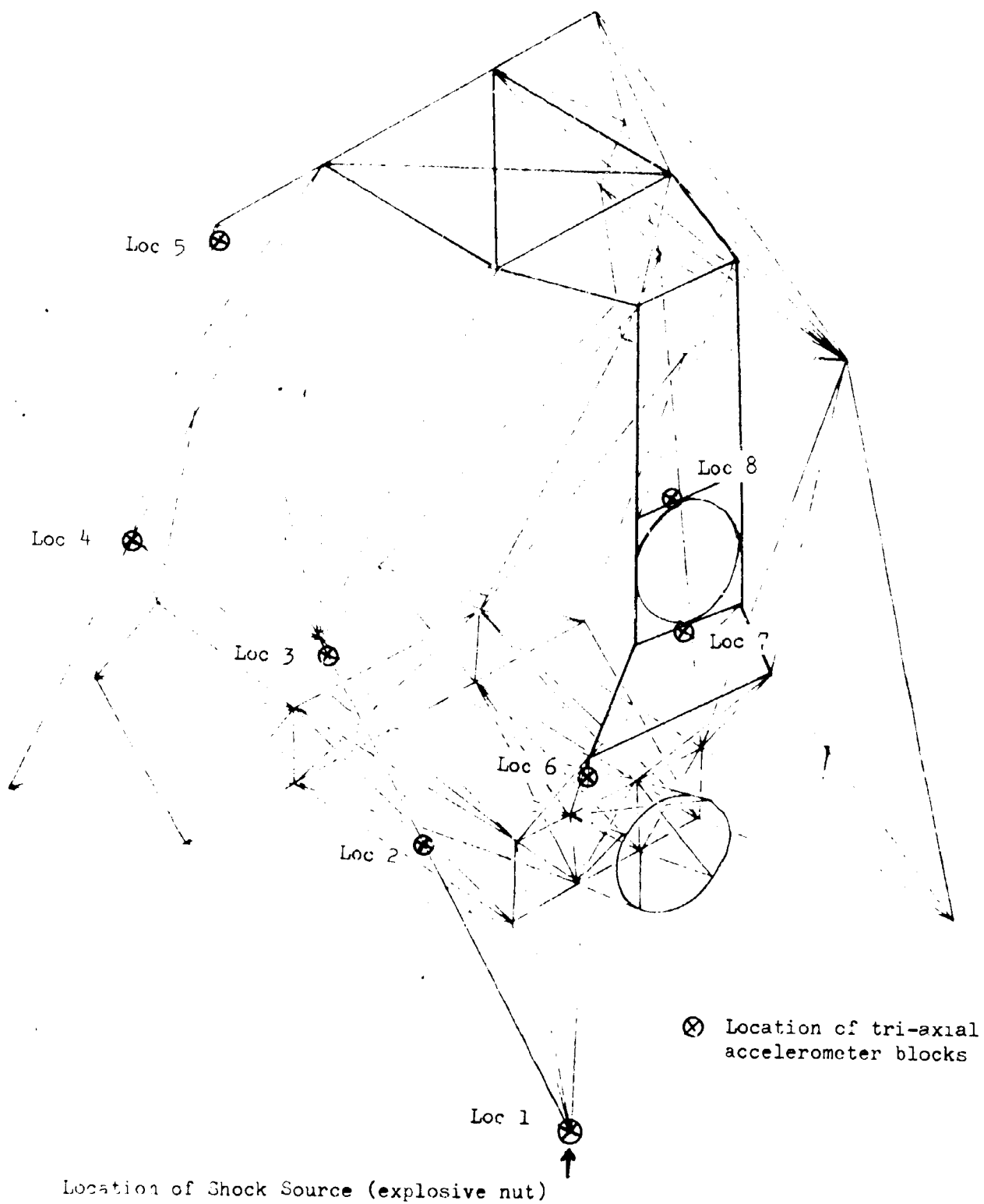
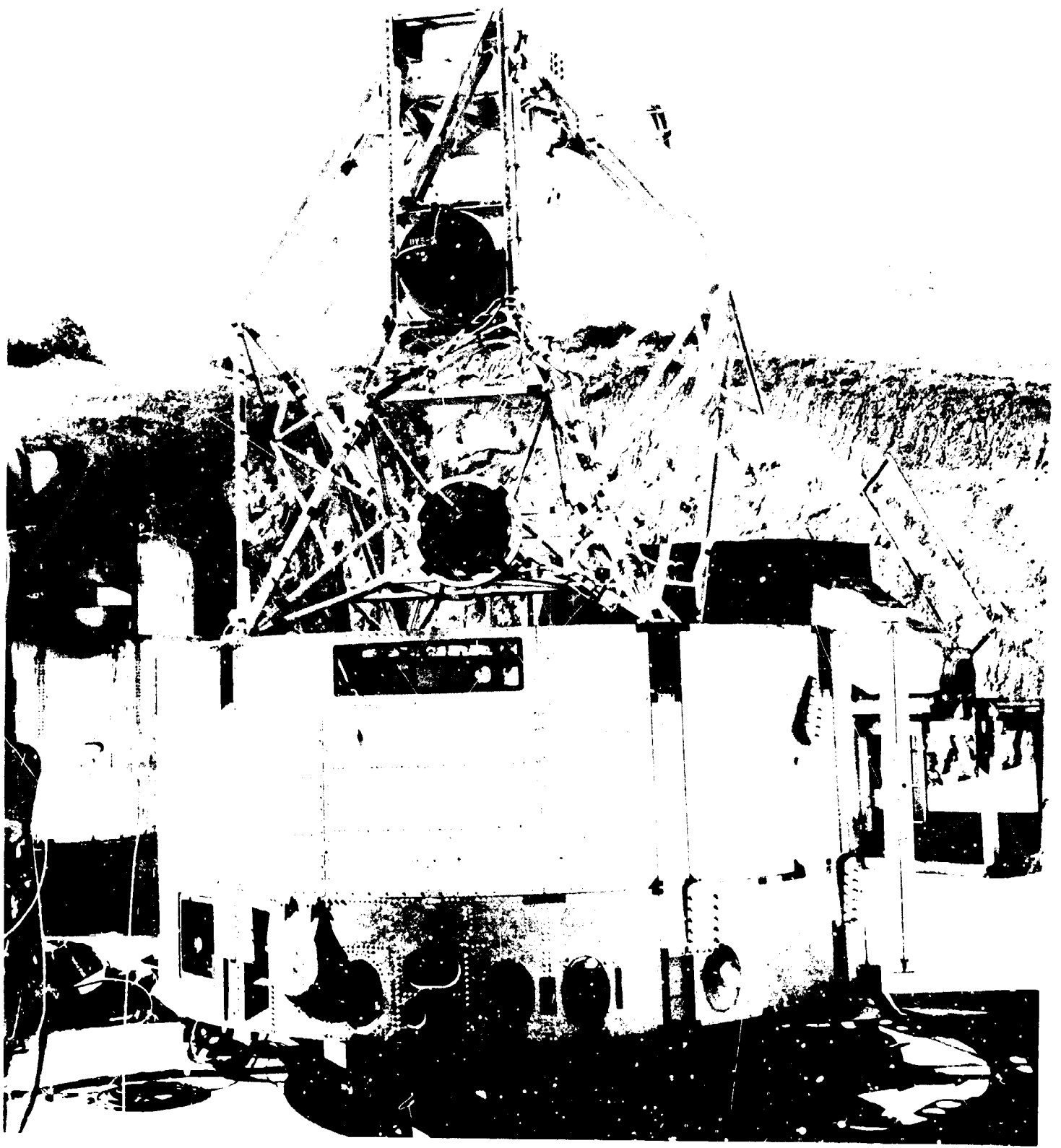


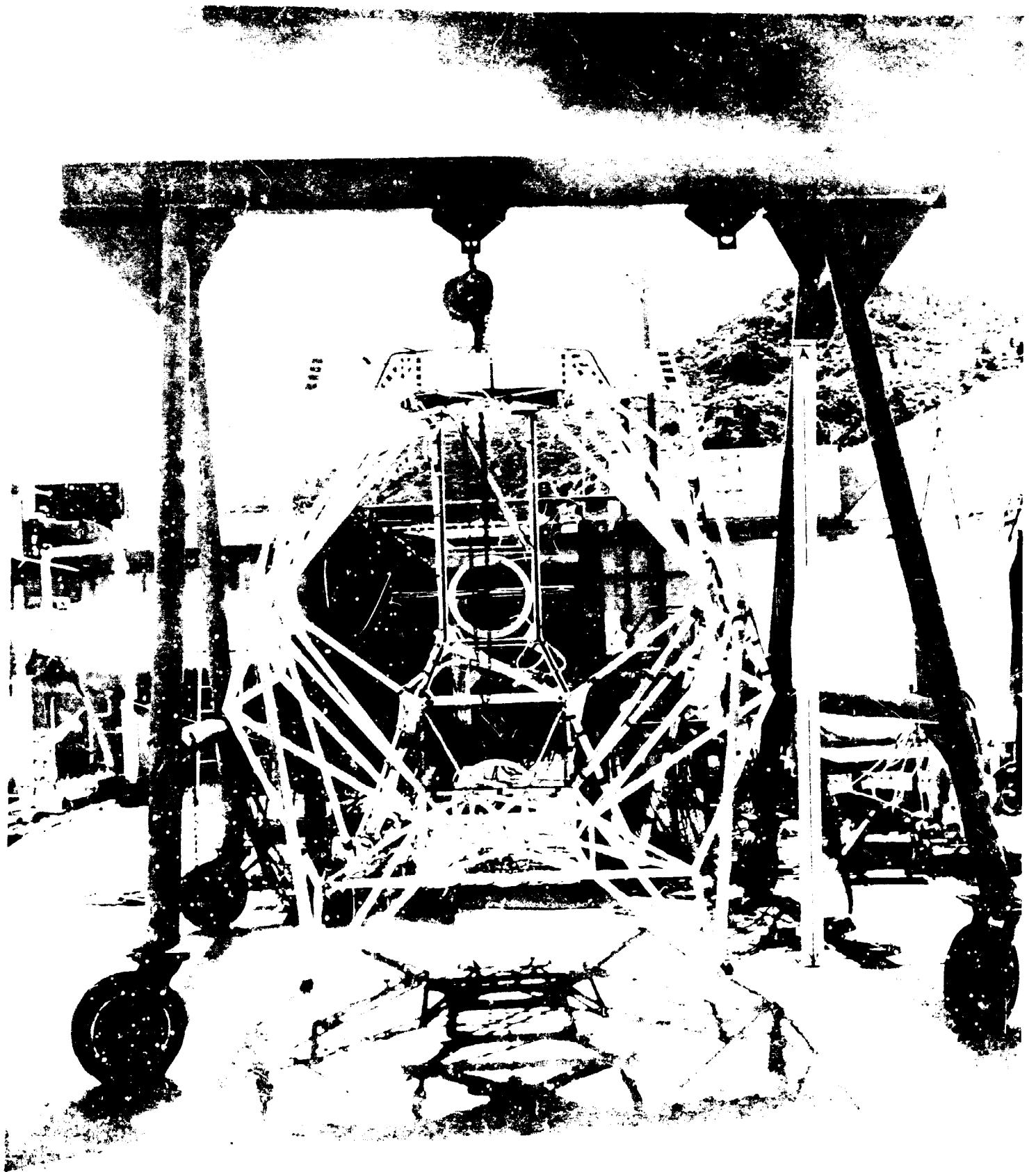
FIGURE II.B.1-2

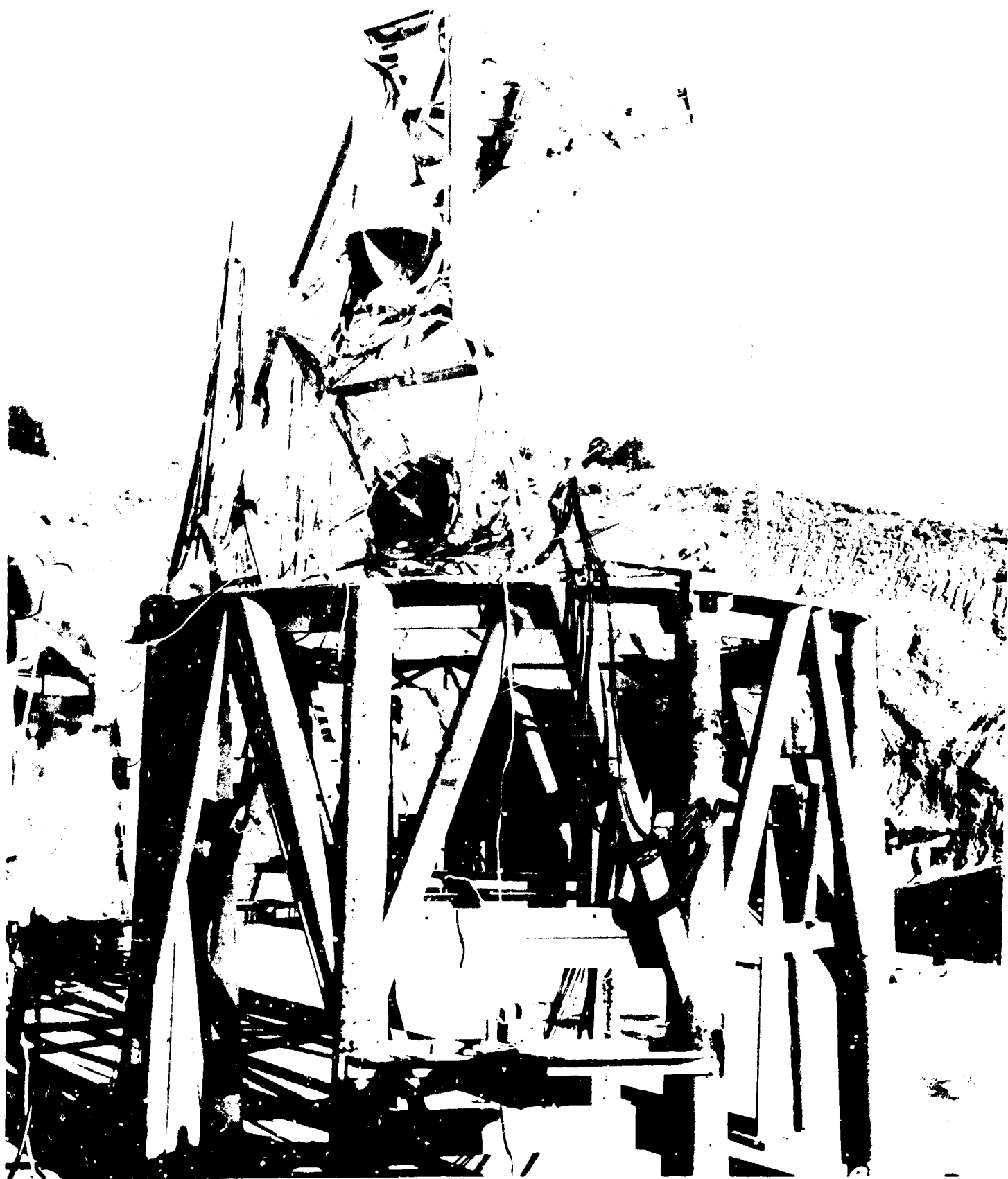
LOCATIONS OF ACCELEROMETERS ON PAYLOAD TRUSS



THE CRANE AT THE SITE

OF THE DAM





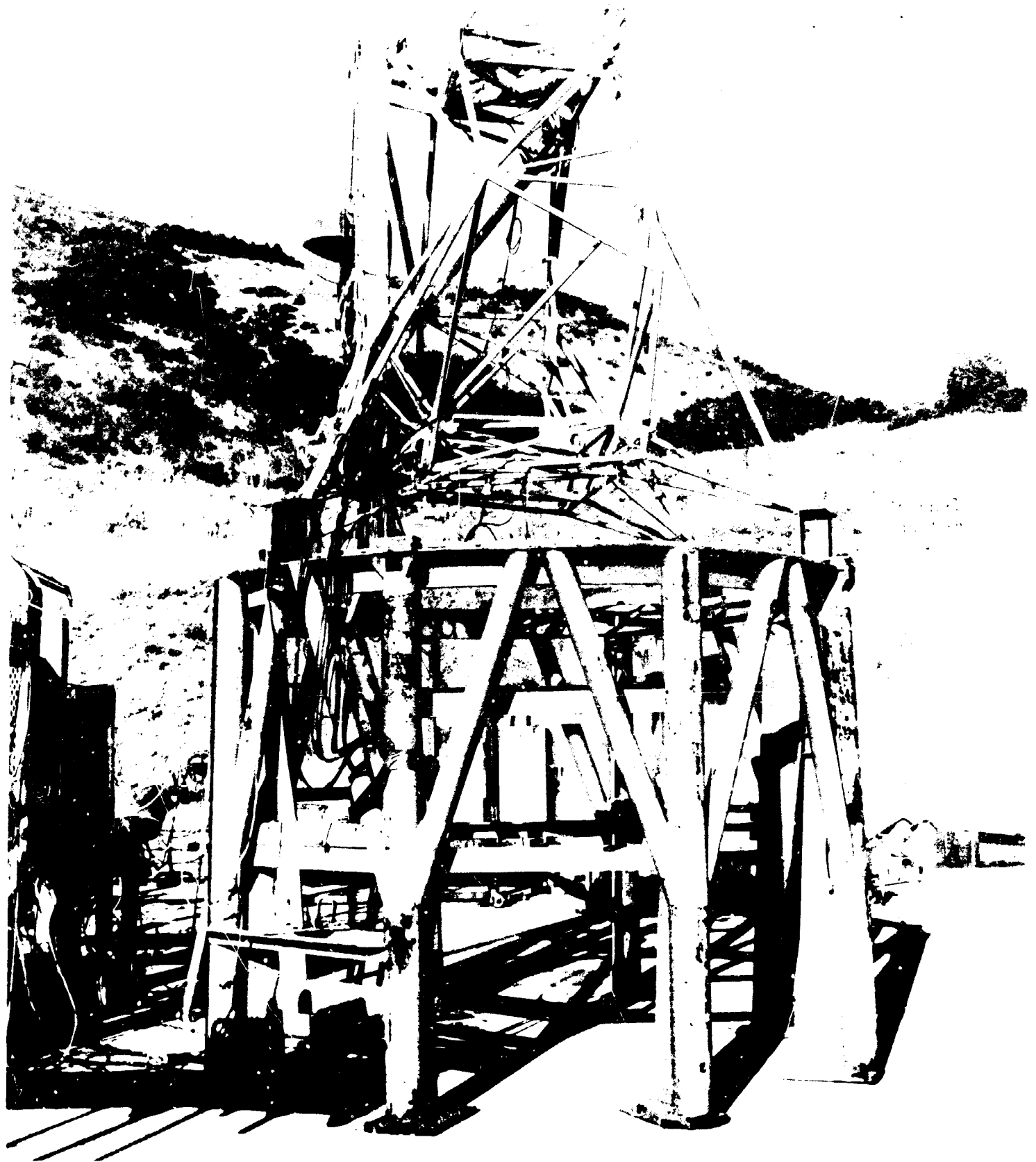
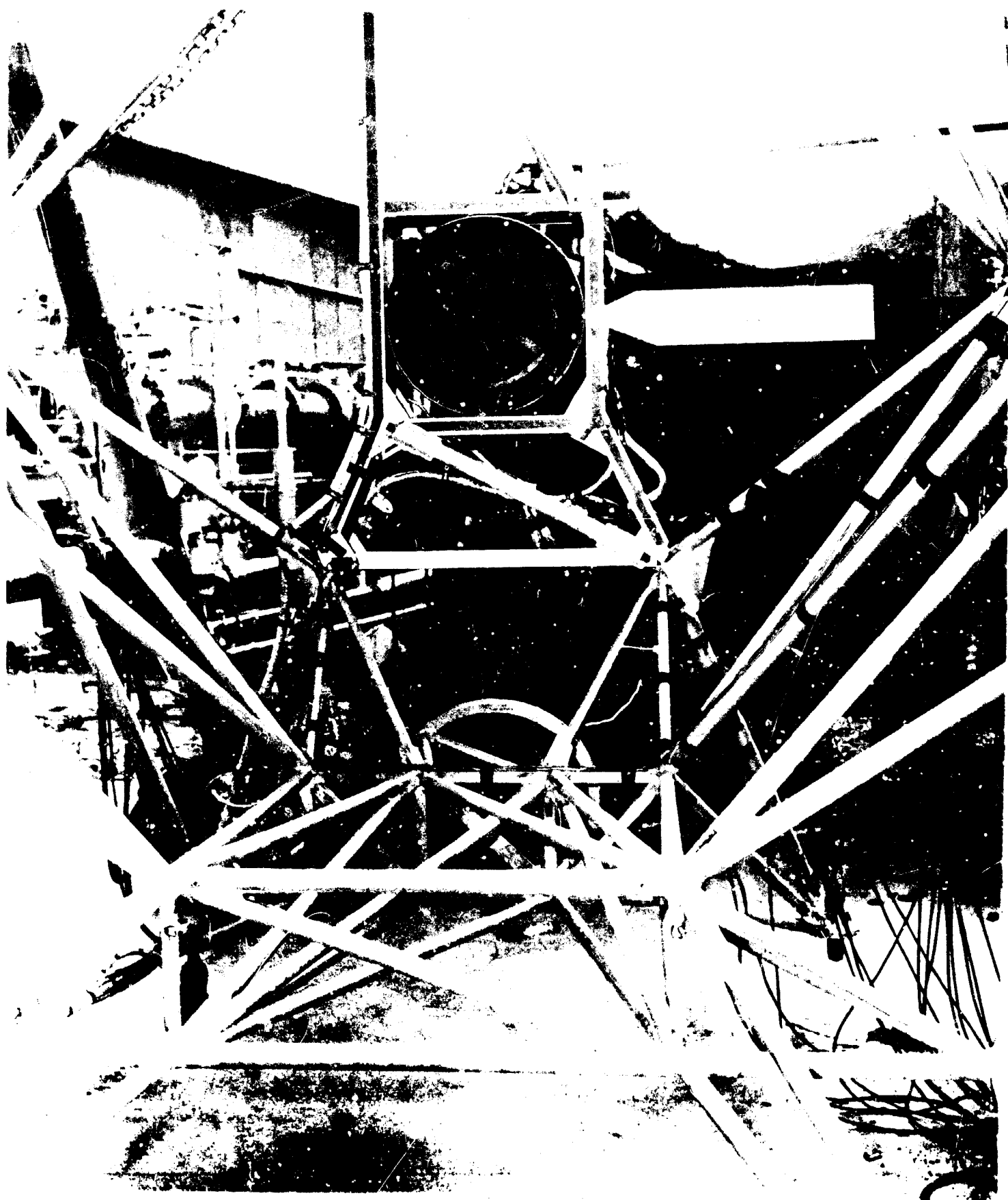


FIGURE II.B.1-6

WOODEN CRANE AT THE SITE OF THE 1950S
RECONSTRUCTION OF THE BRIDGE





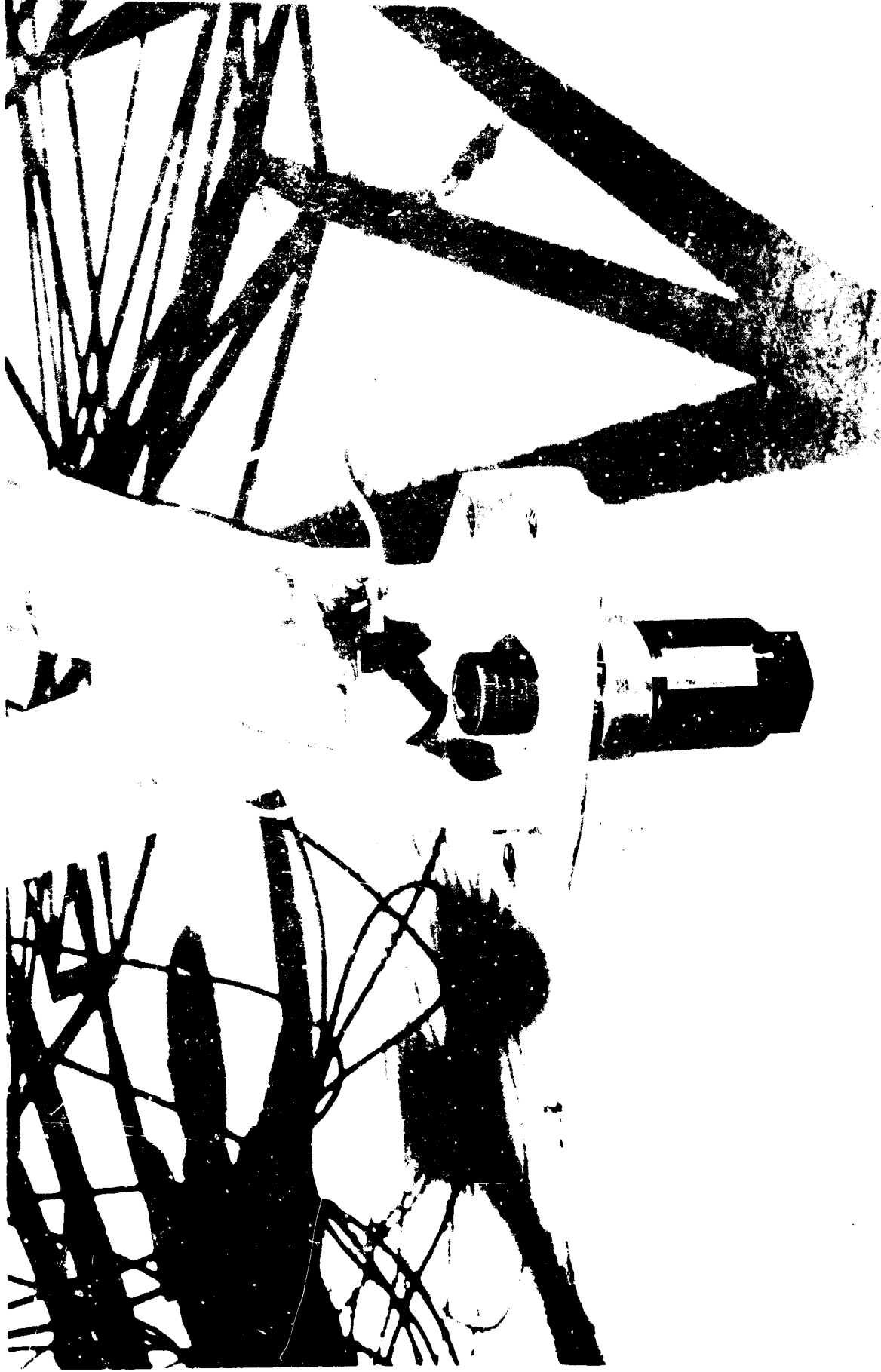


FIGURE 11. B. 1-9
[The person in the white protective suit is wearing a mask and holding a cylindrical object.]

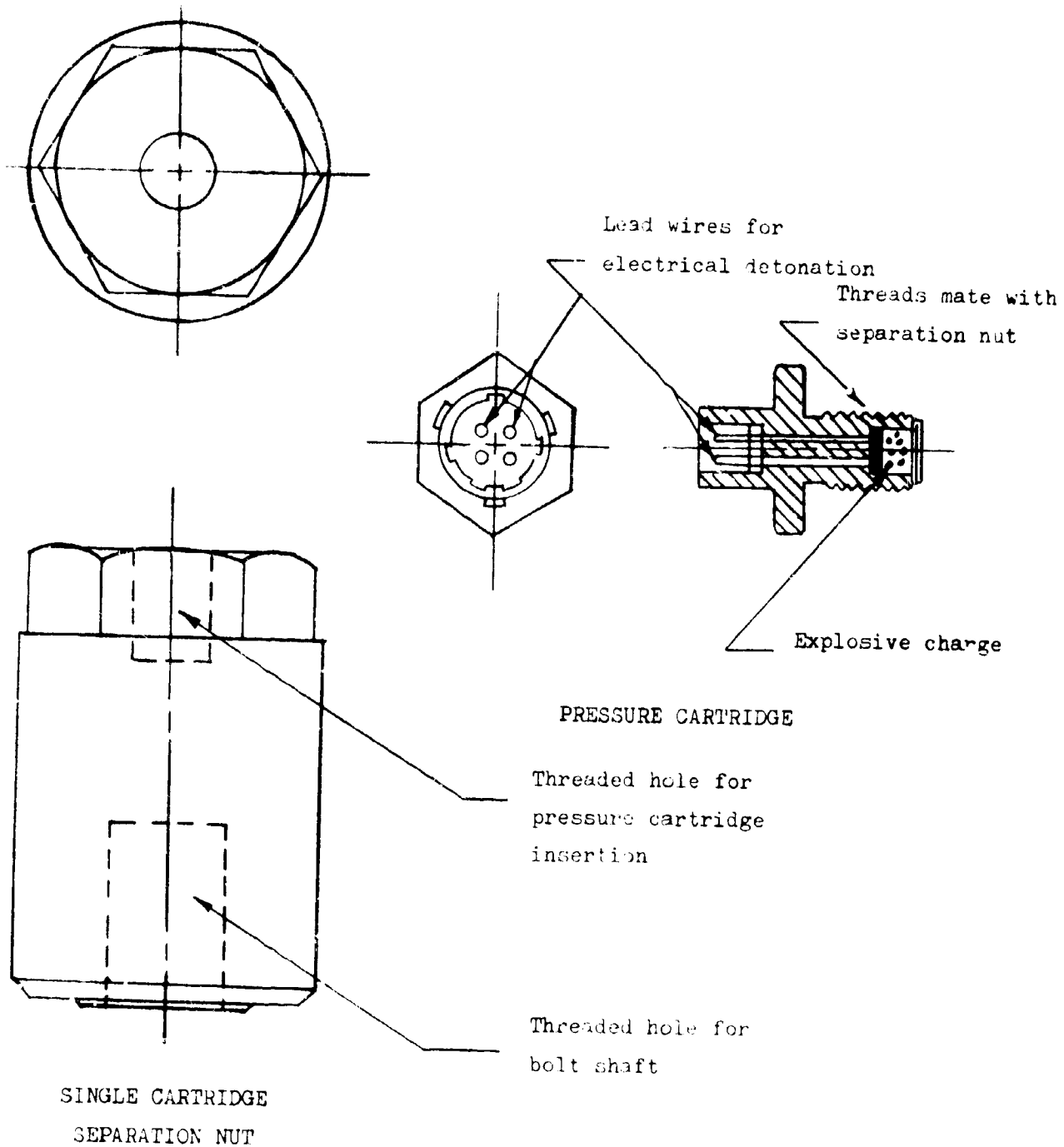
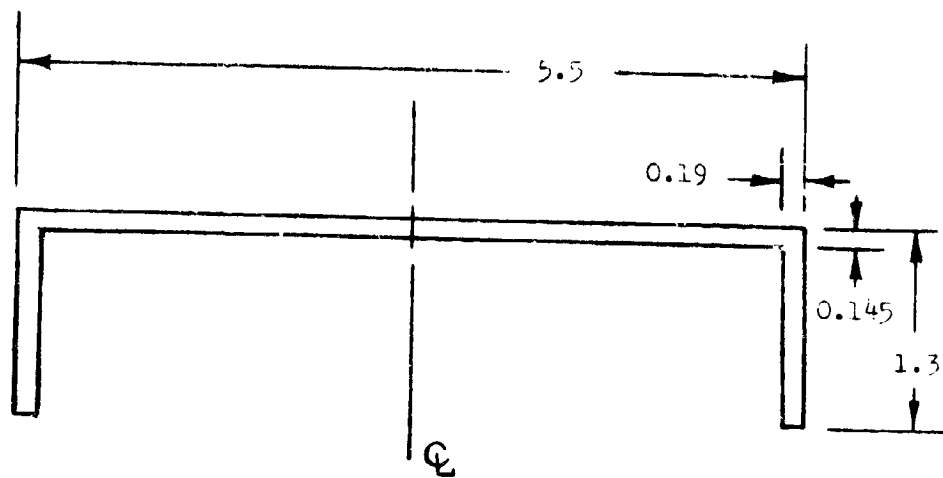
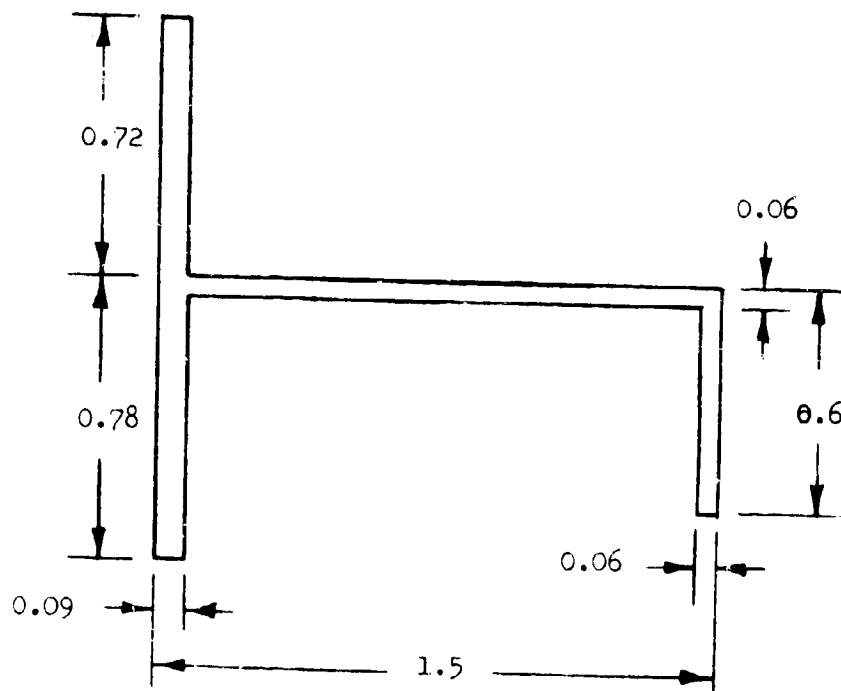


FIGURE II.B.1-10

SEPARATION NUT

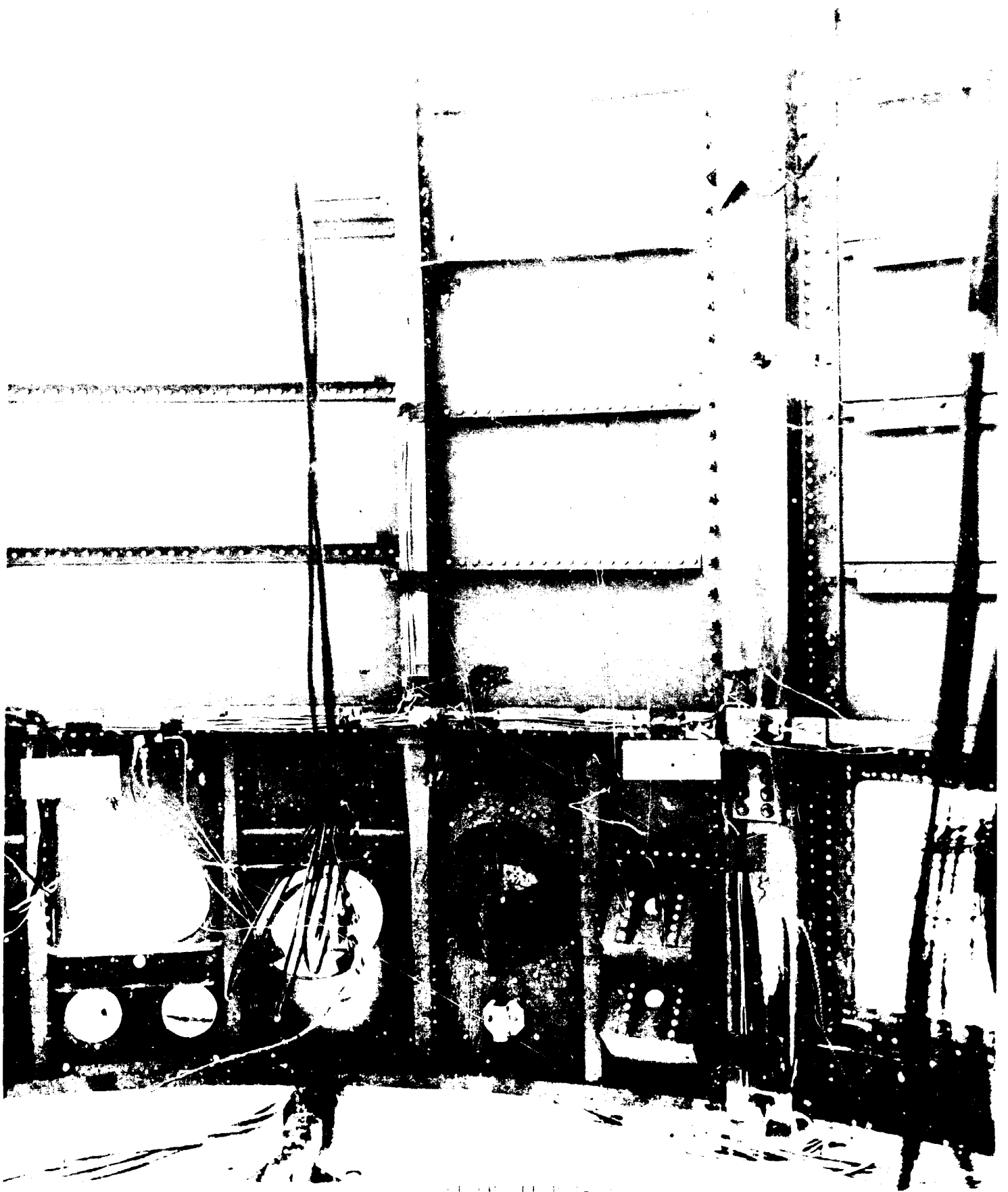


RING-FRAME
DIMENSION OF SECTION AT STATION 77



DIMENSIONS OF LONGERON SECTION

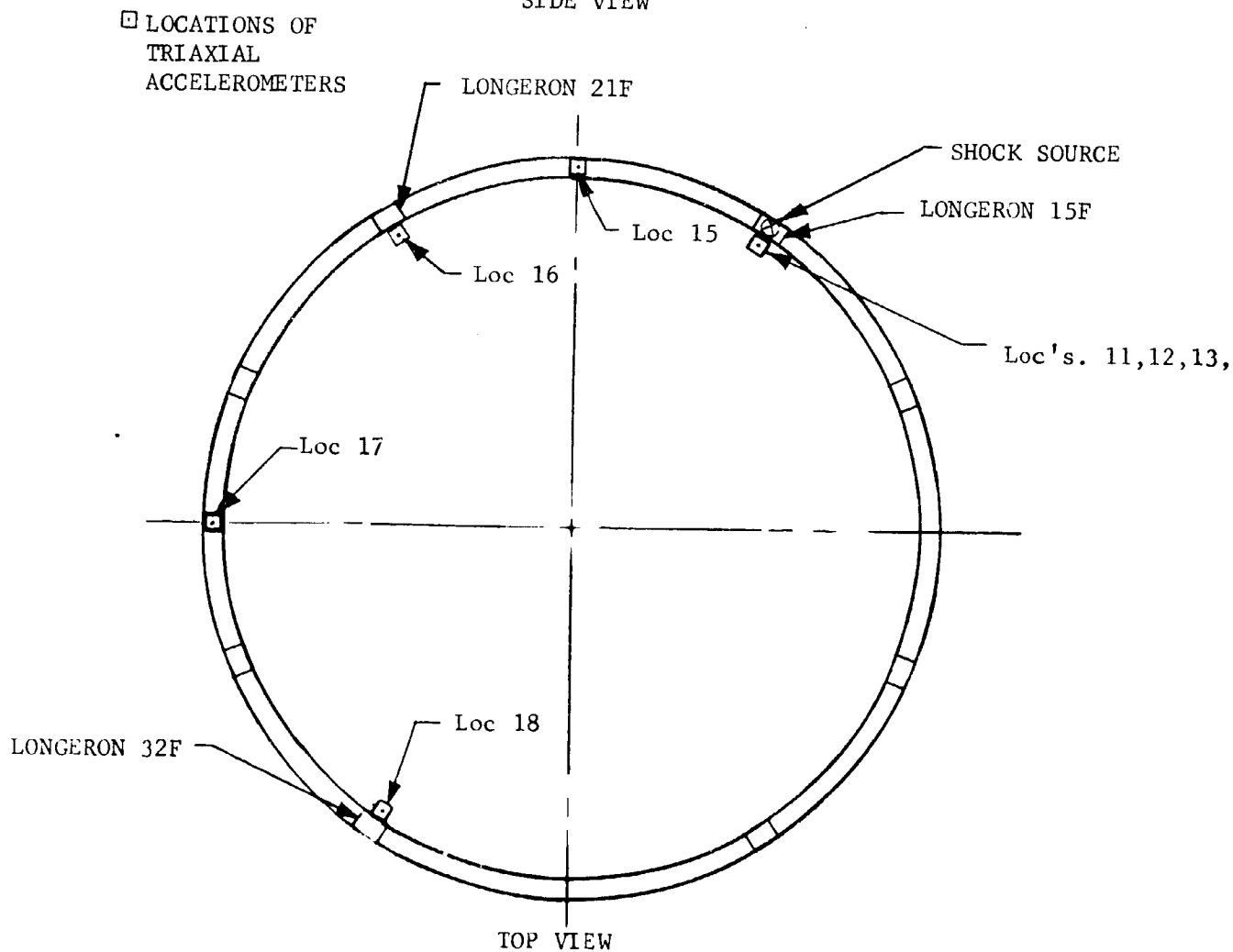
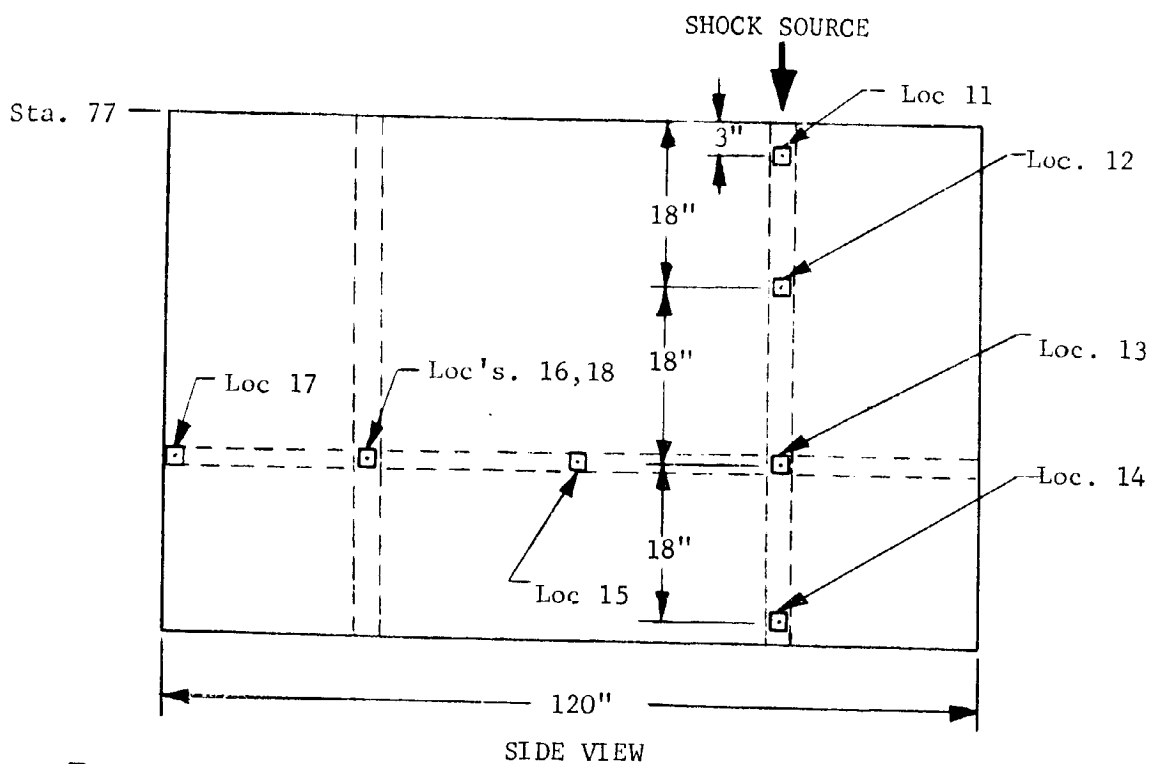
FIGURE II.B.1-11
SECTIONAL DIMENSIONS



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REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.



LOCATIONS OF ACCELEROMETERS IN TRANSTAGE SKIRT

FIGURE II.B.1-13

TEST ITEM: Condensation in 1 PART NO. _____
 SERIAL NO. _____ TEST DATE: September 1954
 SHOCK AXIS: Vertical SHOCK NO.: 11, 12, and 13

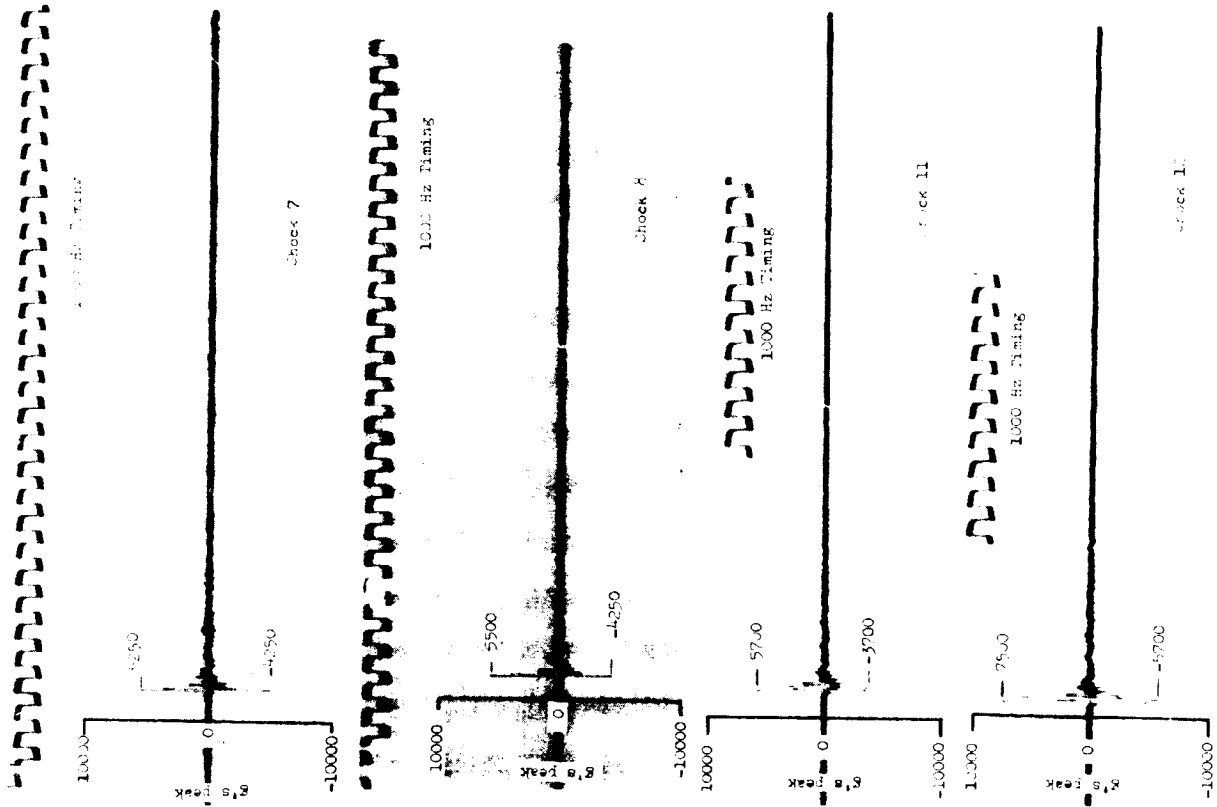
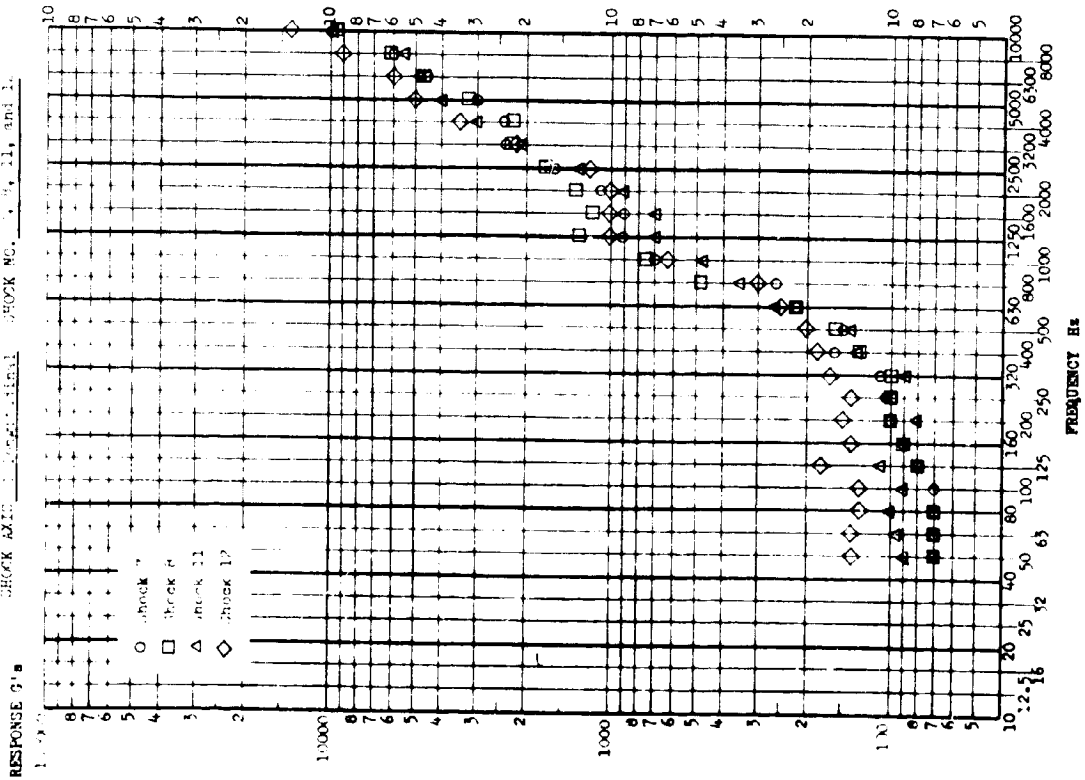


FIGURE 11.B.1-14

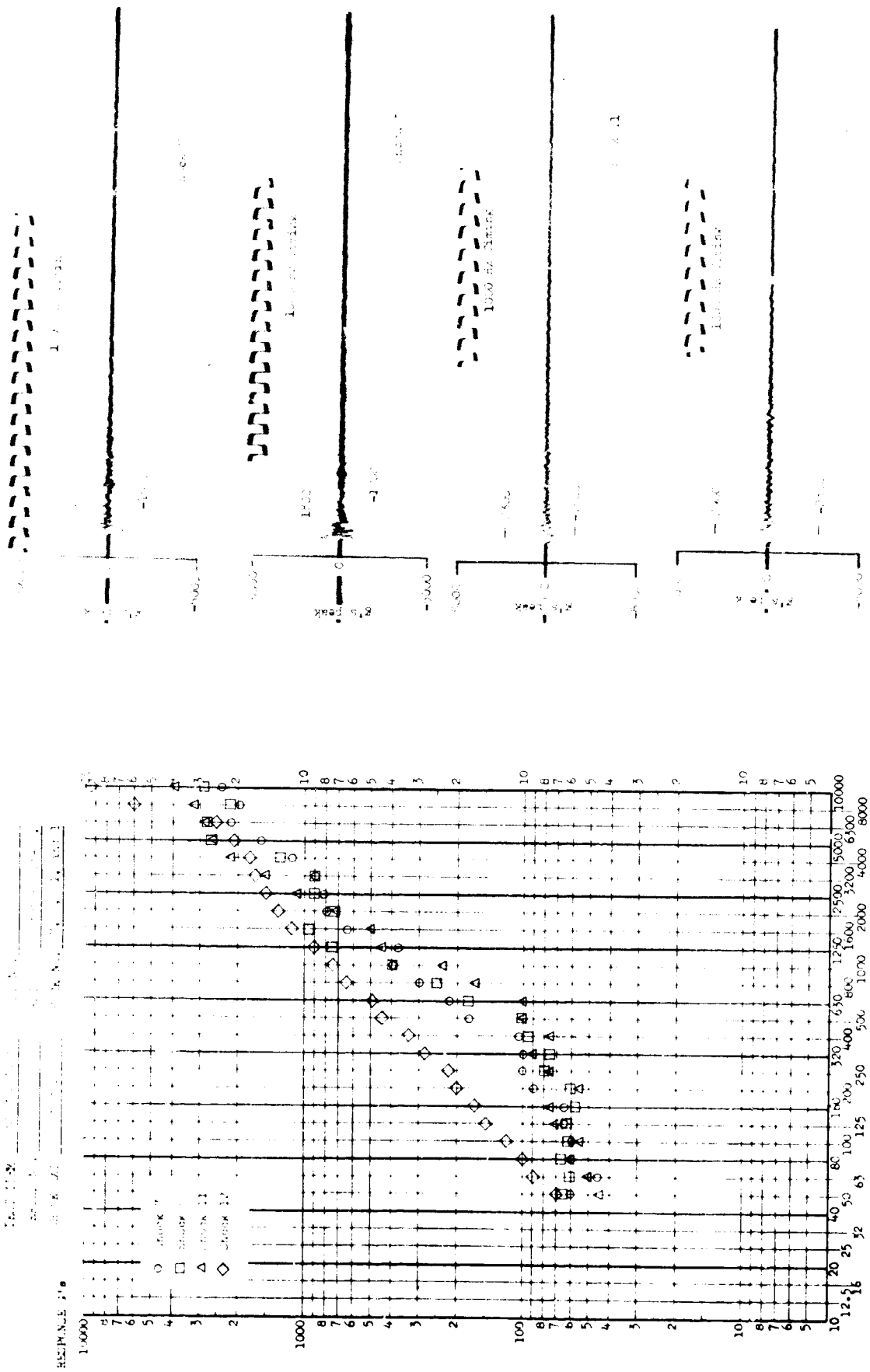


FIGURE 11.B.1-15

TEST ITEM: [unclear] [unclear]
 SERIAL NO.: [unclear]
 CHECK NO.: 7, 8, 11, 14, 15, 16

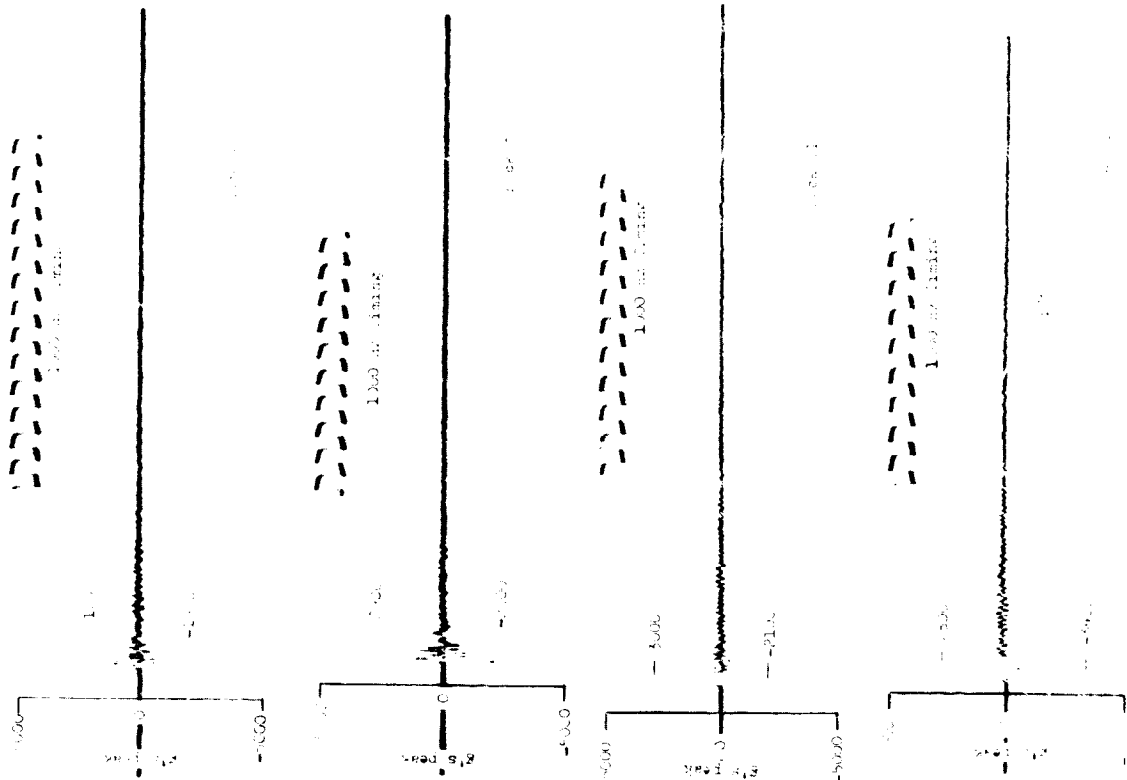
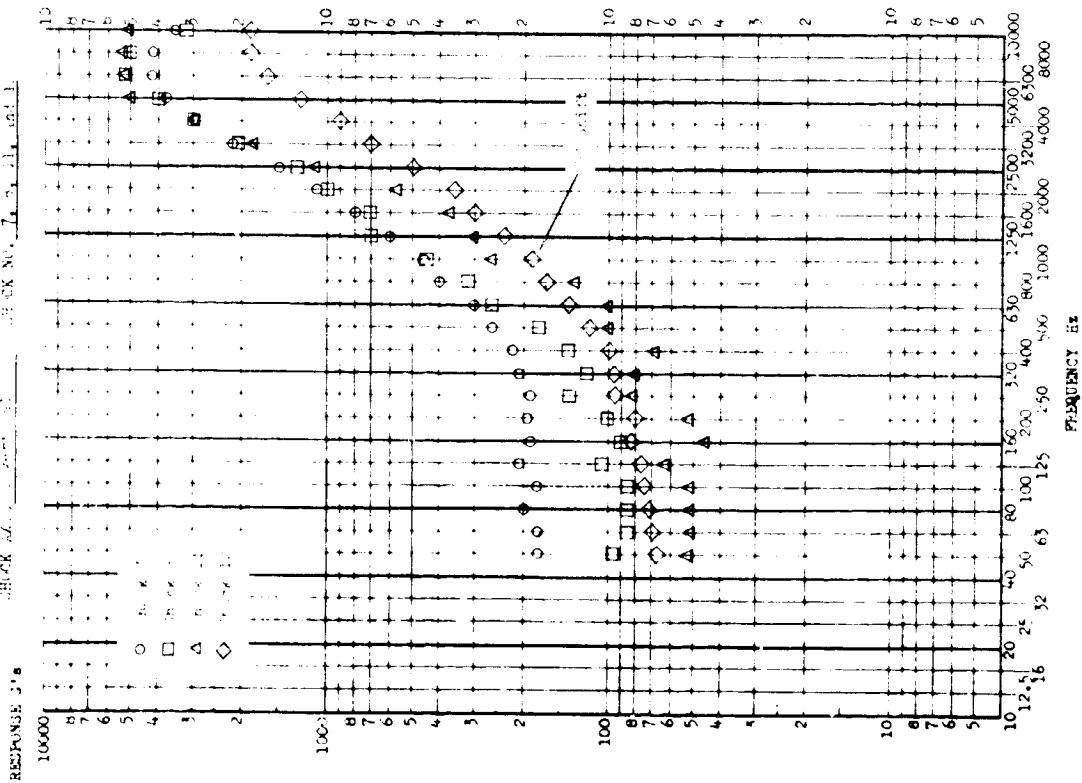


FIGURE II.B.1-16

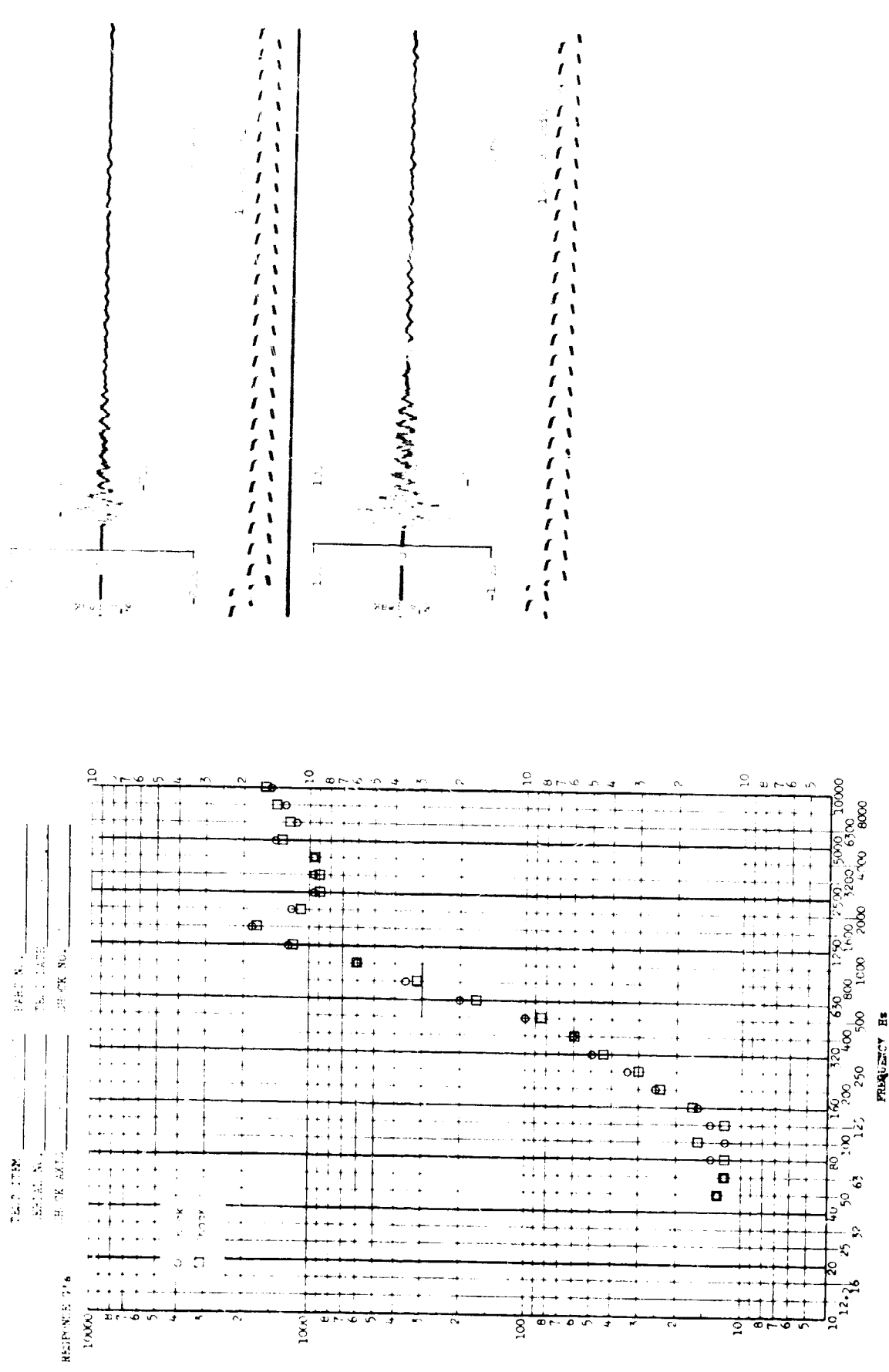


FIGURE 11.8.1-17

TEST ITEM _____ PART NO. _____
 SERIAL NO. _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. 1 and 18

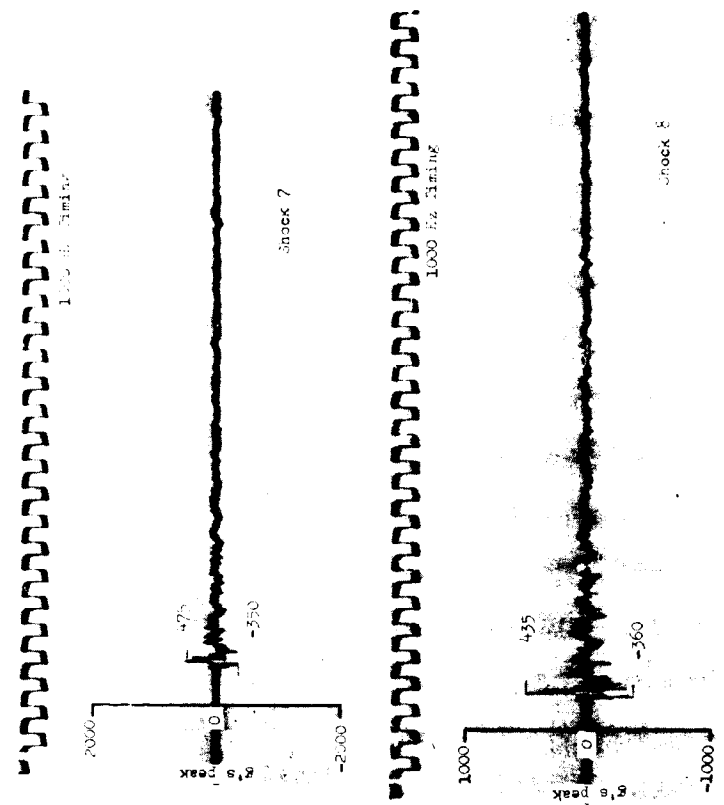
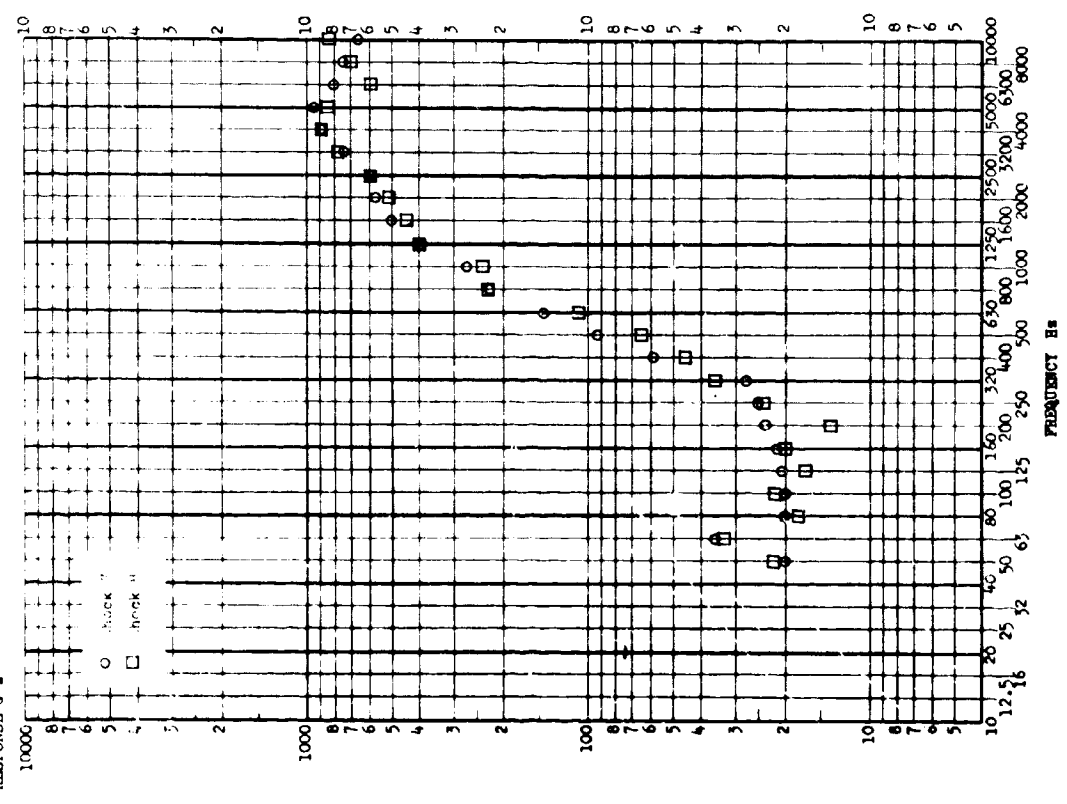


FIGURE 11.B.1-18

TEST ITEM: [REDACTED] PART NO.: [REDACTED]
 SERIAL NO.: [REDACTED] TEST DATE: [REDACTED]
 SHOCK AXIS: [REDACTED] SHOCK NO.: [REDACTED]

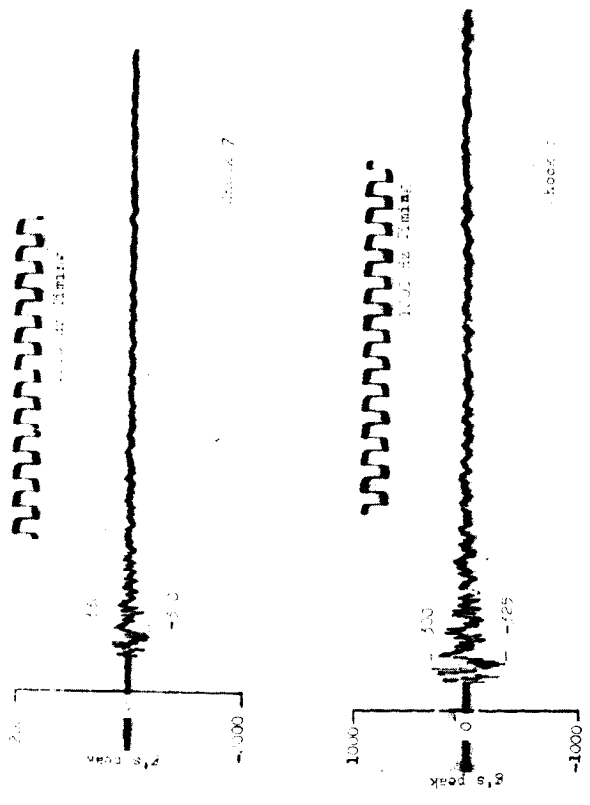
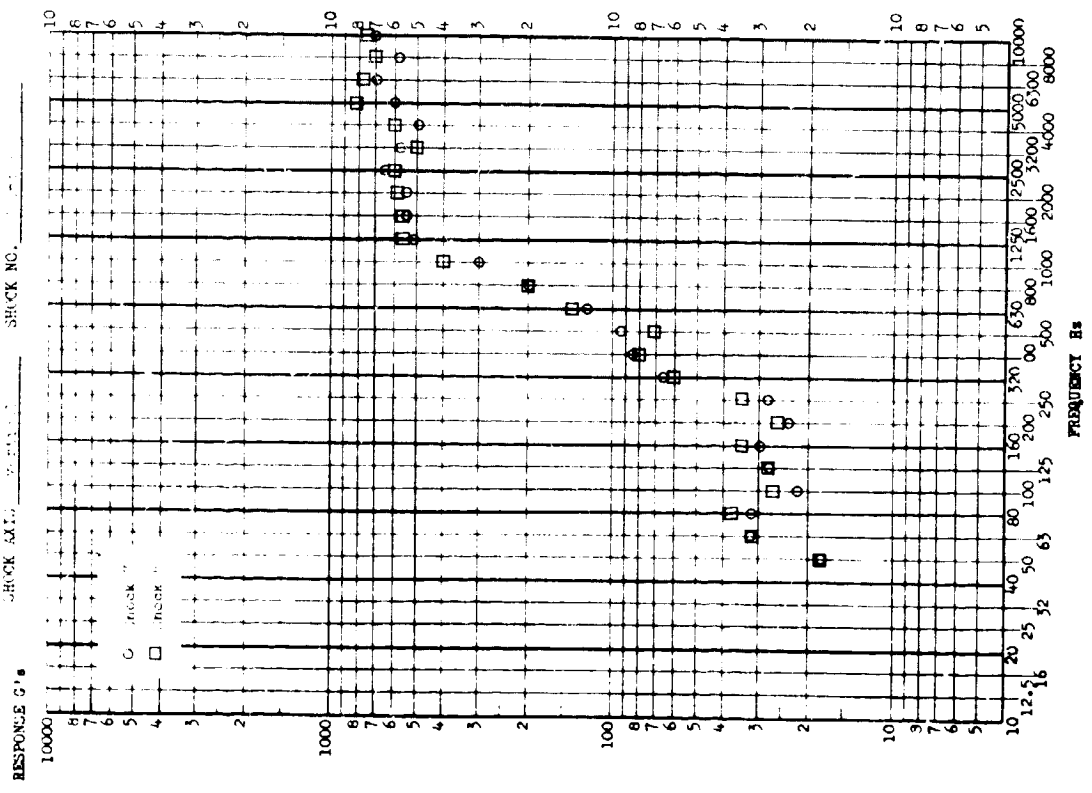


FIGURE II.B.1-19

TEST UNIT configuration: PART No. _____
 SERIAL No. _____
 CHECK No. 1, 2, 3, and 4 _____
 CHECK No. 5, 6, and 7 _____

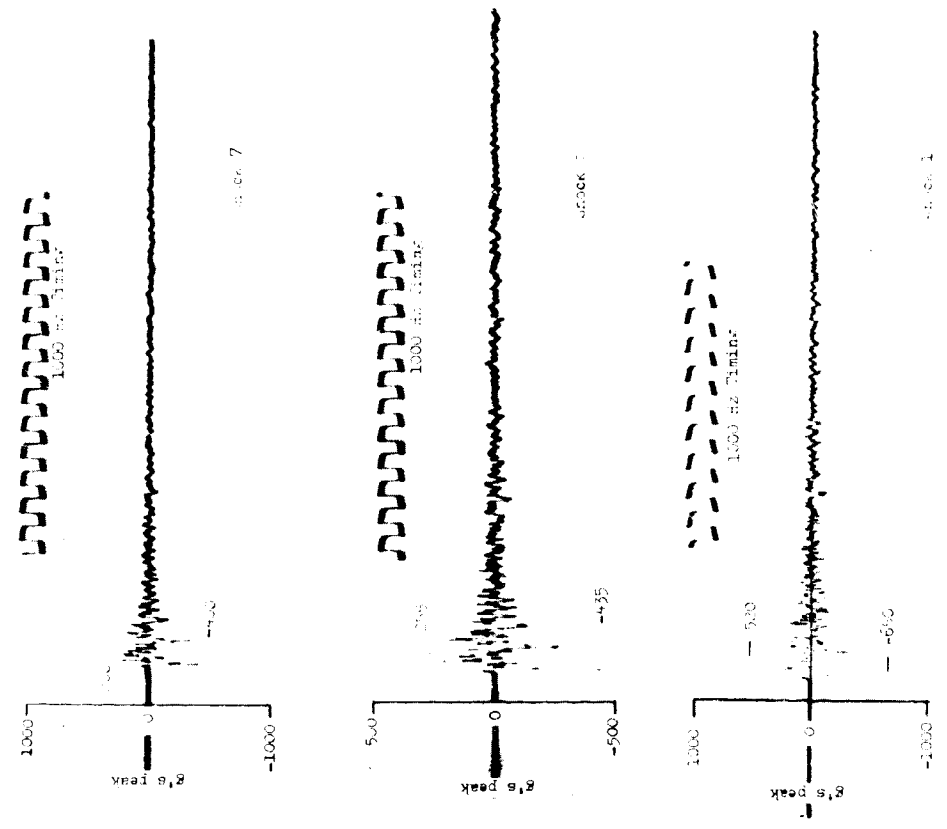
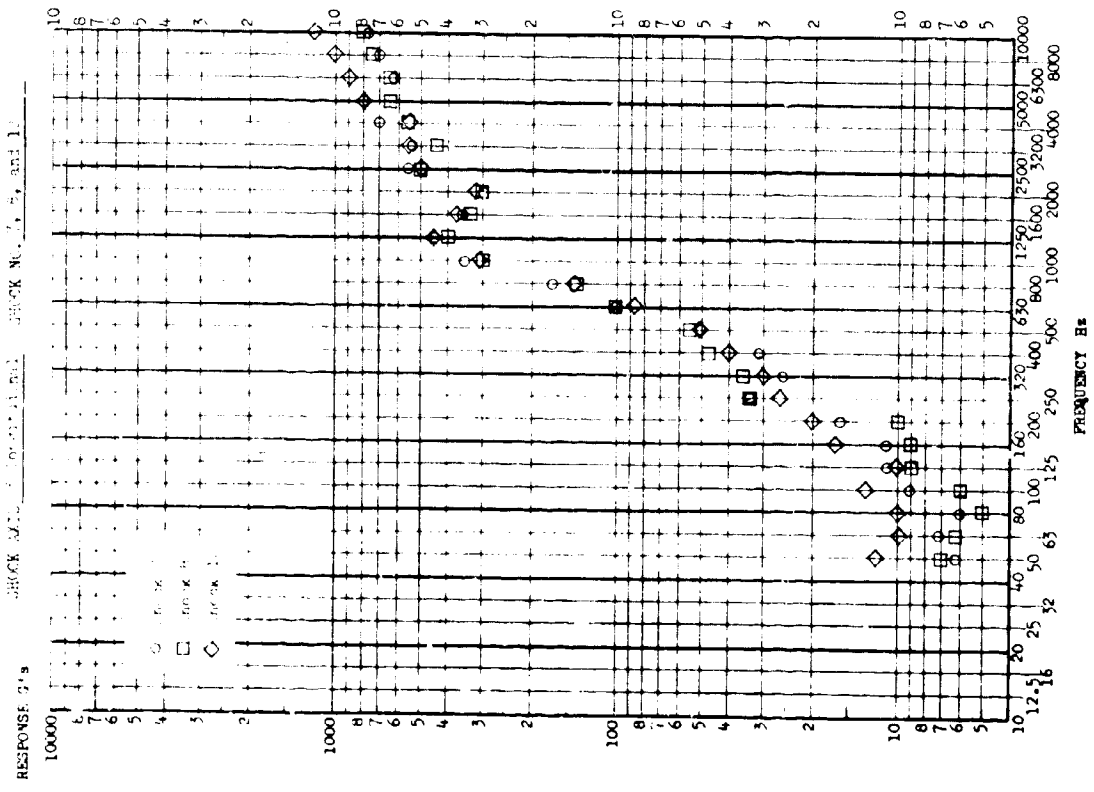


FIGURE 11.B.1-20

TEST ITEM SUBMISSION 1 PART 5
 SERIAL N. 14-20-1000000-1-1-1-1-1-1
 CHECK NO. 7, 8, 9, 10, 11

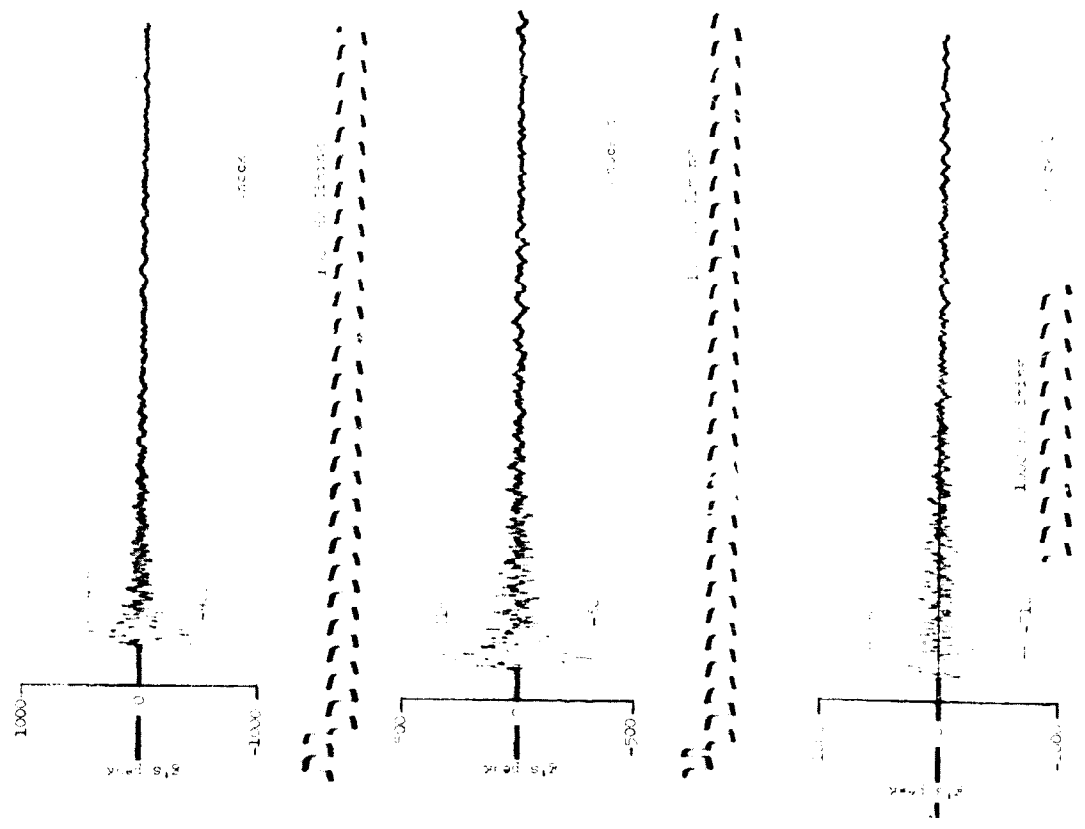
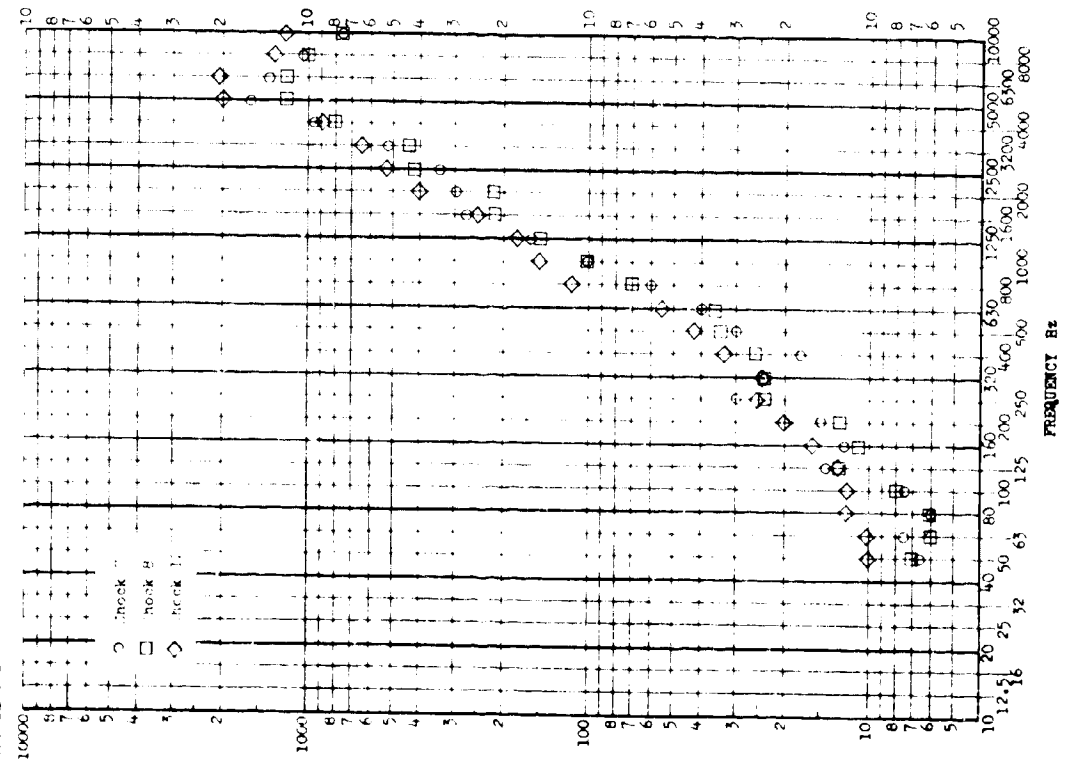


FIGURE 11.B.1-21

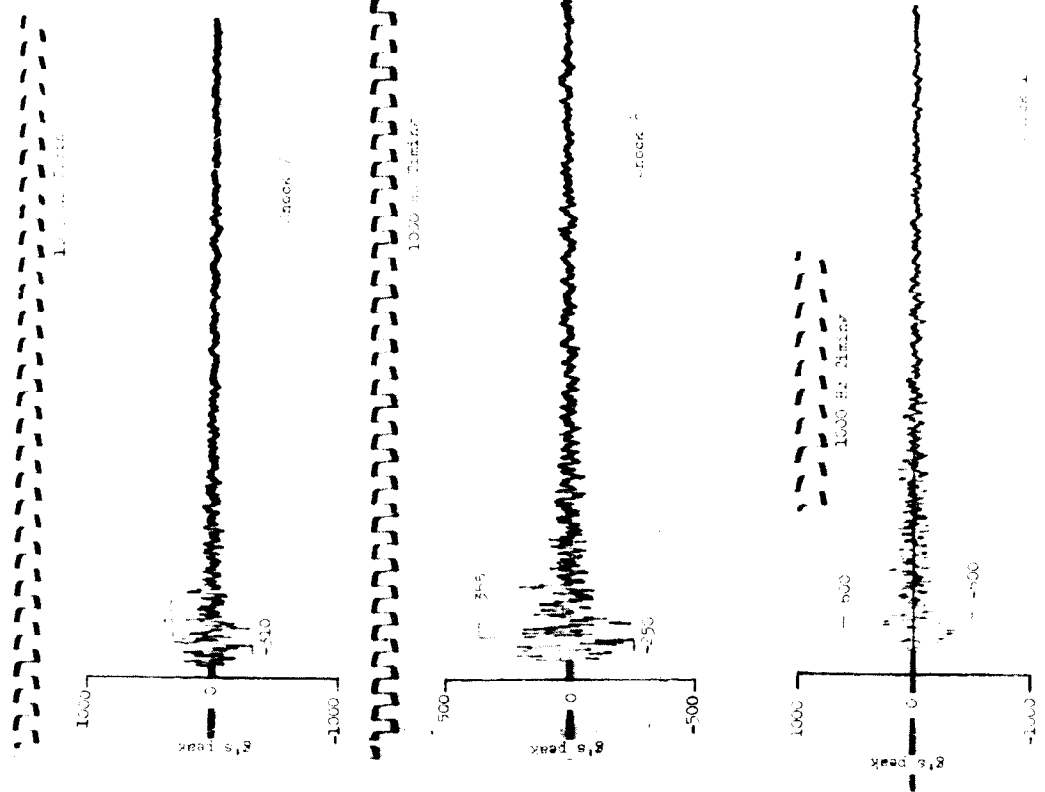
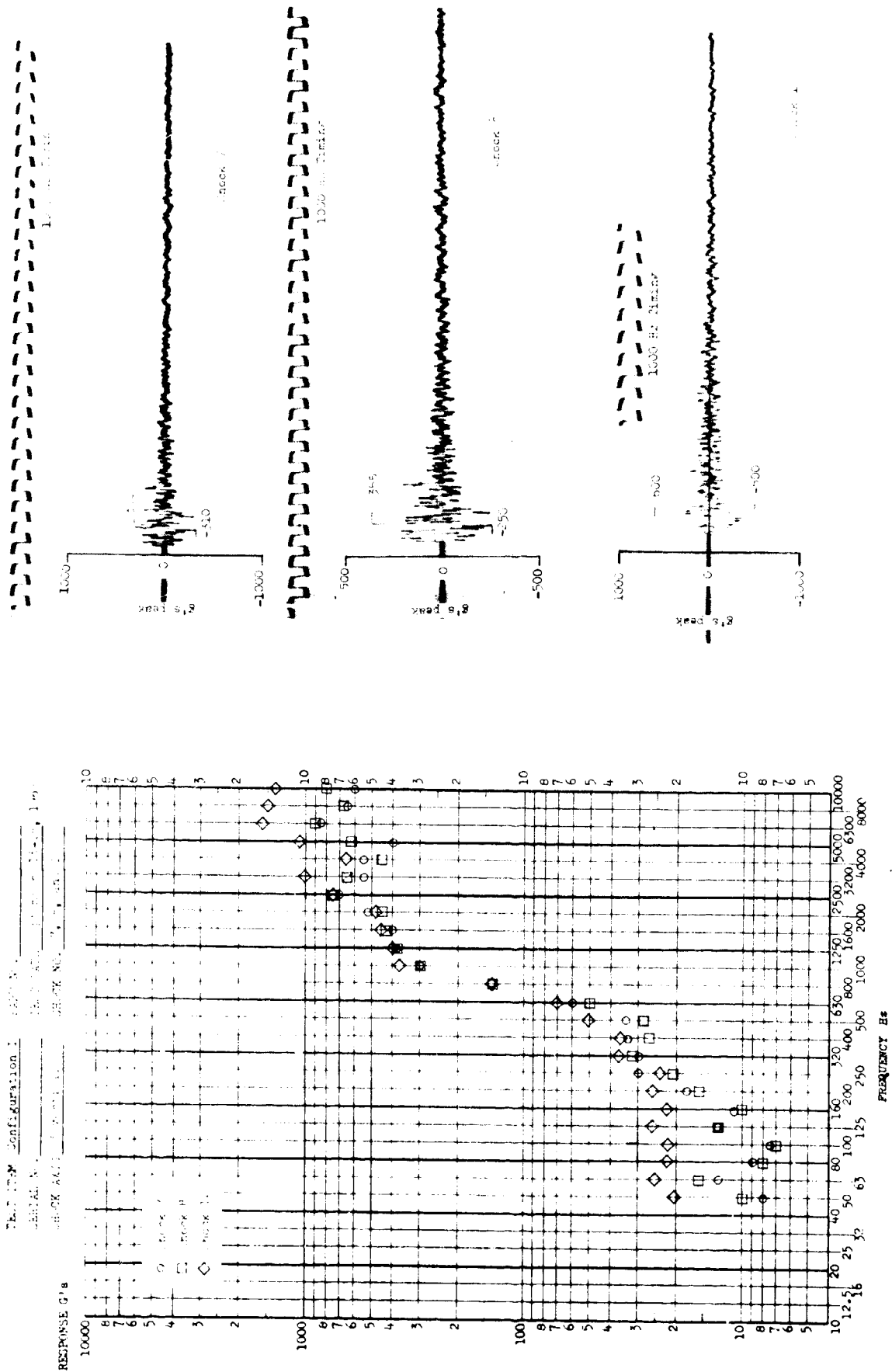


FIGURE II.B.1-22

TEST ITEM: RECEIVER PART NO.
 SERIAL NO. DATE
 CHECK AXES: CHECK NO.

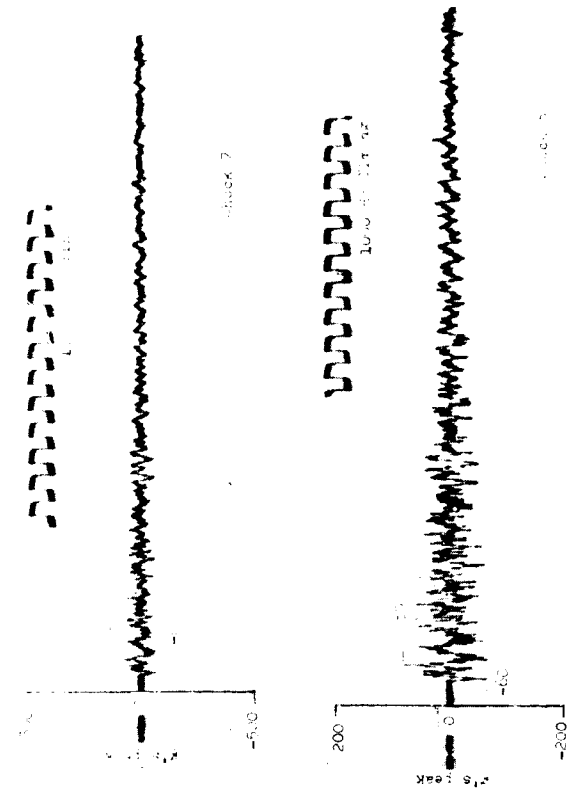
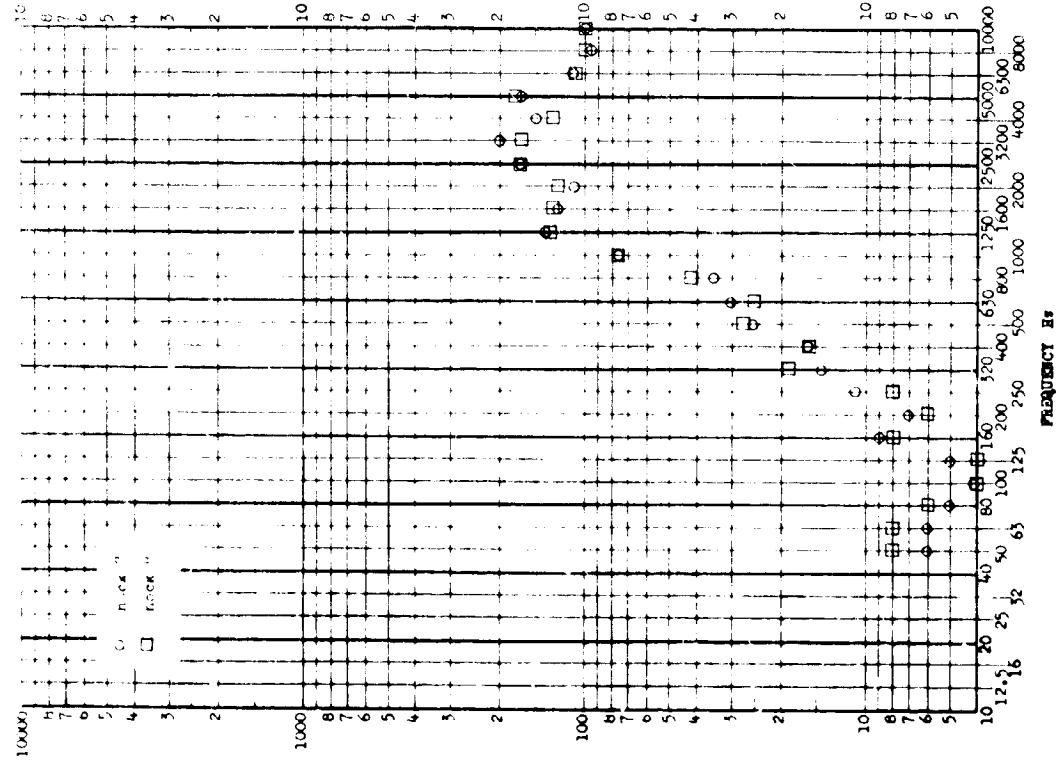


FIGURE 11.B.1-23

TEST ITEM Configuration I PART No. _____
 SERIAL No. _____ TEST DATE: _____
 CHECK AXIS _____ CHECK NO. _____

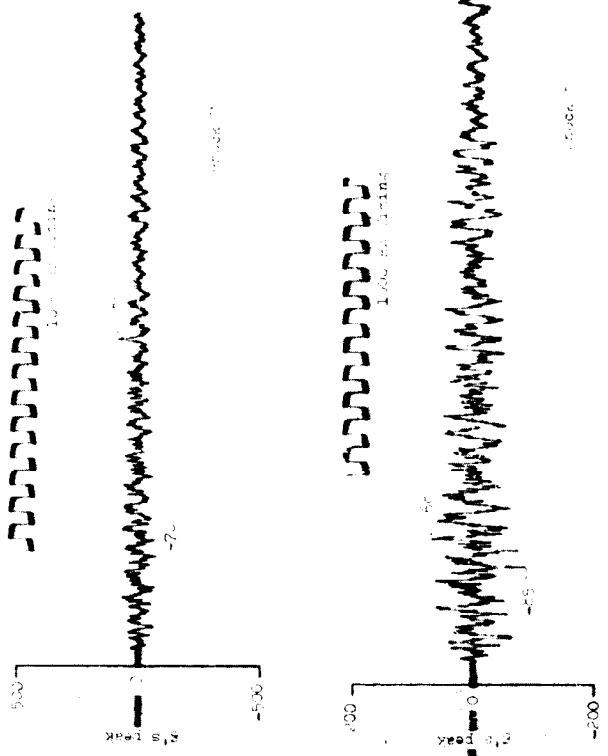
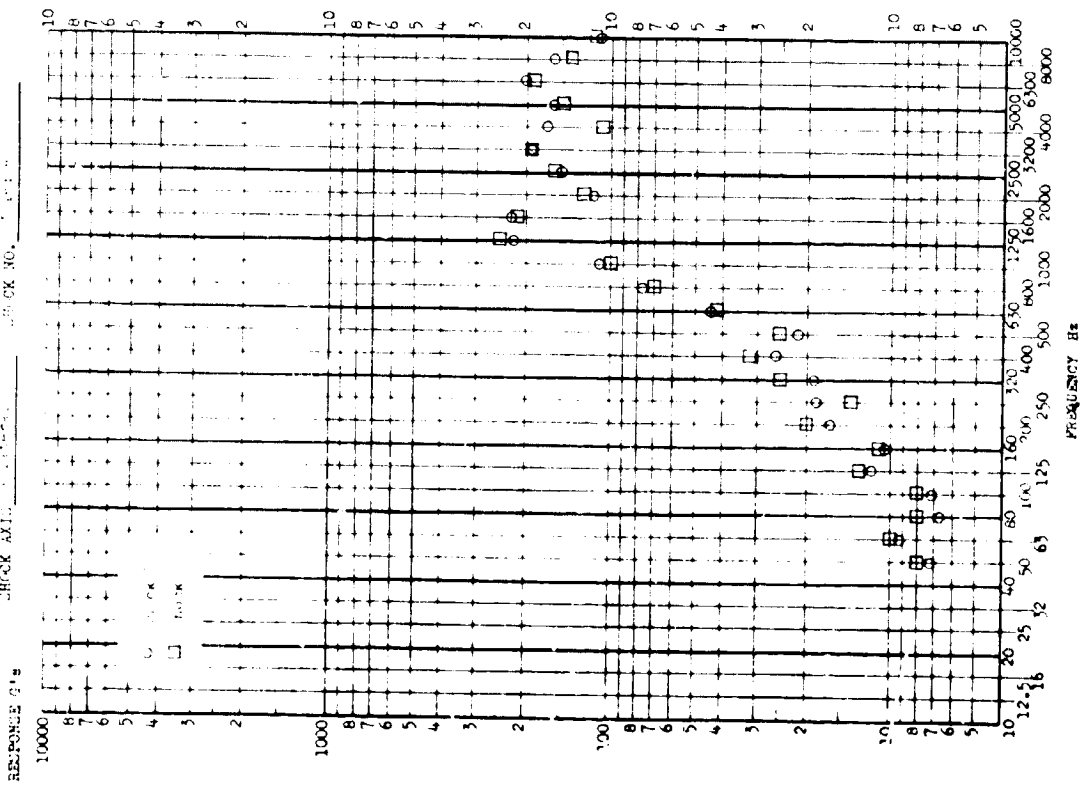


FIGURE 11.8.1-24

DEPT. OF AGRICULTURE
 SPECIAL INVESTIGATION
 WASHINGTON, D. C.
 REPORT E-24
 1:0000
 10-100
 100
 100

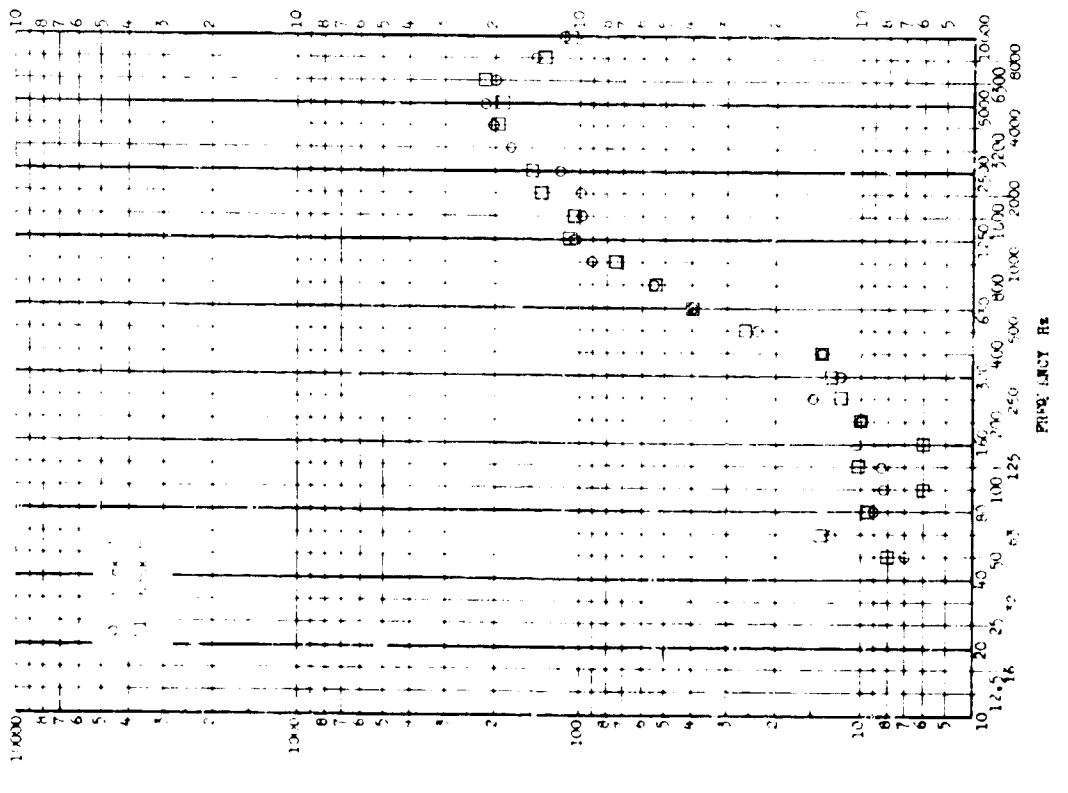
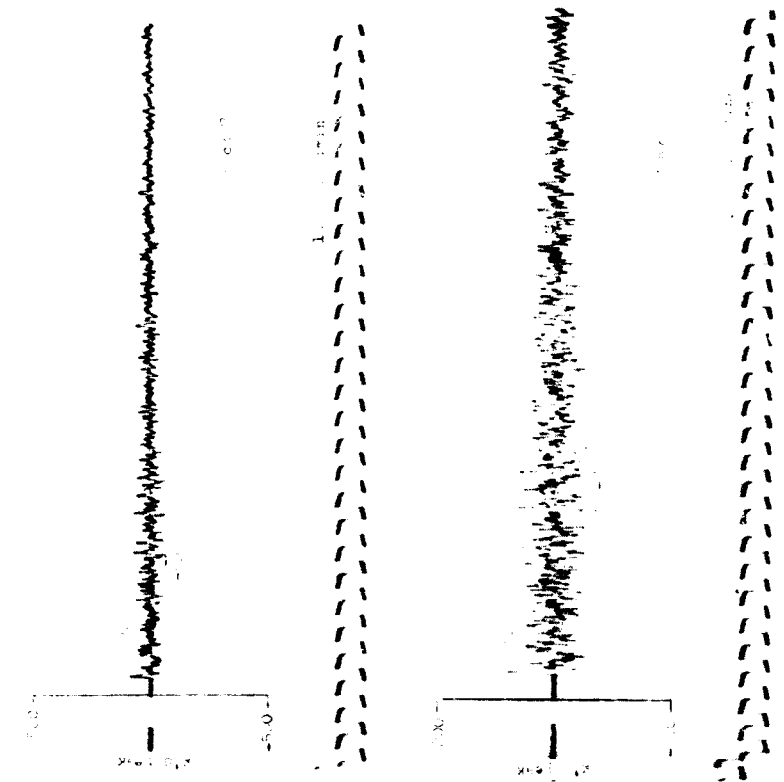


FIGURE I.I.B.1-25

TEST ITEM Identification: PAGE 5

SERIAL N. DATE

SHOCK ACC. EXP. NO.

SHOCK NO.

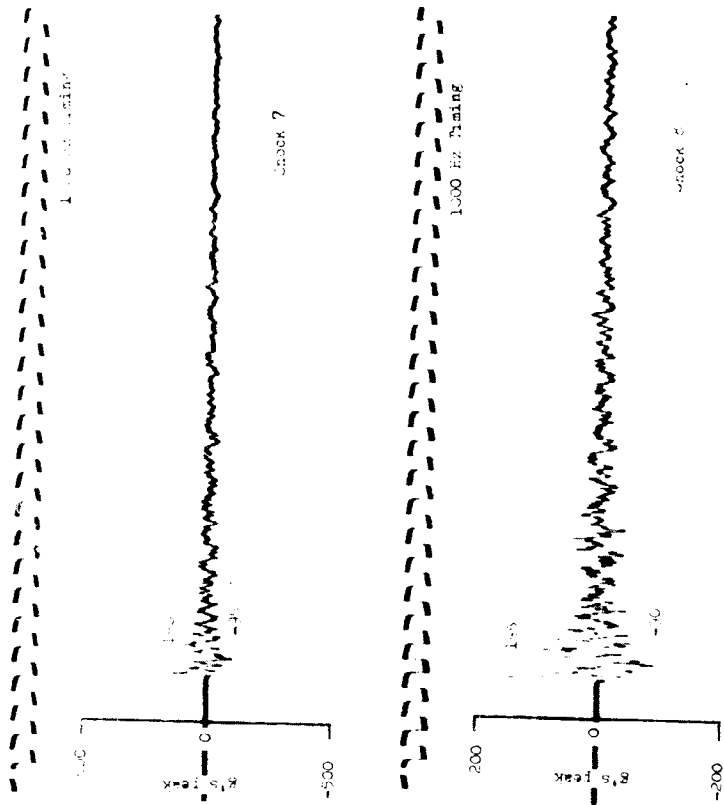
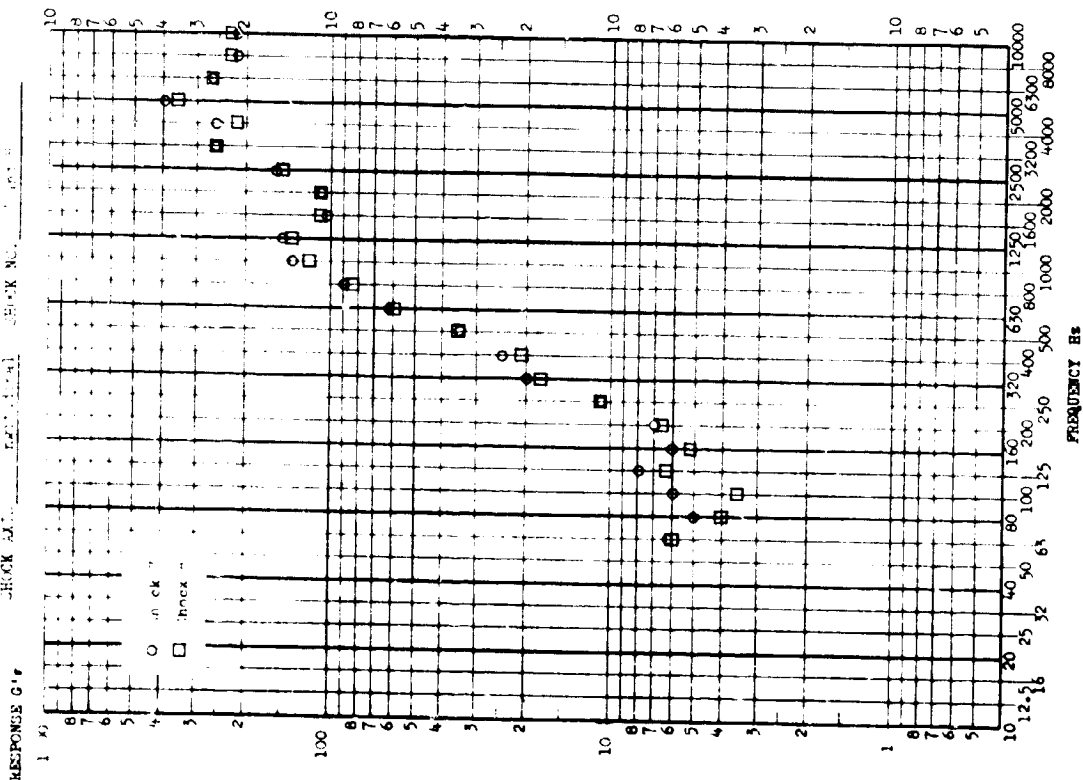


FIGURE 11.B.1-26

TEST ITEM: 2025-10-1-1 DATE: 10/1/57
 DRAWING NO.: 10-1-1 WORK NO.: 10-1-1

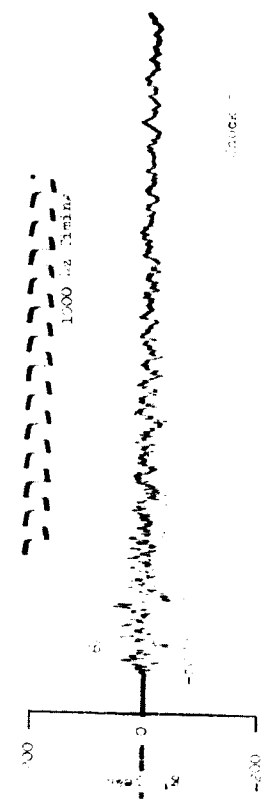
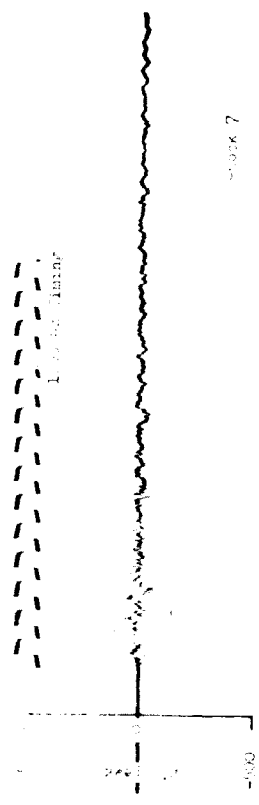
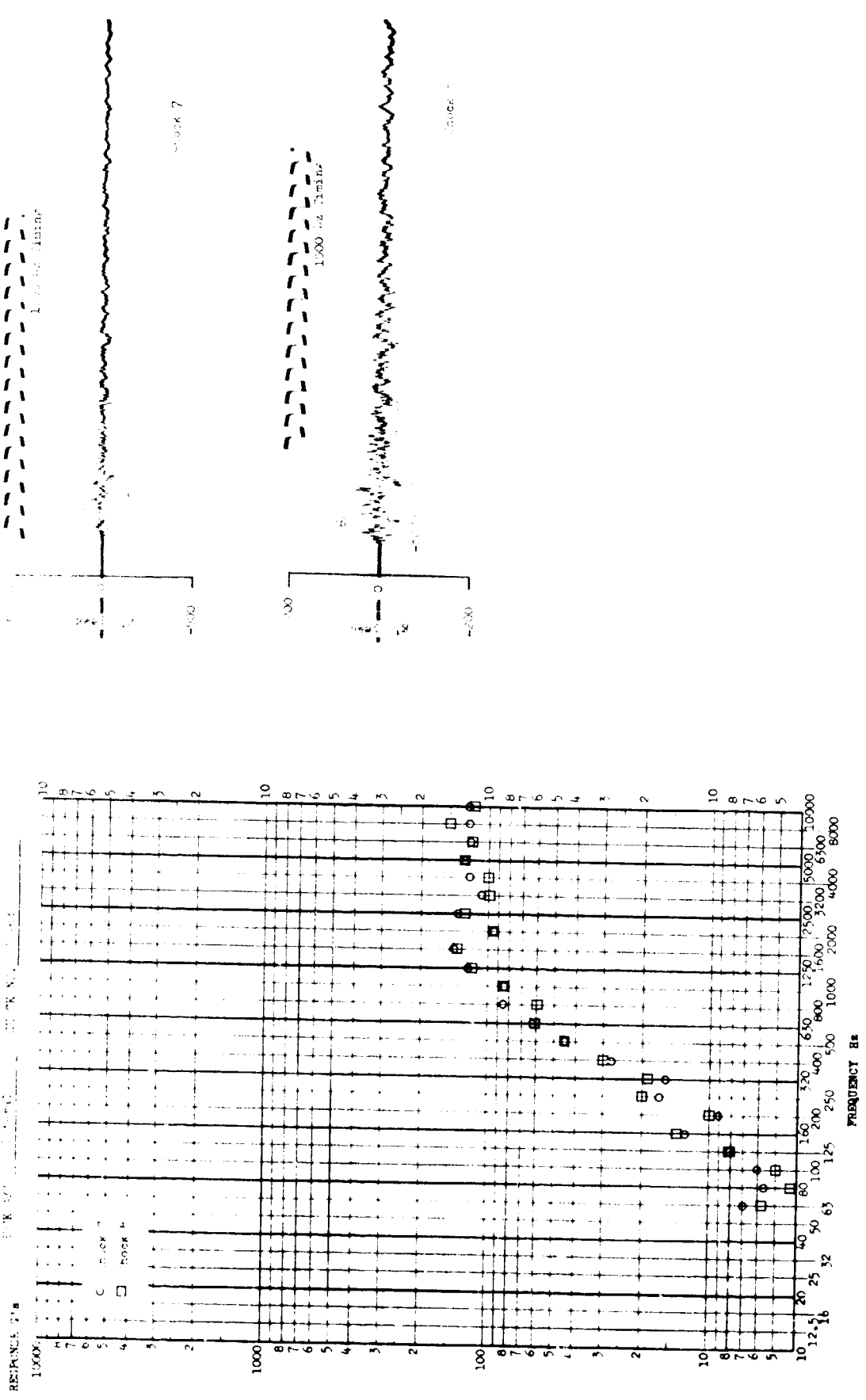


FIGURE 11.B.1-27

TEST ITEM: CONVERSION PART NO.
 SERIAL NO. DATE:
 REF. NO. WORK NO.

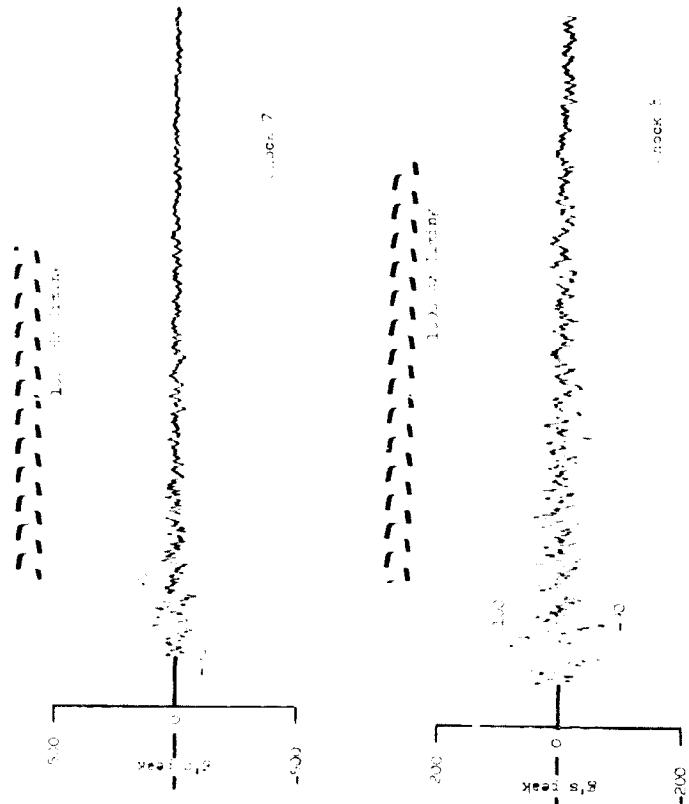
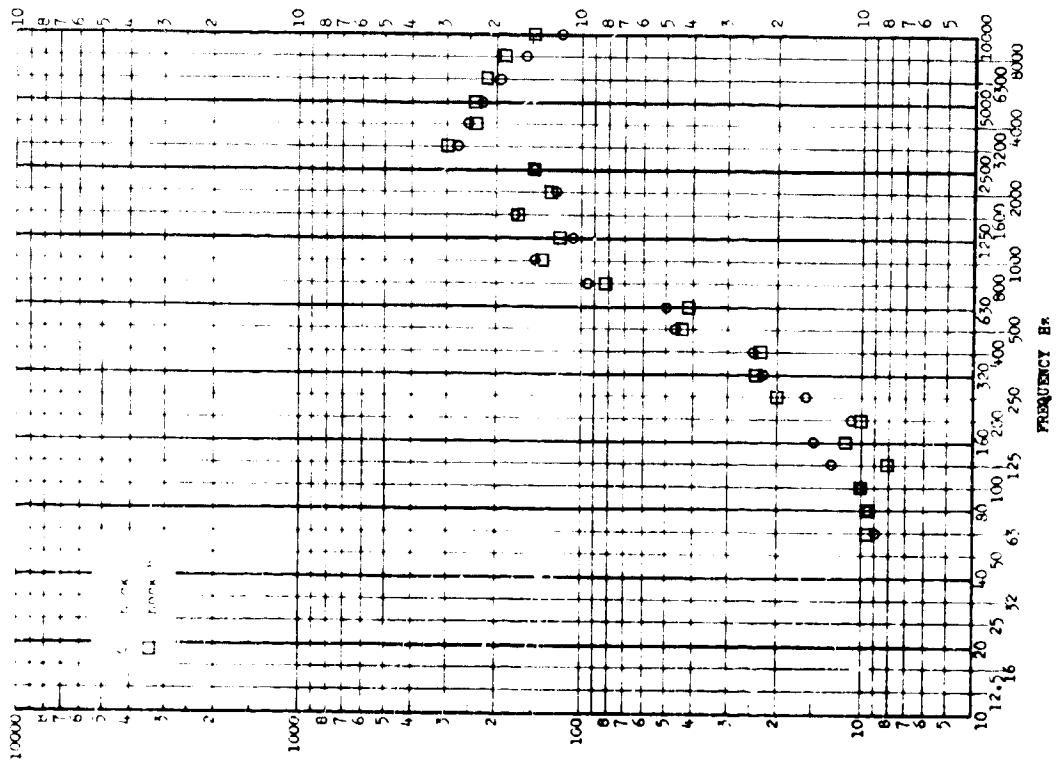


FIGURE II.B.1-28

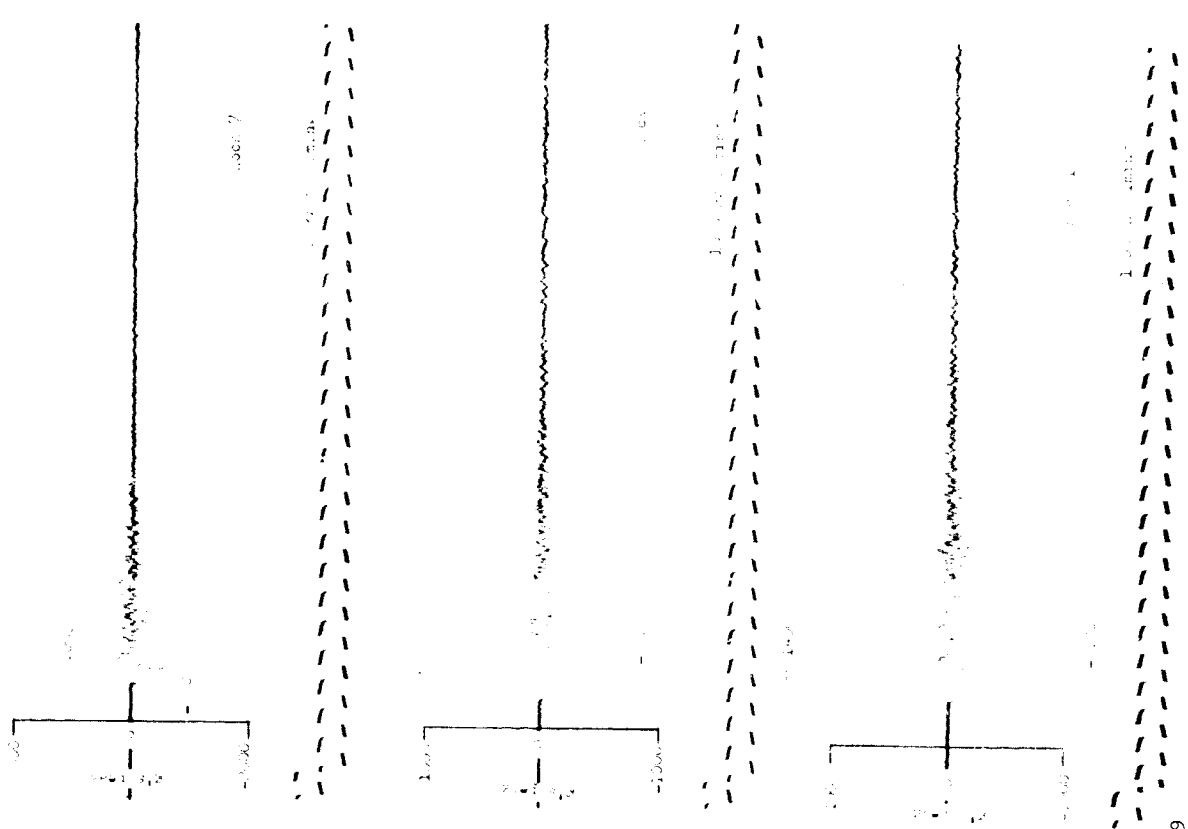
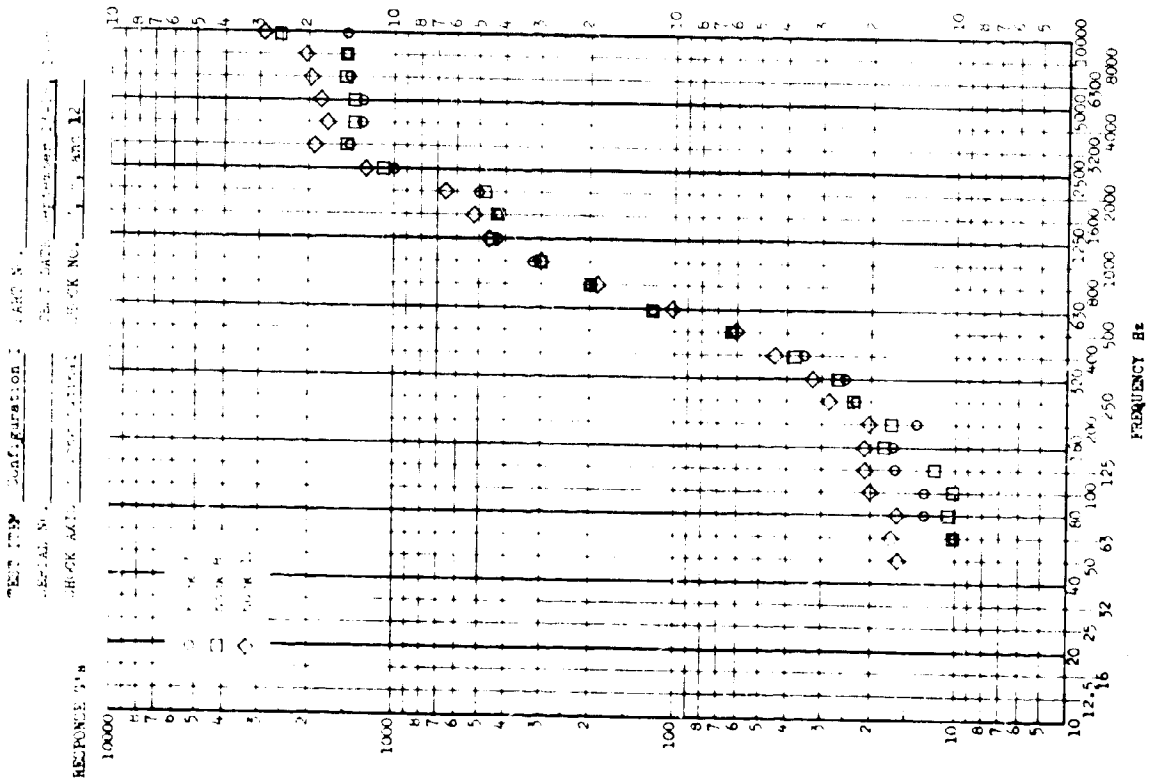


FIGURE 11.B.1-29

TEST ITEM Configuration I
 SERIAL No. SEP LATE September 1954
 SHOCK NO. 7, 8, and 12

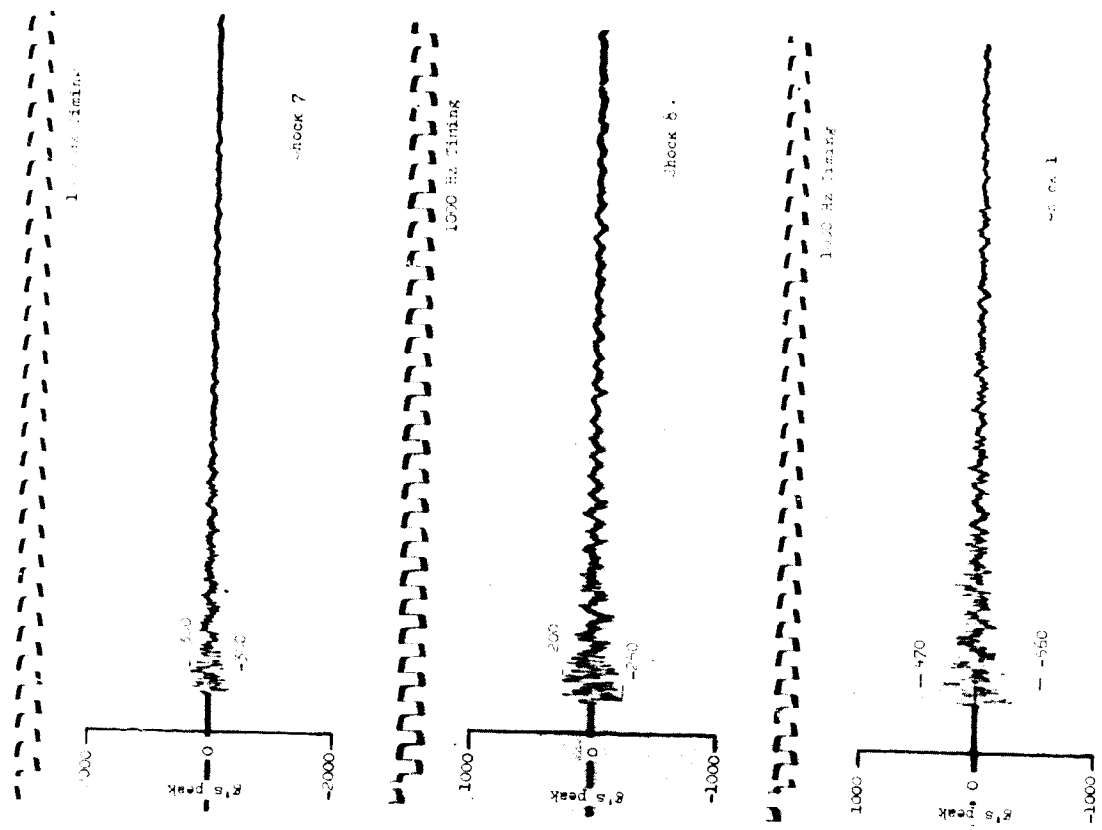
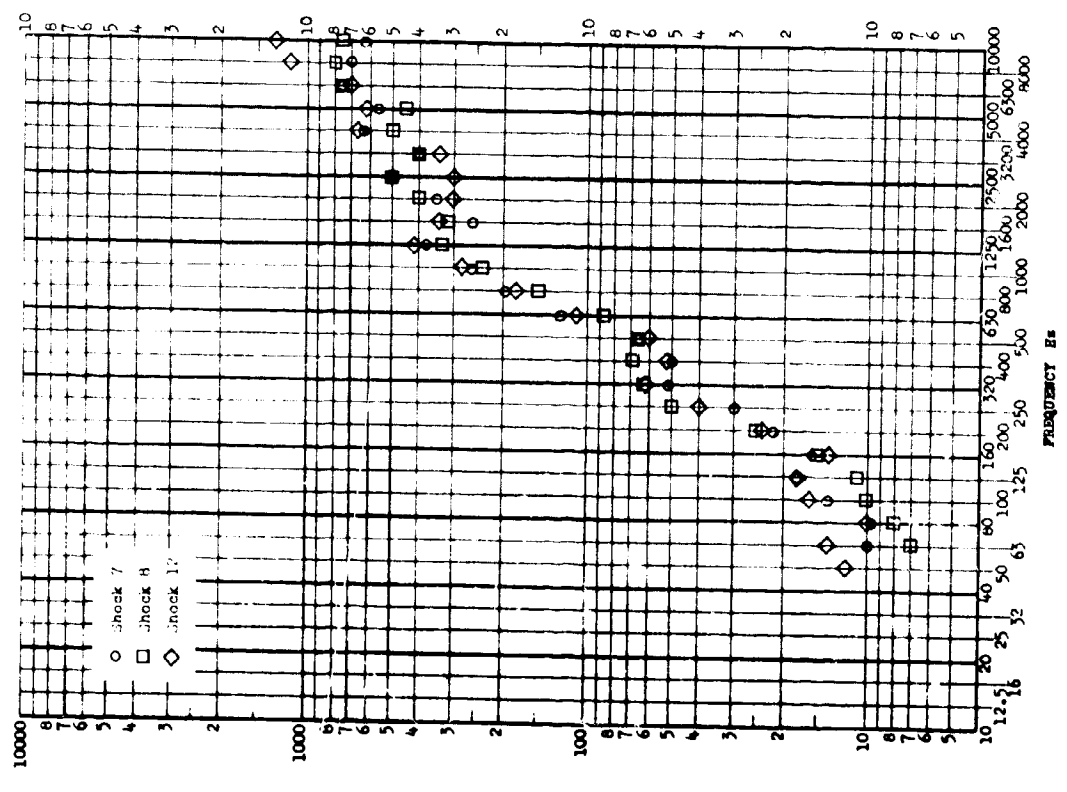


FIGURE 11.B.1-30

TEST BY: CONFIDENTIAL 1000 S.
 SERIAL NO.: 7517
 CHECK BY: WATERBURY WORK NO.: 1000

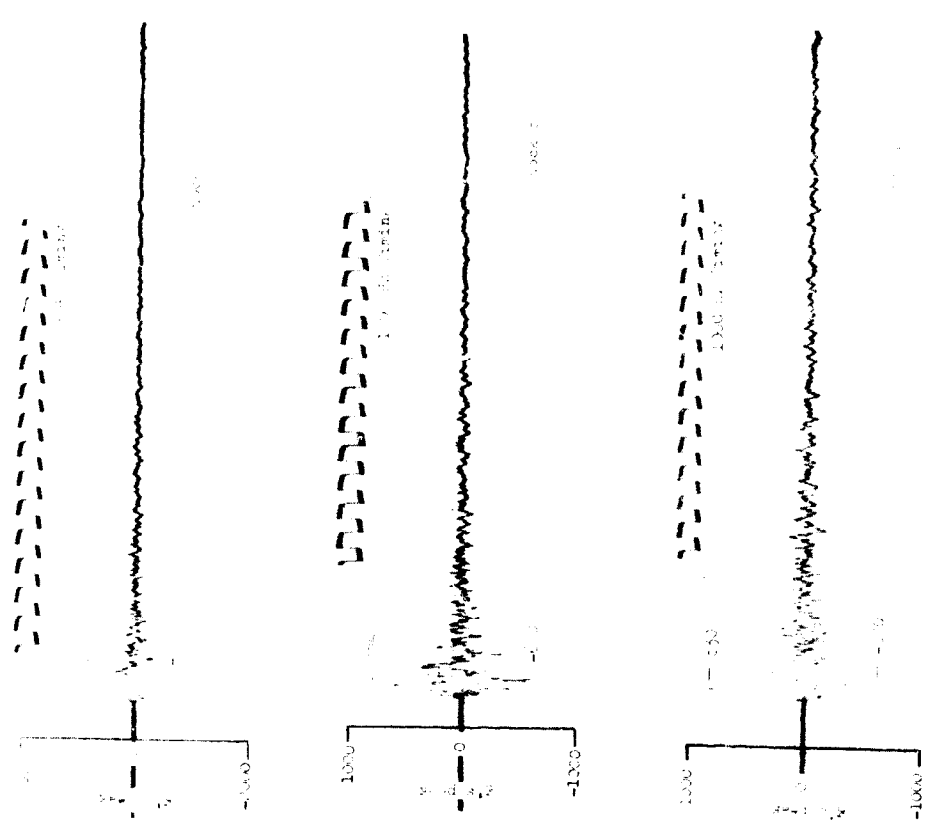
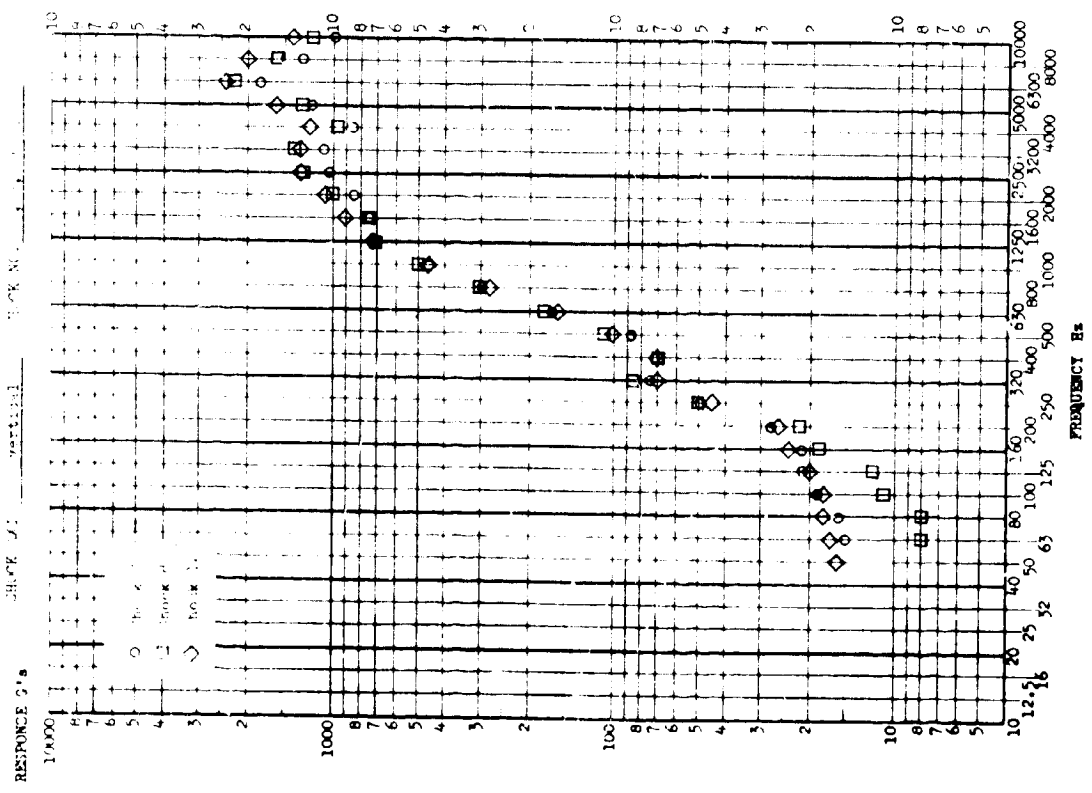


FIGURE 11.B.1-31

TEST ITEM CONFIGURATION: PART 5
 SERIAL NO.: 10000000000000000000
 CHECK NO.: 00000000000000000000

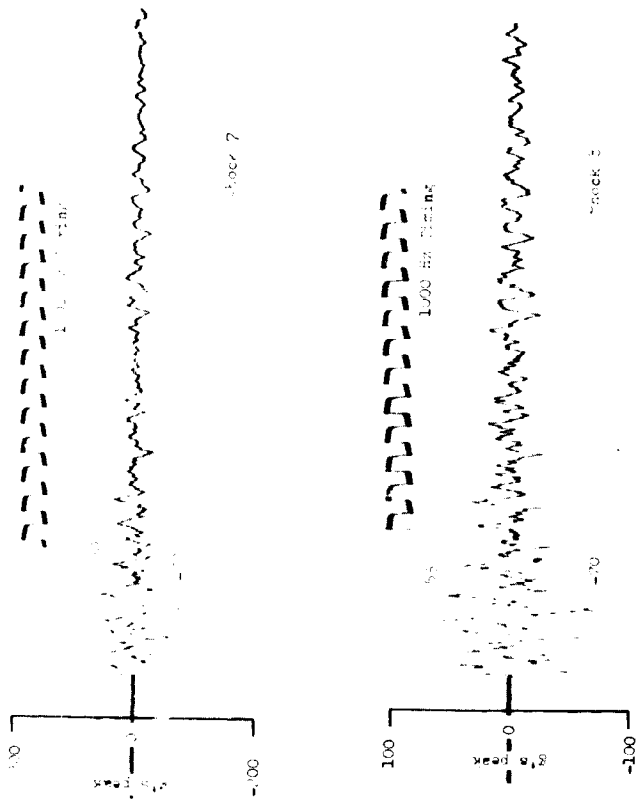
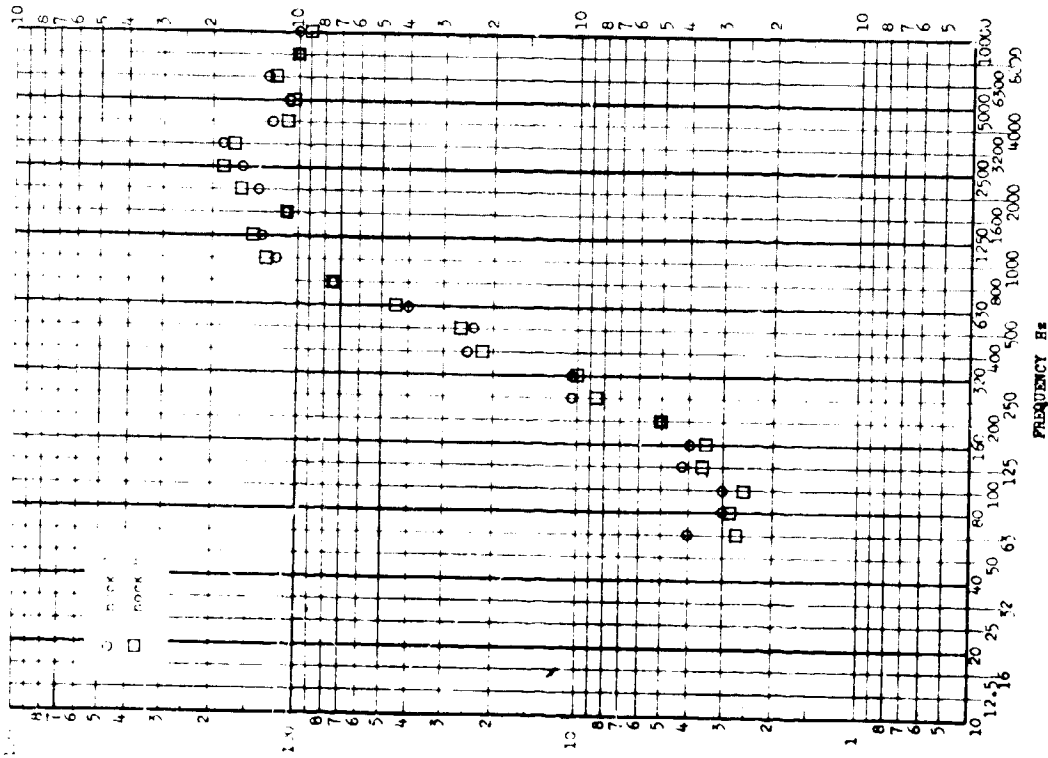


FIGURE II.8.1-32

TEST ITEM CONFIDENTIAL I PART NO. _____
 SERIAL NO. _____ PLANT DATE: September 14, 1968
 SHOCK AX 10 _____ SHOCK NO. _____

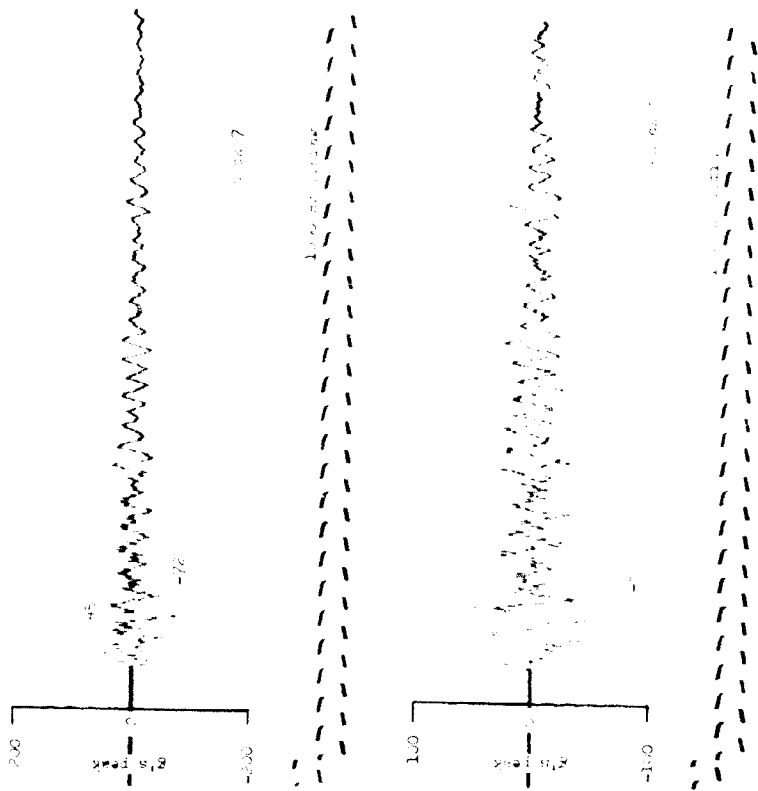
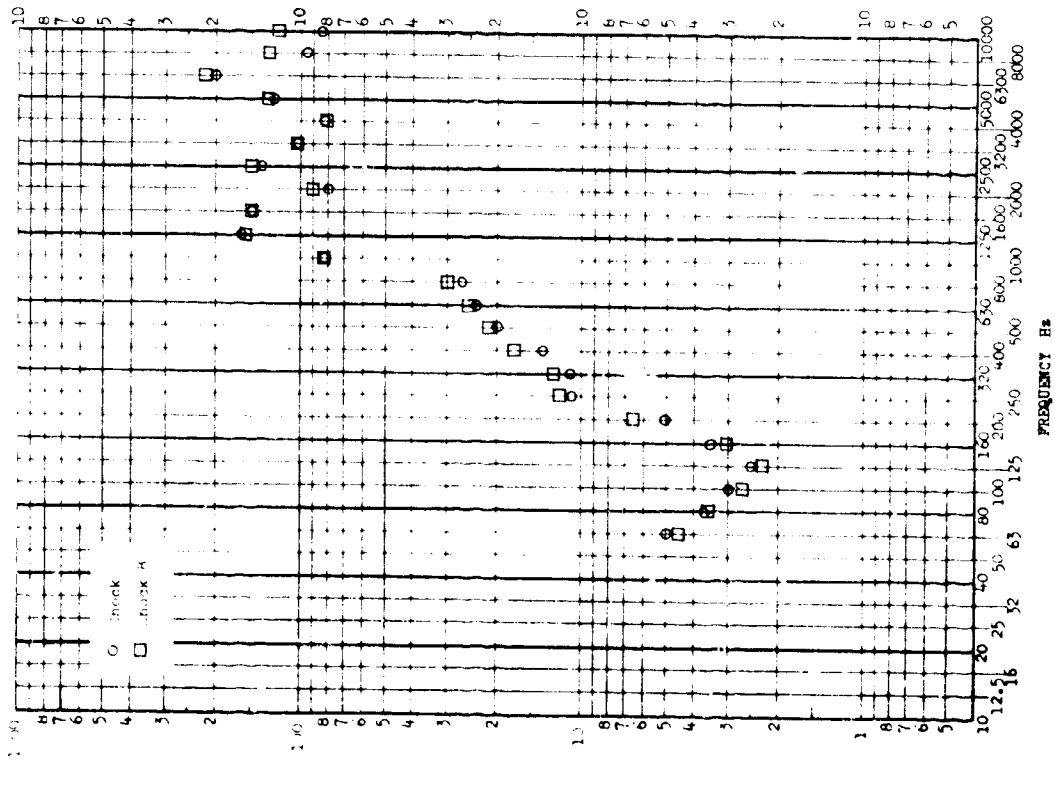


FIGURE 11.9.1-33

TEST ITEM: [REDACTED]
 SERIAL NO.: [REDACTED]
 CHECK NO.: [REDACTED]

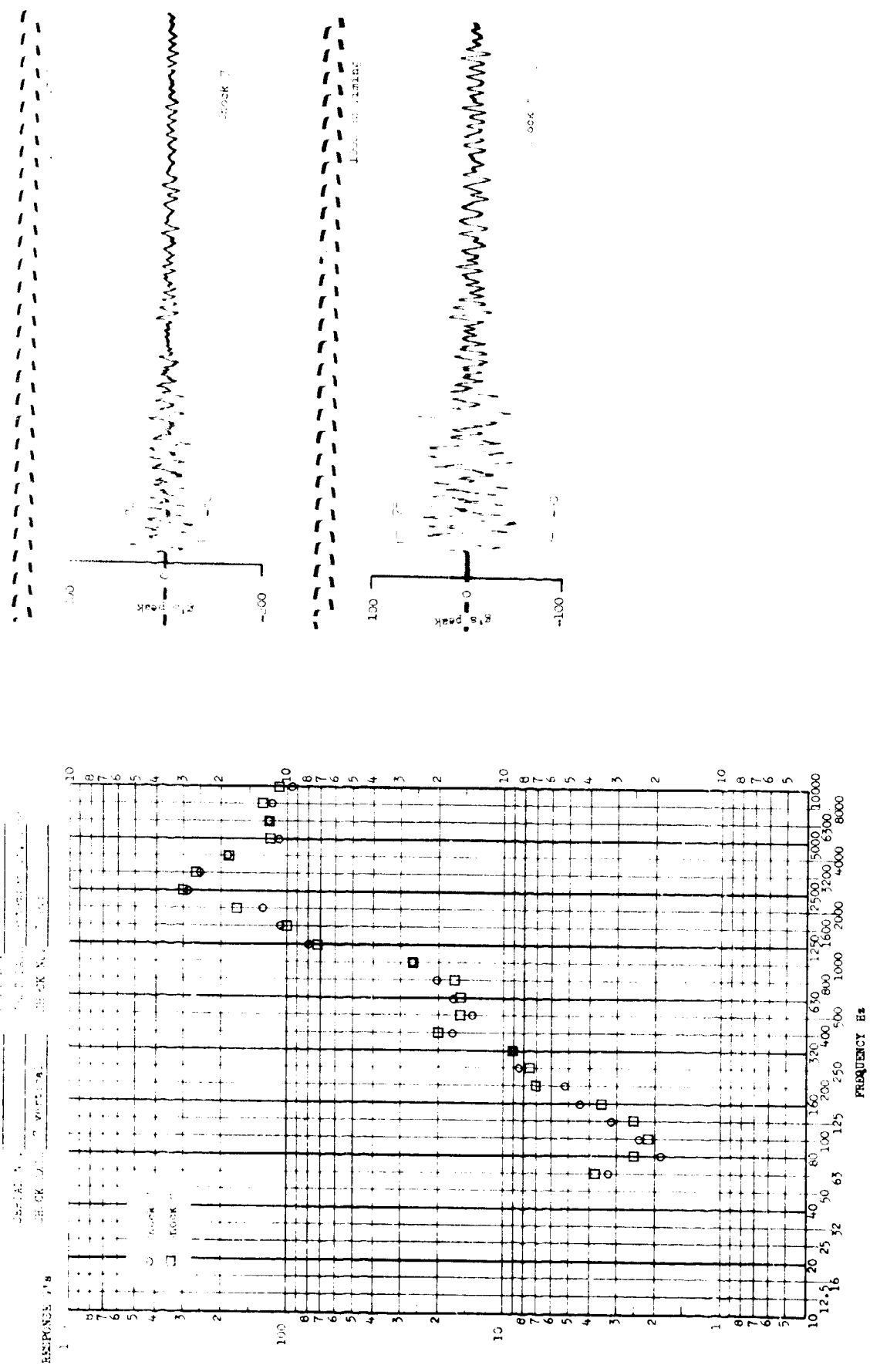


FIGURE II.B.i-34

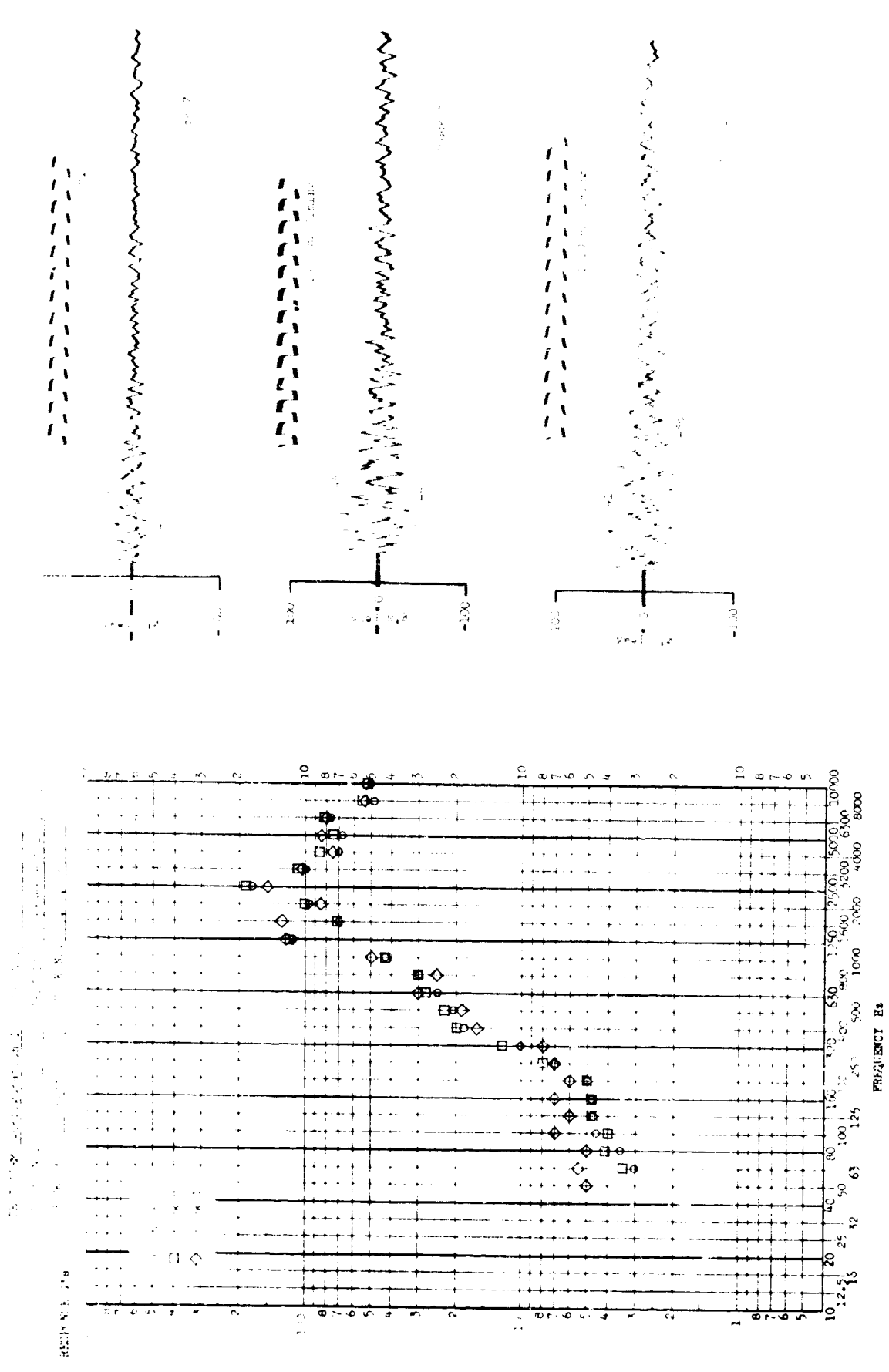


FIGURE II.B.1-35

TEST TYPE: Configuration I PART NO. _____
 SERIAL NO. _____ TEST DATE: September 11, 1969
 SHOCK AXIS: Lateral SHOCK NO.: 1, 8, and 17

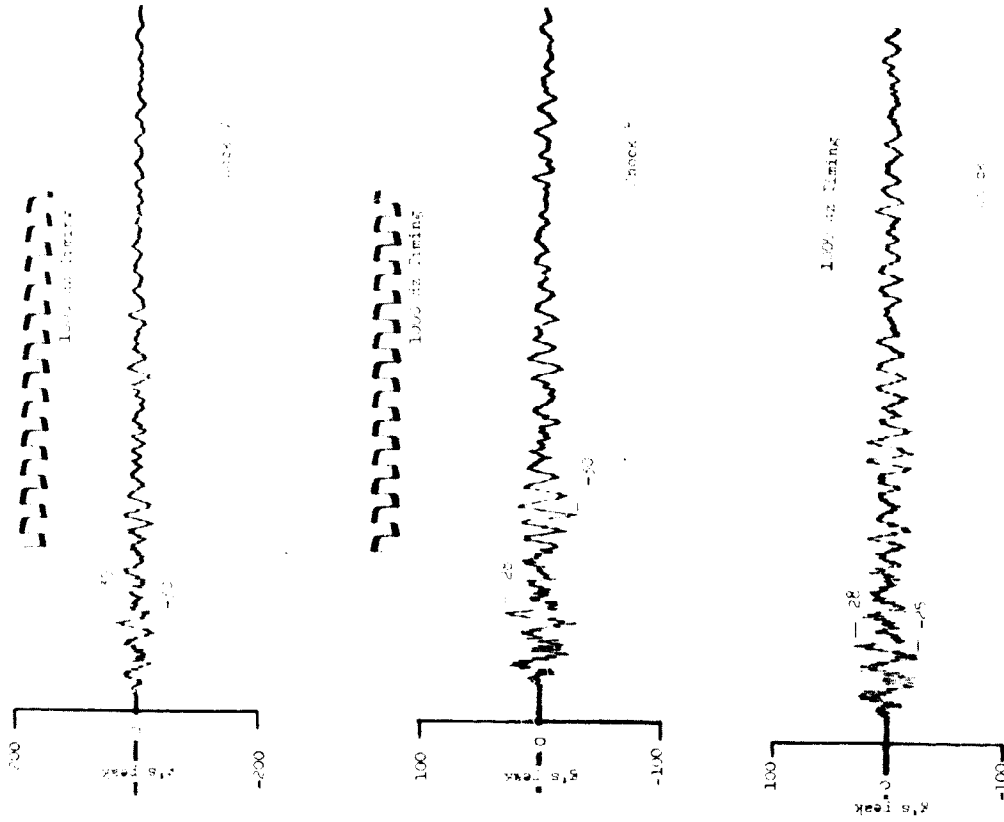
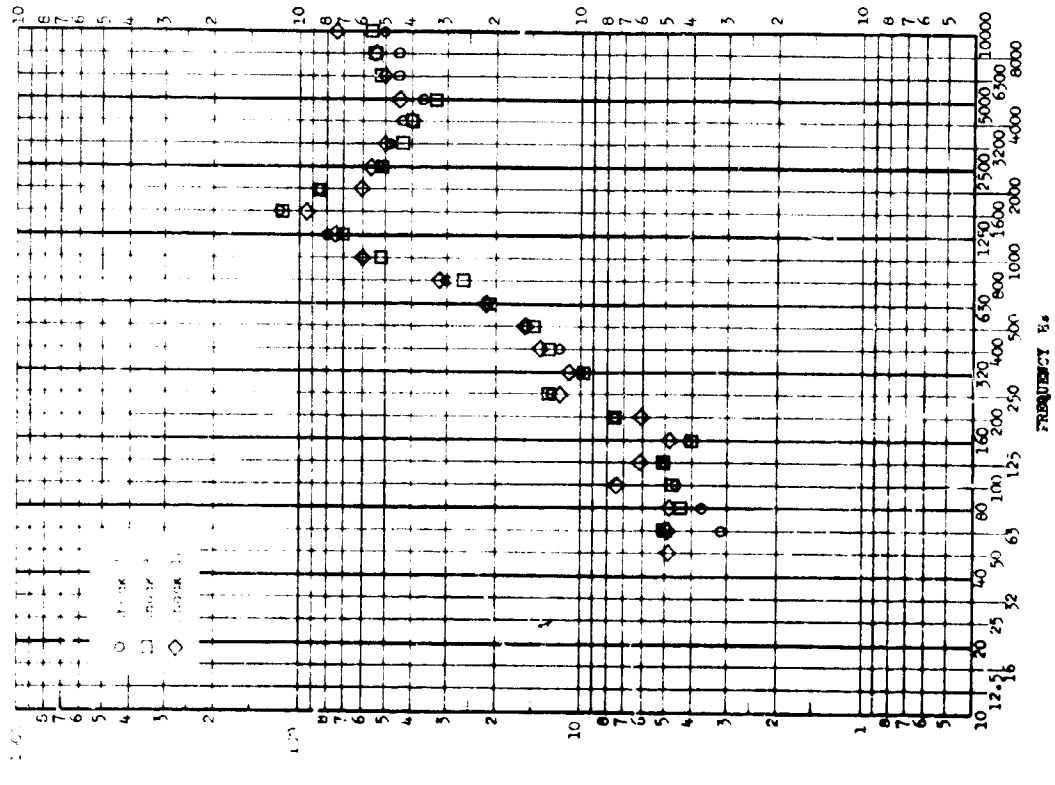


FIGURE II.B.1-36

PAGE NO. _____
 TEST NO. _____

TEST ITEM _____
 PART NO. _____
 SERIAL NO. _____
 CHECK NO. _____

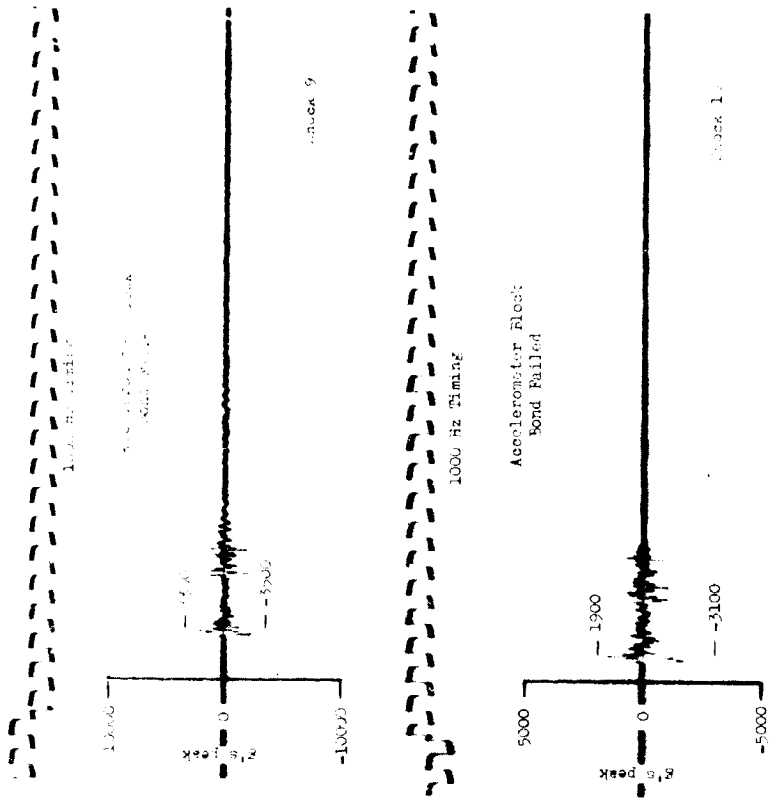
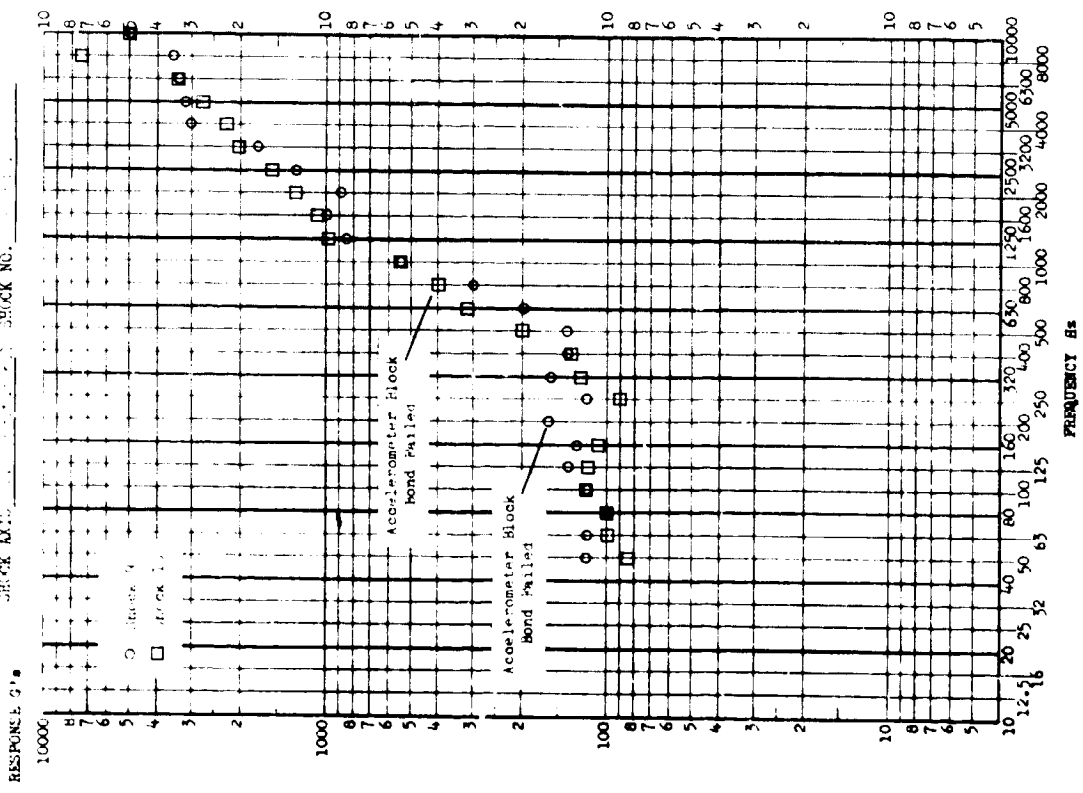


FIGURE II.B.1-38

REPORT NO. 118
 PROJECT NO. 118
 DATE 11/1/54

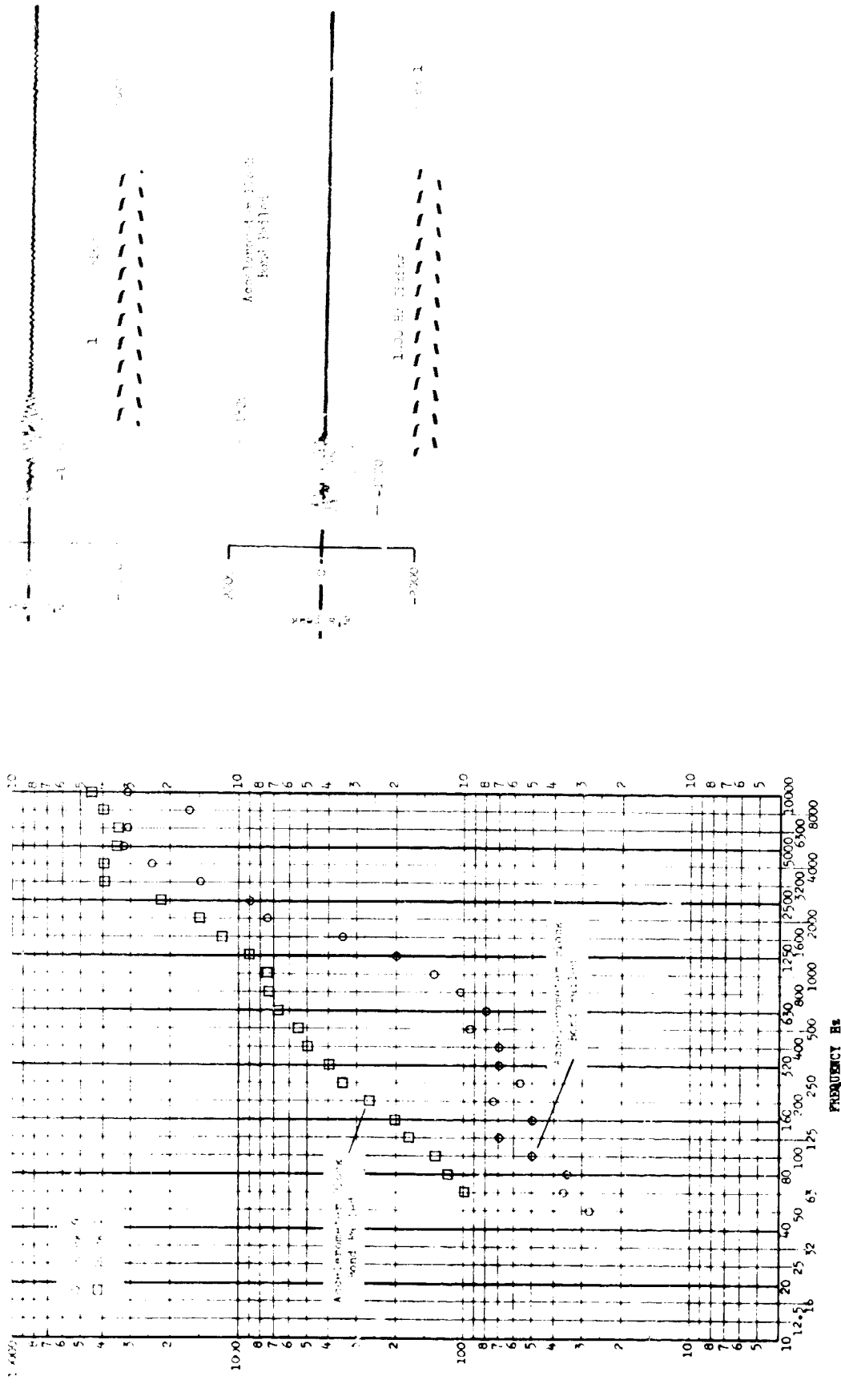


FIGURE 11.8.1-29

PAGE NO. _____
 TEST NO. _____

TEST ITEM _____ PART N. _____
 SERIAL N. _____ TEST DATE _____
 CHECK MARK _____ CHECK NO. _____

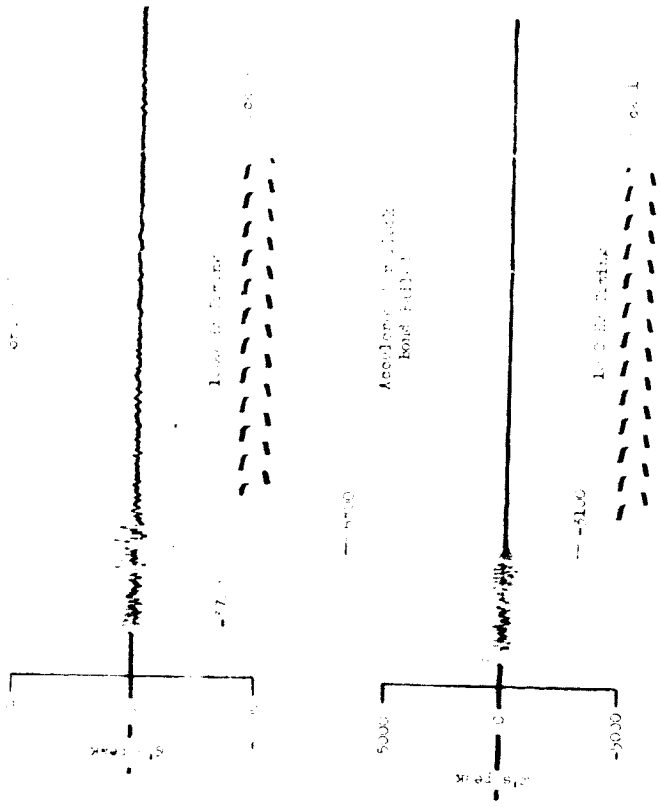
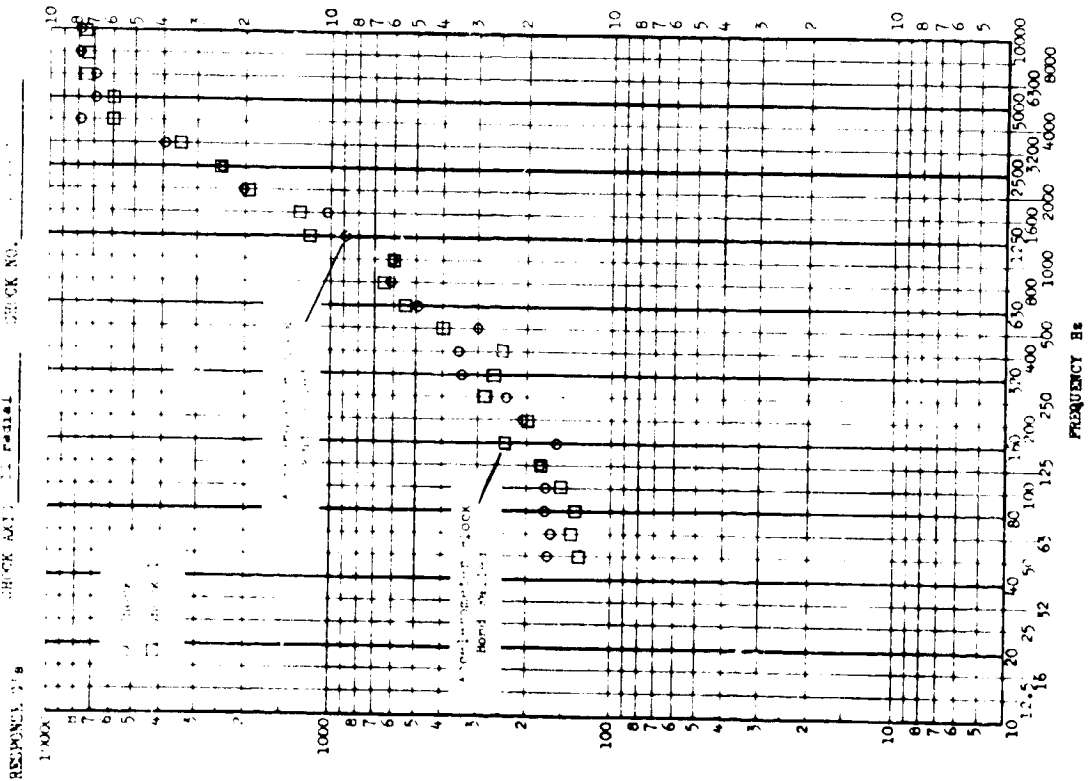


FIGURE 11.B.1-40

PAGE NO. _____
 TEST NO. _____

TEST ID: _____
 PART NO.: _____
 SERIAL NO.: _____
 CHECK NO.: _____

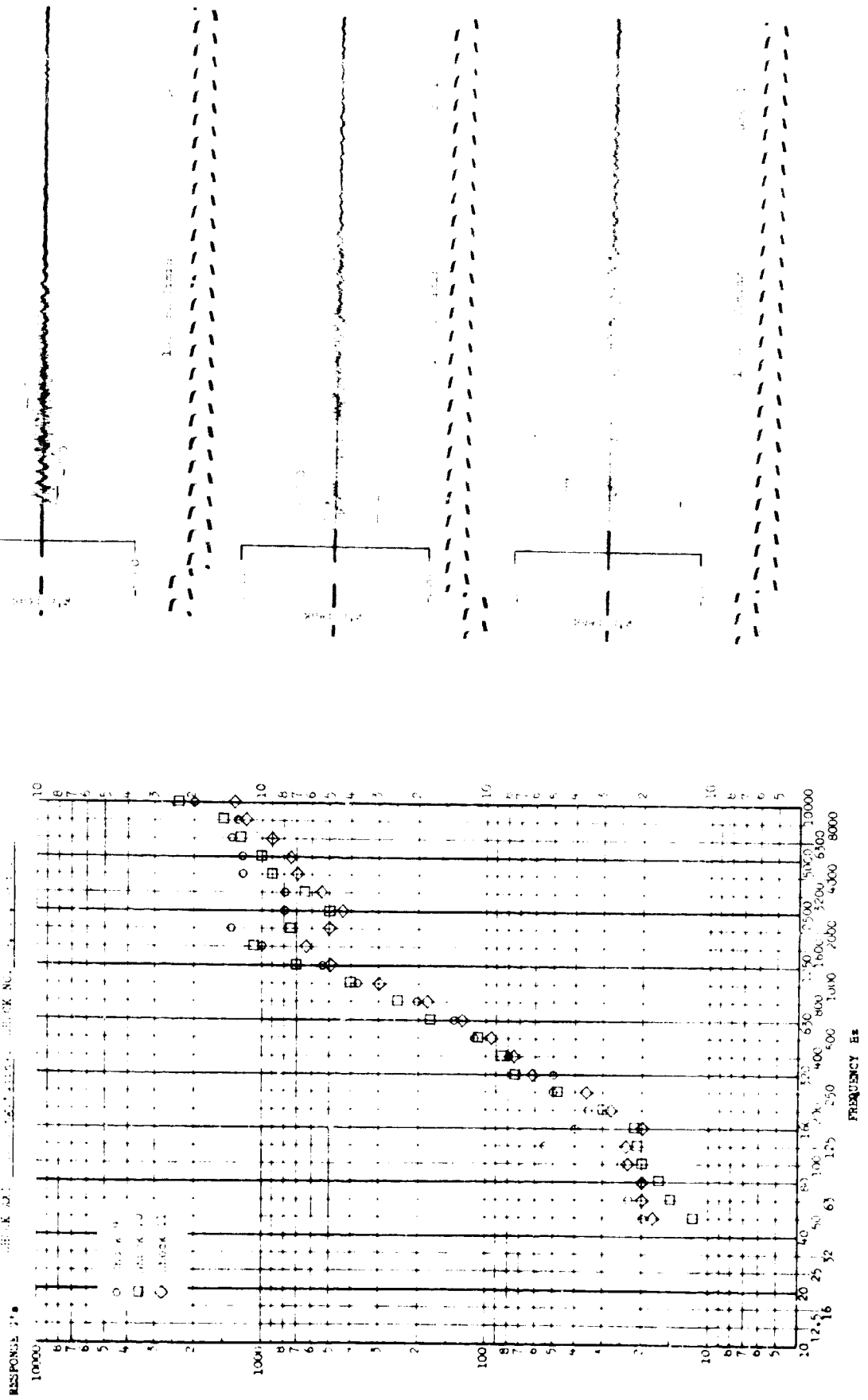
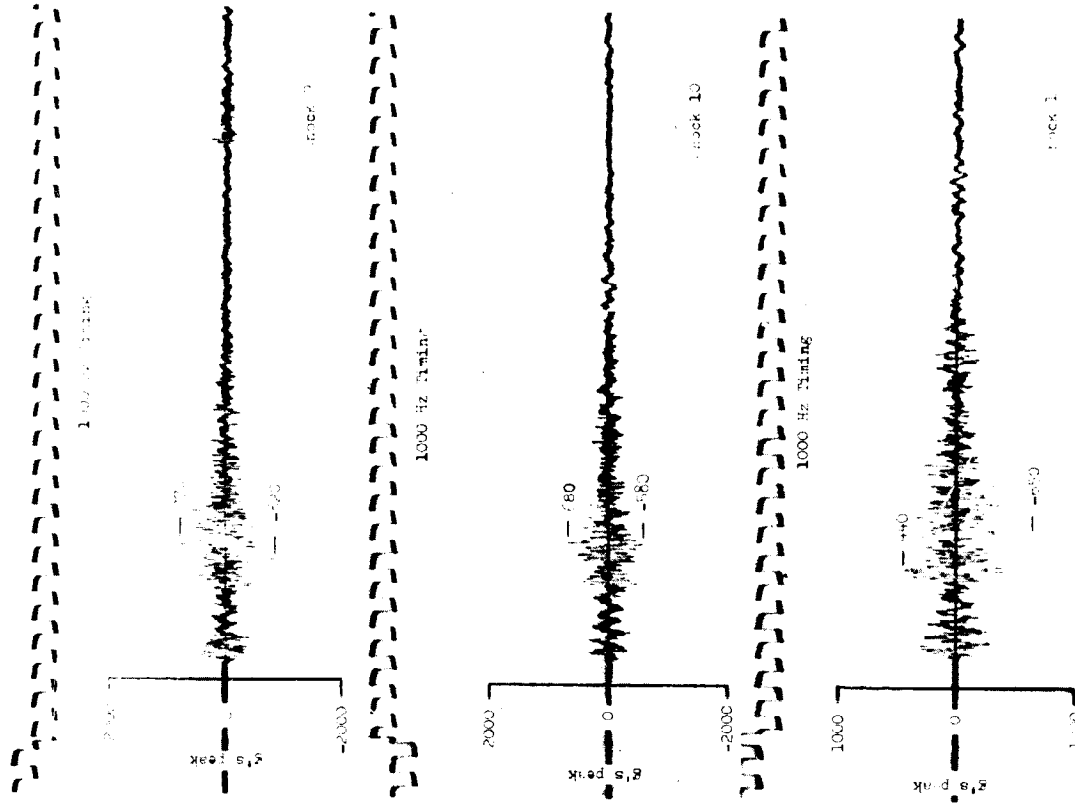
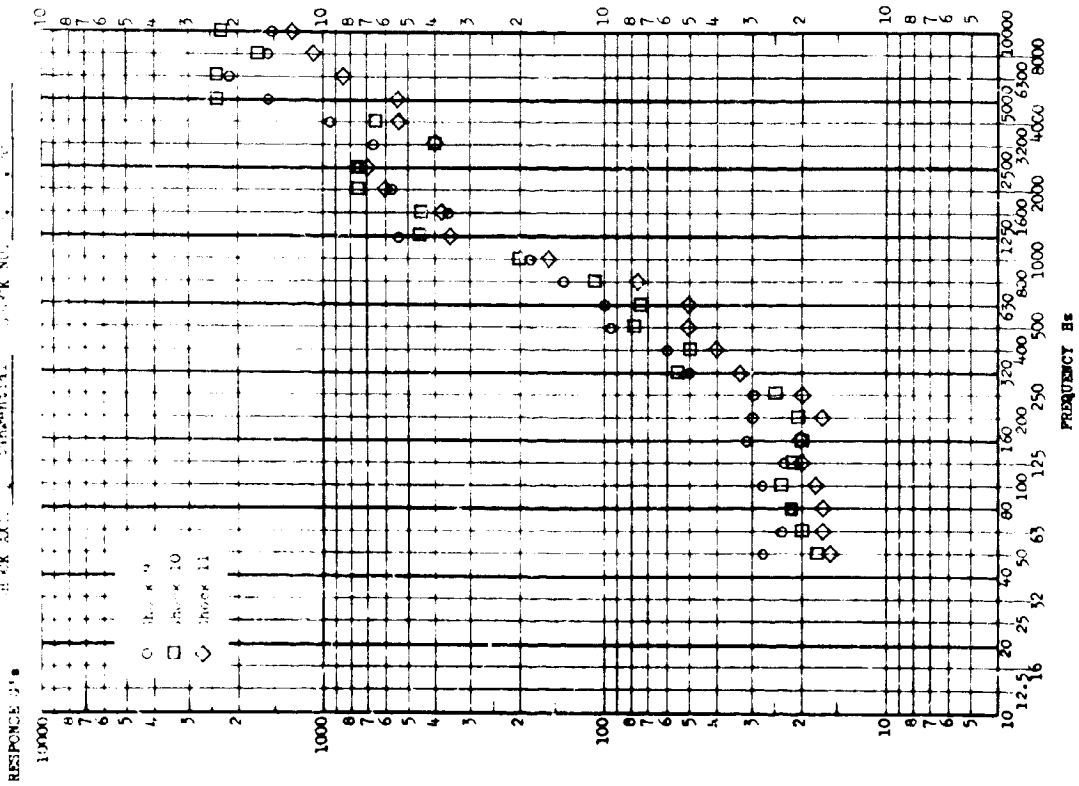


FIGURE 11.8.1-41

TEST ITEM: _____
 SERIAL NO.: _____
 CHECK NO.: _____



TEST NO. _____
 INSTRUMENT NO. _____
 OPERATOR NO. _____
 DATE _____

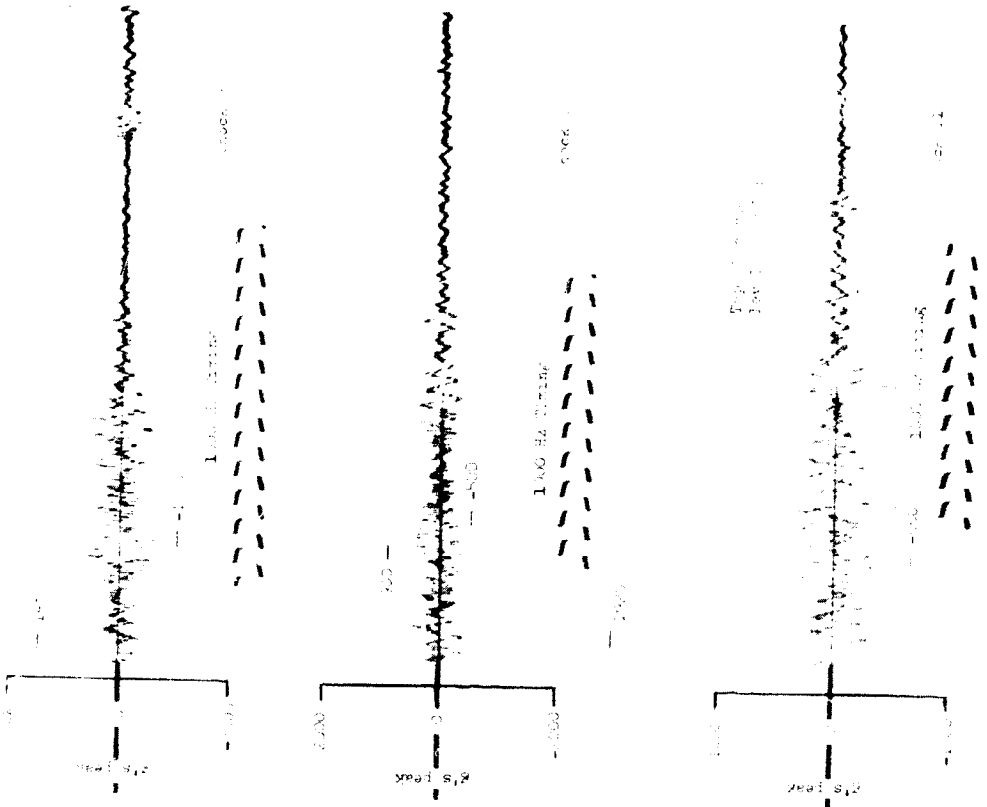
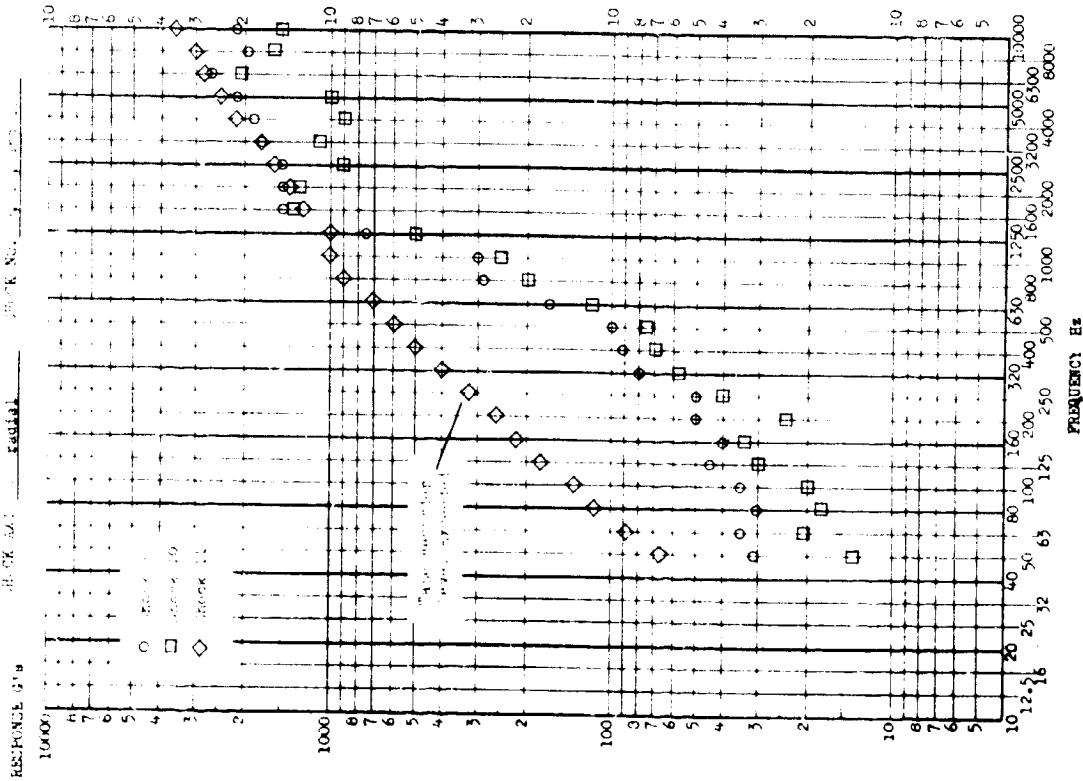


FIGURE 11.B.1-43

PAGE NO. _____
 TEST NO. _____

TEST ITEM CONFIDENTIAL PART NO. _____
 SERIAL NO. _____
 CHECK AND DATE _____
 CHECK NO. _____

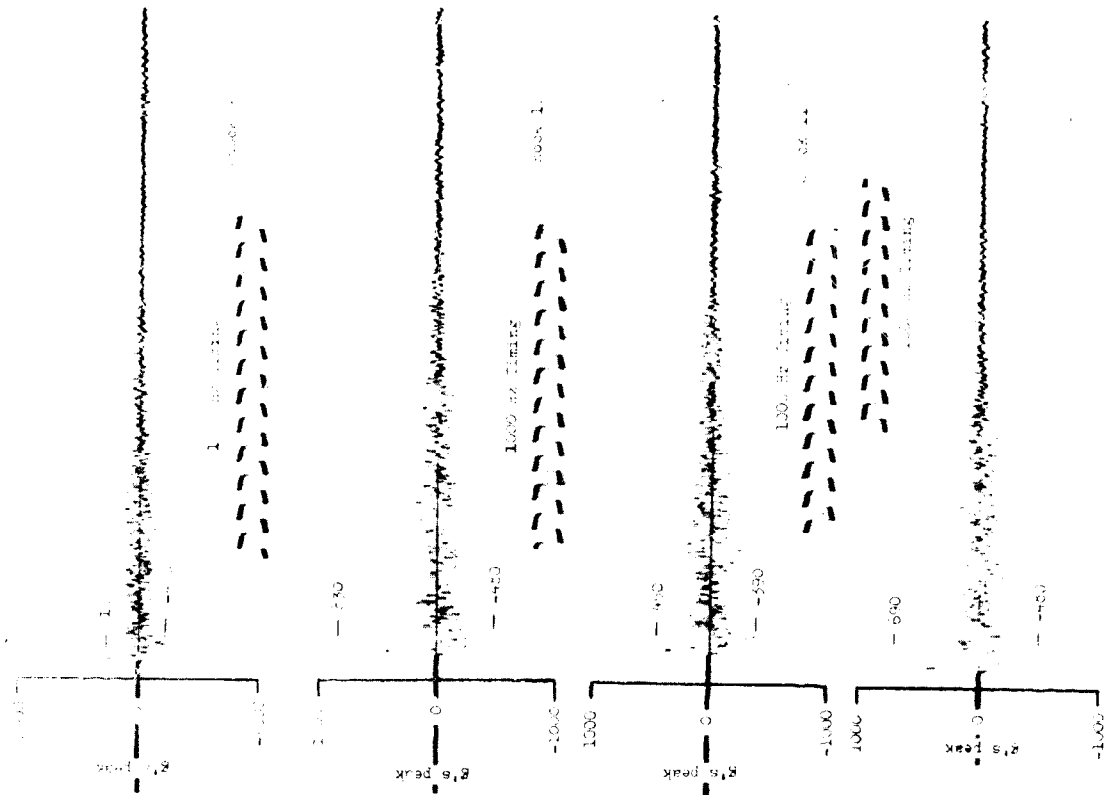
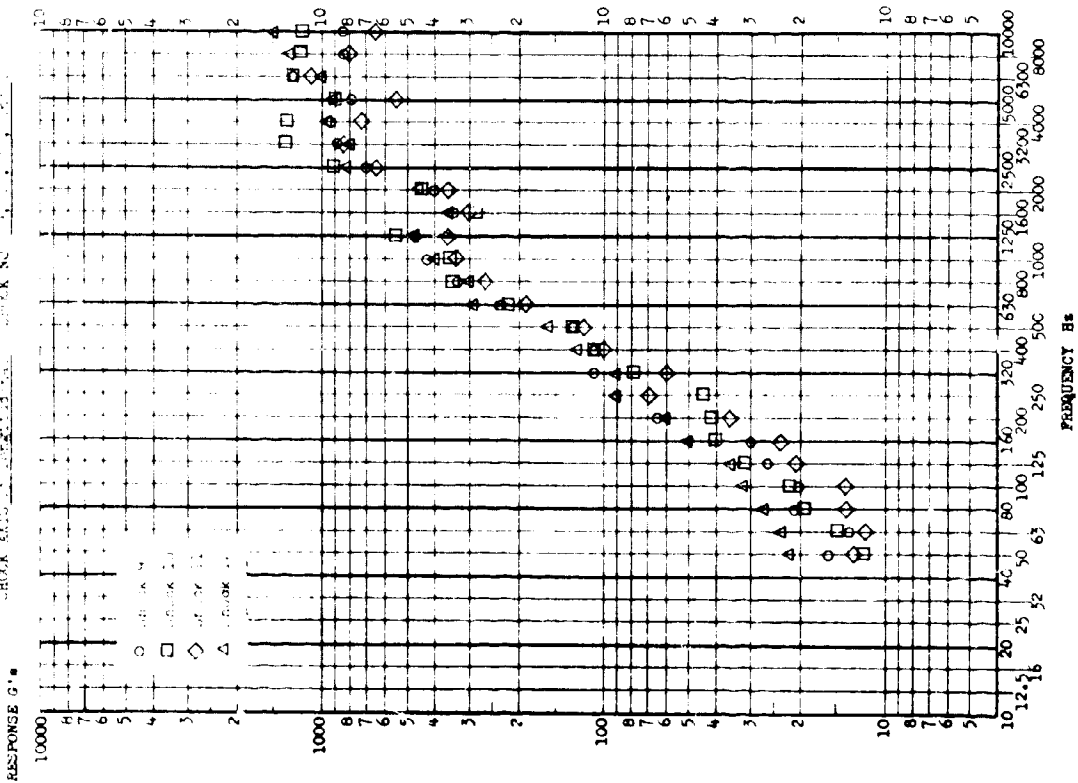


FIGURE 11.B.1-44

PAGE NO. _____
 TEST NO. _____

TEST ITEM: _____
 SERIAL NO. _____
 CHECK DATE: _____

TEST DATE: _____
 CHECK NO.: _____

RESPONSE μV

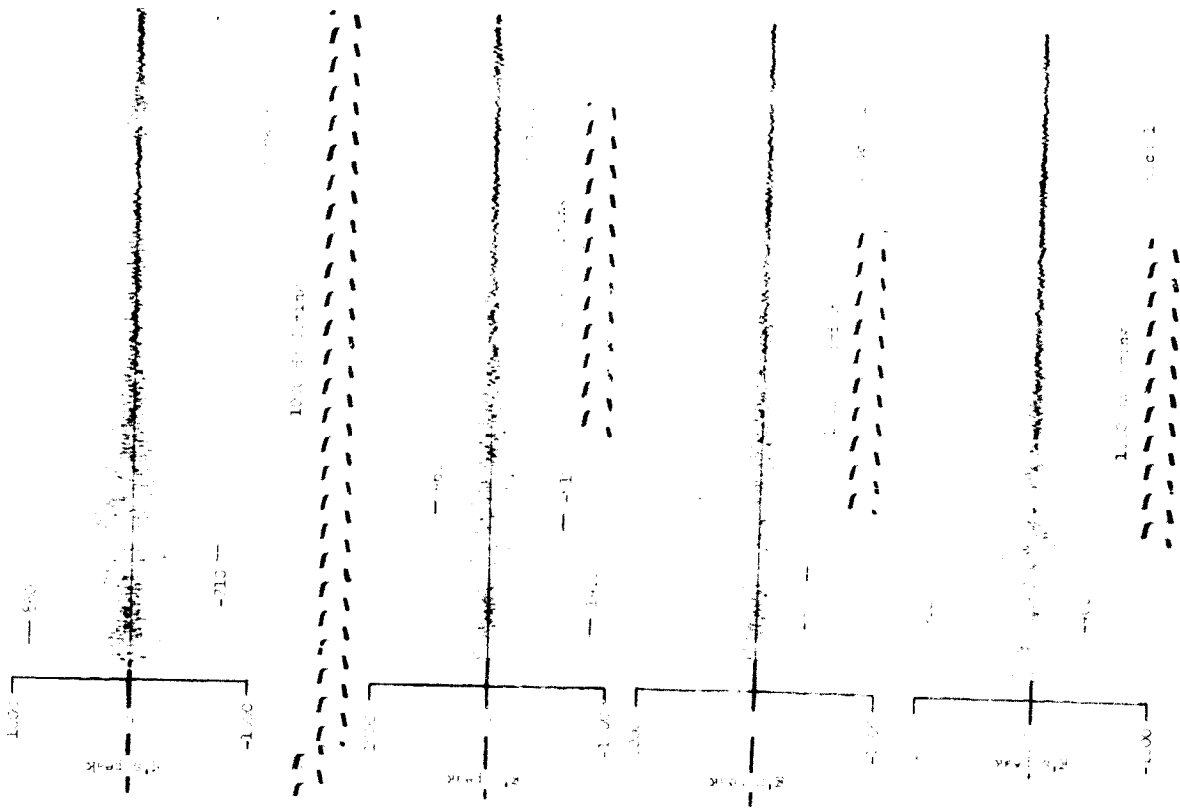


FIGURE II.B.1-45

PAGE NO. _____
 TEST NO. _____

TEST ITEM _____
 SERIAL NO. _____
 CHECK MARK _____

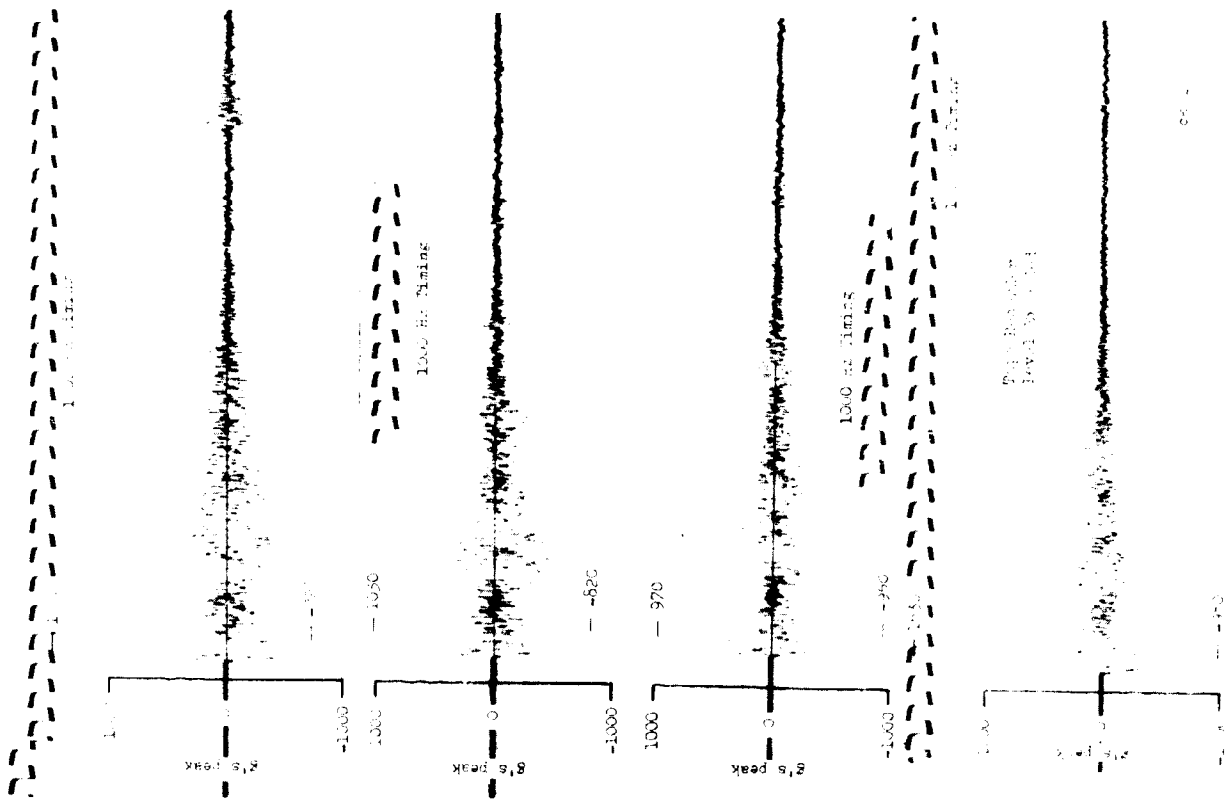
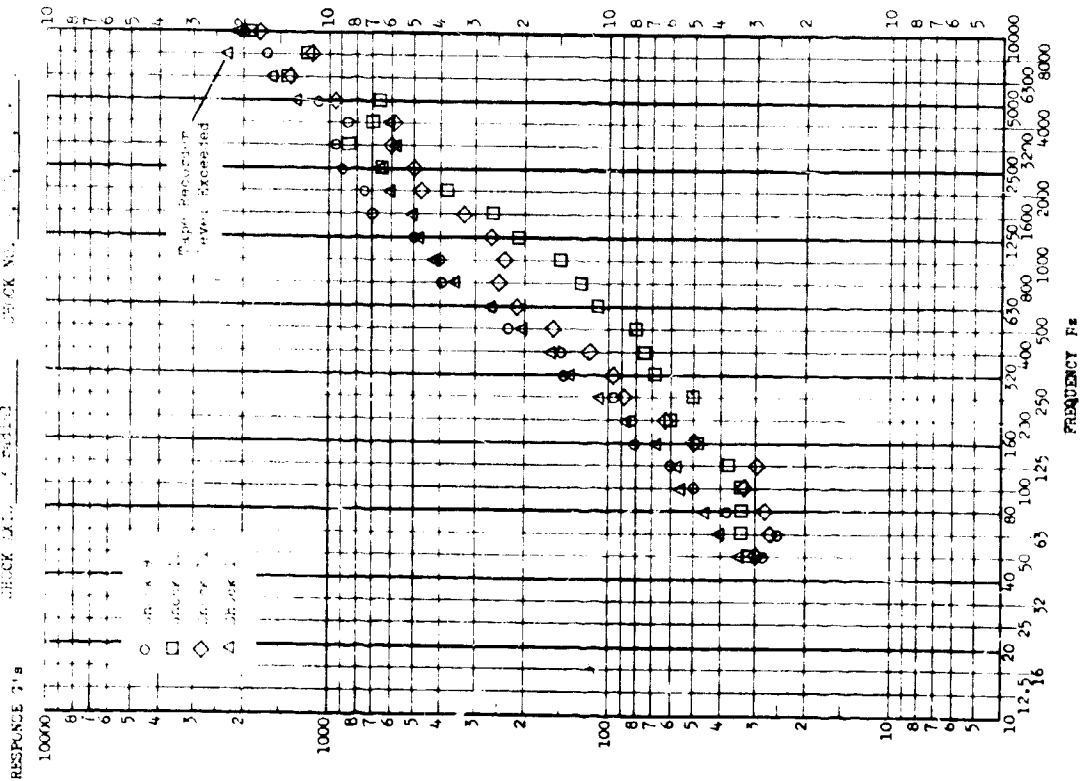


FIGURE 11.B.1-46

DATE: _____
 PAGE NO. _____

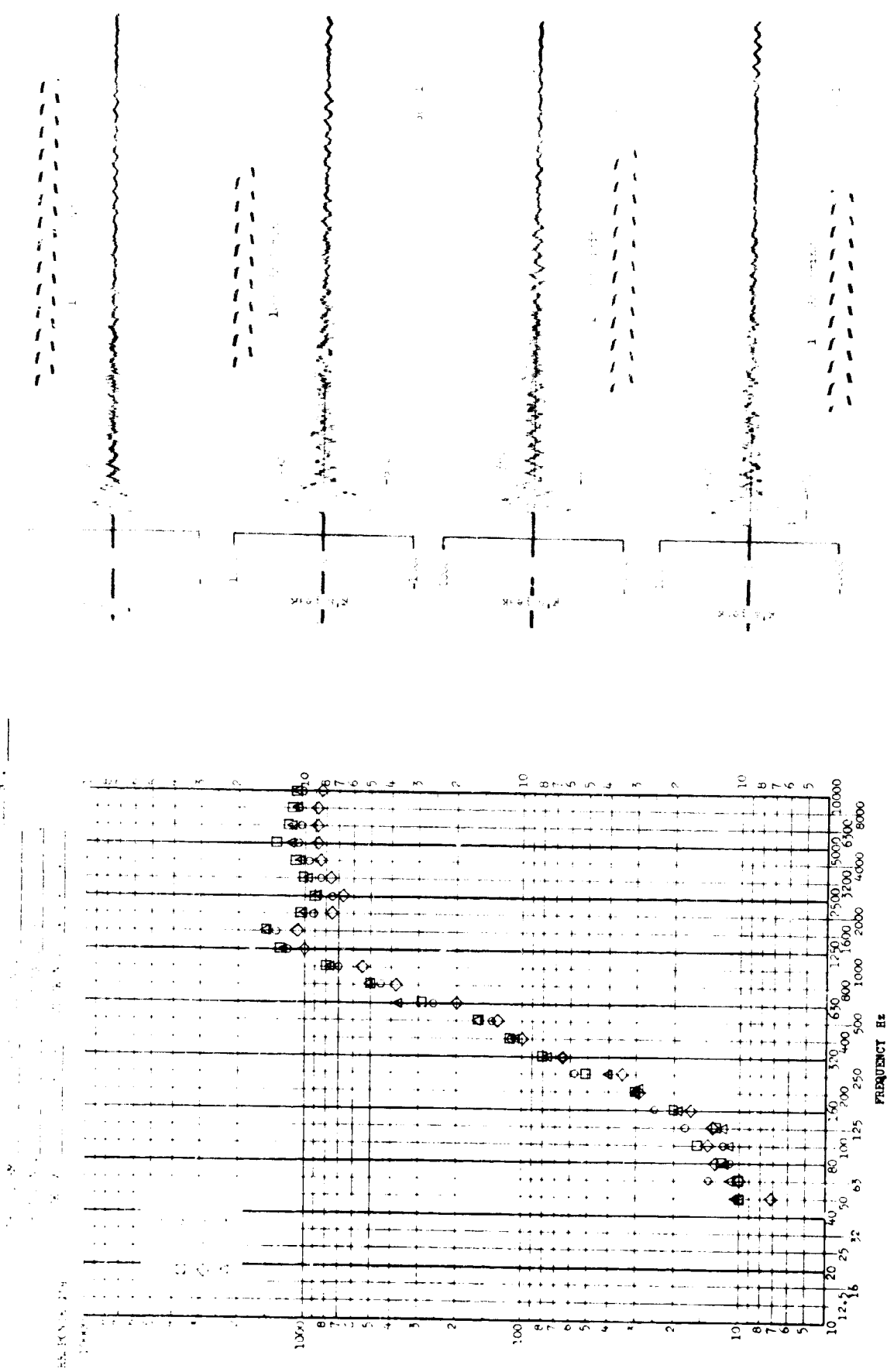


FIGURE 11.B.1-47

PAGE NO. _____
 TEST NO. _____

TEST ITEM _____ PART NO. _____
 SERIAL NO. _____ TEST DATE _____
 CHECK OUT _____ LANGENFELZ _____ CHECK NO. _____

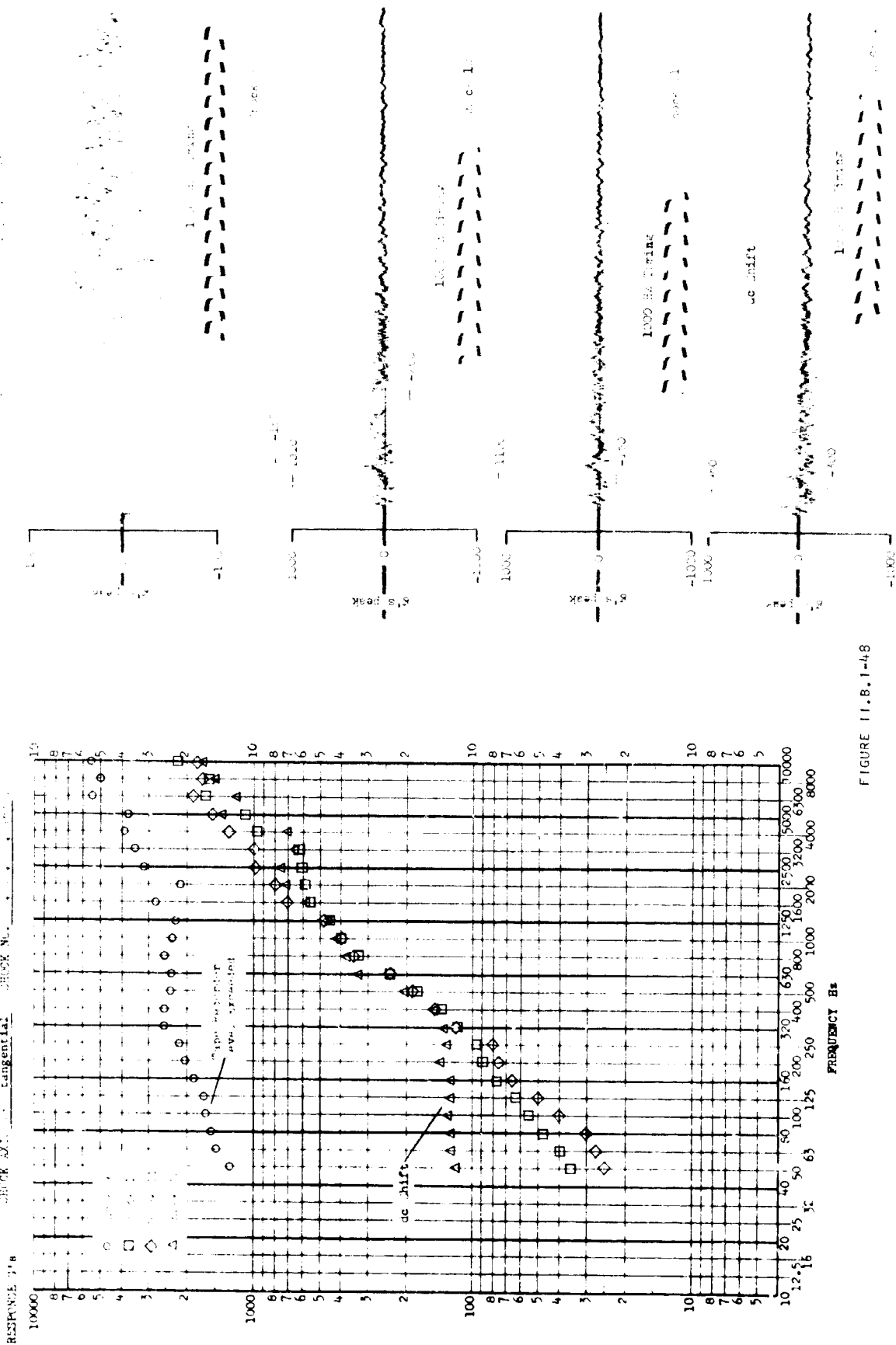


FIGURE 11.B.1-48

PAGE NO. _____
 TEST NO. _____

TEST ITEM: _____ FACT No. _____
 SERIAL No. _____ TEST DATE: _____
 CHECK NO. _____ CHECK NO. _____

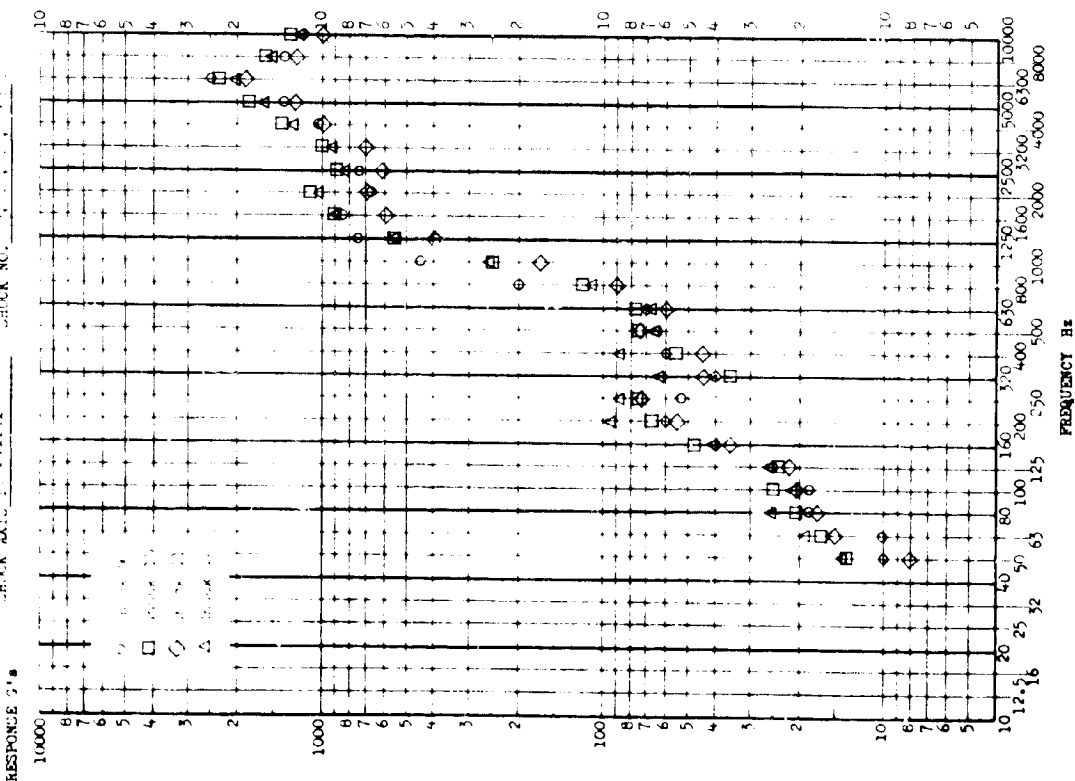
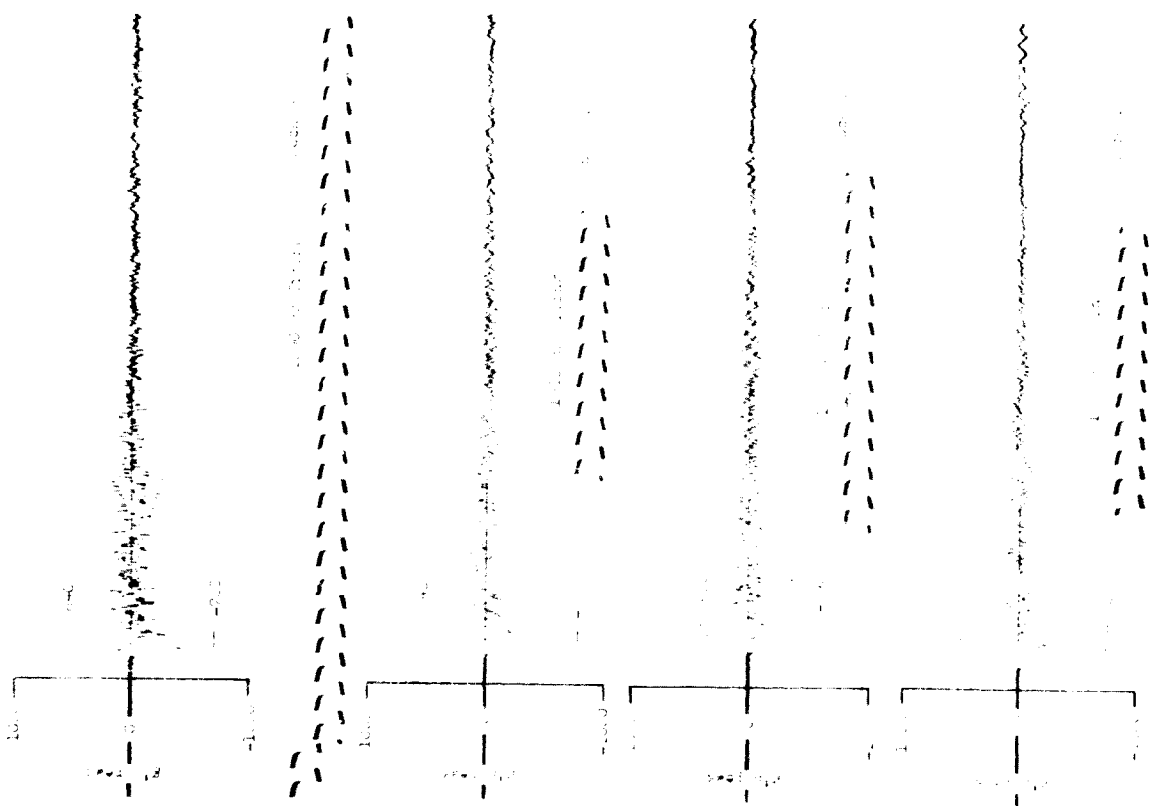


FIGURE II.B.1-49



PAGE NO. _____
 TEST NO. _____

TEST ITEM: _____
 SERIAL NO.: _____
 TEST ADDRESS: _____
 TEST DATE: _____
 TEST TIME: _____

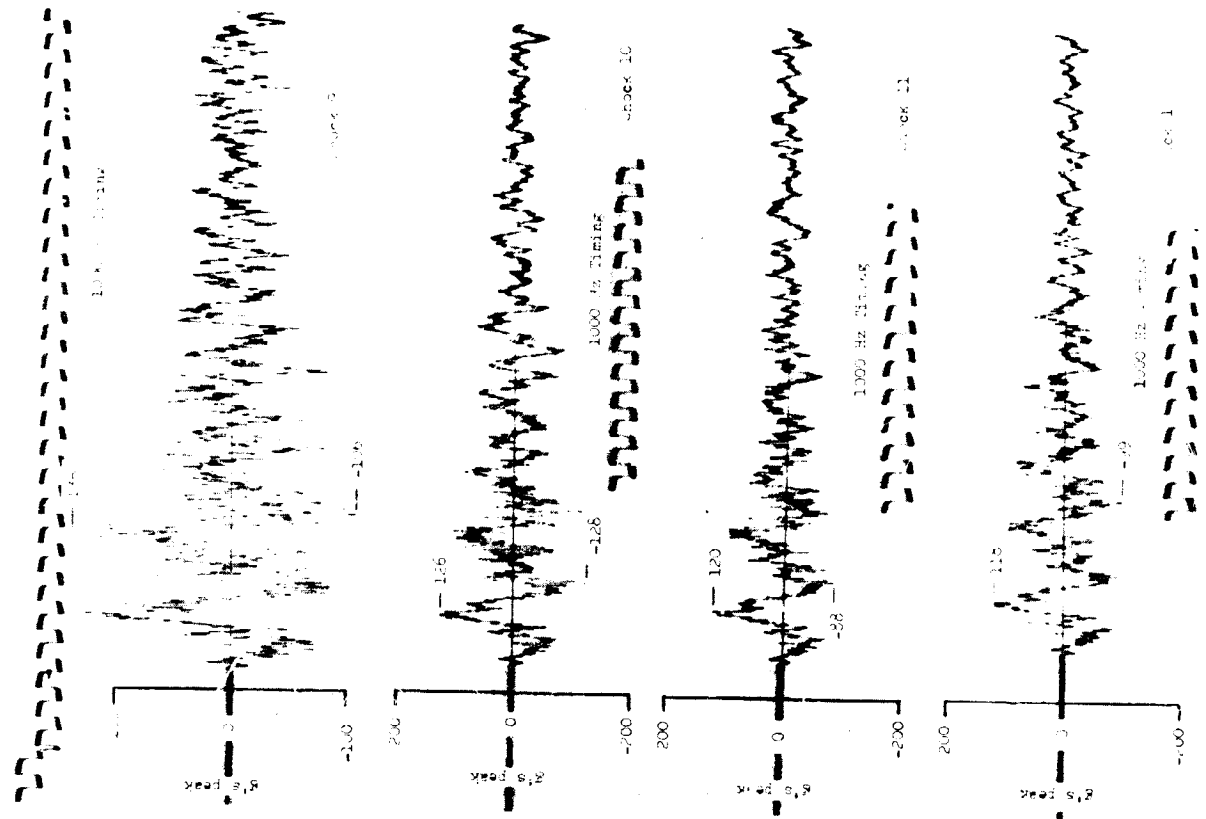
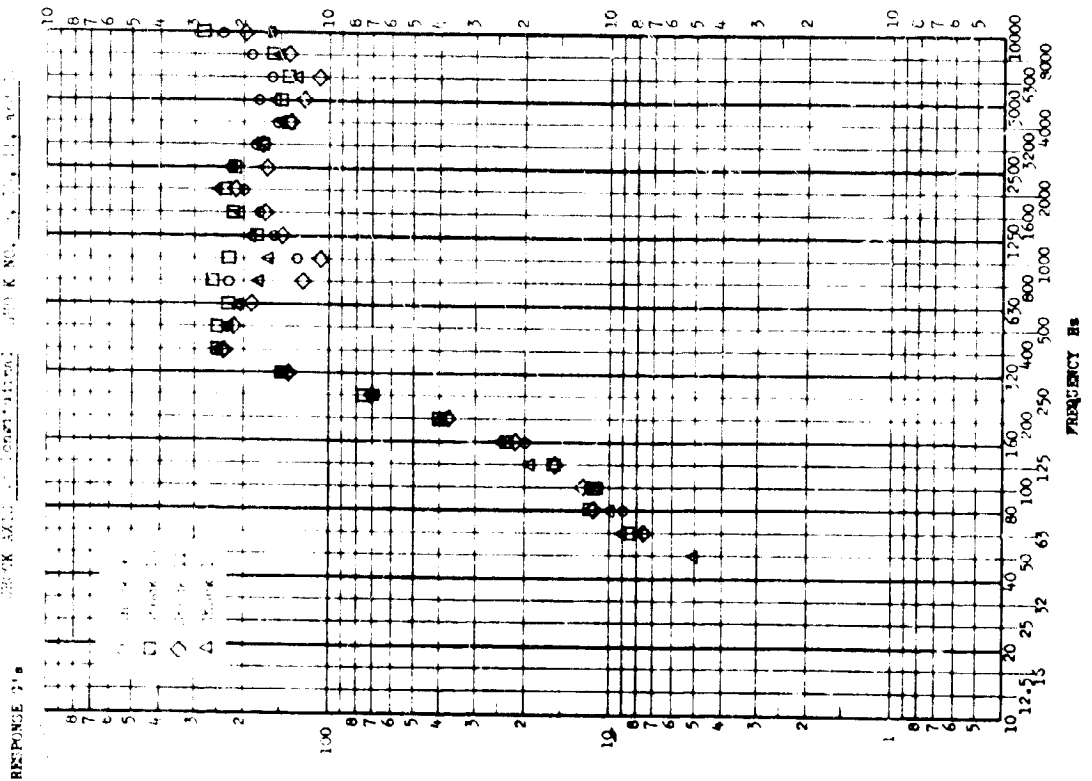


FIGURE 11.B.1-50

TEST LOG
 TEST No. _____
 TEST DATE _____
 TESTER _____
 LABORATORY _____

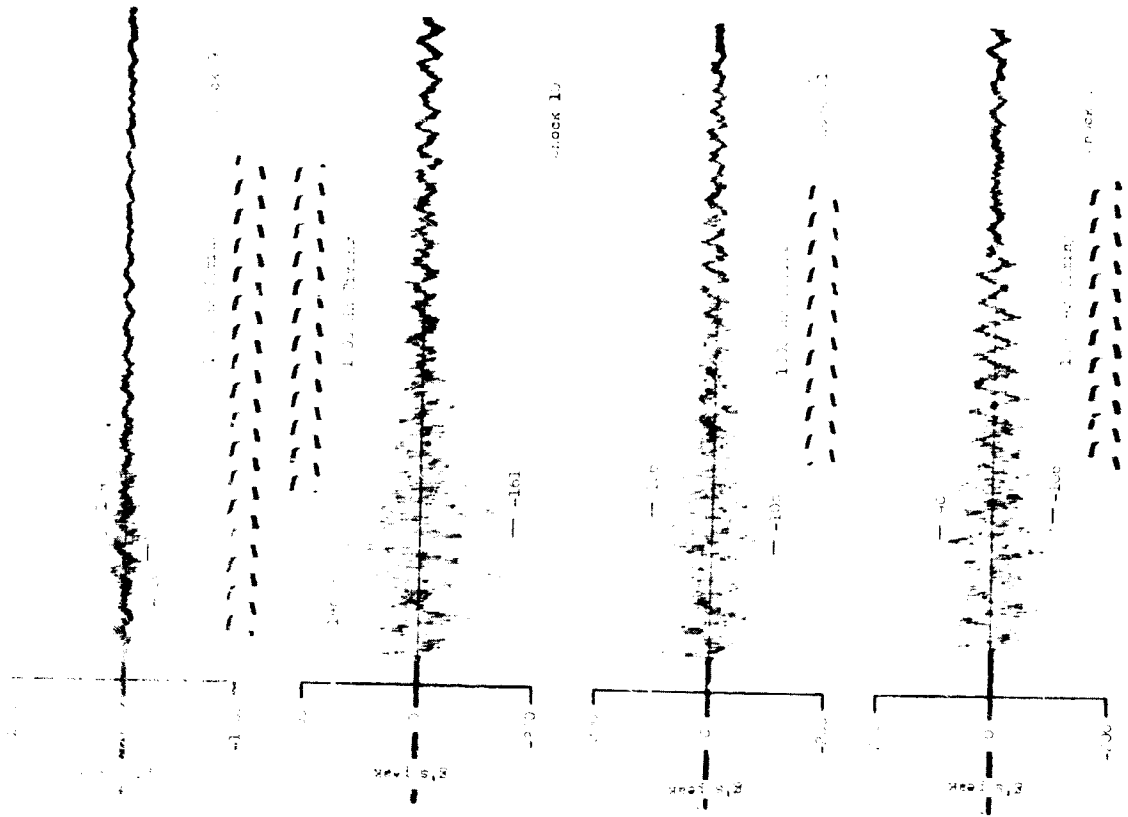
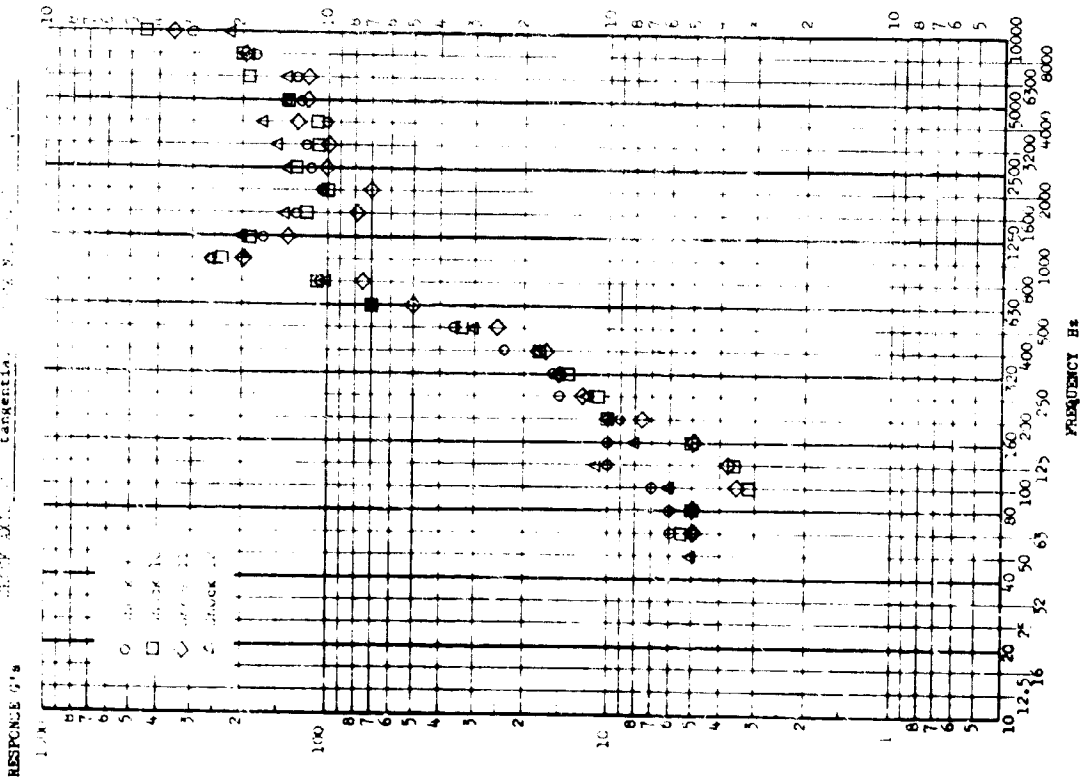


FIGURE II.B.1-51

PAGE NO. _____
TEST NO. _____

TEST ITEM: _____ PART NO. _____
SERIAL NO. _____ TEST DATE: _____
SHOCK AXIS: _____ SHOCK NO. 1, 10, 100, 1000

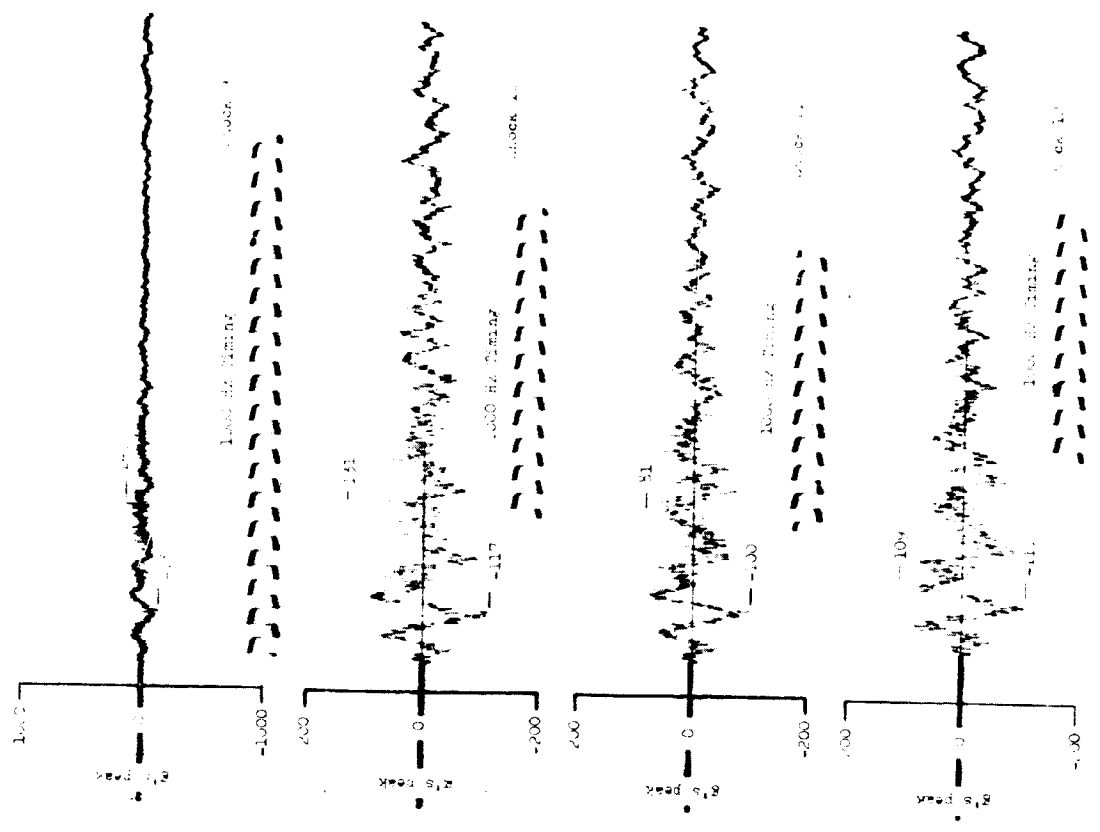
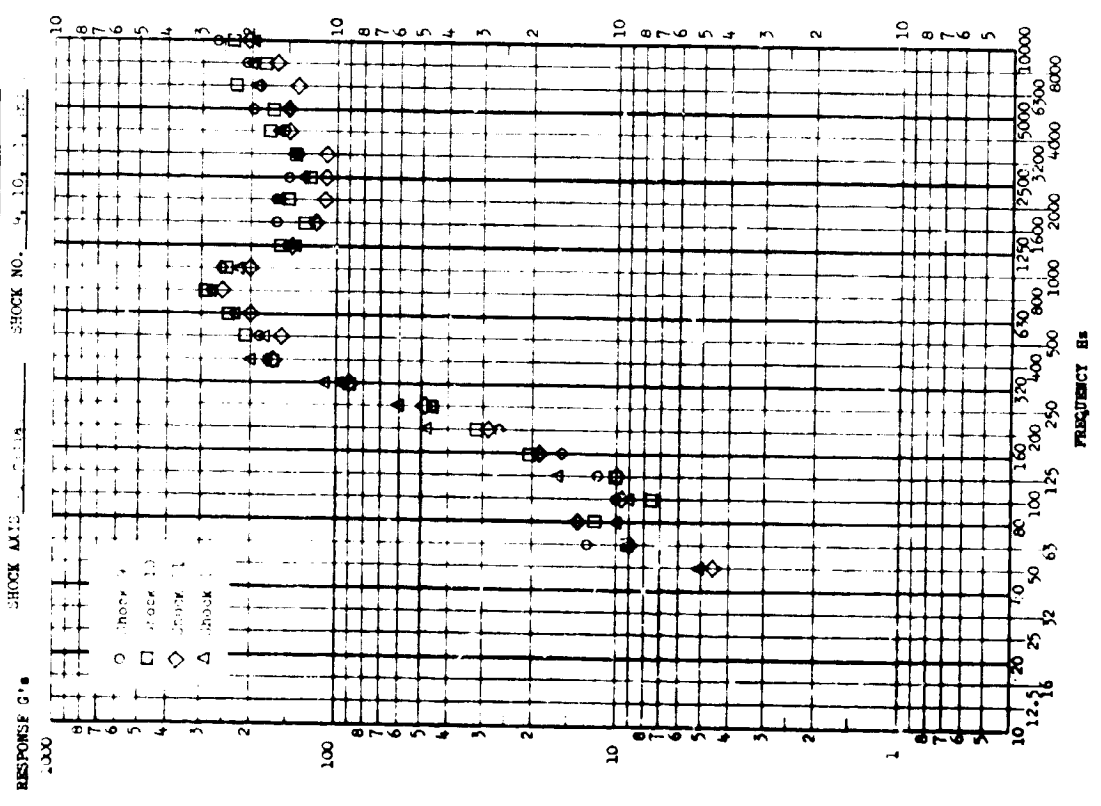


FIGURE 11.B.1-52

TEST ITEM: _____
 SERIAL NO.: _____
 CHECK NO.: _____

PART NO.: _____
 PART DATE: _____
 DRAWING NO.: _____

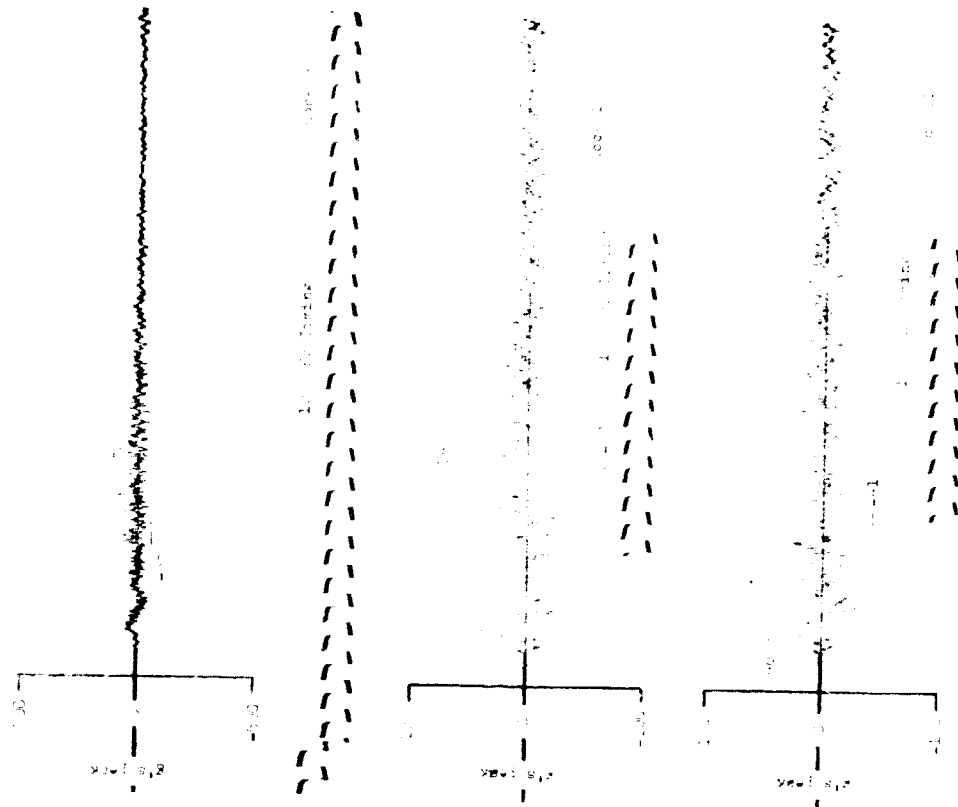
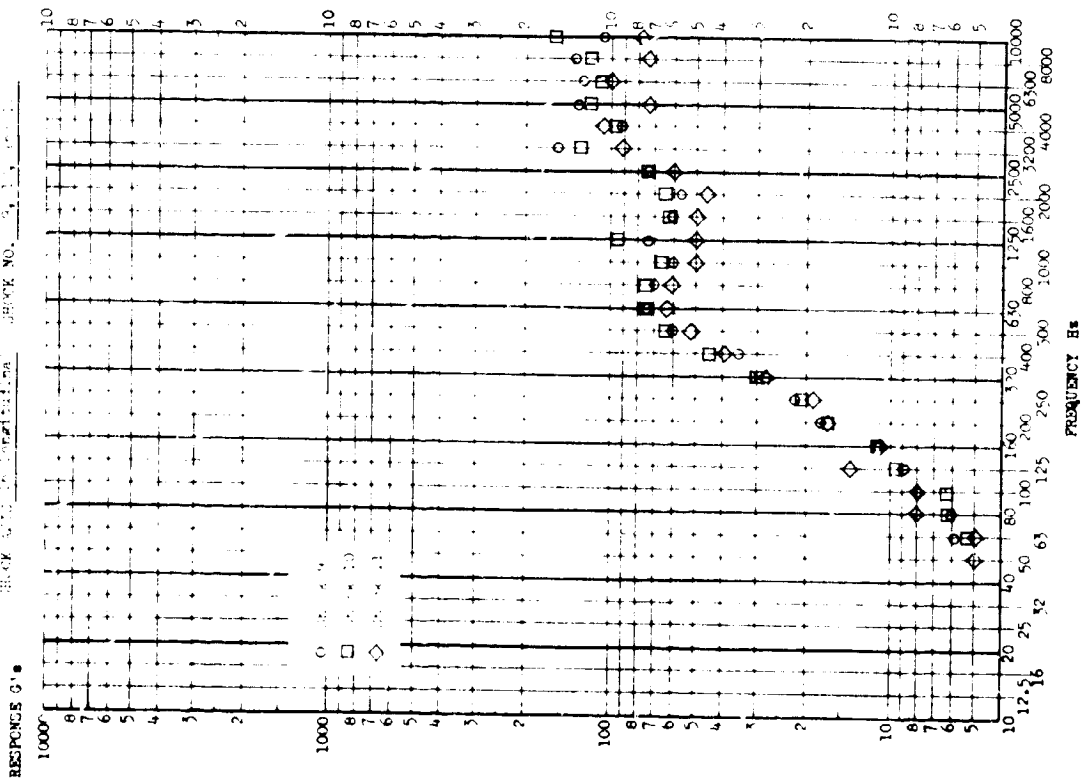


FIGURE 11.B.1-53

PAGE NO. _____
 TEST NO. _____

TEST ITEM _____ PART NO. _____
 SERIAL NO. _____ TEST DATE _____
 CHECK NO. _____ CHECK NO. _____

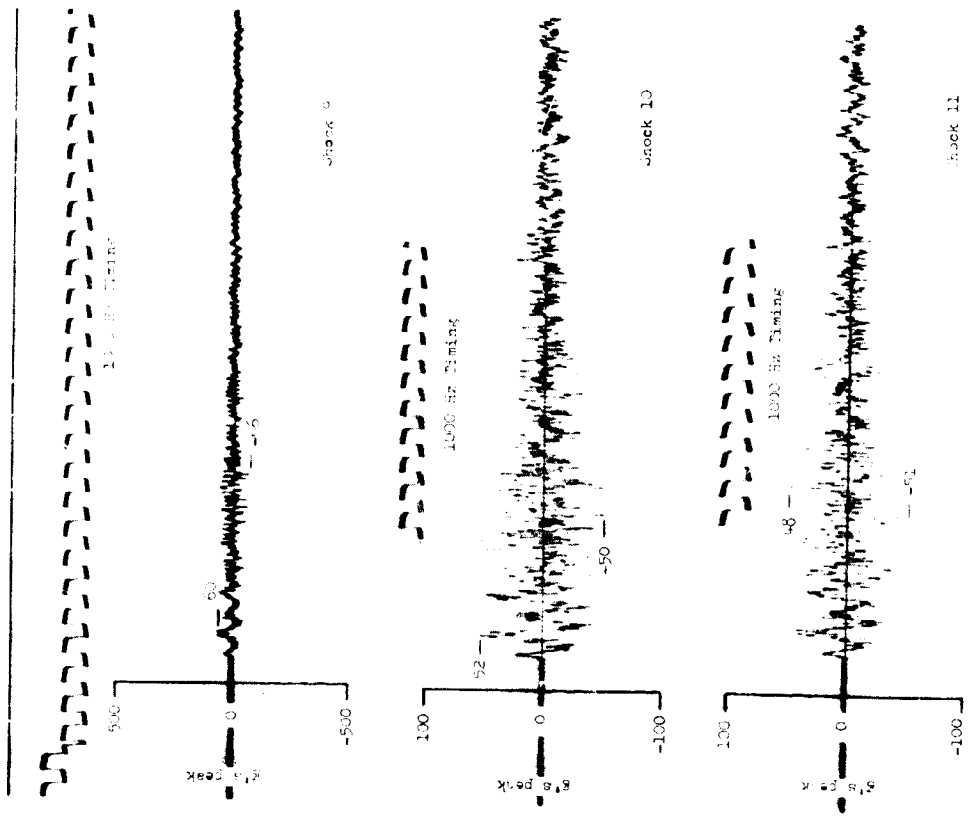
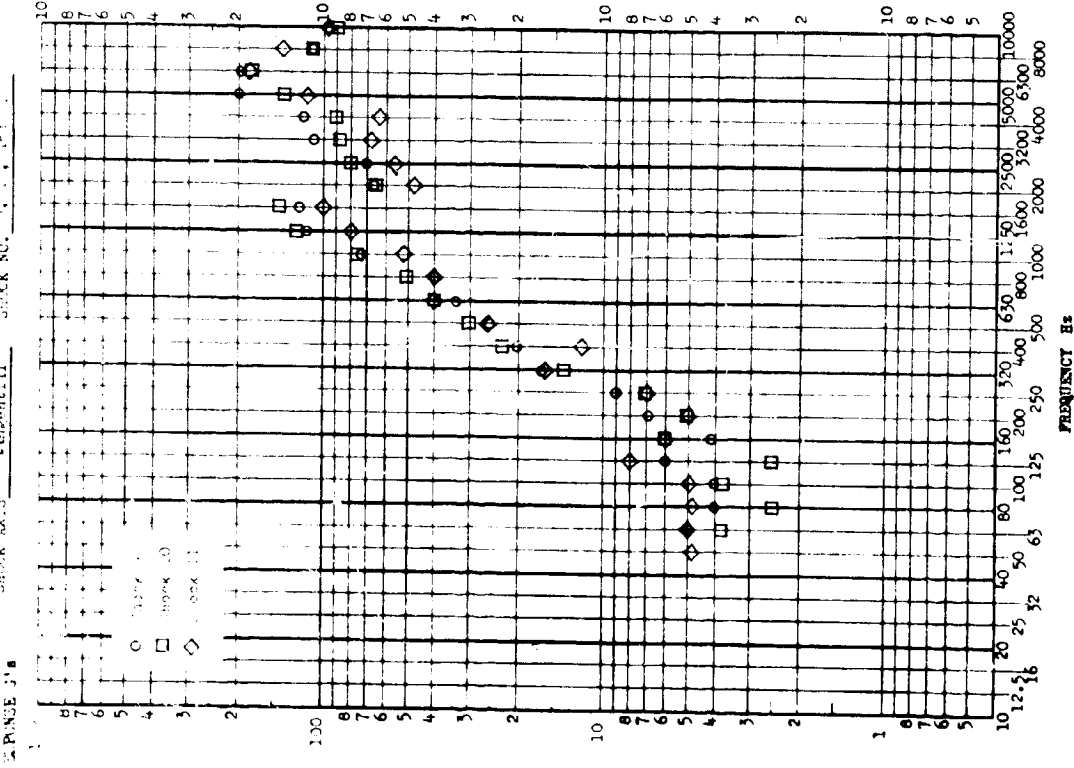


FIGURE 11.B.1-54

PAGE NO. _____
 TEST NO. _____

TEST ITEM: _____ PART NO. _____
 SERIAL NO. _____ TEST DATE: _____
 HOOK MARK: radial CHECK NO. _____

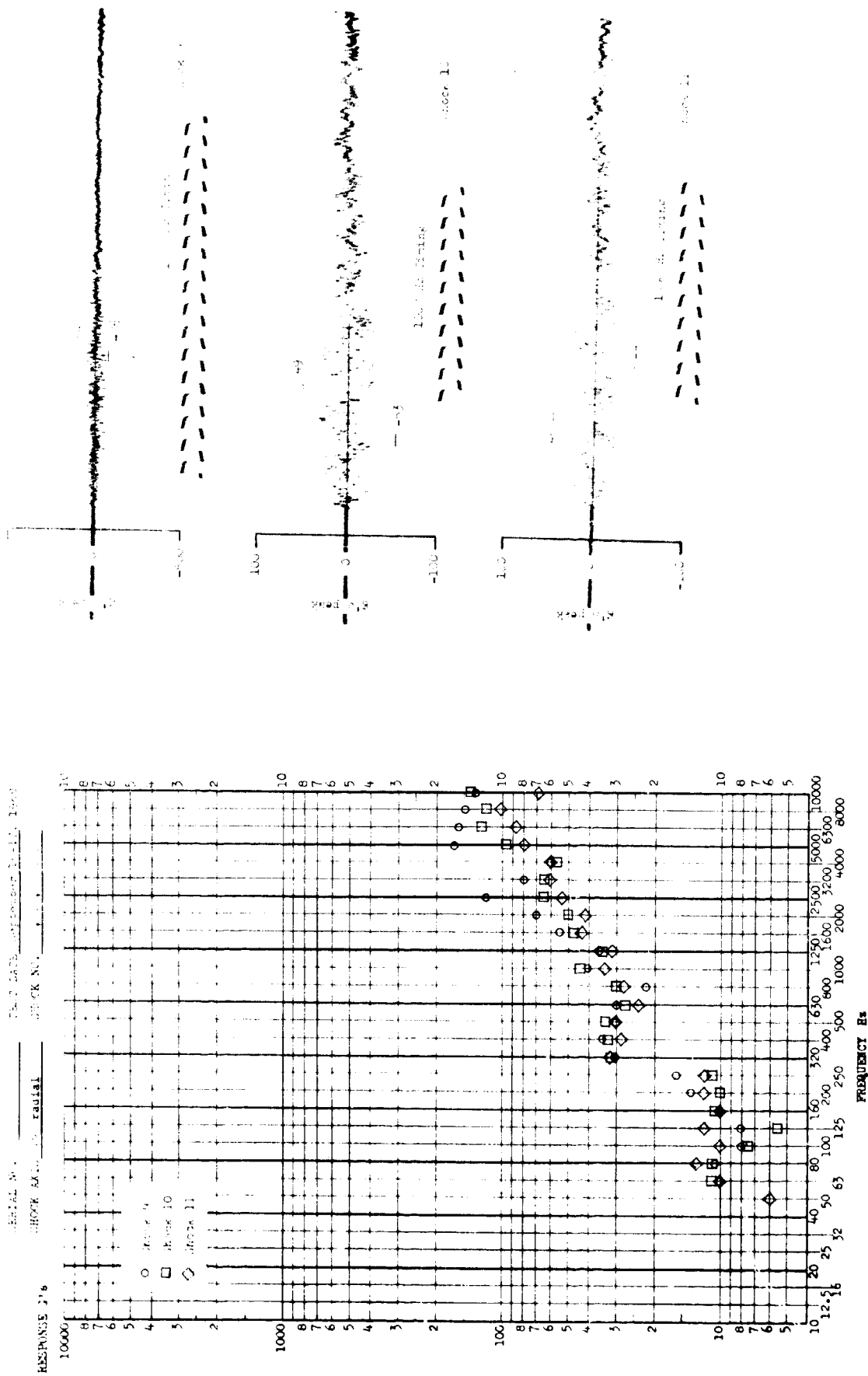


FIGURE 11.8.1-55

PAGE NO. _____
TEST NO. _____

TEST ITEM _____ PART NO. _____
SERIAL NO. _____ TEST DATE _____
SHOCK AXIS _____ SHOCK NO. _____

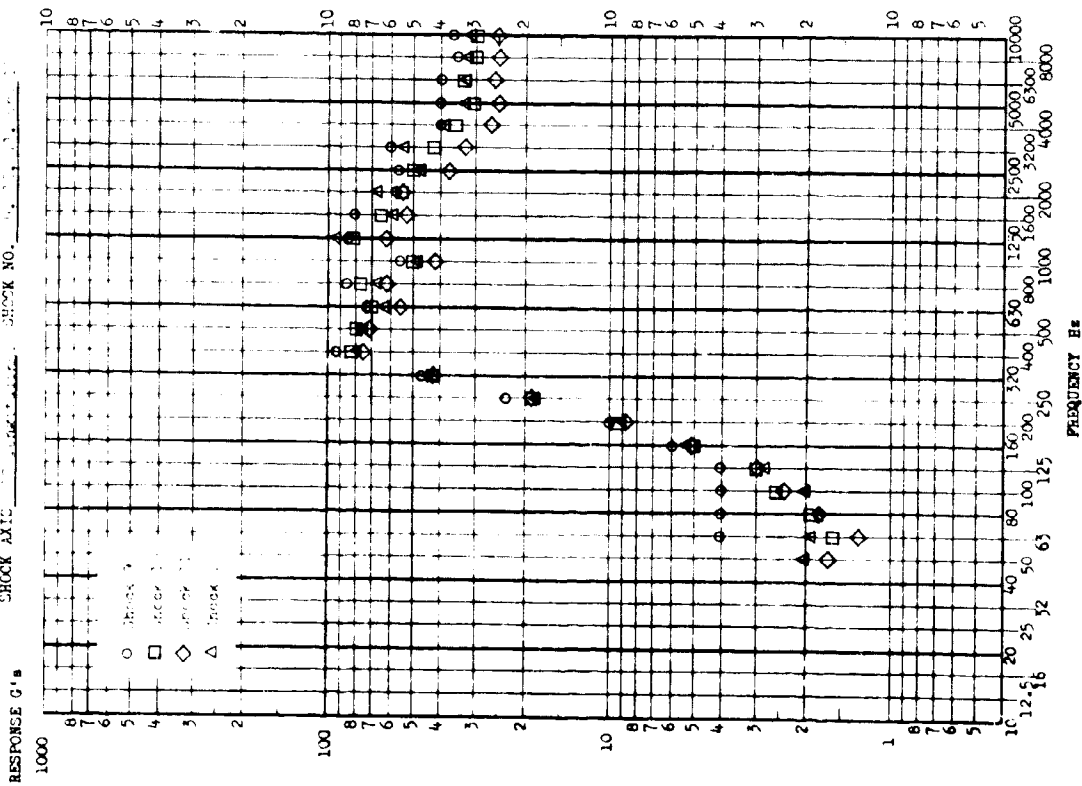


FIGURE 11.B.1-56

PAGE NO. _____
 TEST NO. _____

TEST ITEM _____ PART NO. _____
 SERIAL NO. _____ TEST DATE _____
 CHECK NO. _____ SHOCK NO. _____

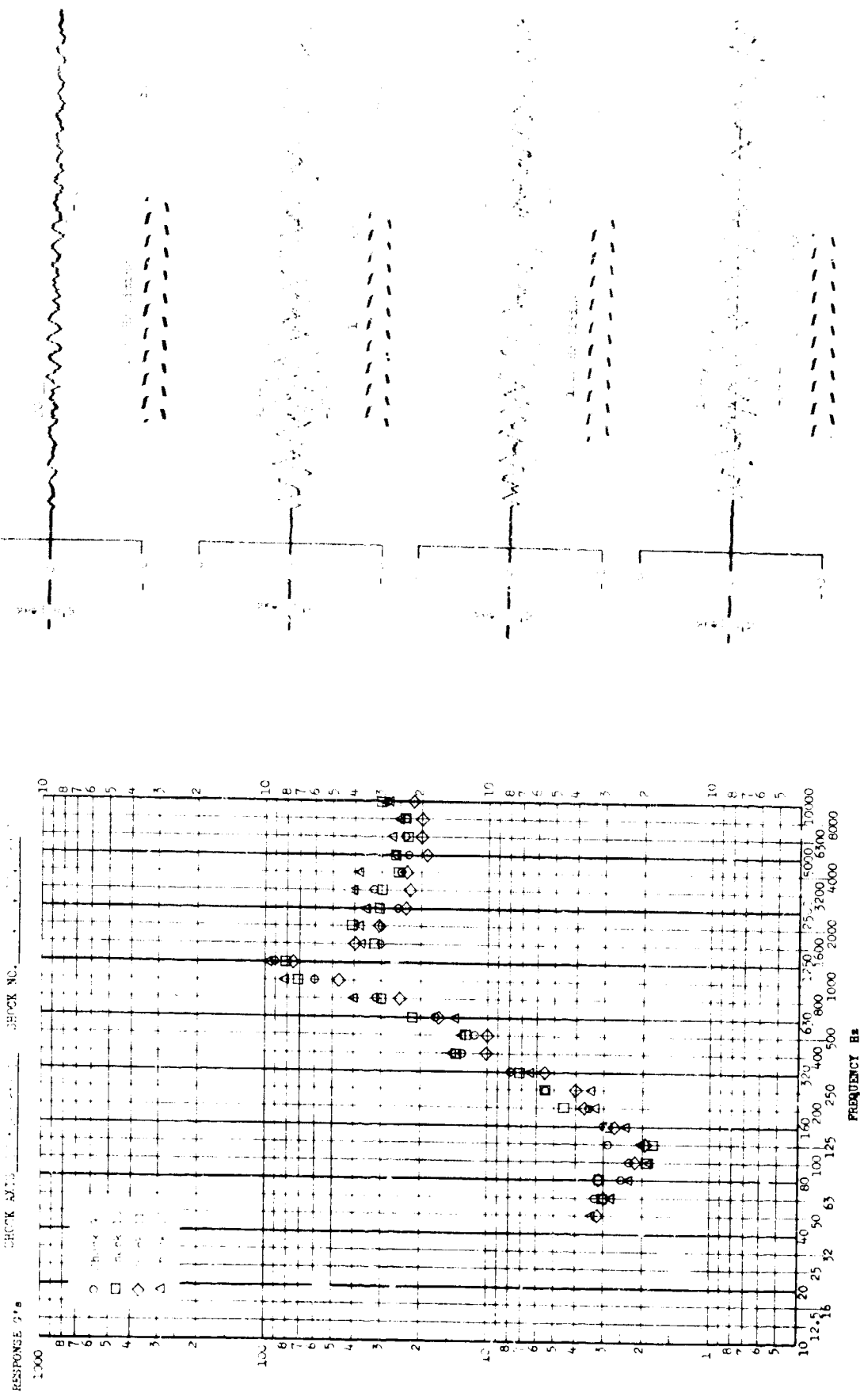


FIGURE II.B.1-57

PAGE NO. _____
 TEST NO. _____

TEST ITEM _____ PART NO. _____
 SERIAL NO. _____ TEST DATE _____
 CHECK NO. _____

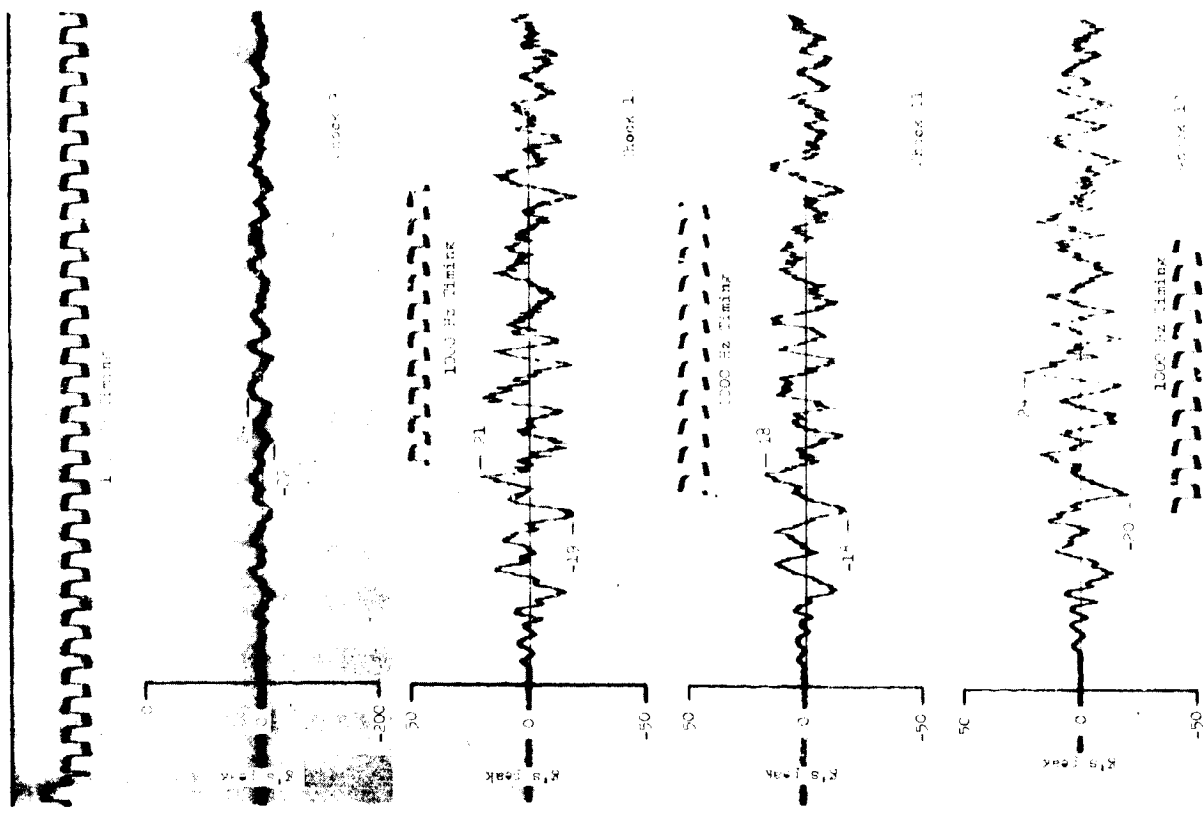
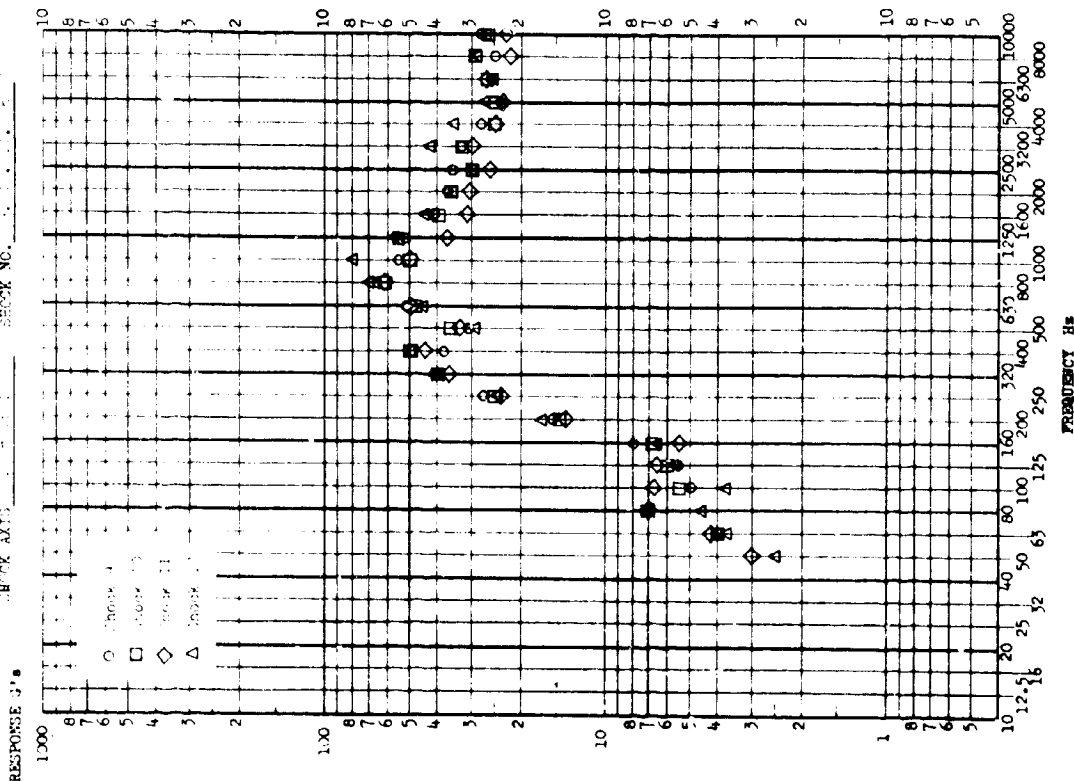


FIGURE 11.B.1-58

PAGE NO. _____
 CASE NO. _____

TEST ITEM _____
 DATA No. _____
 SHOCK DATA _____
 SHOCK No. _____

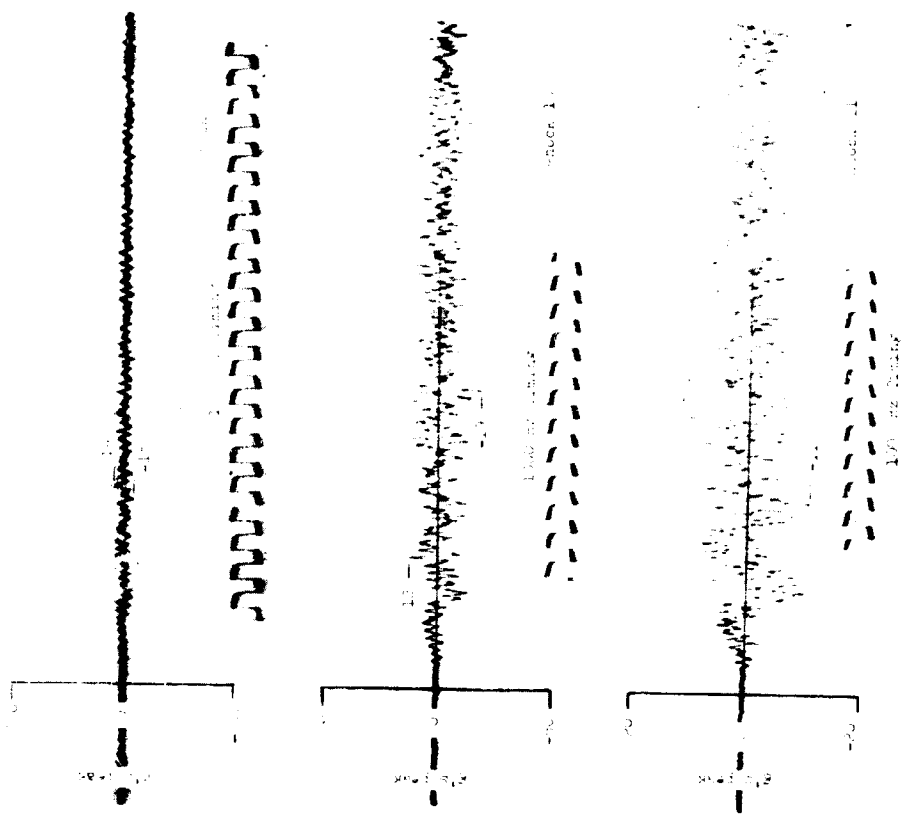
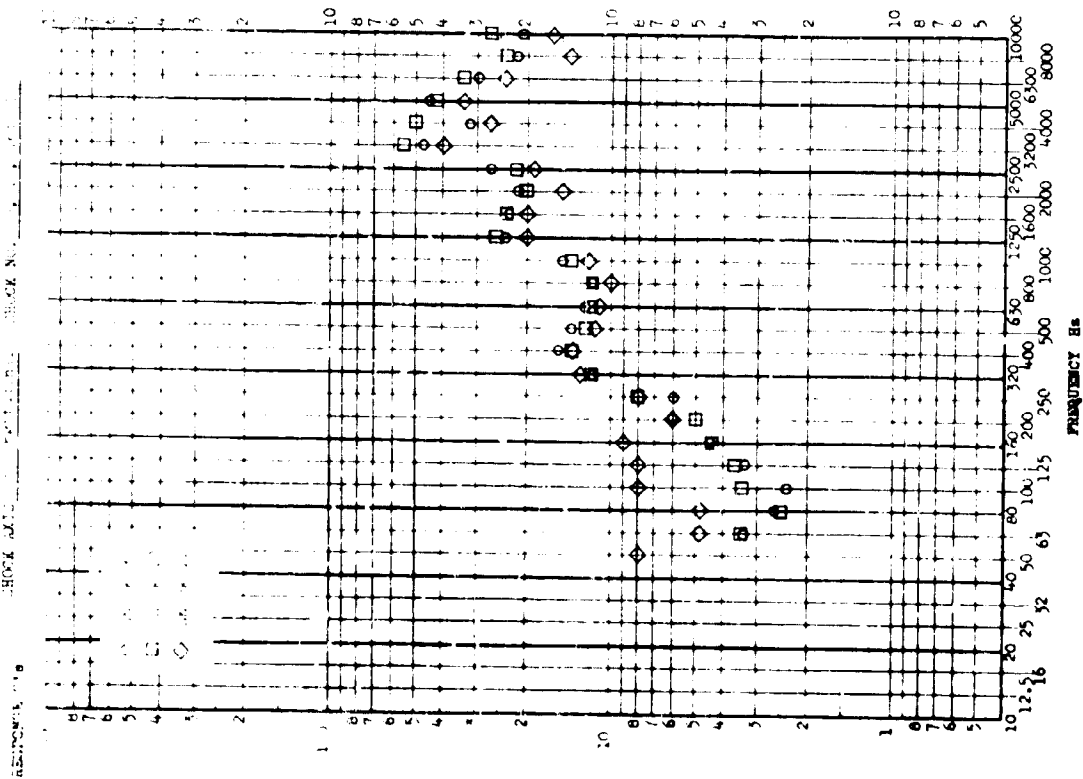


FIGURE 11.B.1-59

PAGE NO. _____
TEST NO. _____

TEST ITEM: _____
SERIAL NO.: _____
CHECK NO.: _____

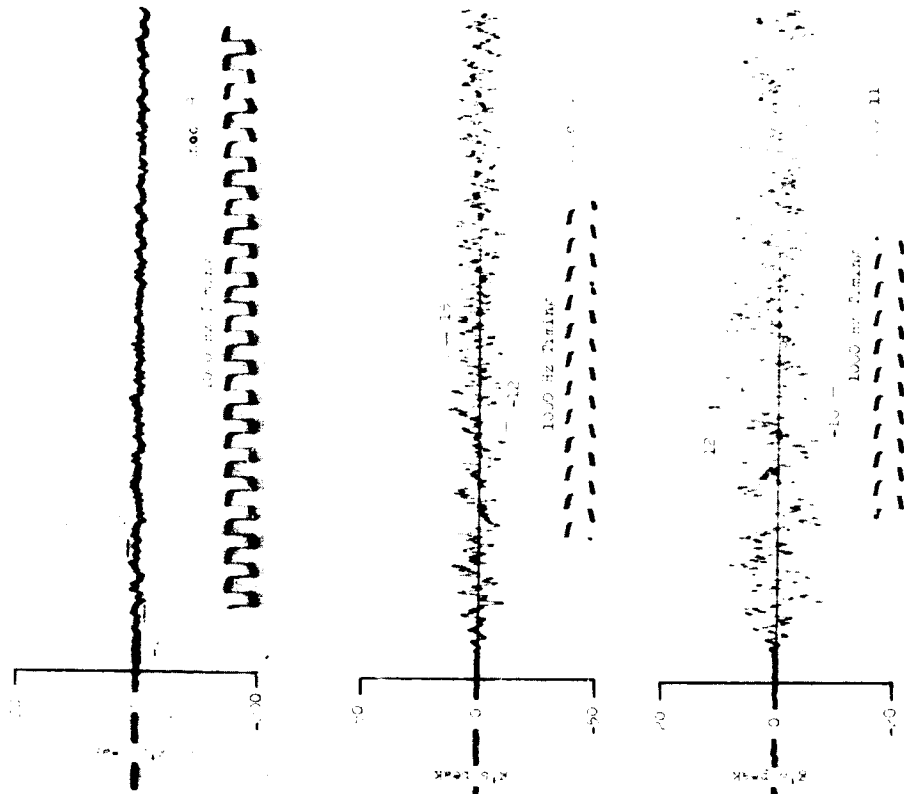
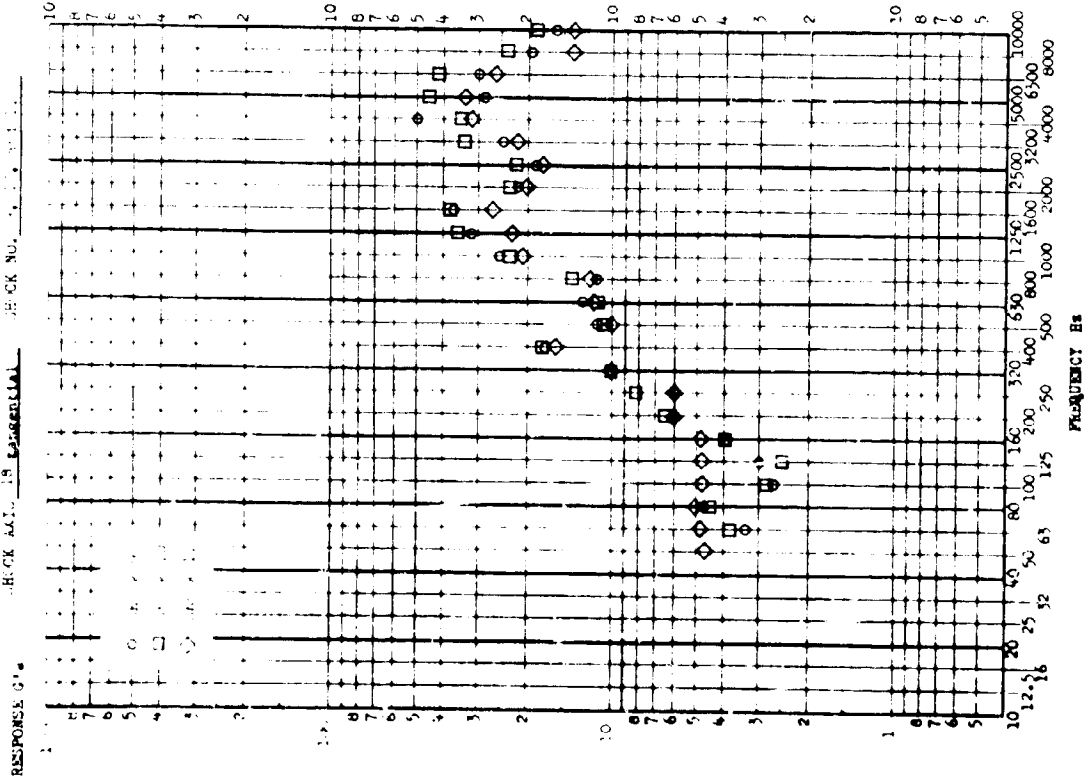


FIGURE 11.B.1-60

PAGE NO. _____
TEST NO. _____

TEST ITEM _____ PART NO. _____
SERIAL NO. _____ TEST DATE _____
CHECK AXIS _____ CHECK NO. _____

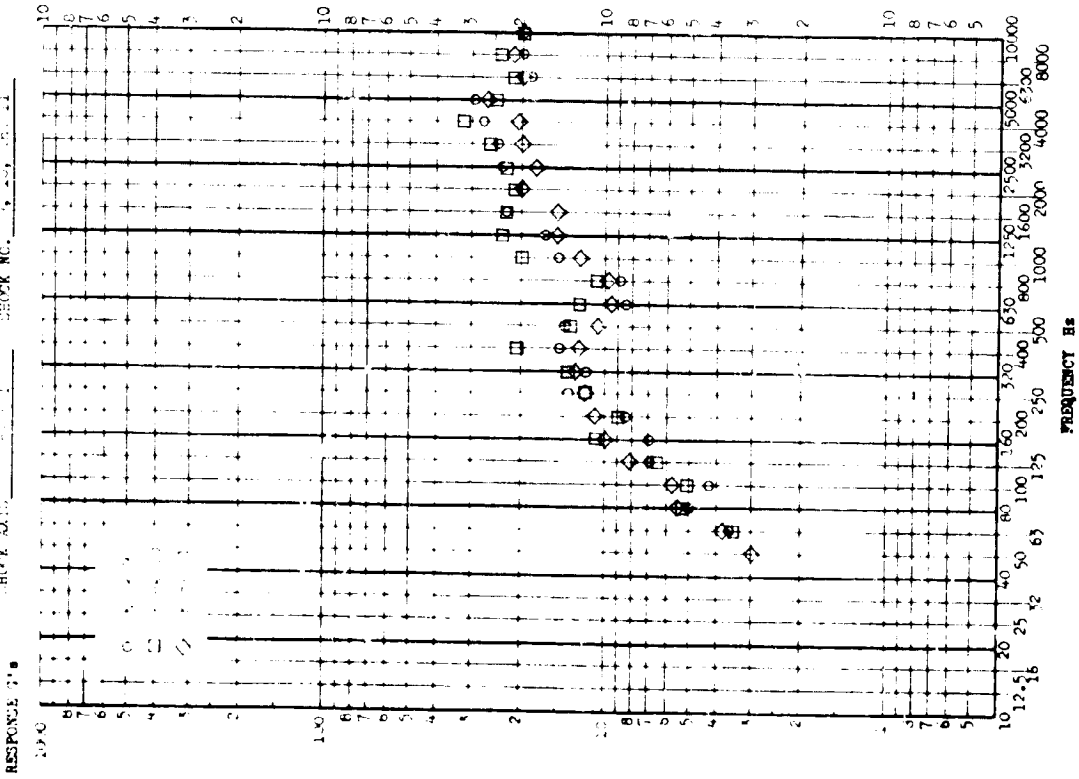


FIGURE 11.B.1-61

TEST LOG - C-1000-116 (REV. 1)

TEST NO. 116
 TEST DATE 11/16/62
 TEST TIME 10:00 AM
 TEST LOCATION 116

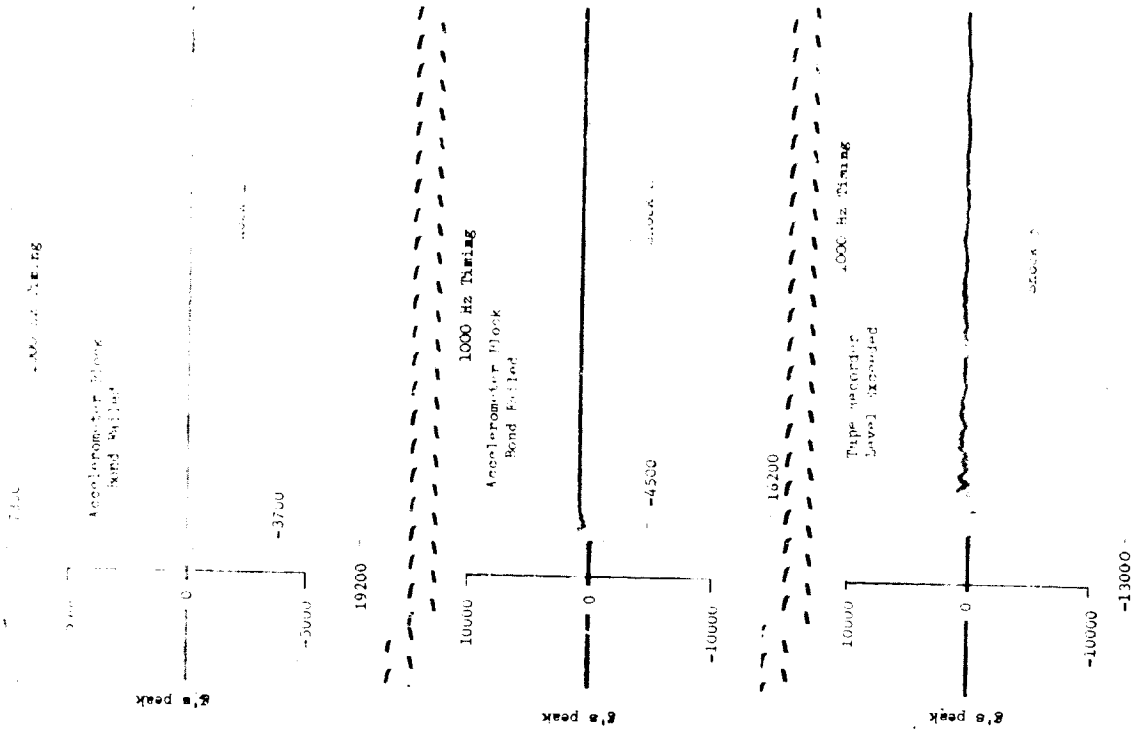
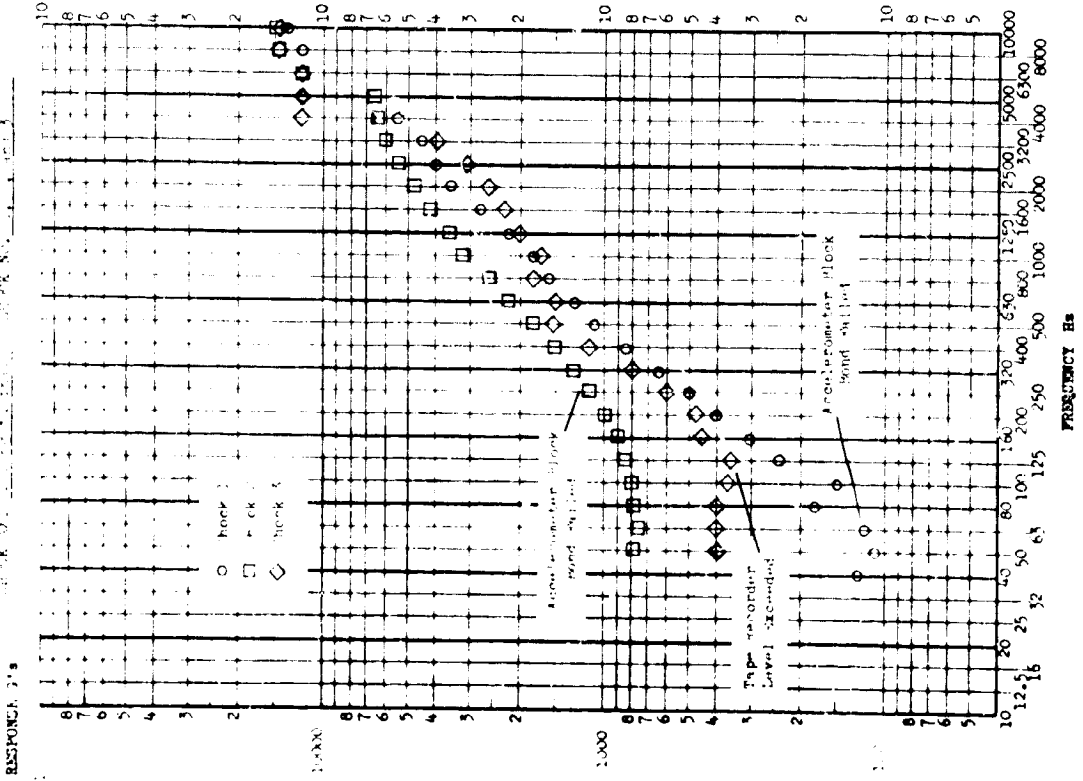


FIGURE 11.B.1-62

REPORT NO. 118
 TITLE: C-1000 Hz Timing
 PROJECT NO. 118

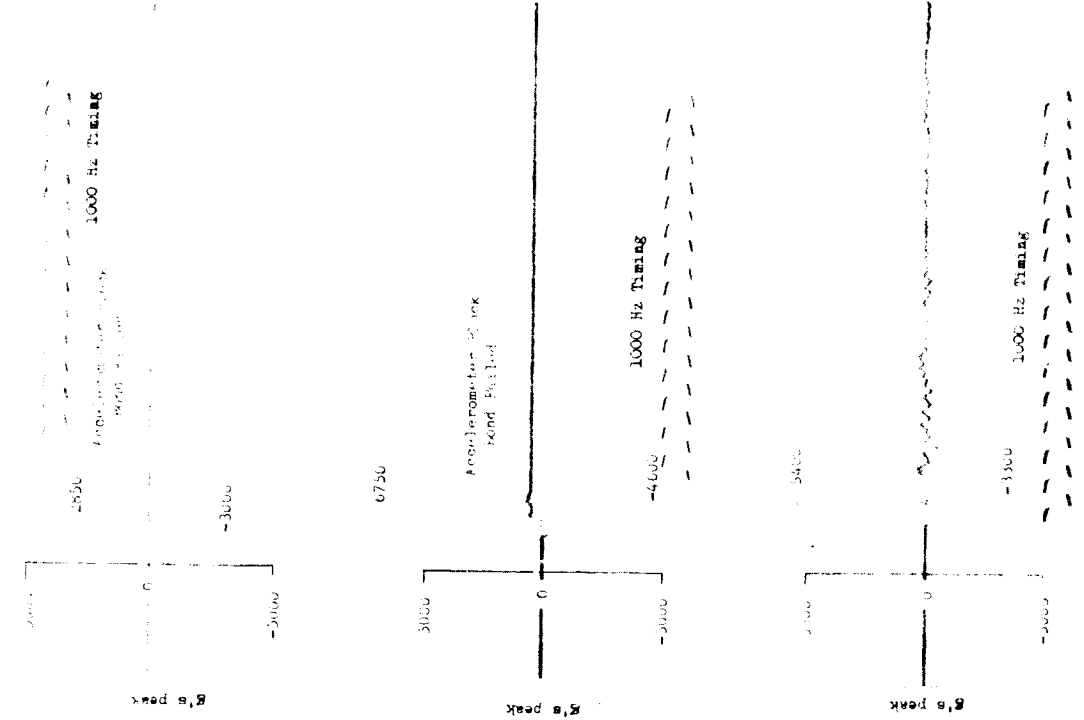
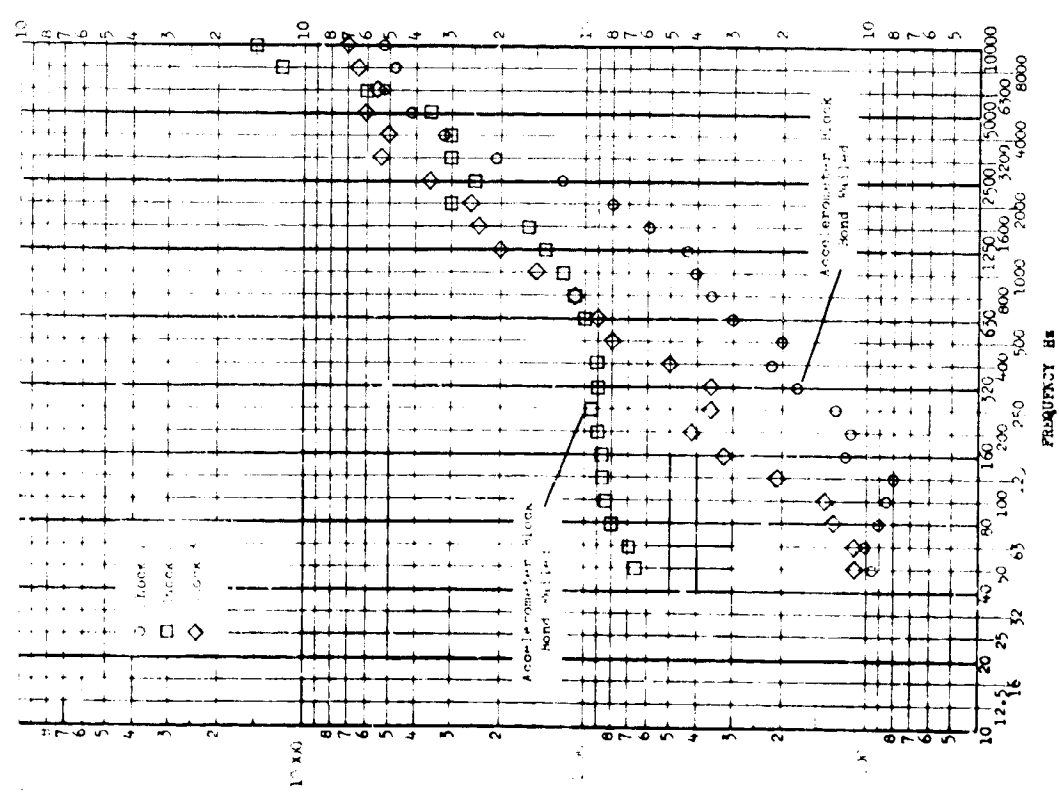


FIGURE 11.B.1-63

TEST ITEM: Compensation IIa PART V
 SERIAL NO.: 267 1455 SEPTEMBER 6-1-1960
 CHECK NO.: 1, 2, and 3

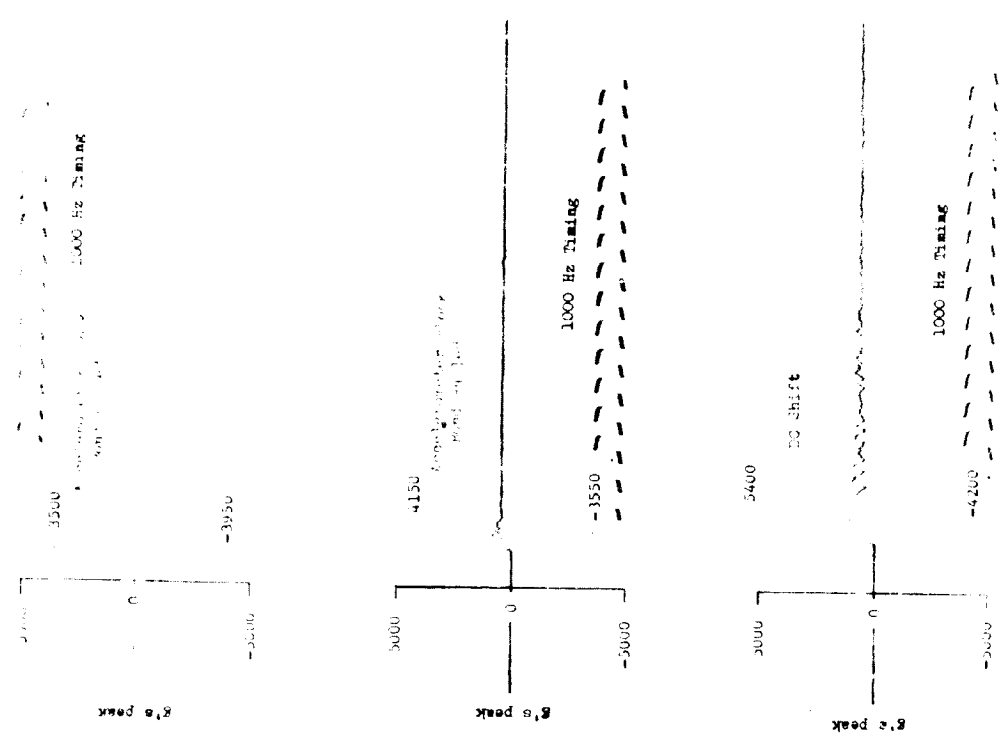
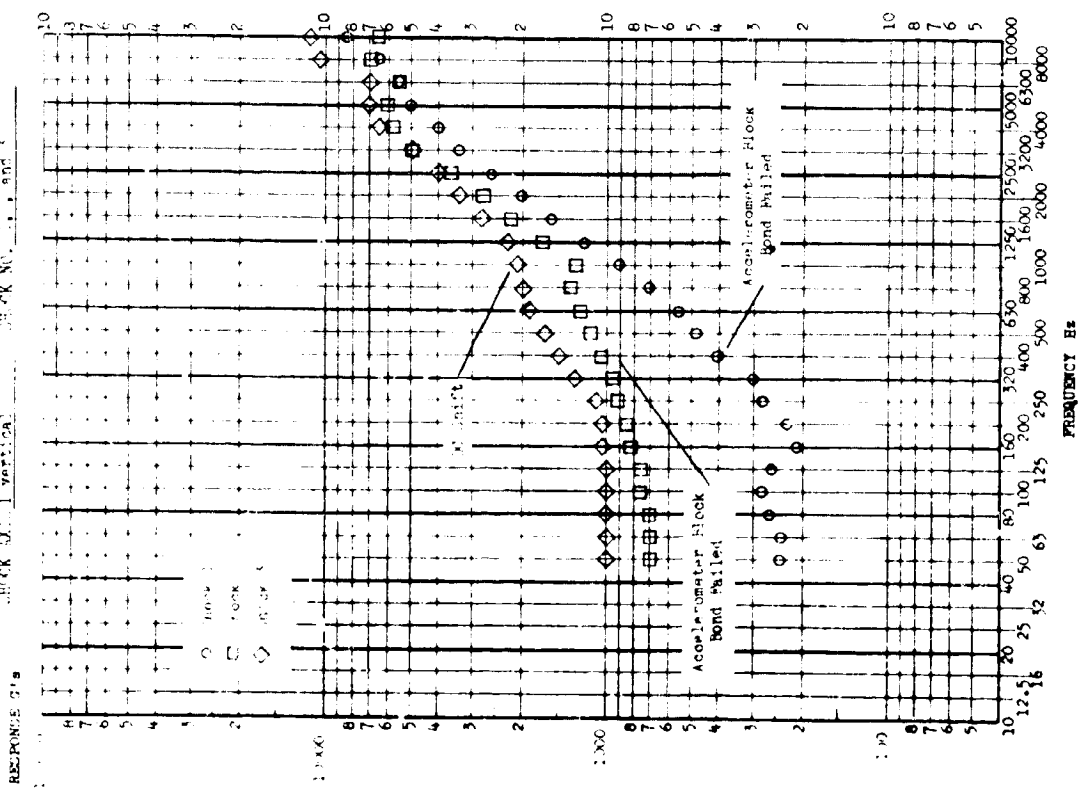


FIGURE 11.8.1-64

TEST ITEM Configuration II, Part A
 SERIAL NO. [blacked out]
 SHOCK MATH [blacked out] SHOCK NO. 1, 2, and 3

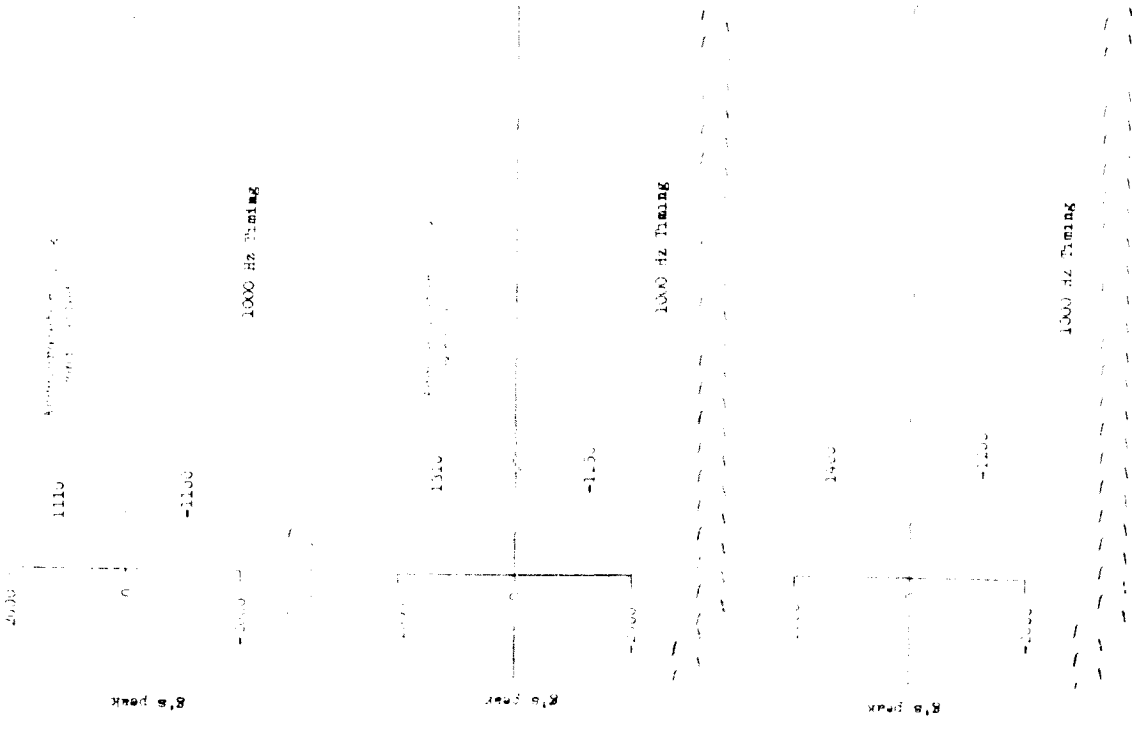
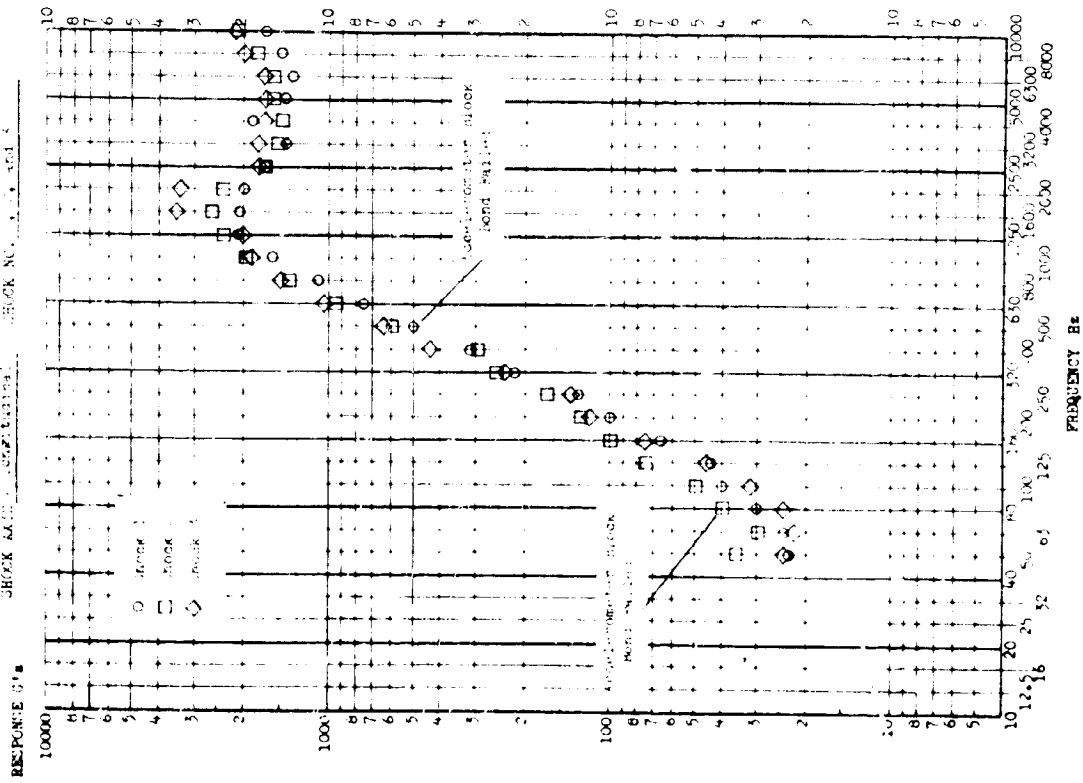


FIGURE 11.8.1-65

TEST ITEM: CONNECTIONS TO AIR IN
 SERIAL NO.: 10000000000000000000
 CHECK NO.: 10000000000000000000

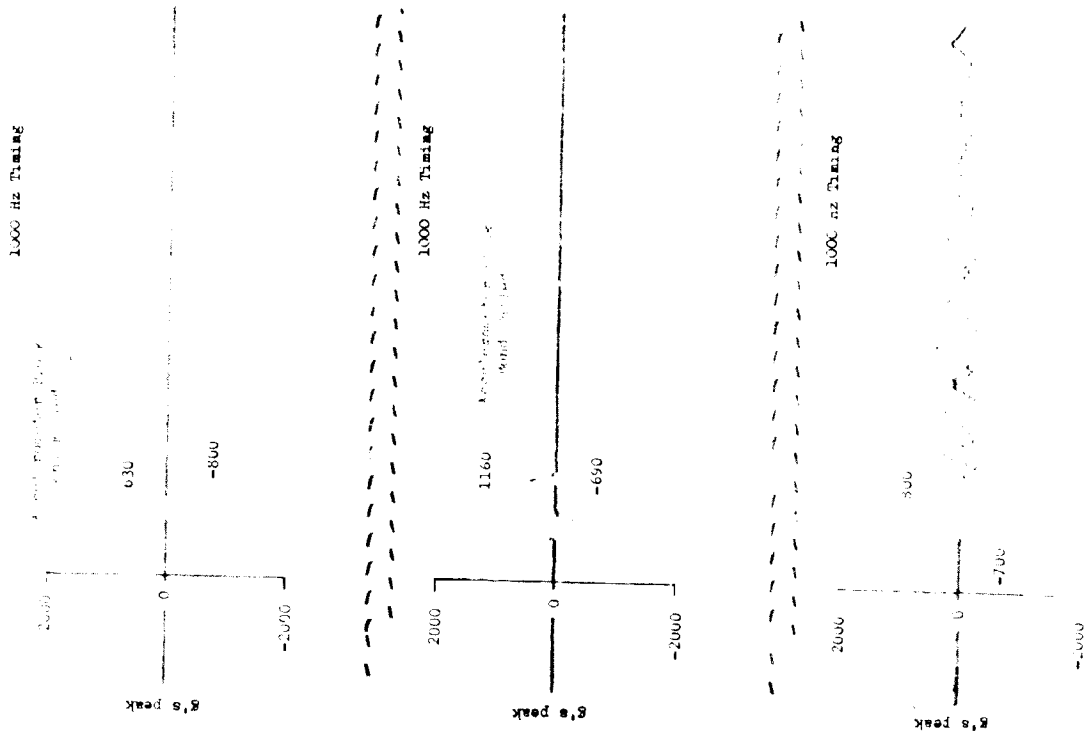
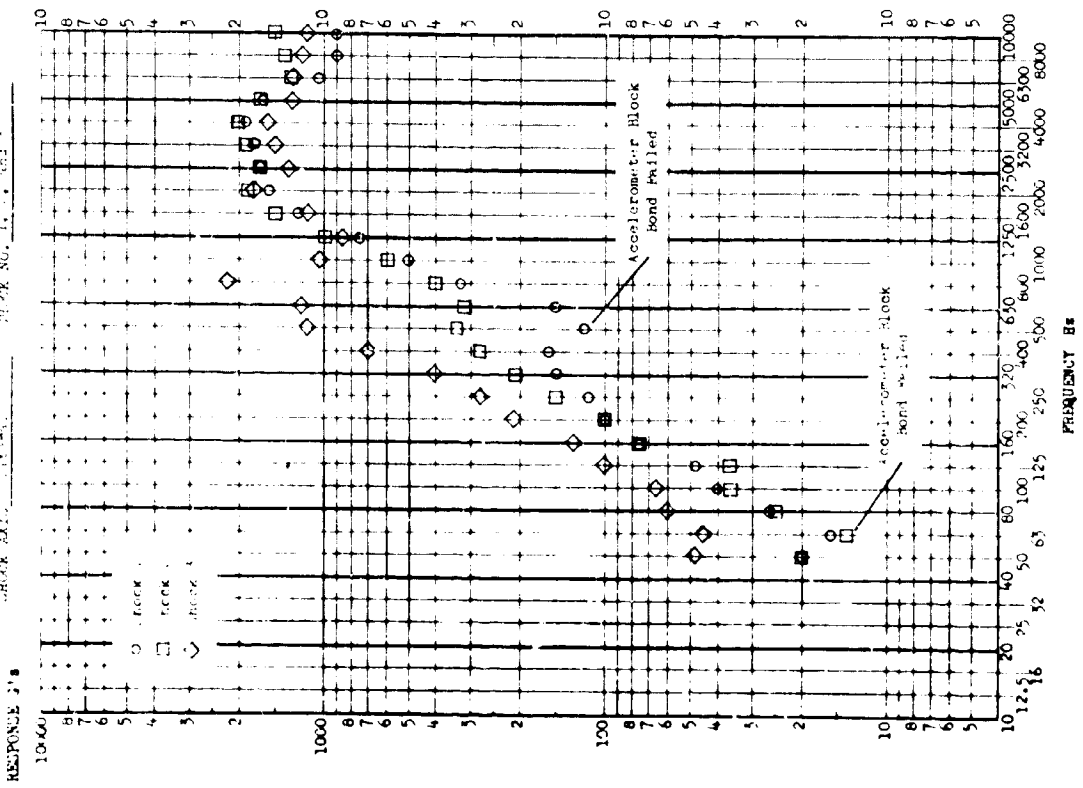


FIGURE 11.B.1-66

TEST ITEM Qualification IIa (Part 1)
 SERIAL N. 252 (ACE, Resonance 2-13) (one)
 TEST DATE 20-APR-67
 TEST CASE 20-APR-67

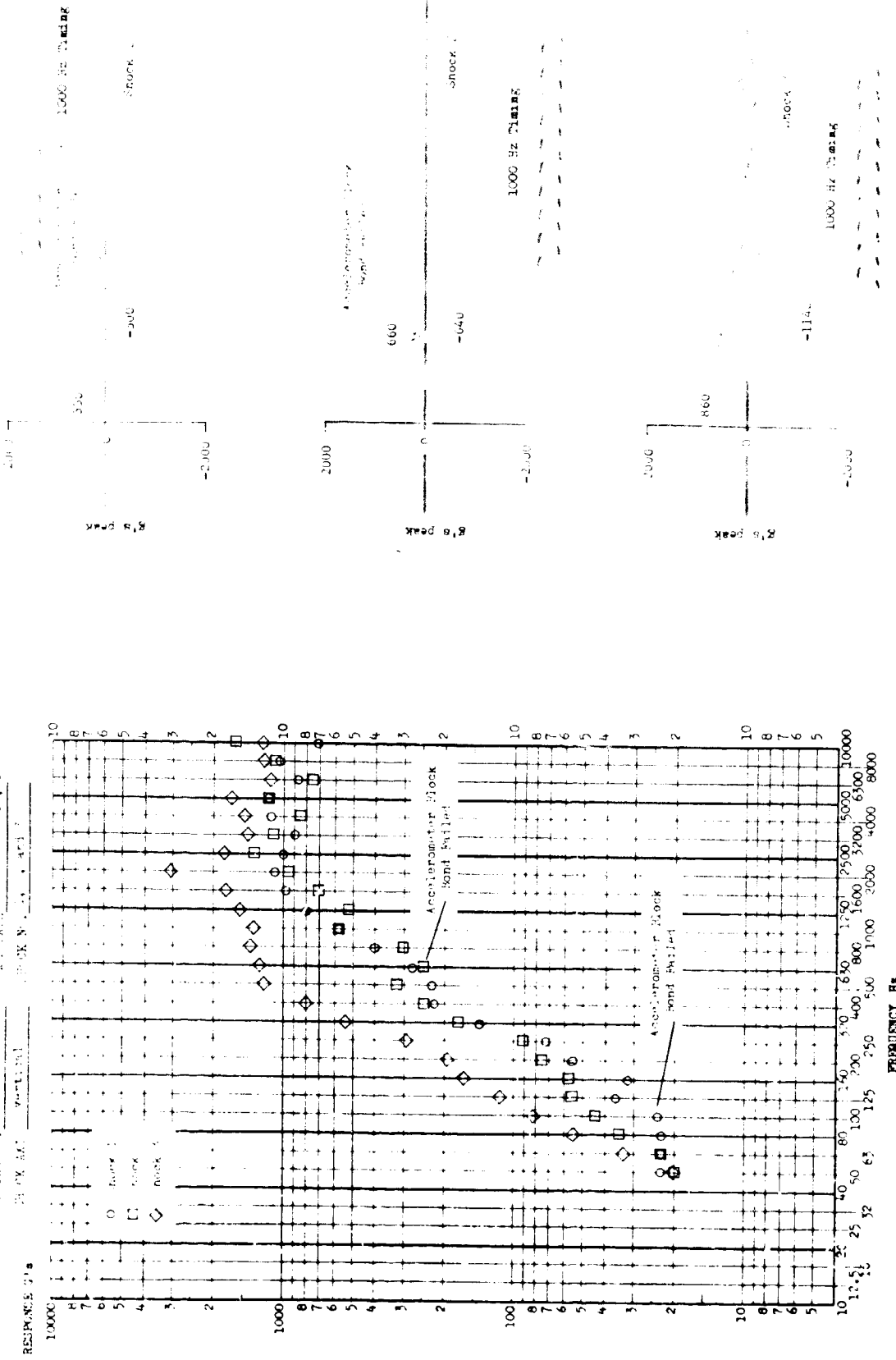


FIGURE II.B.1-67

TEST ITEM Configuration IIa PART NO.
 SERIAL NO. TEST DATE September 6-10, 1968
 SHOCK AXIS longitudinal SHOCK NO. 1, 2, and 3

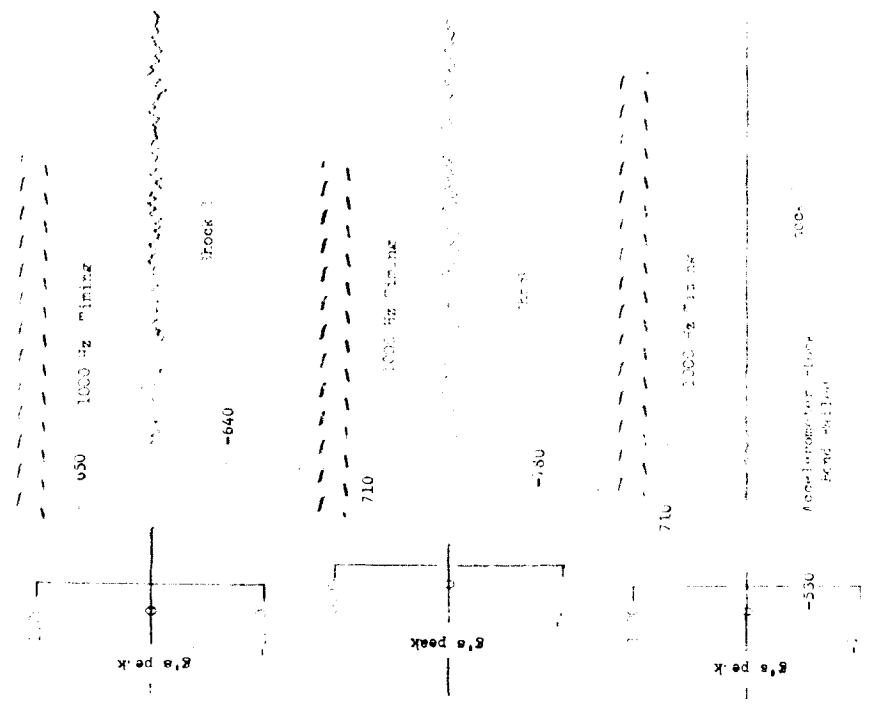
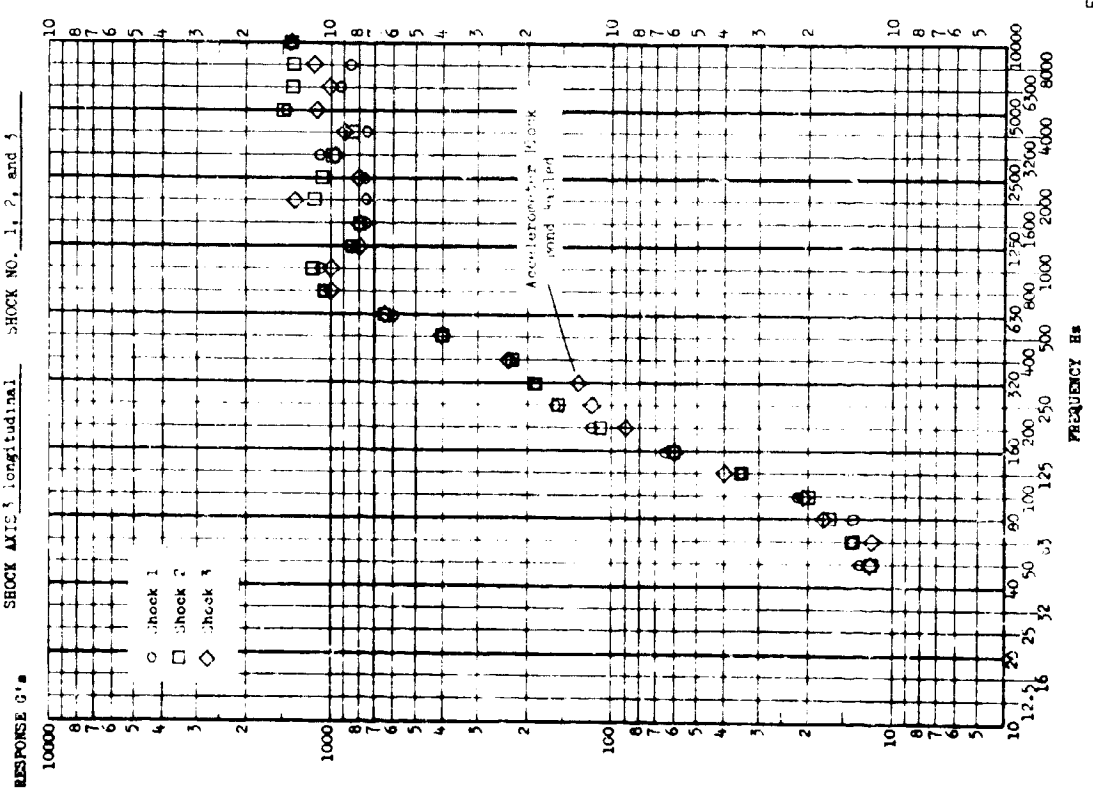


FIGURE II.B.1-68

TEST ITEM: Conc. Suspension Ila PART NO. _____
 SERIAL NO. _____ DATE TEST: SEPTEMBER 11, 1969
 CHECK NO. 5 (1-5-7-9) CHECK NO. 1, 3, and 7

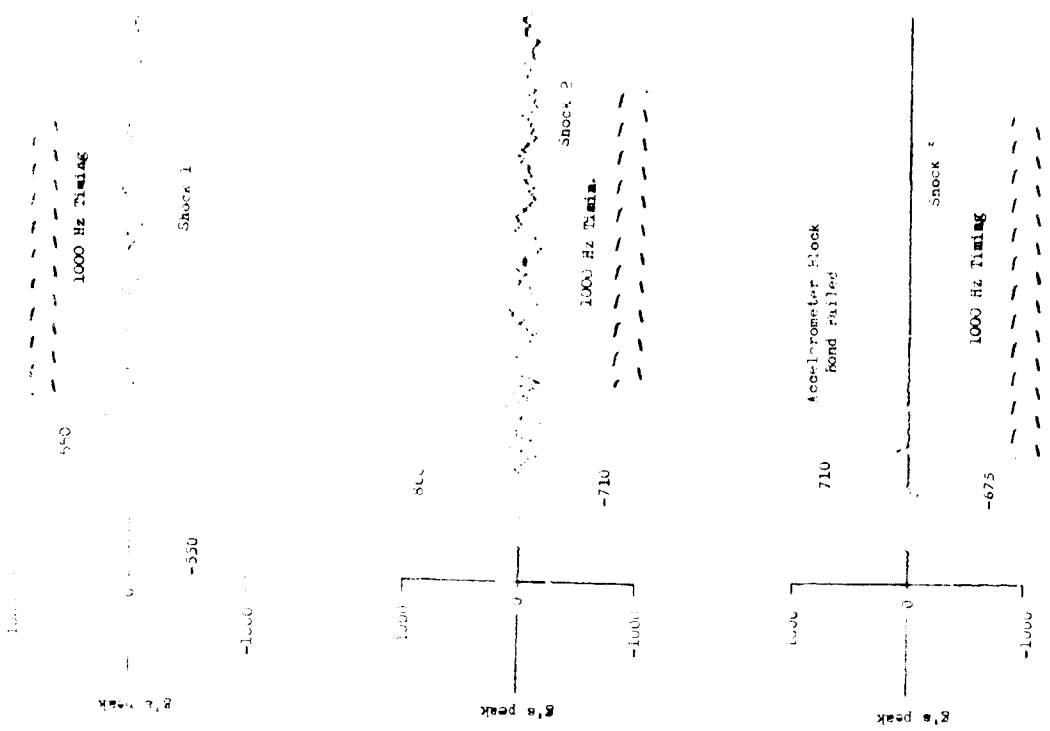
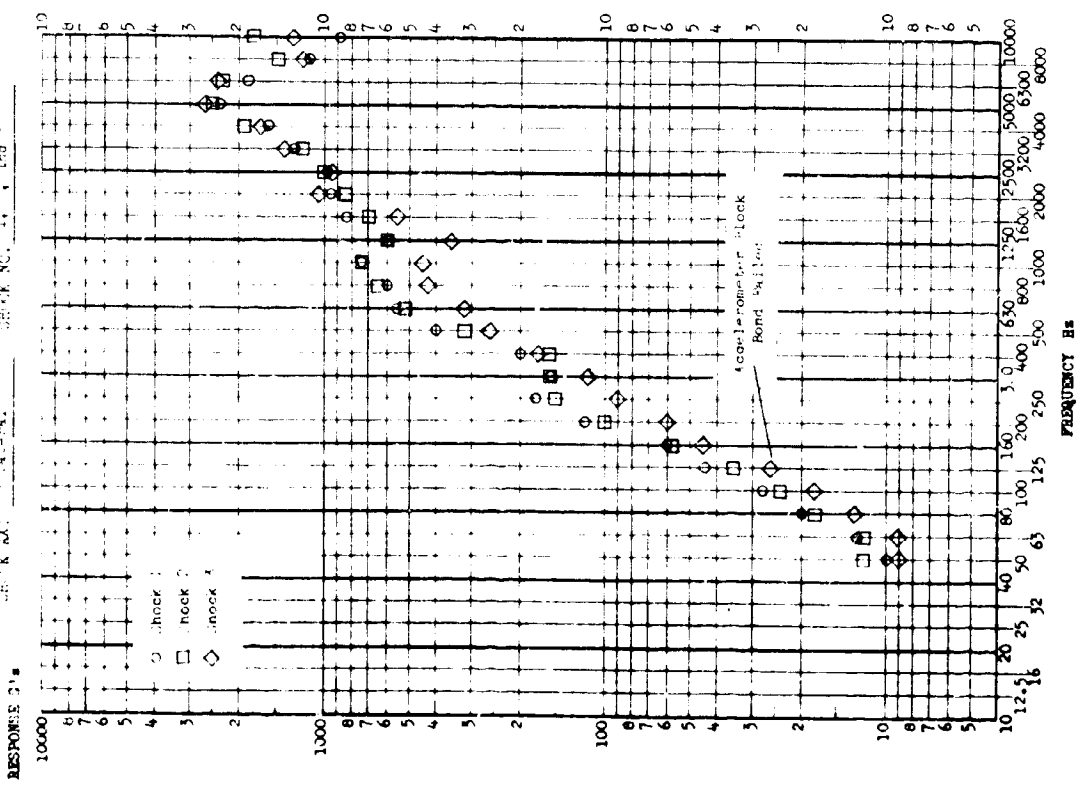


FIGURE 11.B.1-69

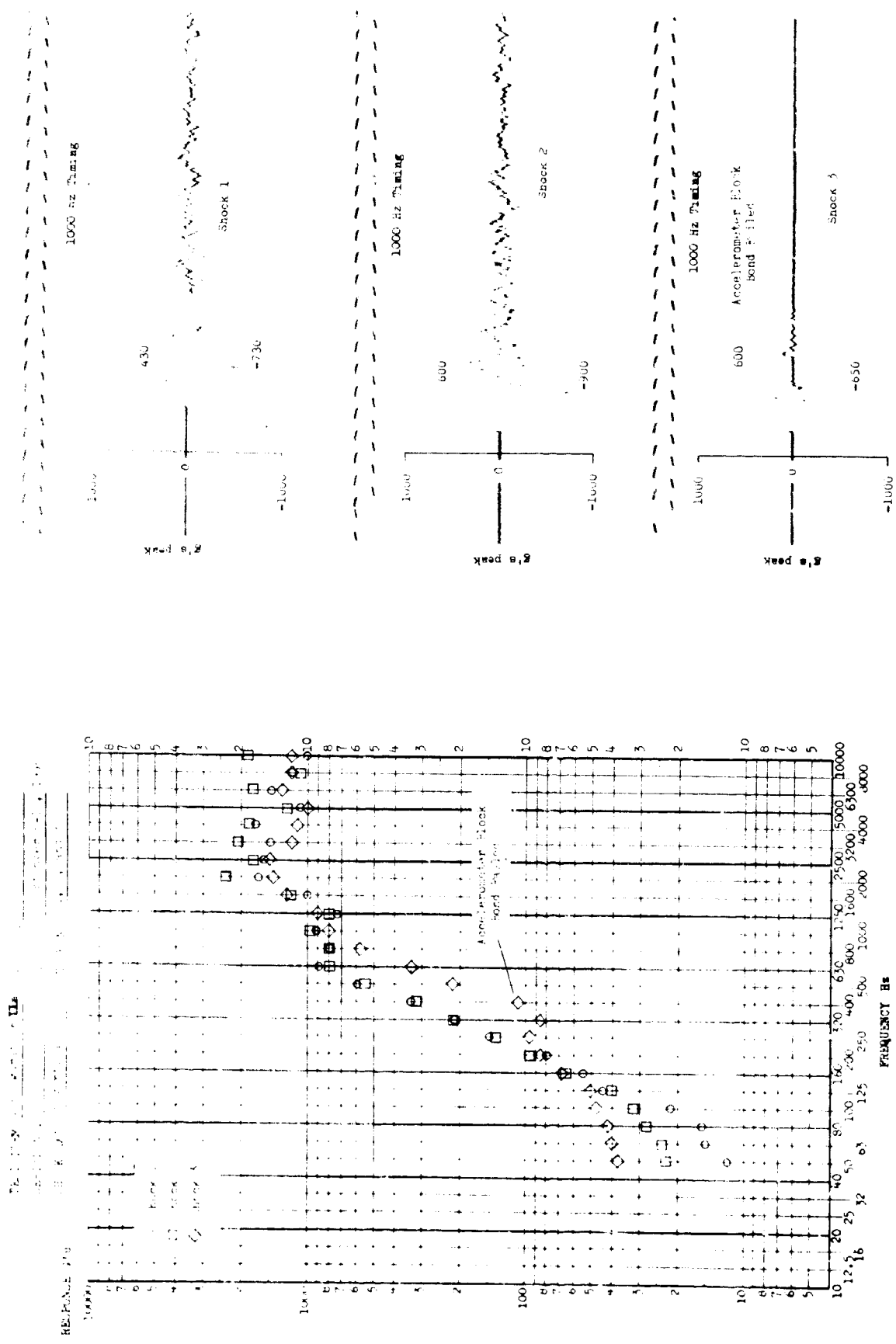


FIGURE 11.B.1-70

TEST ITEM Configuration IIa PART N
 SERIAL NO. TEST DATE September 6-10, 1969
 SHOCK AXIS longitudinal SHOCK NO. 1, 2, and 3

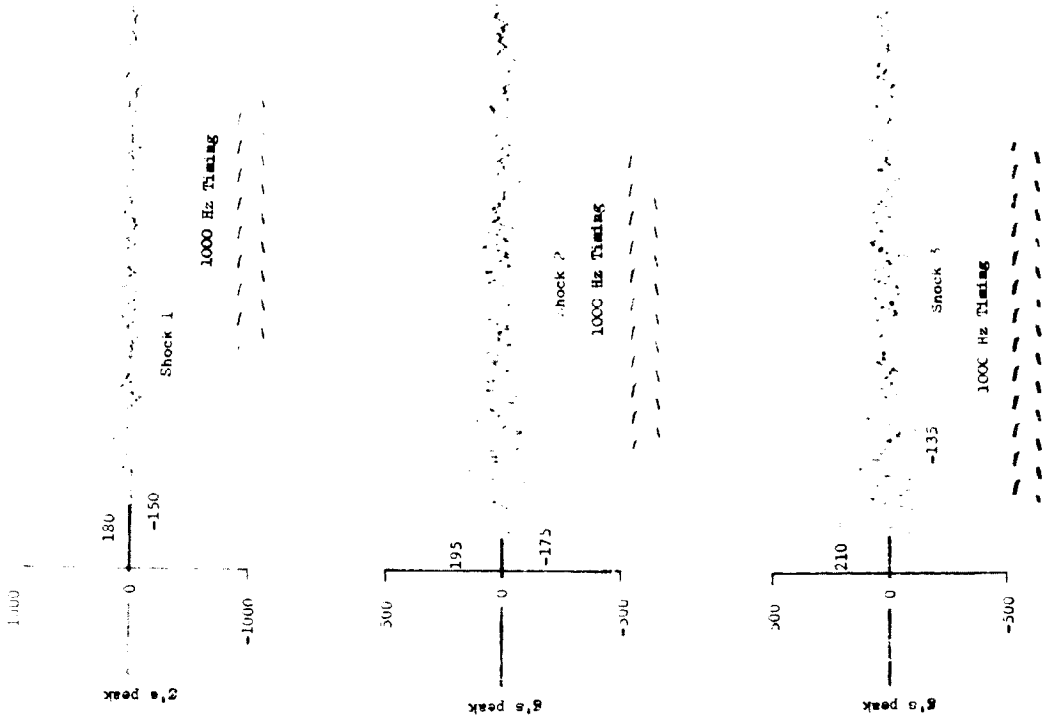
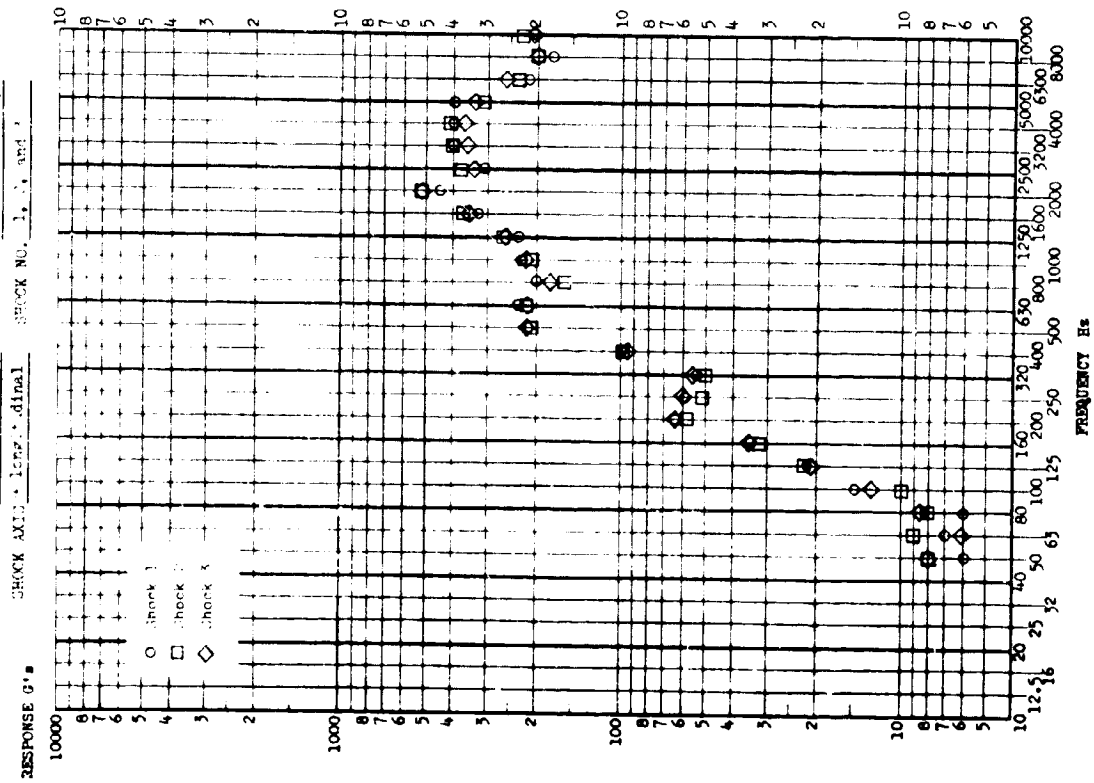


FIGURE 11.B.1-71

TEST ITEM: Condensation IIIa PARG NO.
 SERIAL NO.: 75-1049 September 6-10, 1968
 SHOCK AMPLITUDE: Internal SHOCK NO.: 1, 2, and 3

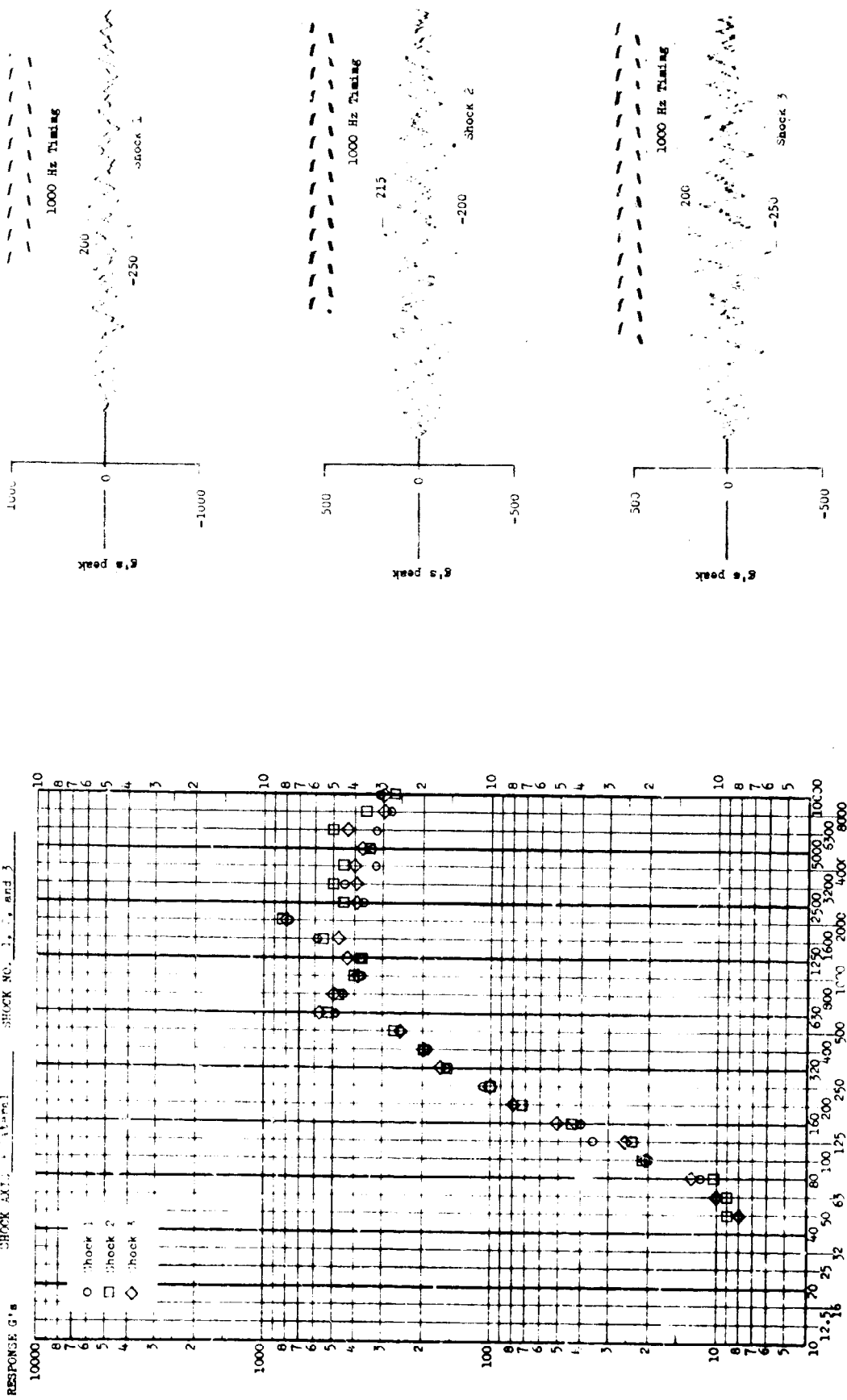


FIGURE II.B.1-72

TEST ITEM: Configuration ILS PART NO.
 SERIAL NO. TEST DATE: September 6-10, 1966
 SHOCK AXIS: vertical SHOCK NO.: 1, 2, and 3

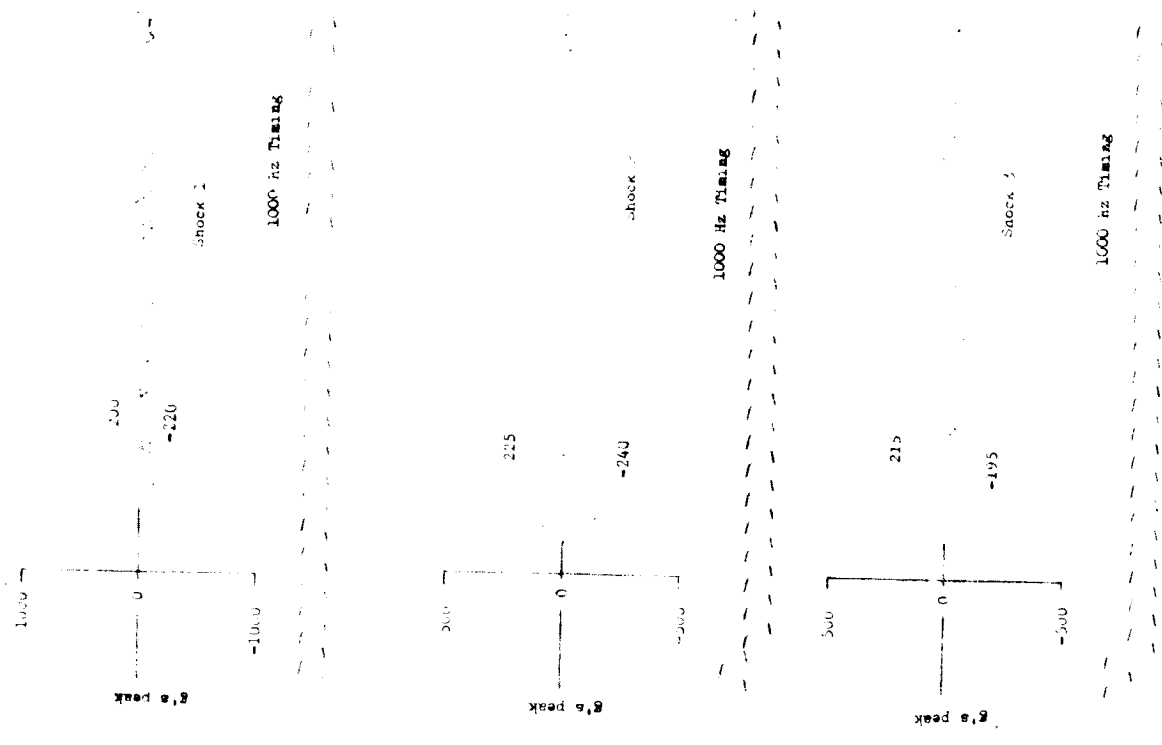
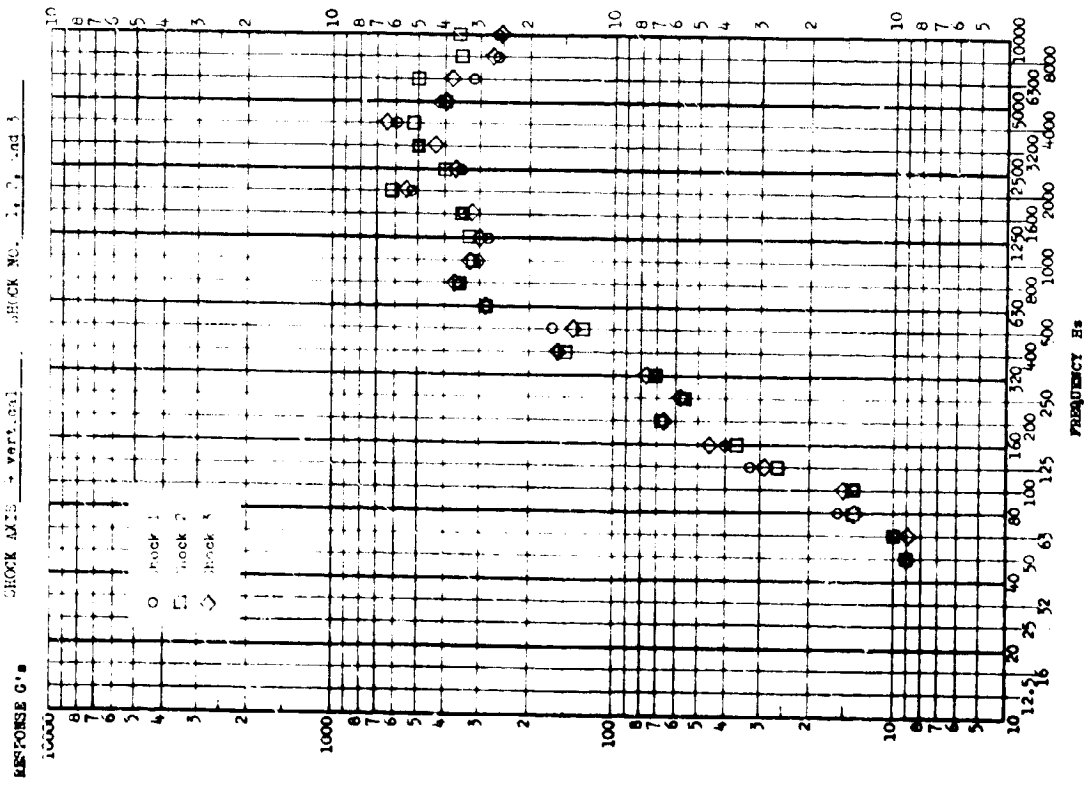


FIGURE 11.B.1-73

TEST ITEM Configuration II's PART NO.
 SERIAL NO. _____ TEST DATE September 2-10, 1968
 SHOCK AXIS 5 longitudinal SHOCK NO. 1, 2, and 3

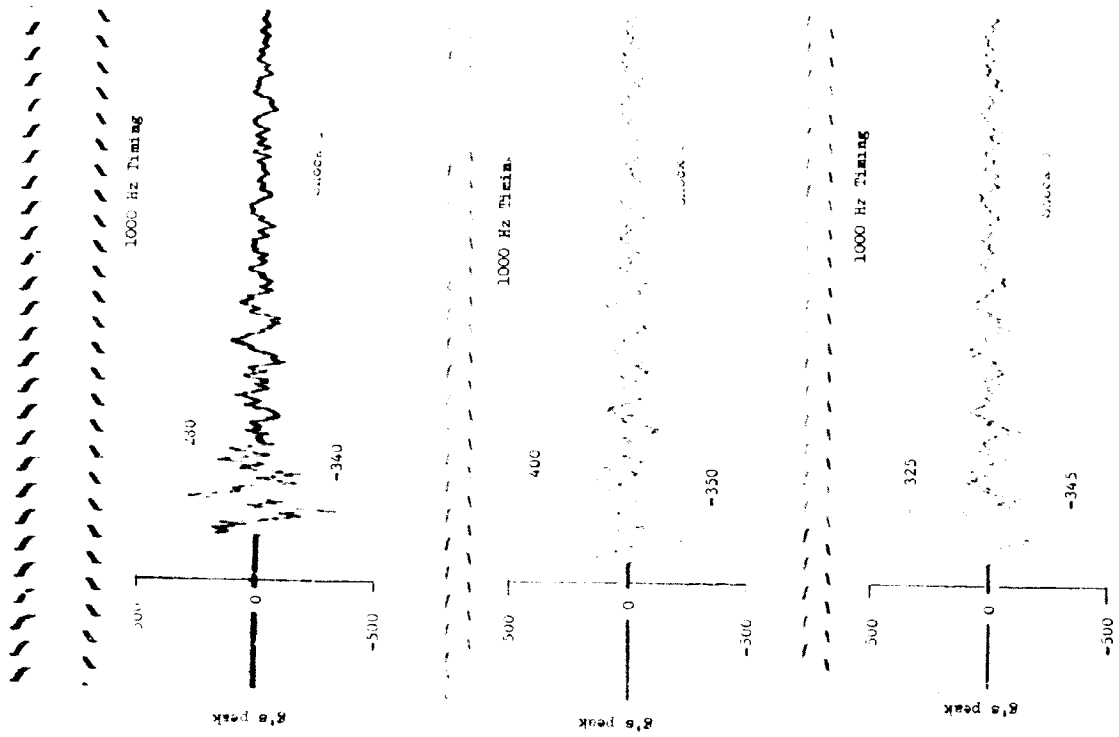
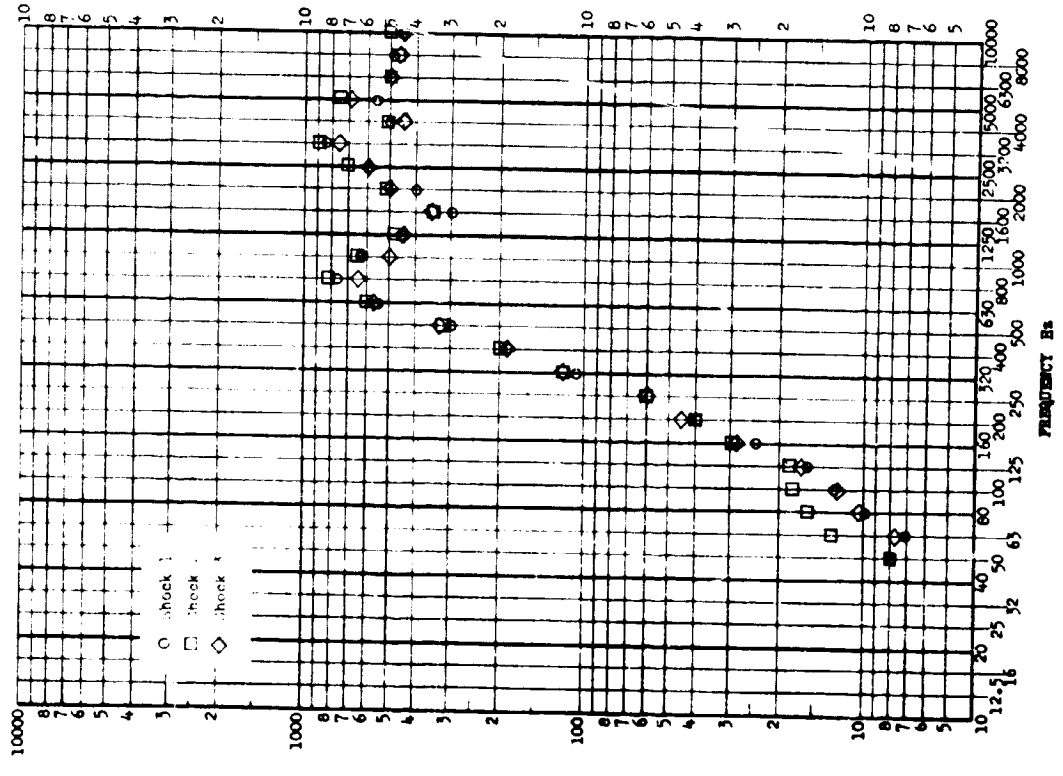


FIGURE 11.B.1-74

TEST ITEM Configuration II, PART NO. _____
 SERIAL NO. _____ TEST DATE September 22-10, 1962
 SHOCK AXIS 5 lateral SHOCK NO. 1, 2, and 3

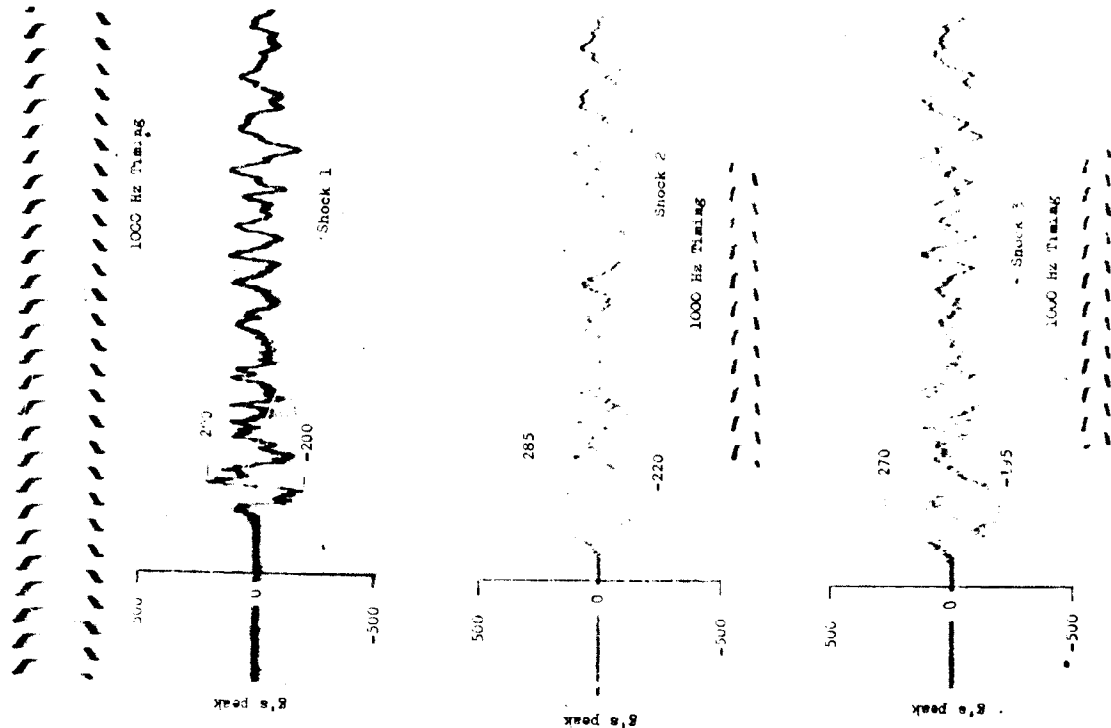
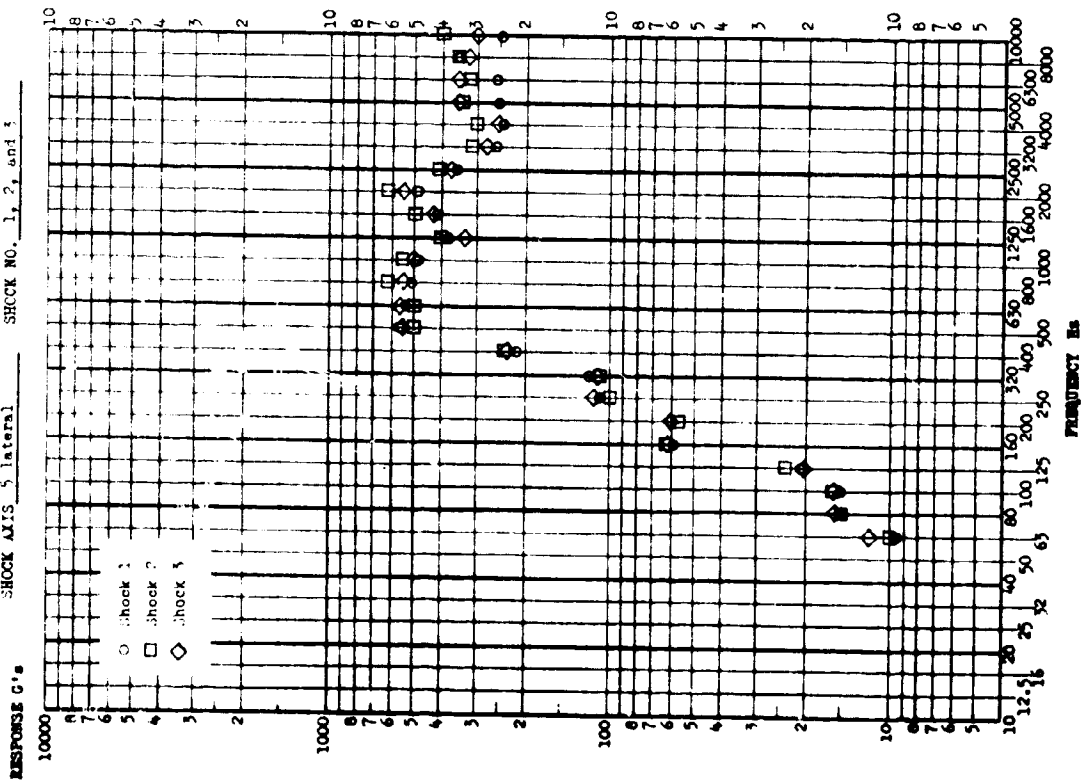


FIGURE II.B.1-75

TEST ITEM Configuration IIa PART NO. _____
 SERIAL NO. _____ TEST DATE September 6-10, 1968
 SHOCK AXIS: _____ SHOCK NO. 1, 2, and 3

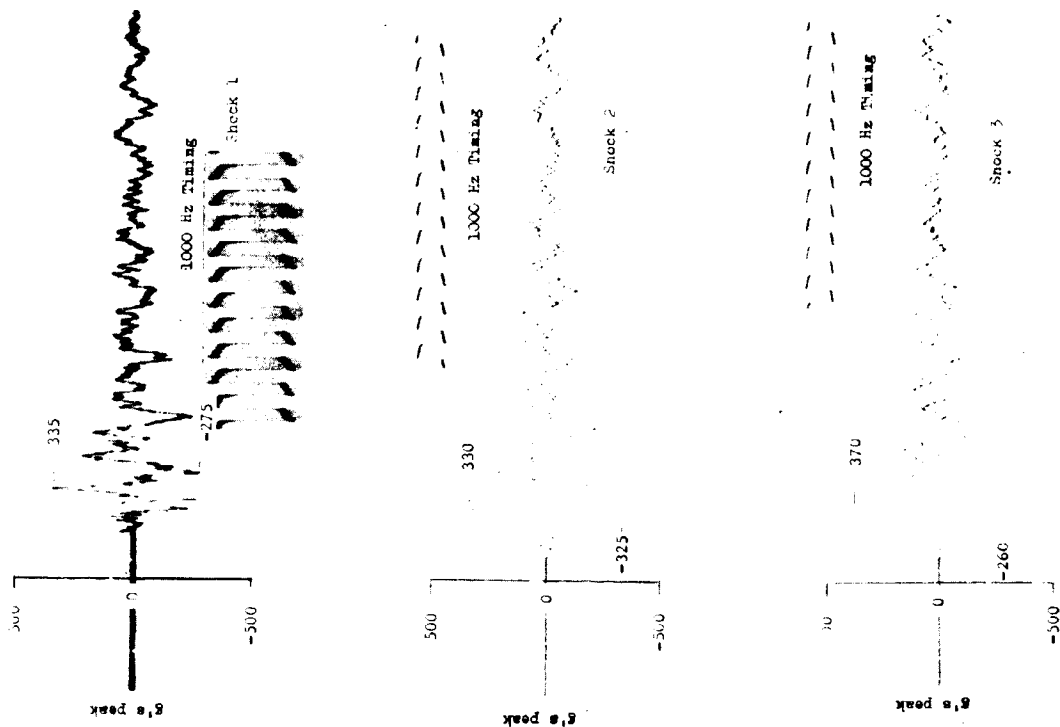
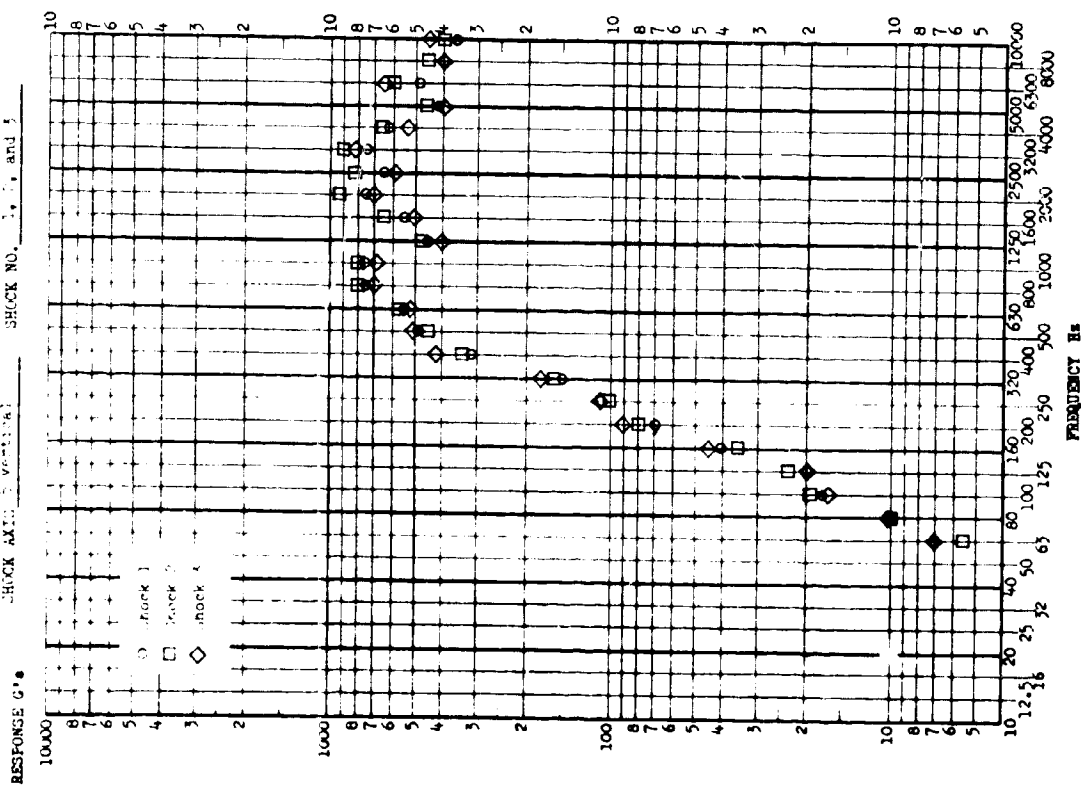


FIGURE II.B.1-76

TEST ITEM: C-100000-111a
 SERIAL: 100000-111a
 BLOCK: 111a
 TEST DATE: 10/10/68
 TEST LOCATION: 111a

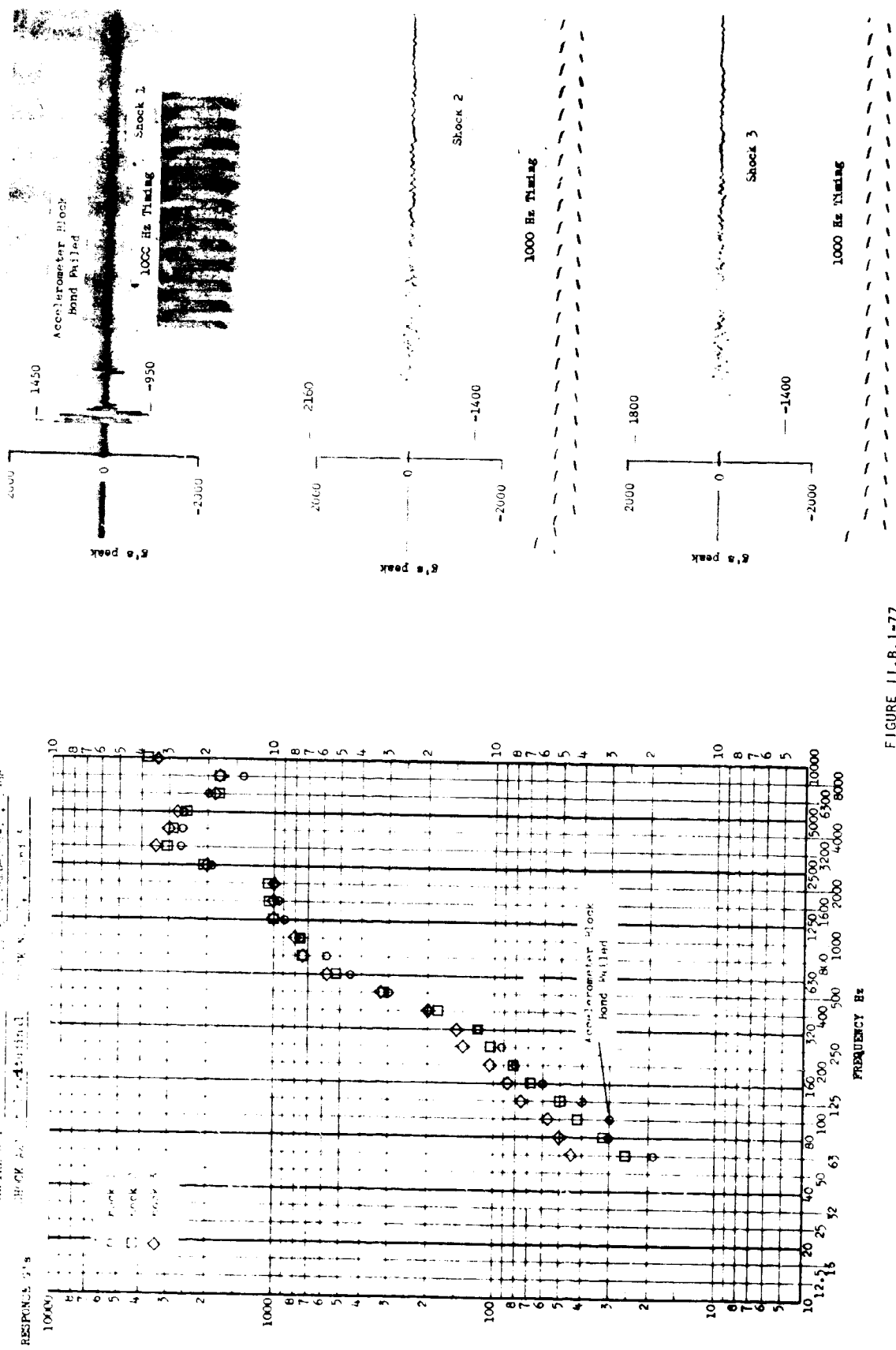


FIGURE 11.B.1-77

TEST ITEM Configuration II, PART NO. _____
 SERIAL NO. _____ TEST DATE September 6-10, 1968
 SHOCK AXES 6, 1, 2, and 3

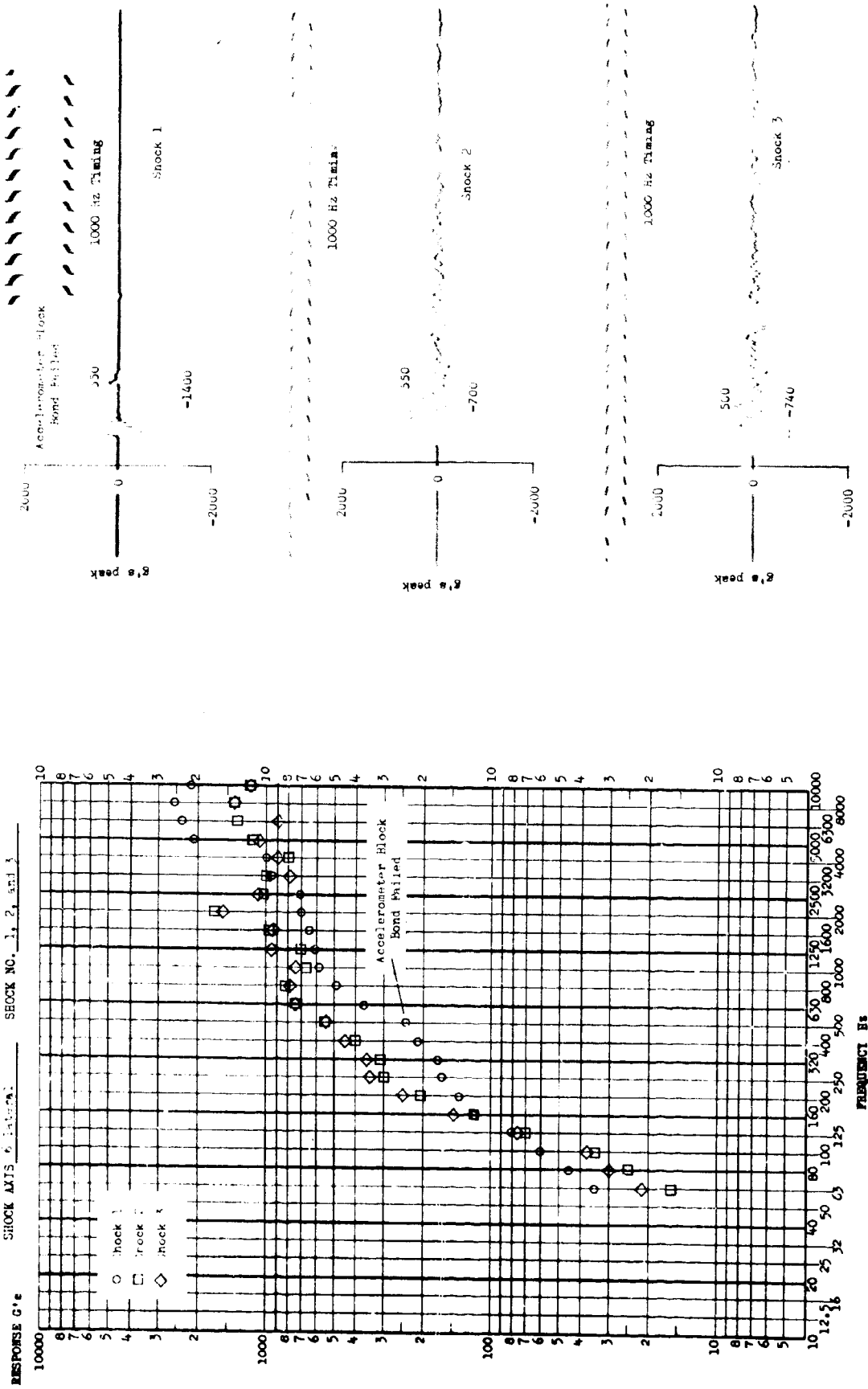
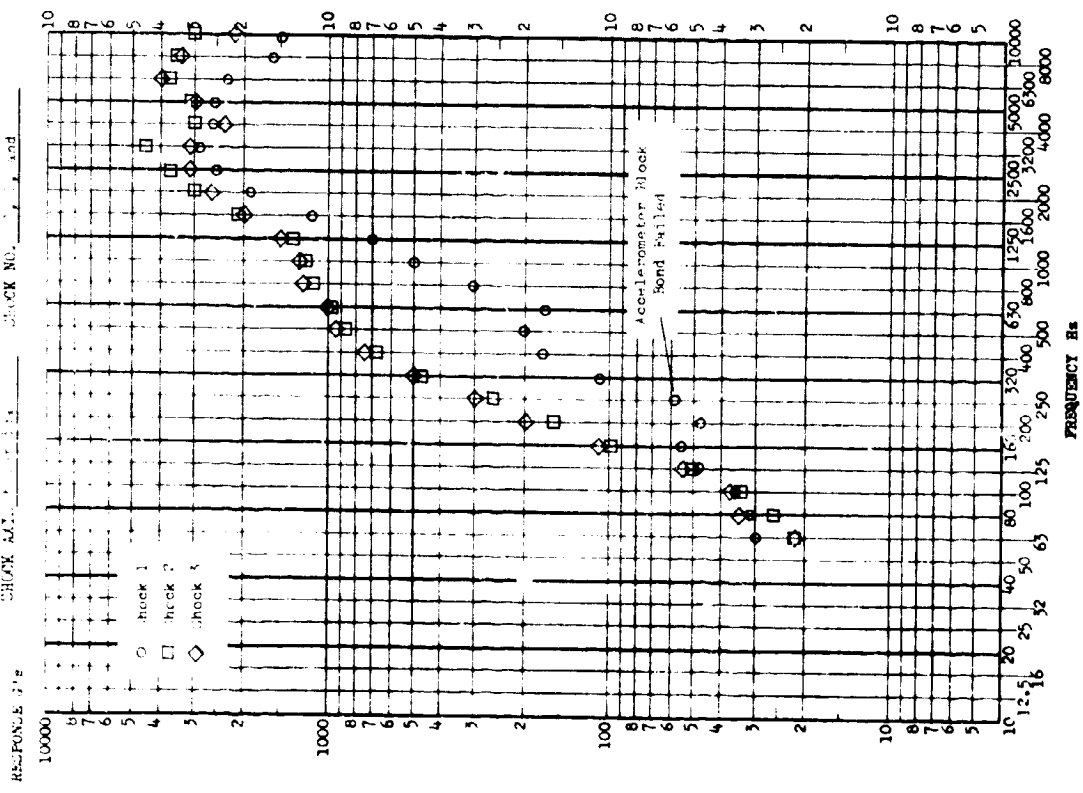
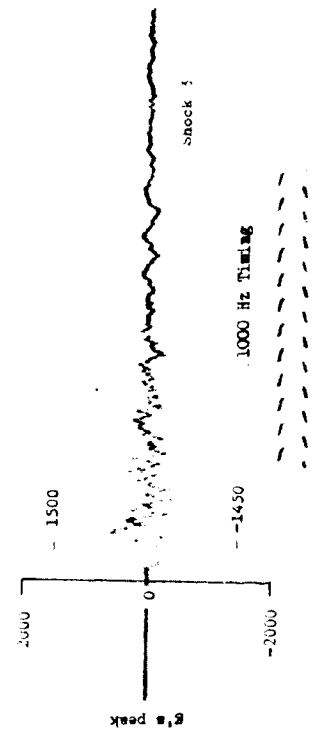
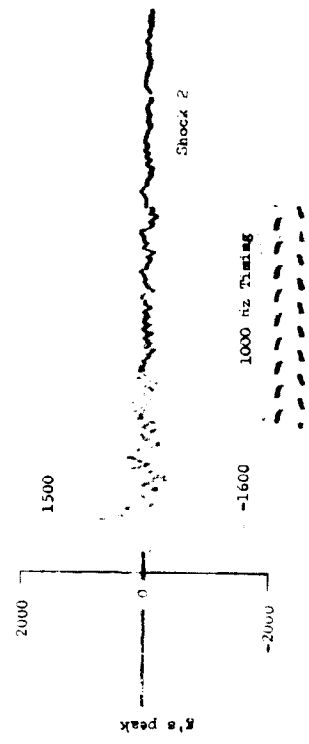
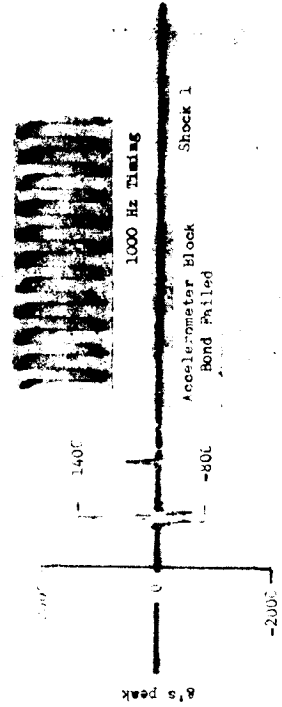


FIGURE II.B.1-78

TEST ITEM: Control Panel III, Part No. 1000
 SERIAL NO.: 1000
 SHOCK ANALYSIS: Shock No. 1, 2, and 3



TEST ITEM: Compressor IIIa PART NO. _____
 SERIAL NO. _____ TEST DATE: SEPTEMBER 11, 1964
 SHOCK ANAL. _____ SHOCK NO. 1, 2, and 3

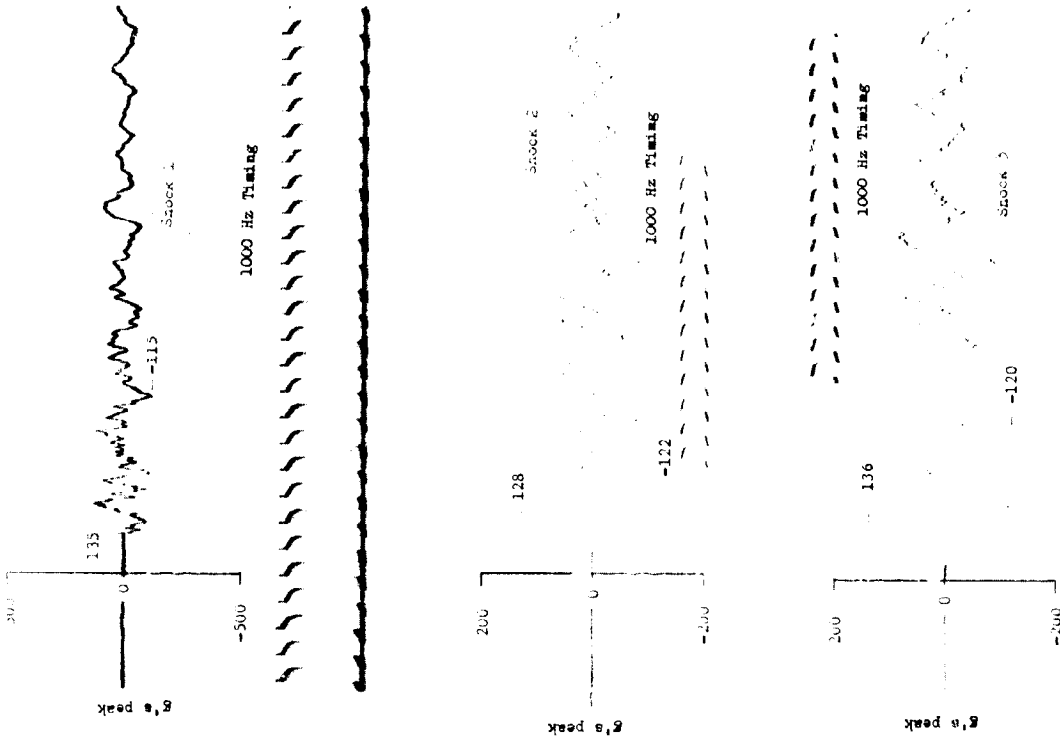
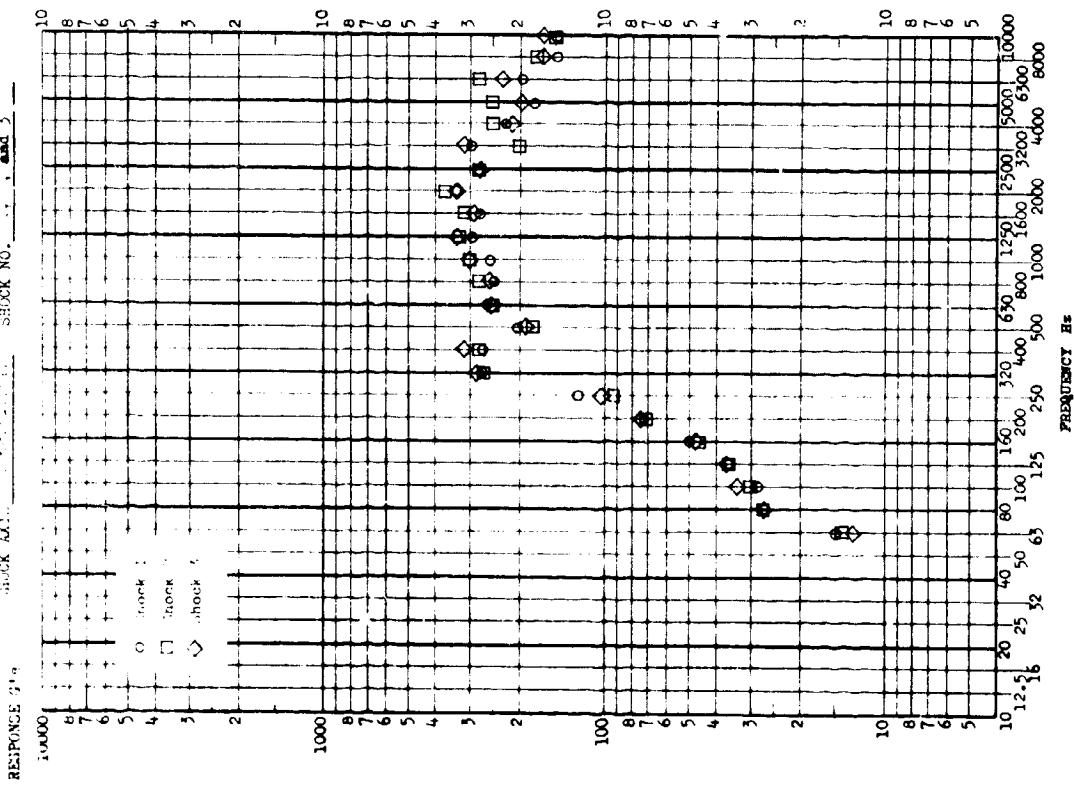


FIGURE 11.B.1-80

TEST ITEM Configuration IIs Part No. _____
 SERIAL NO. _____ TEST DATE September 6-10, 1968
 SHOCK AXIS 7 lateral SHOCK NO. 1, 2, and 3

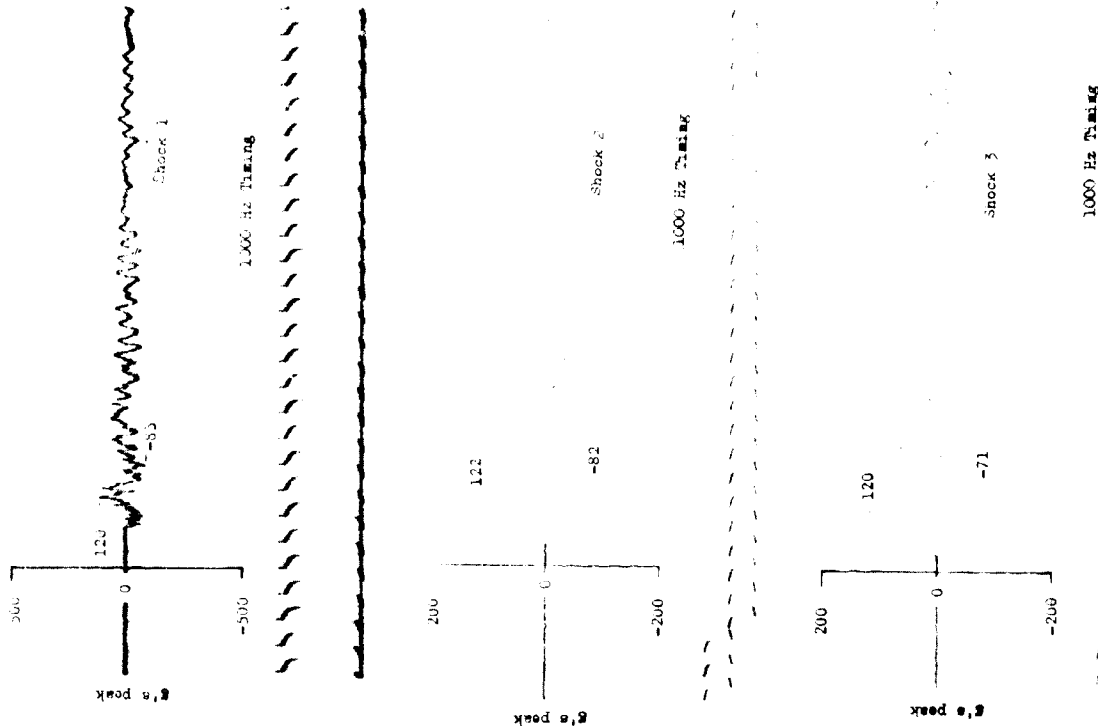
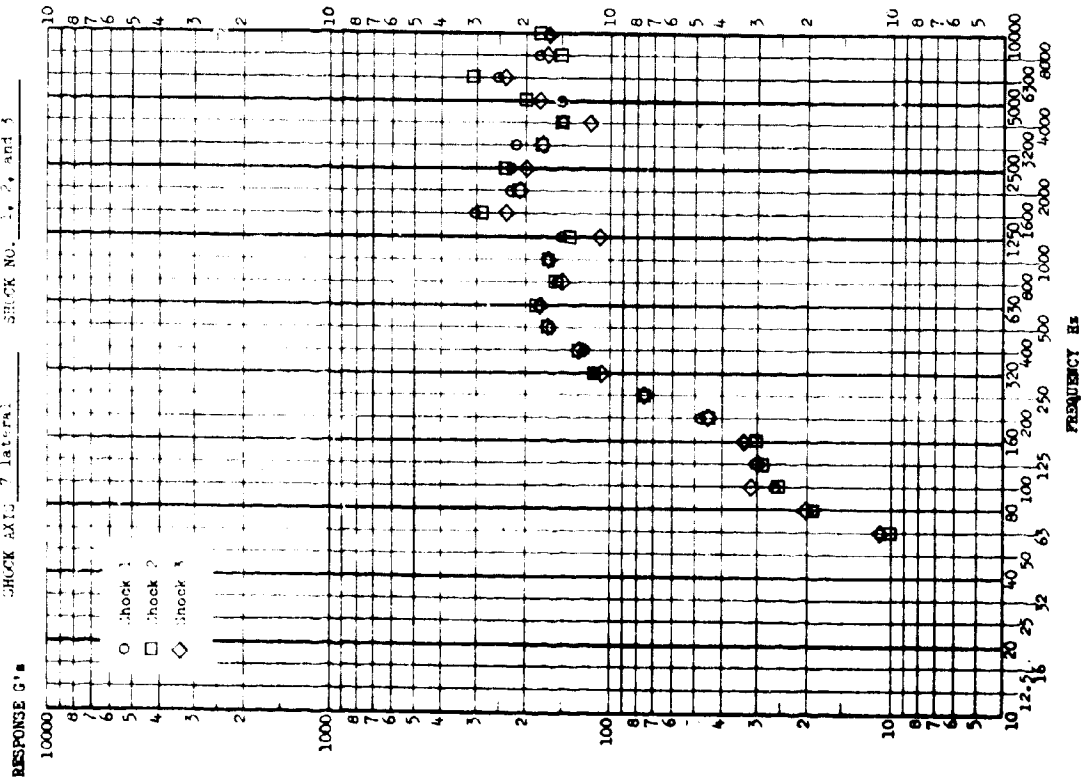


FIGURE II.B.1-81

TITLE: ...
 PROJECT: ...
 DRAWING NO.: ...
 DATE: ...

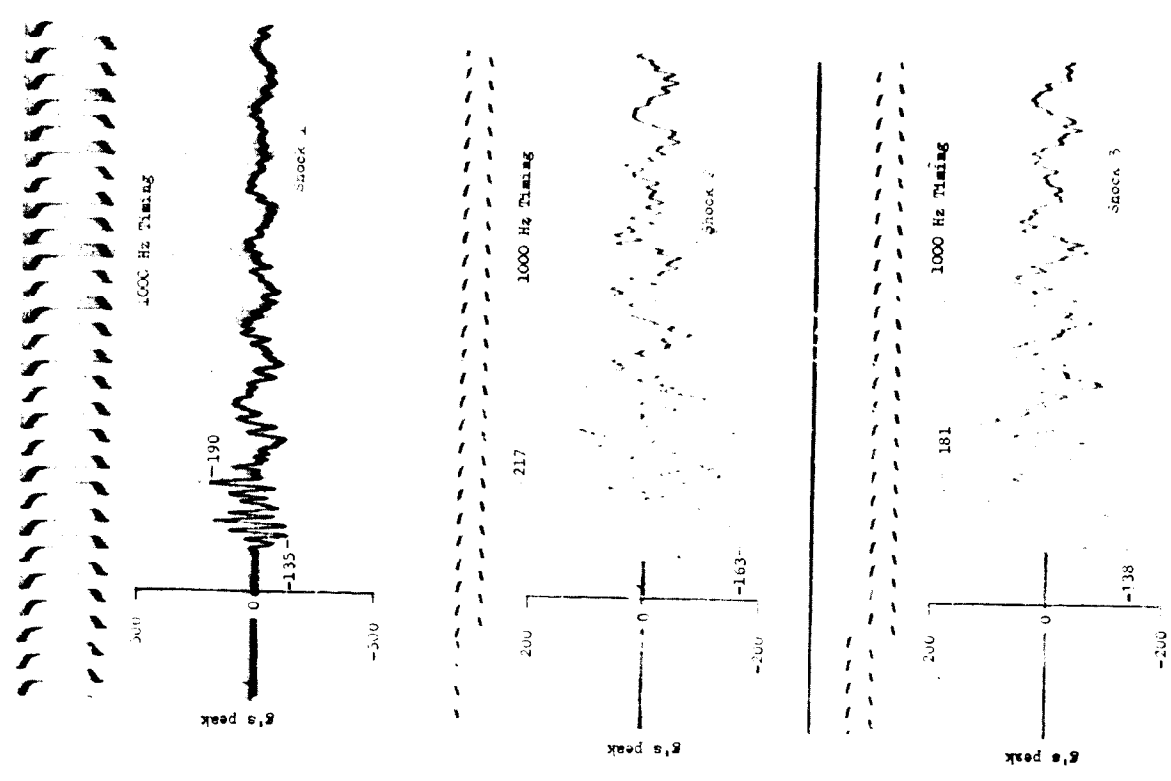
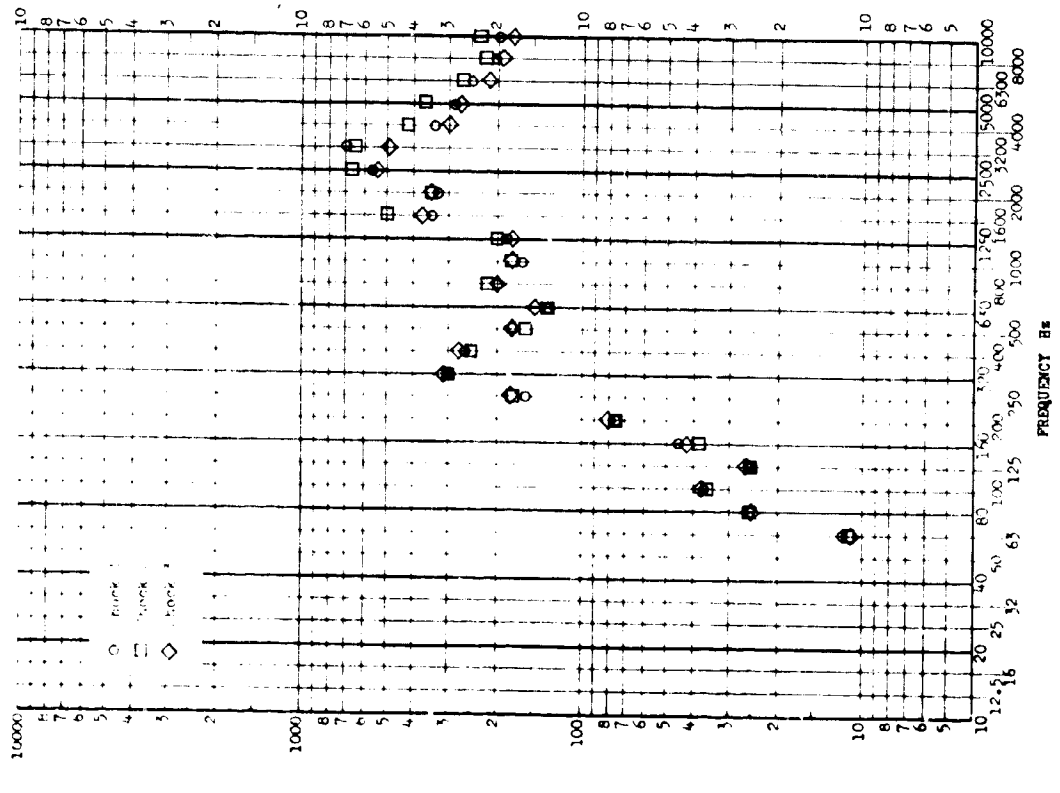


FIGURE II.B.1-82

TEST ITEM Configuration 1a PART NO.
 SERIAL NO. TEST DATE September 5-10, 1968
 SHOCK AXIS 8 longitudinal SHOCK NO. 1, 2, and 3

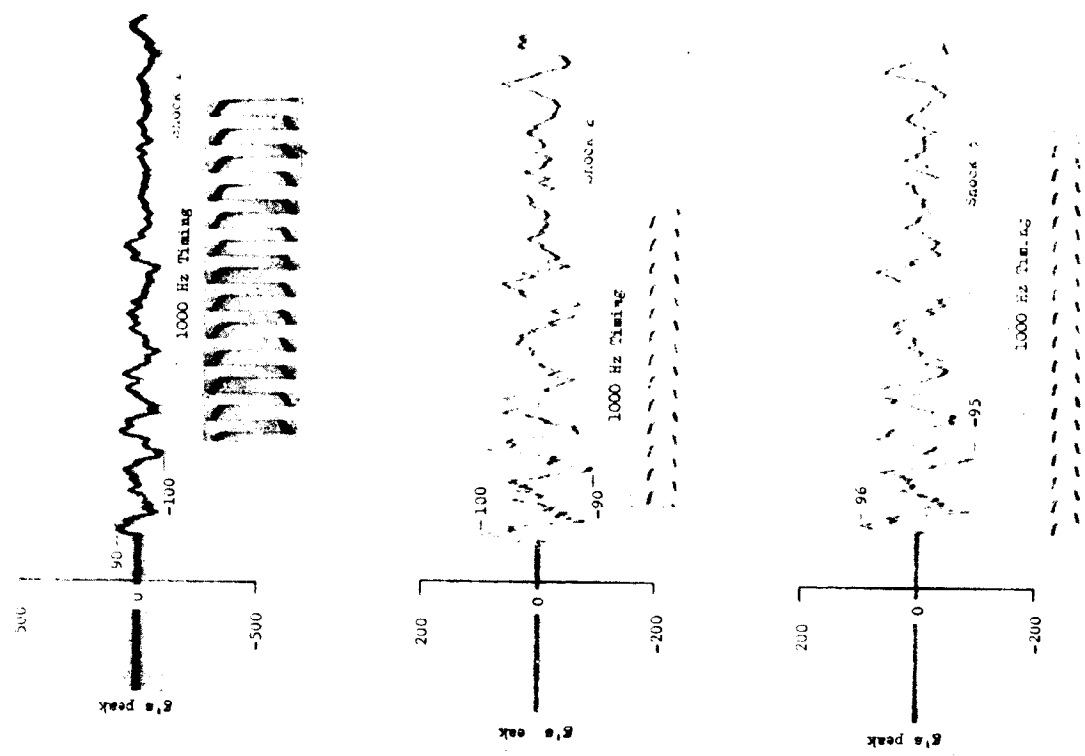
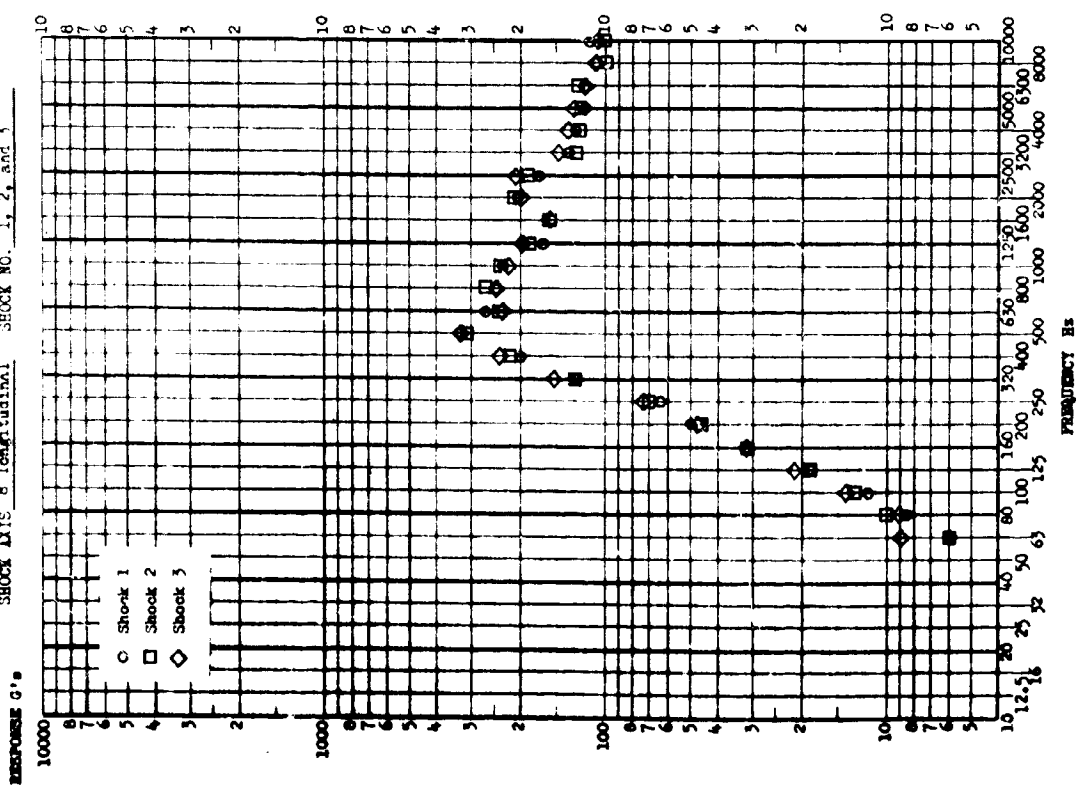


FIGURE 11.8.1-83

TESTING Configuration IIa 1-84 V.
 Serial No. 762783 September 2-11, 1964
 CHECK LOG. (Later) CHECK NO. 1, 2, and 3

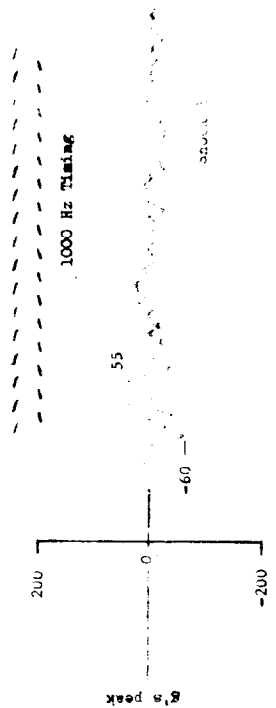
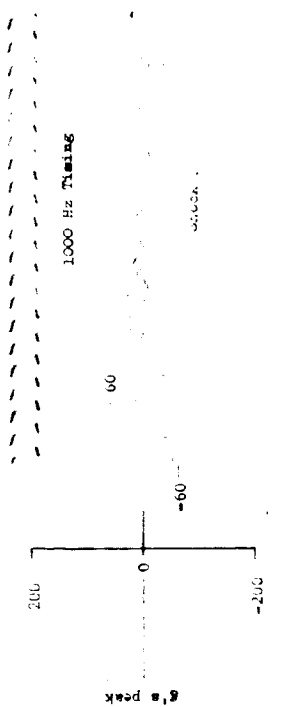
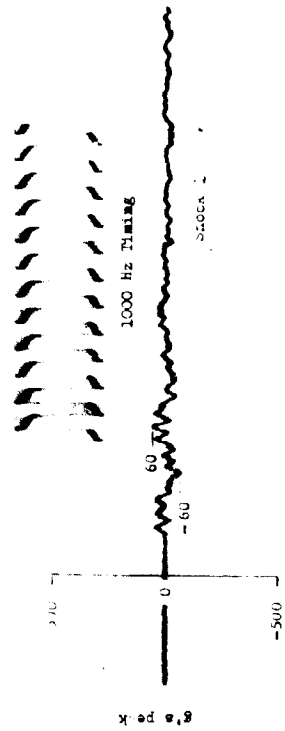
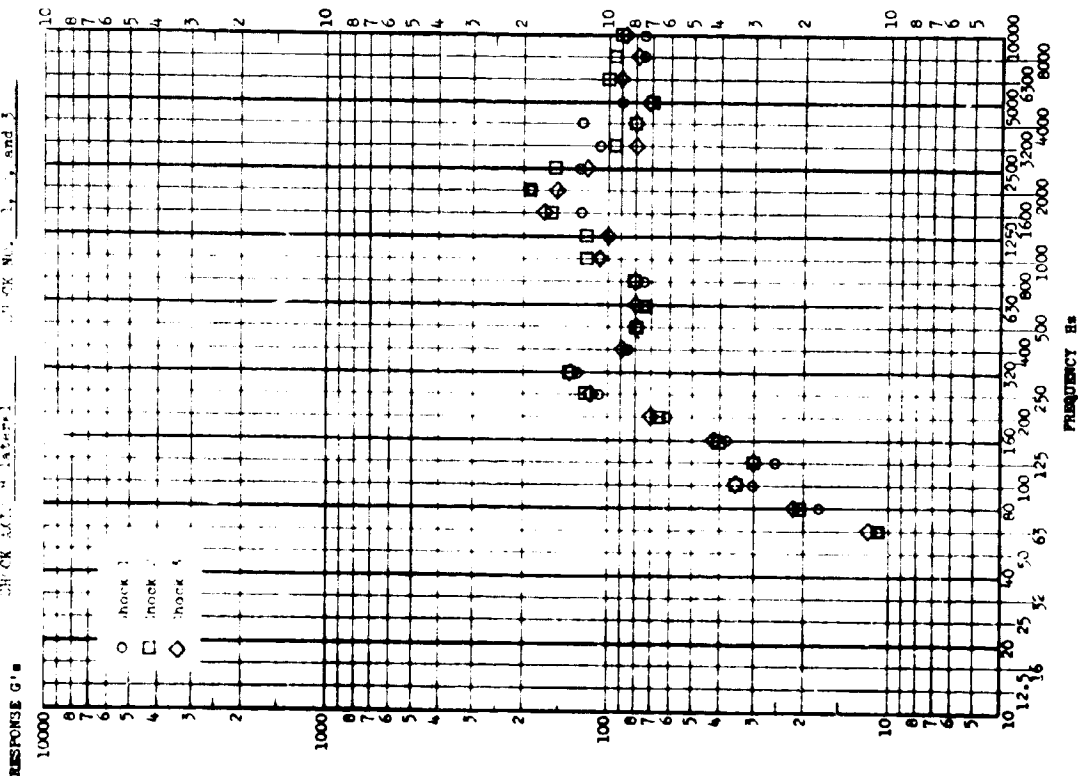


FIGURE 11.B.1-84

THIS ITEM Configuration IIa 197 N
 SERIAL N. 200 1200 September 6-11 1948
 CHECK AREA: 40000000 CHECK NO. 1, 2, and 3

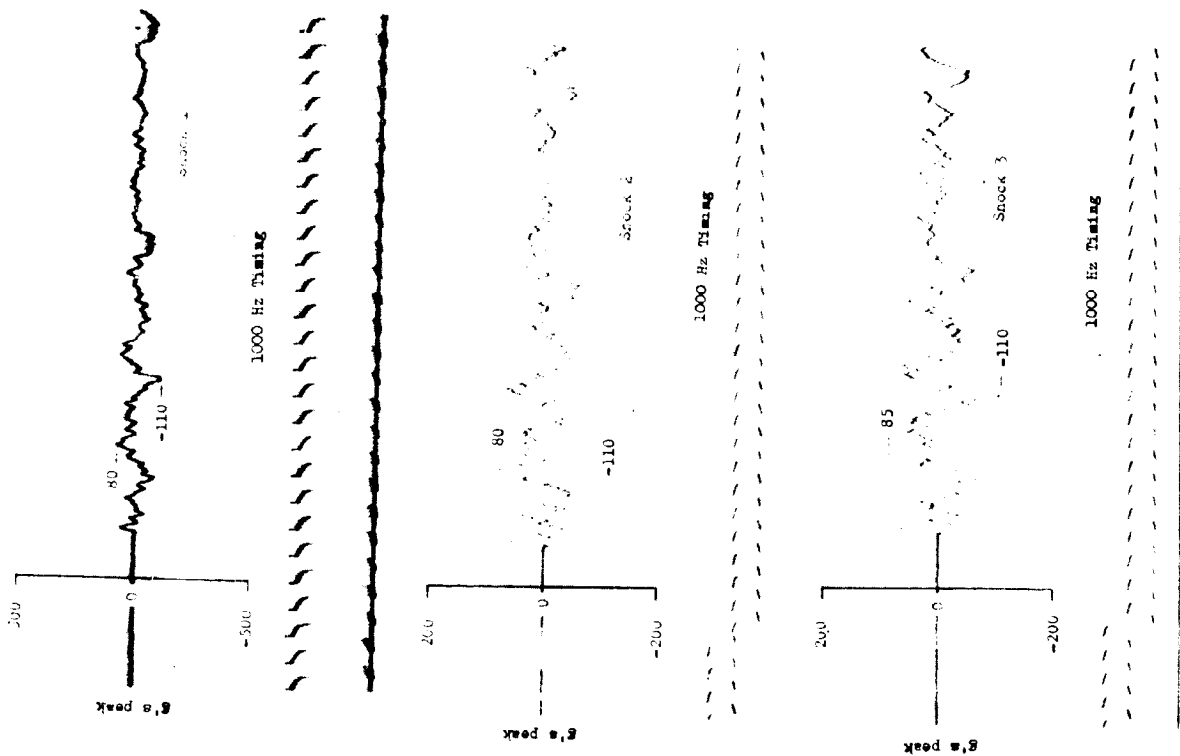
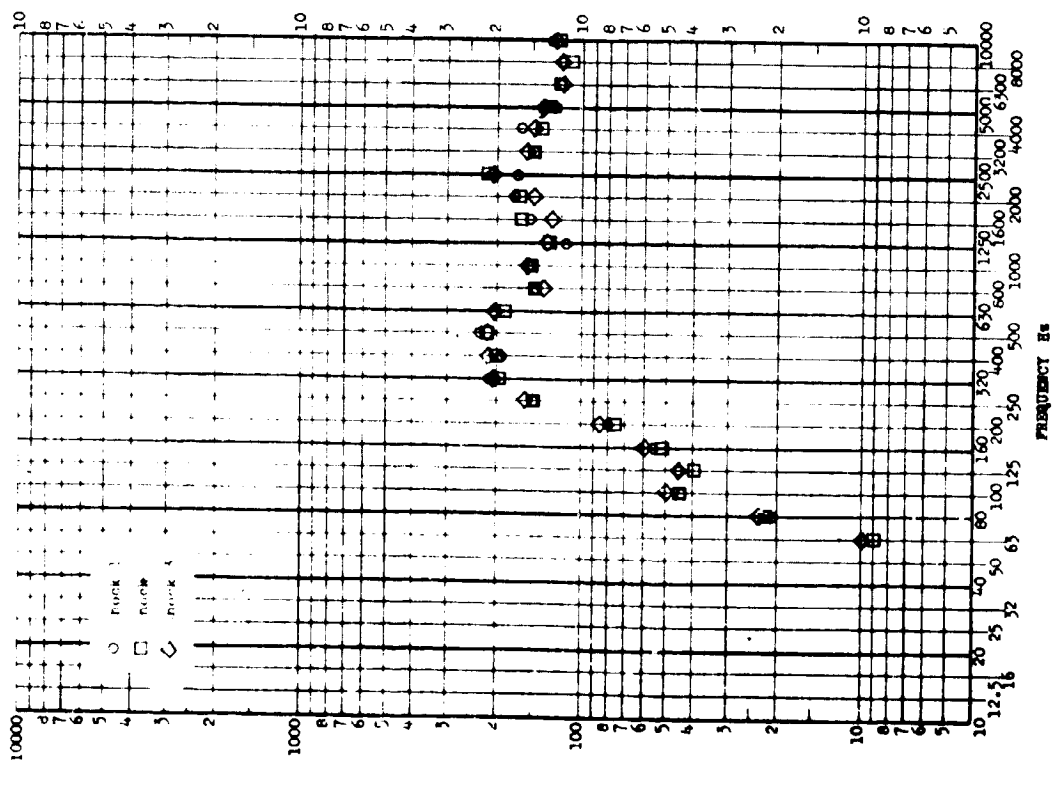


FIGURE II.B.1-85

TEST ITEM CONFIDENTIAL IIB PART NO.
 SERIAL NO. PLT DATE September 10-11, 1968
 SHOCK AXIS 1 (LONGITUDINAL) SHOCK NO. 1, 5, and 6

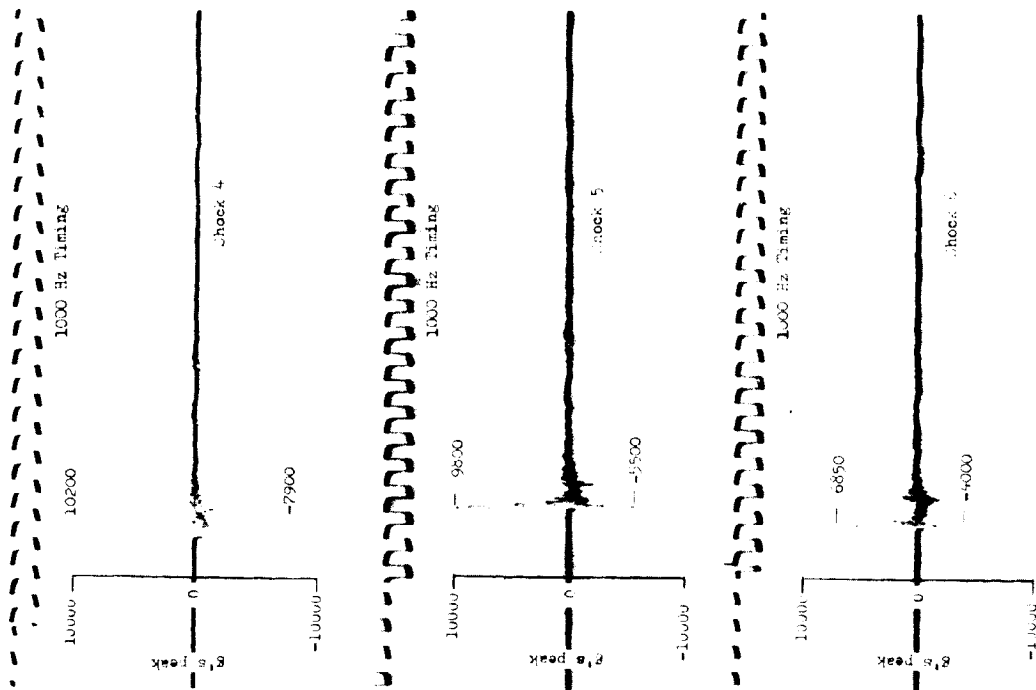
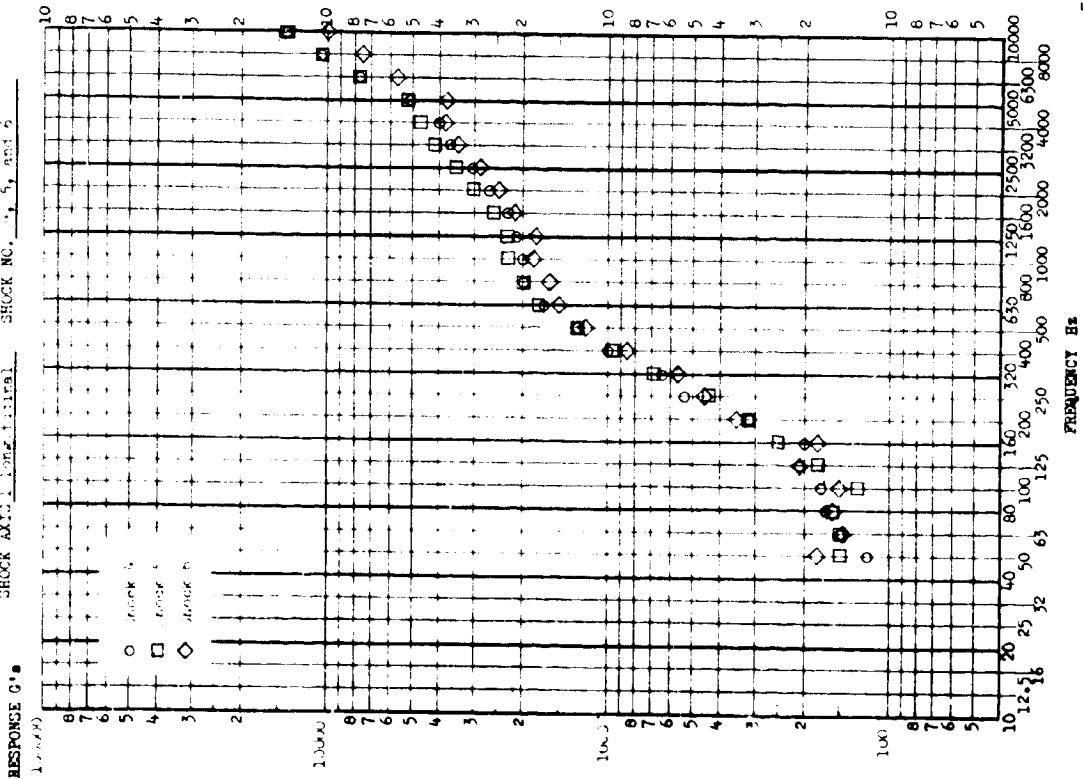


FIGURE 11.B.1-86

TEST ITEM Configuration I in PART NO. _____
 SERIAL NO. _____ TEST DATE September 10-11, 1968
 SHOCK AXIS 1 lateral SHOCK NO. 4, 5, and 6

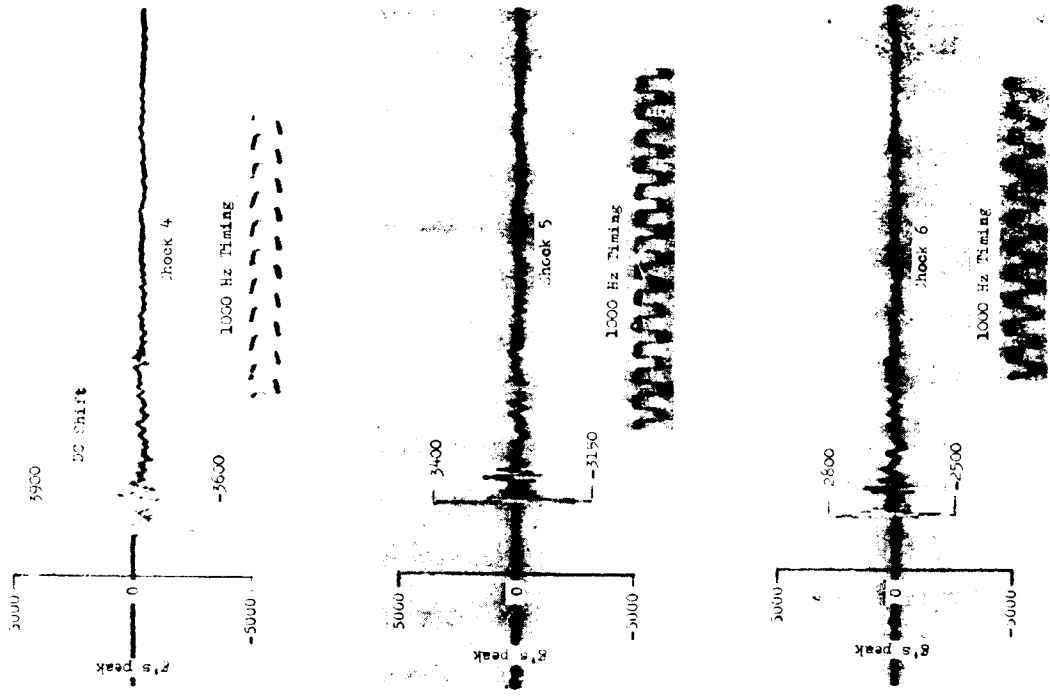
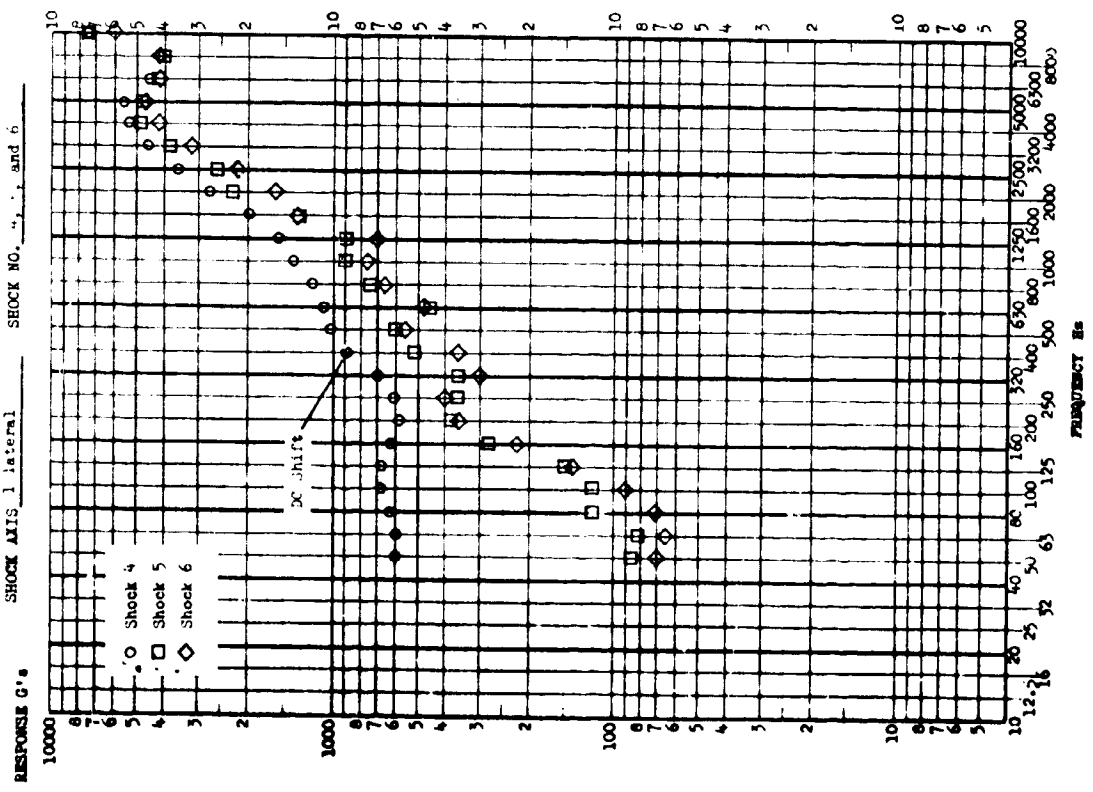


FIGURE 11.B.1-87

TEST ITEM: G. L. ...
 DRAWING NO.: ...
 CHECK NO.: ...

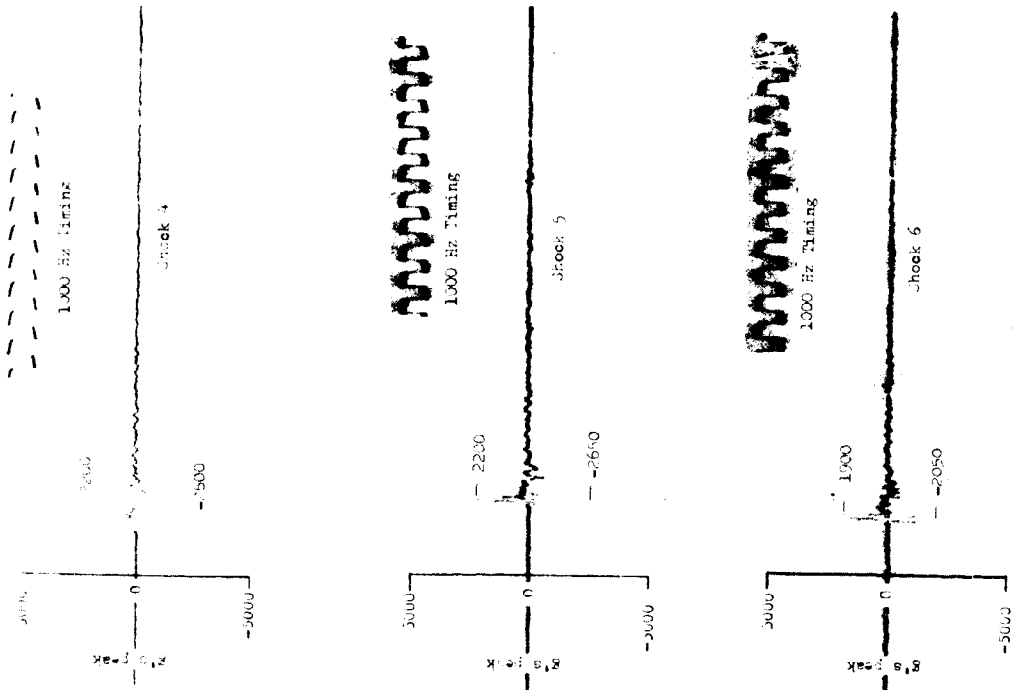
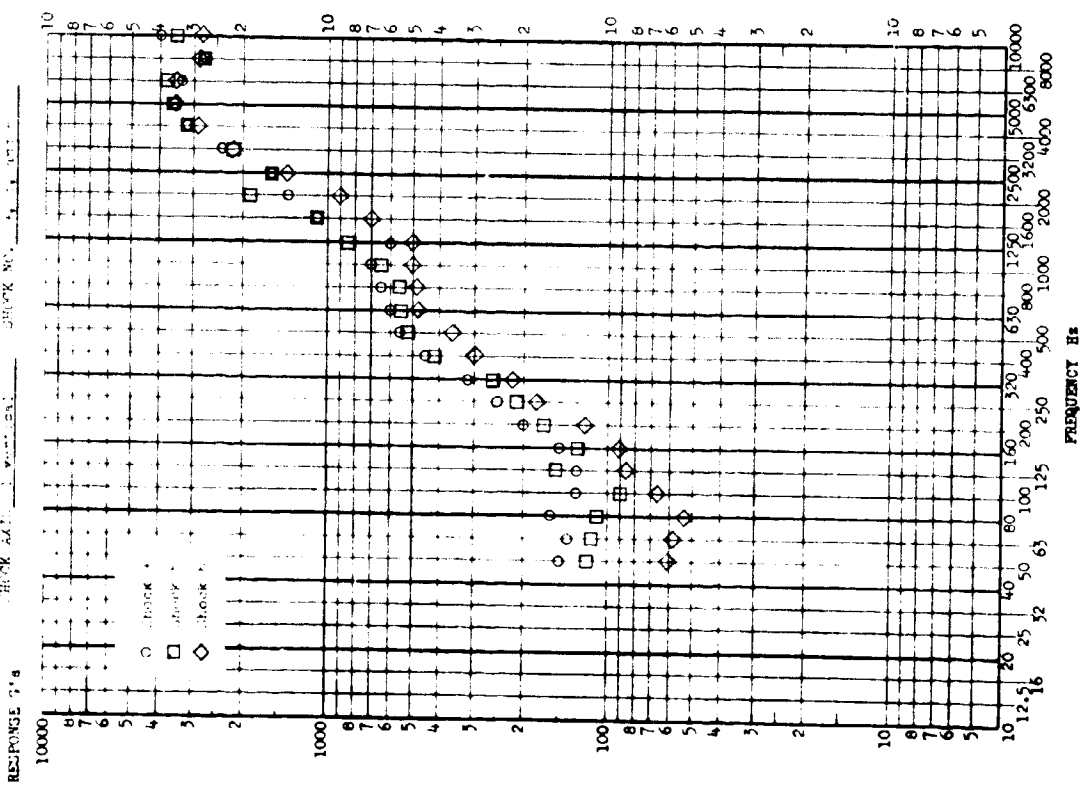


FIGURE II.B.1-88

TEST ITEM: Competition II, Part V
 SERIAL NO.: 25.7 2475, Instrument Ball, Part
 SHOCK AXIS: Longitudinal SHOCK NO.: 3, 4, 5, 6

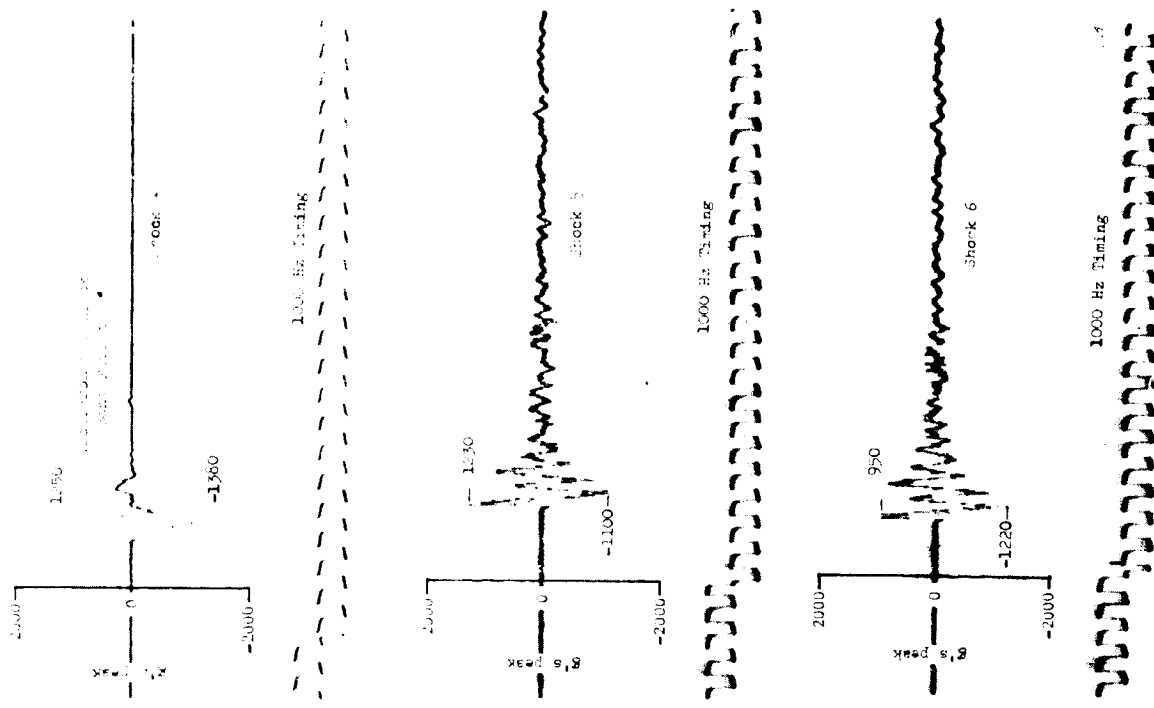
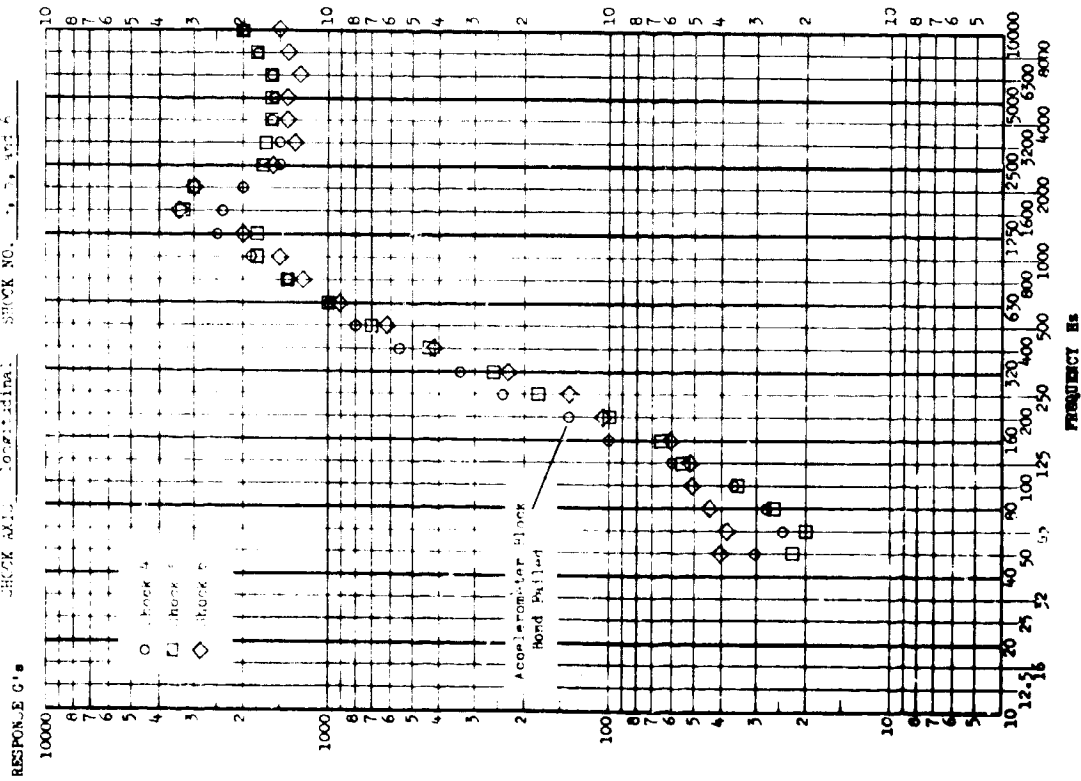


FIGURE II.B.1-89

TEST ITEM Continuation III PART NO.
 SERIAL NO. TEST DATE September 1 - 11, 1964
 SHOCK AXIS Vertical SHOCK NO. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

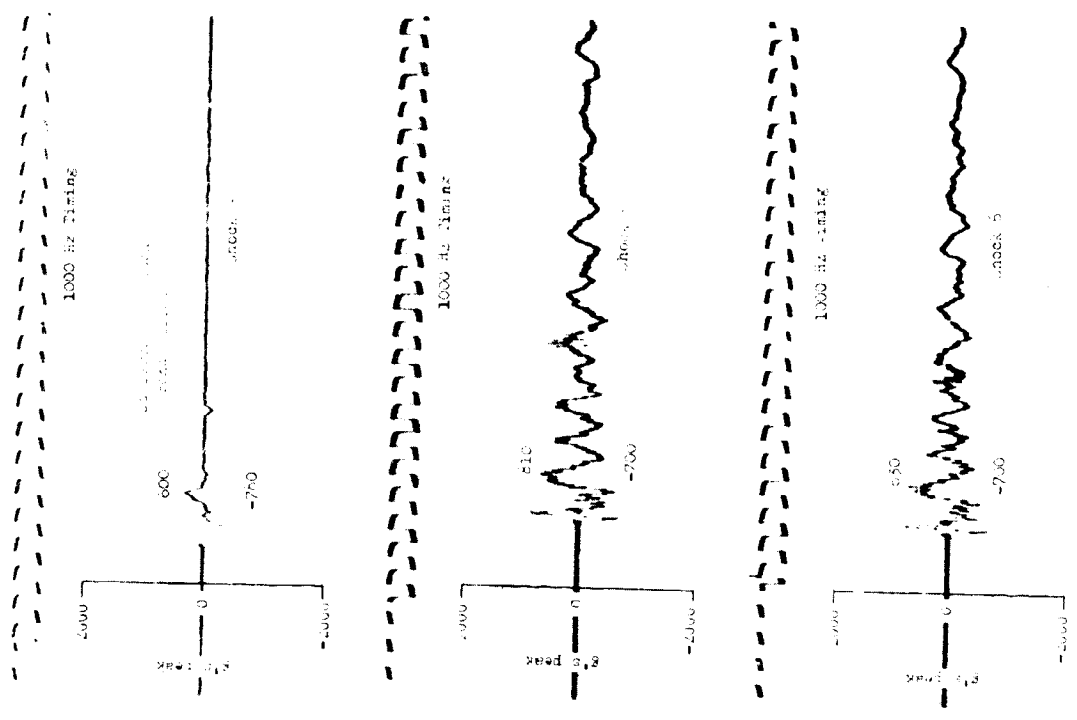
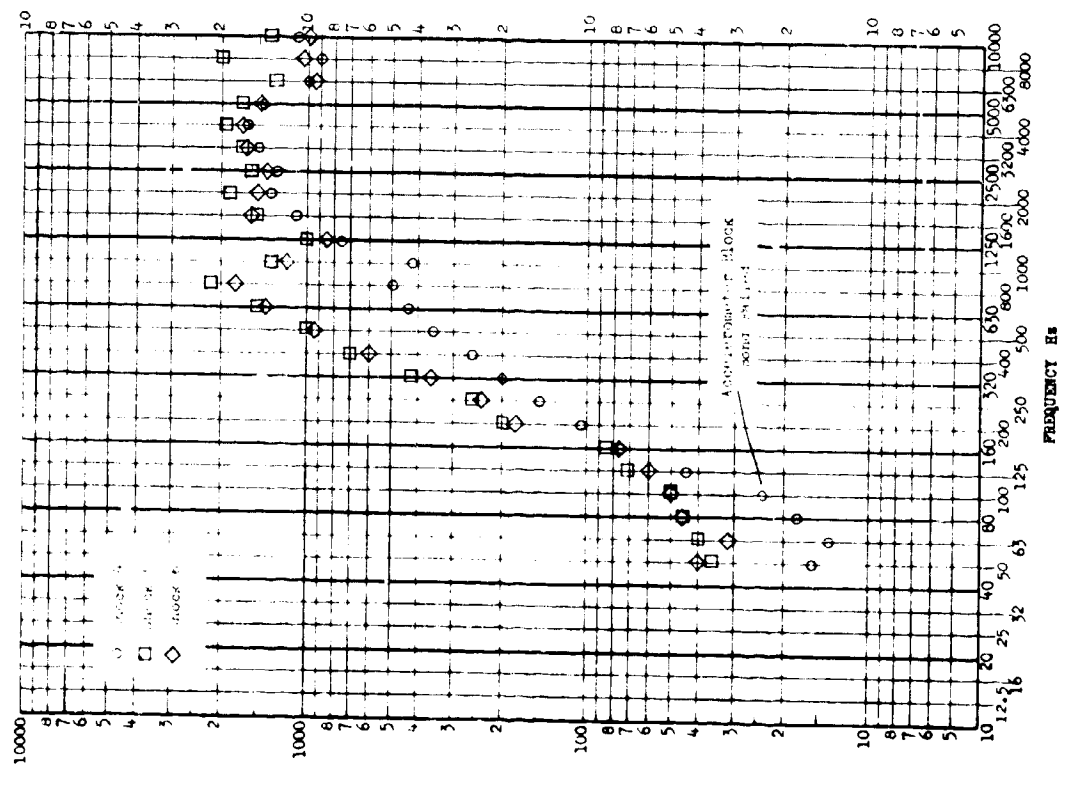


FIGURE II.B.1-90

TEST ITEM CONSPIRACY IFF - ARP No. _____
 SERIAL NO. _____ TEST DATE September 1-11, 1968
 SHOCK AXIS 2 Vertical SHOCK NO. 4, 5, and 6

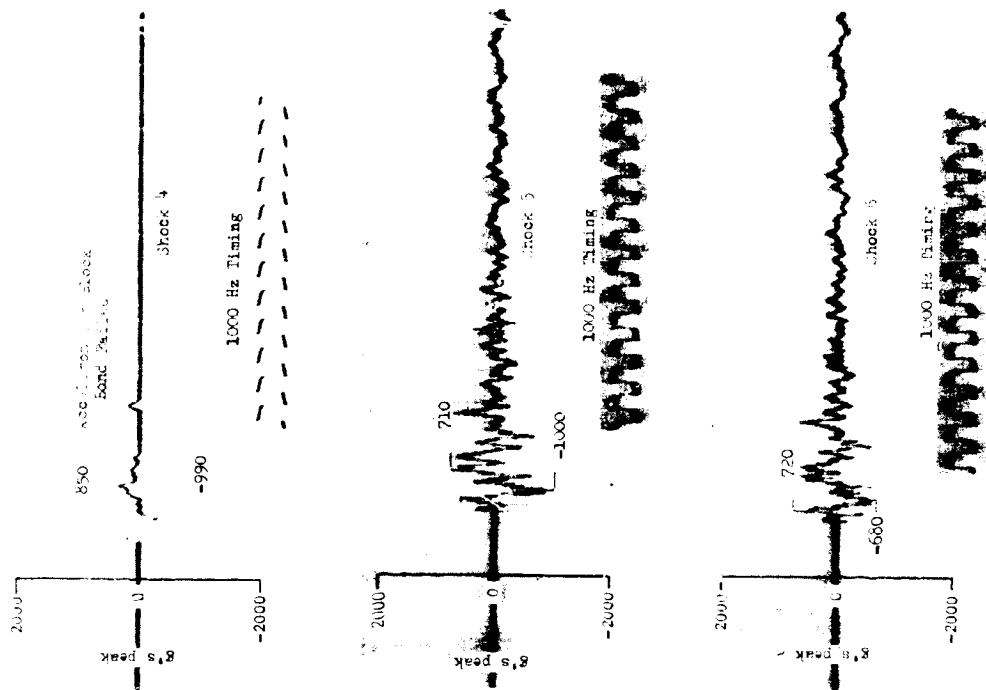
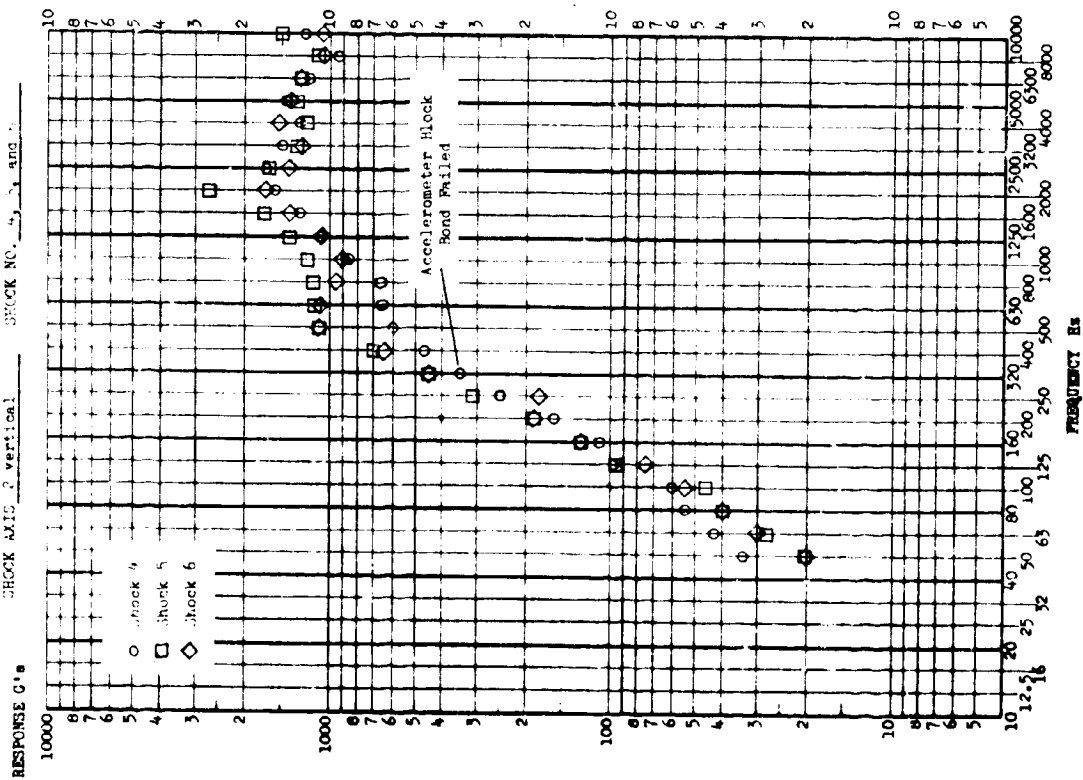


FIGURE 11.8.1-91

TEST ITEM: Condensation III 1000 Hz
 SERIAL NO.: Part 2475 September 19-11-52
 SHOCK AXIS: Longitudinal SHOCK NO.: 4, 5, and 6

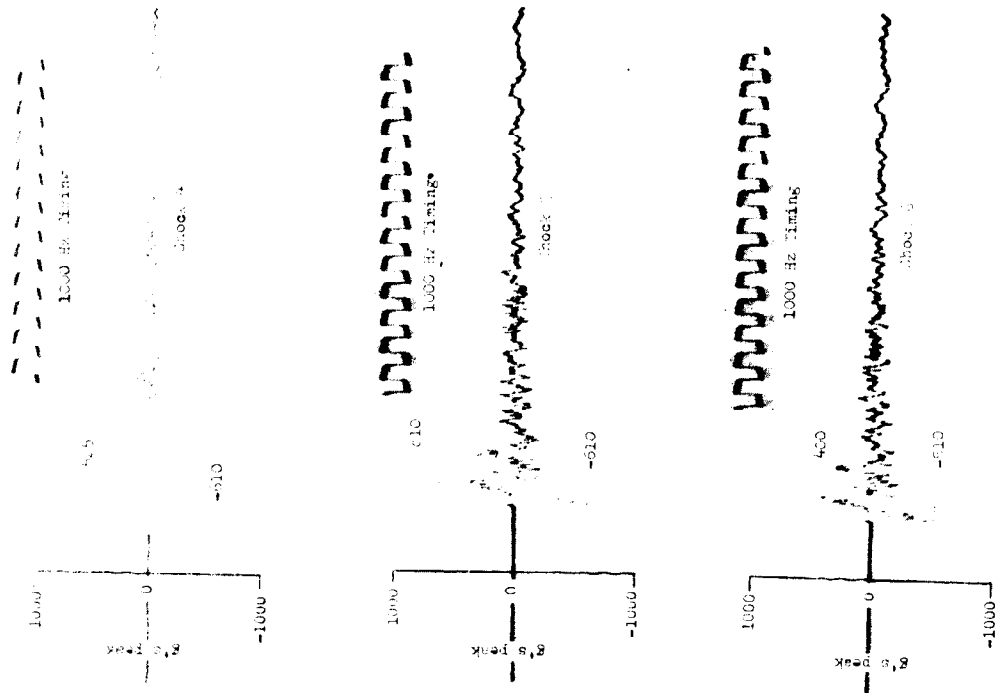
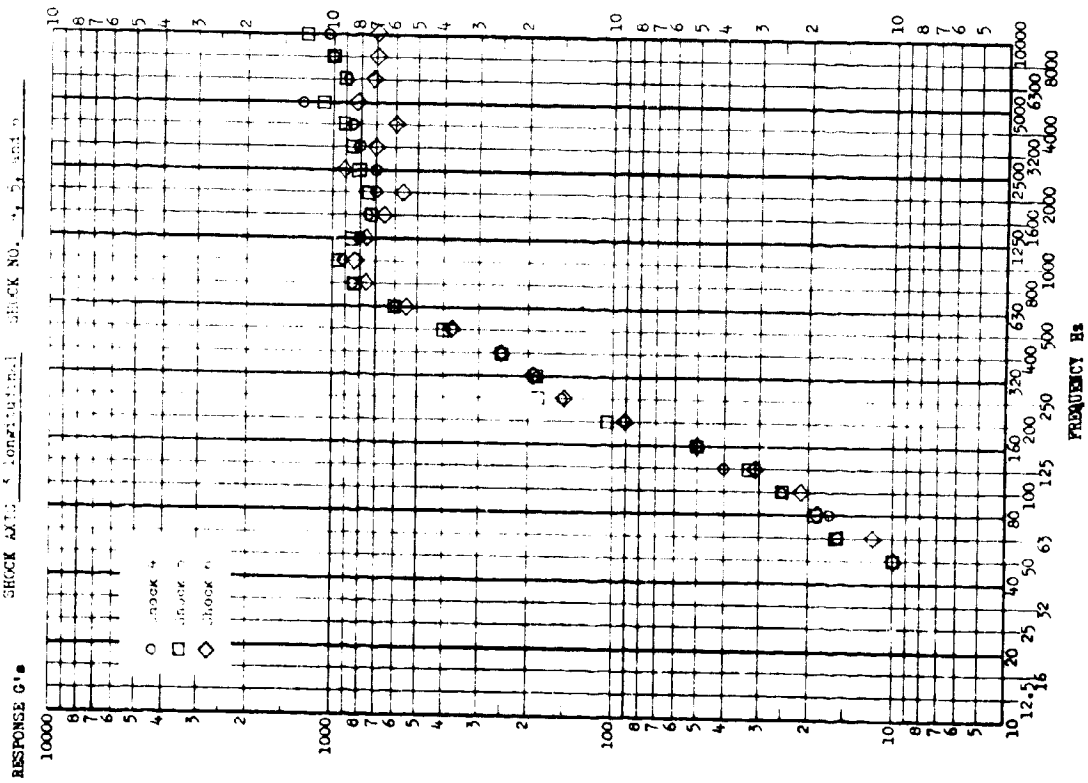


FIGURE 11.B.1-92

TEST ITEM Configuration 11b PART N
 SERIAL NO. 7547 PARTS replacement 1-11-54
 CHECK MAT. 3 Internal SHOCK NO. 4, 5, and 6

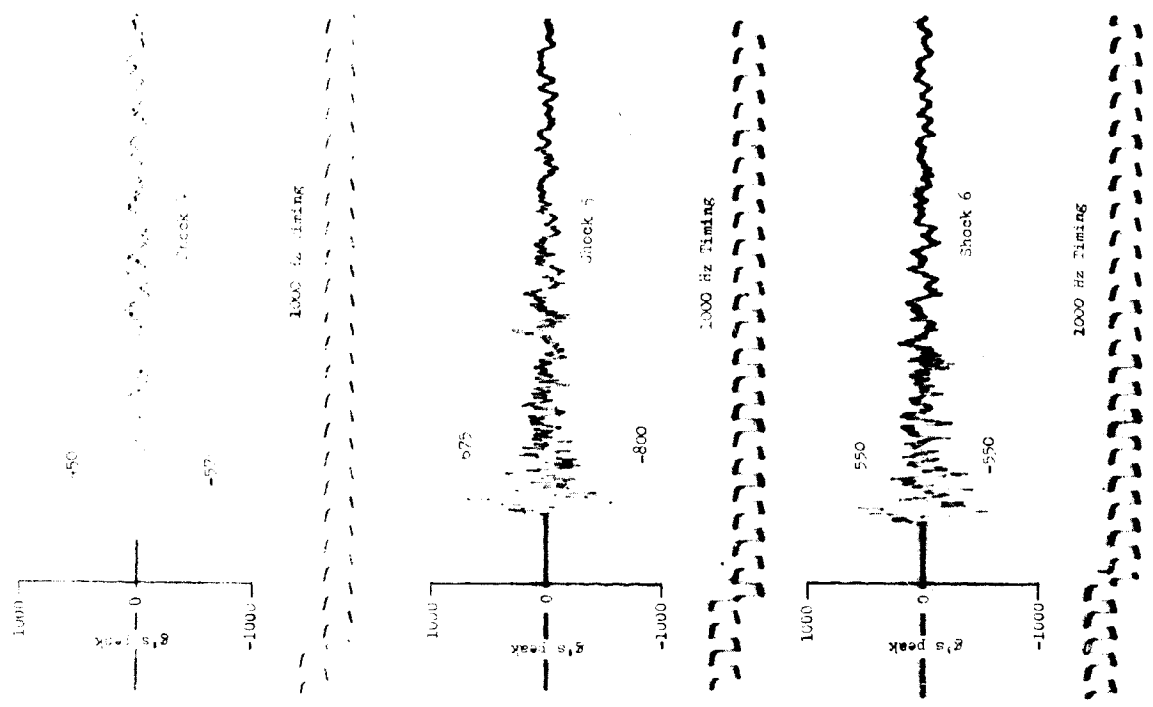
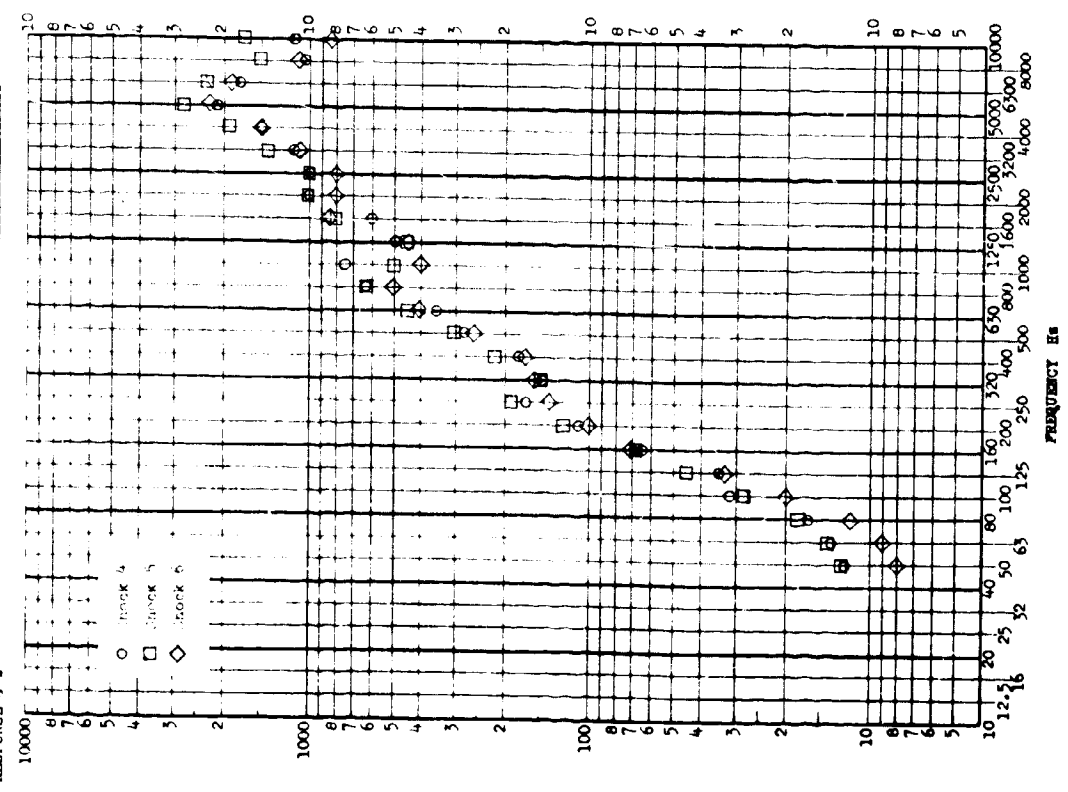


FIGURE 11.B.1-03

TEST ITEM Configuration 11b
 SERIAL No. 75-7 LATE epitimer 10-11, 1068
 SHOCK AXIS 5 vertical; SHOCK NO. 1, 5, and 6

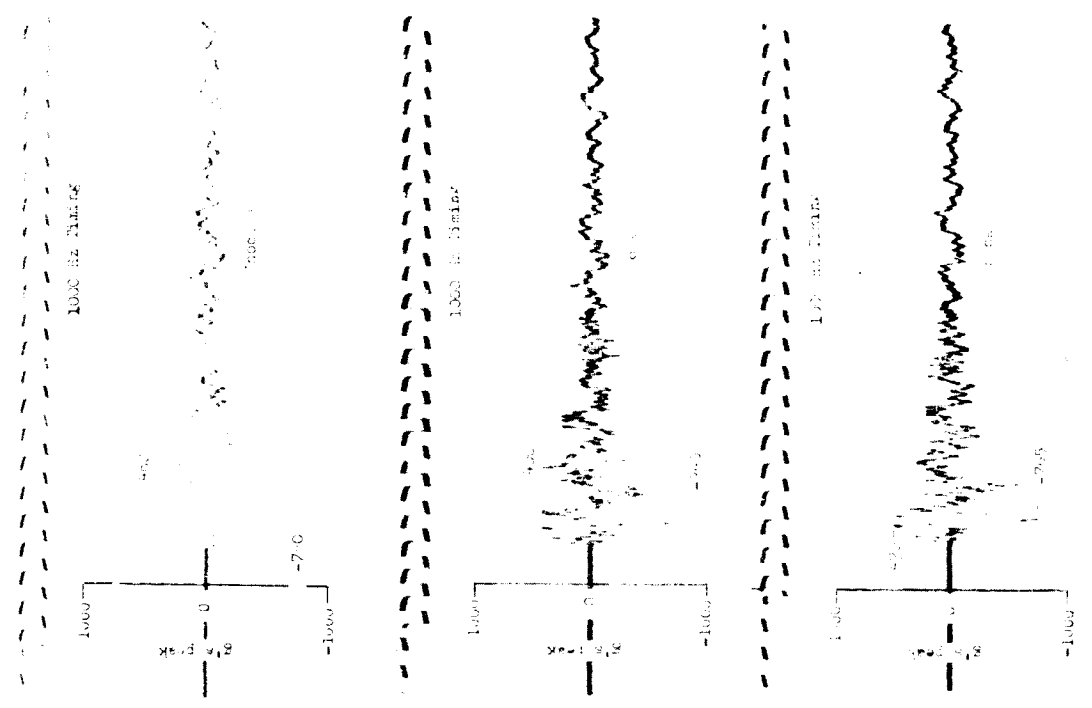
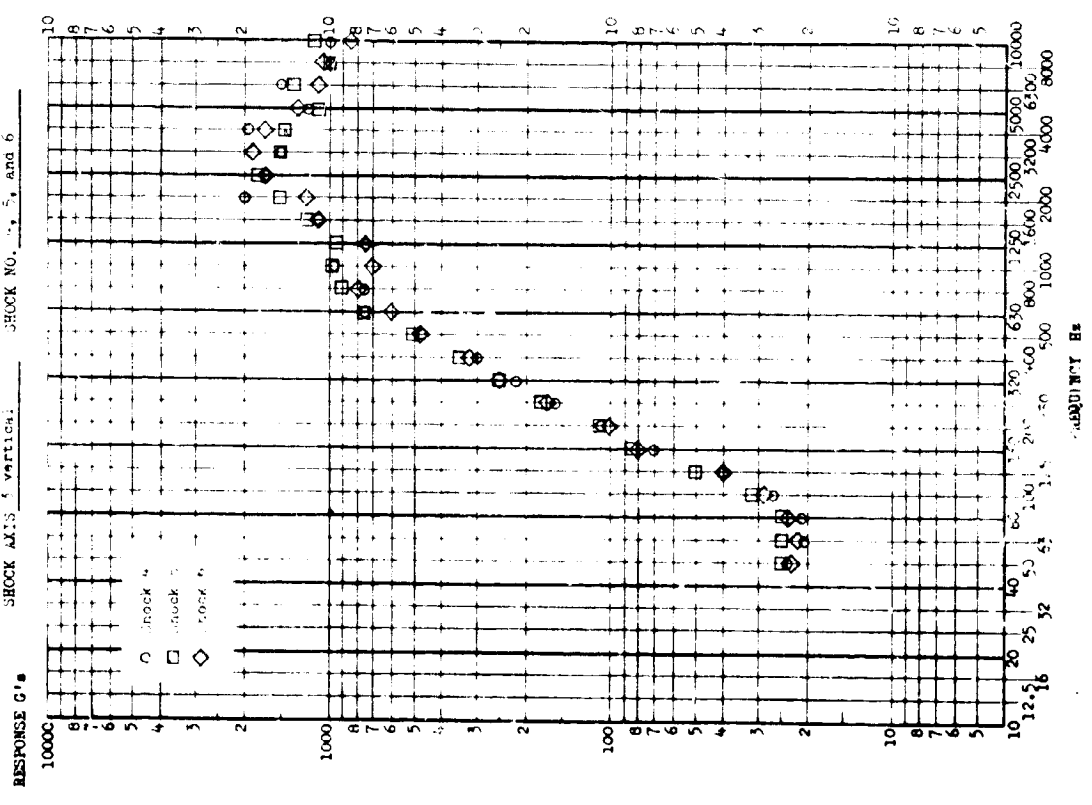


FIGURE 11.B.1-94

TEST ITEM Configuration IIb PANT No. _____
 SERIAL NO. _____ TEST DATE September 1964
 SHOCK AXIS longitudinal SHOCK NO. 1, 2, and 3

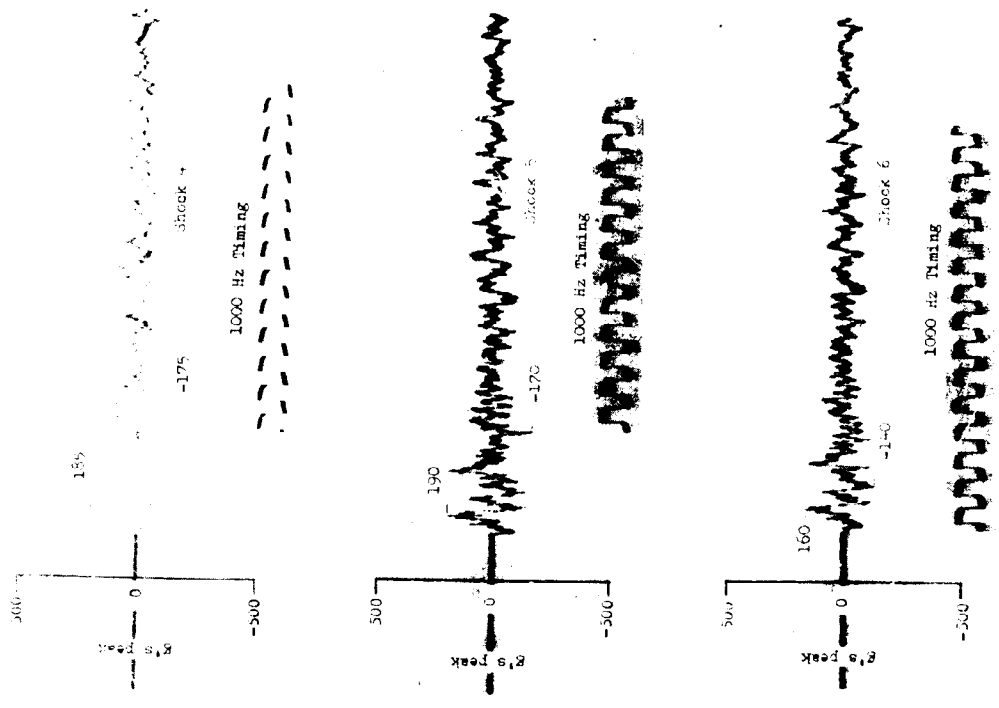
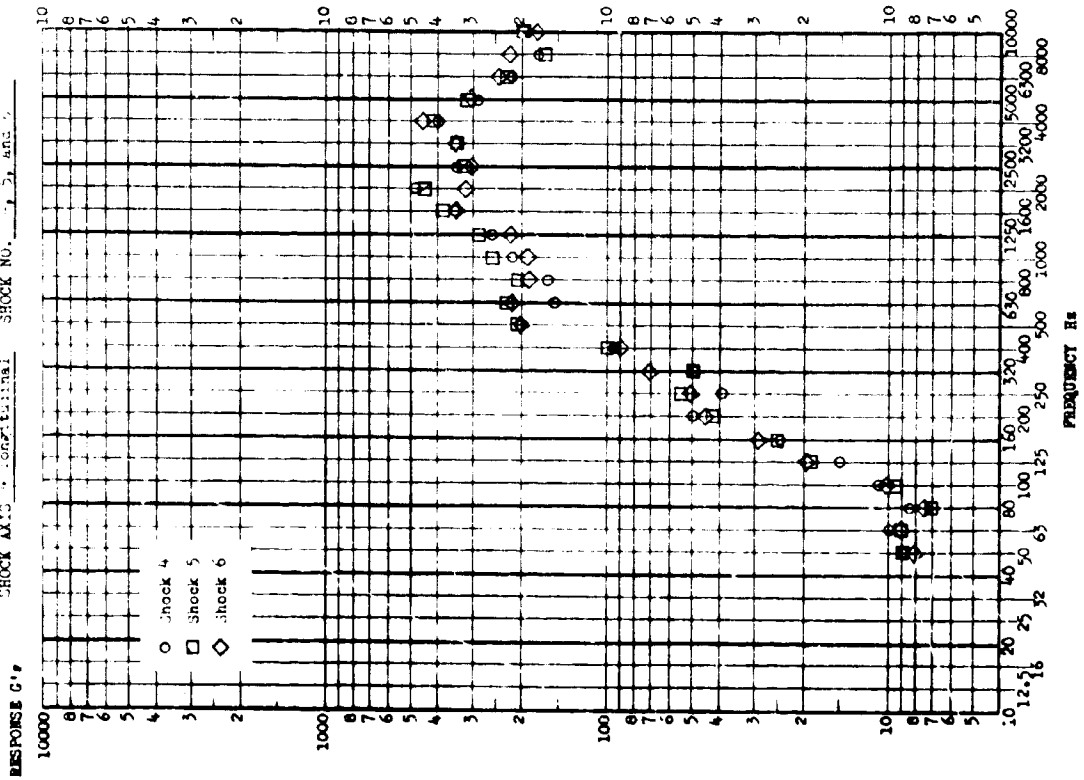


FIGURE II.B.1-95

TEST ITEM CONTINUED FROM PART No. _____
 SERIAL No. _____ TEST DATE September 13-14, 1966
 CHECK NO. 11-2-66-15

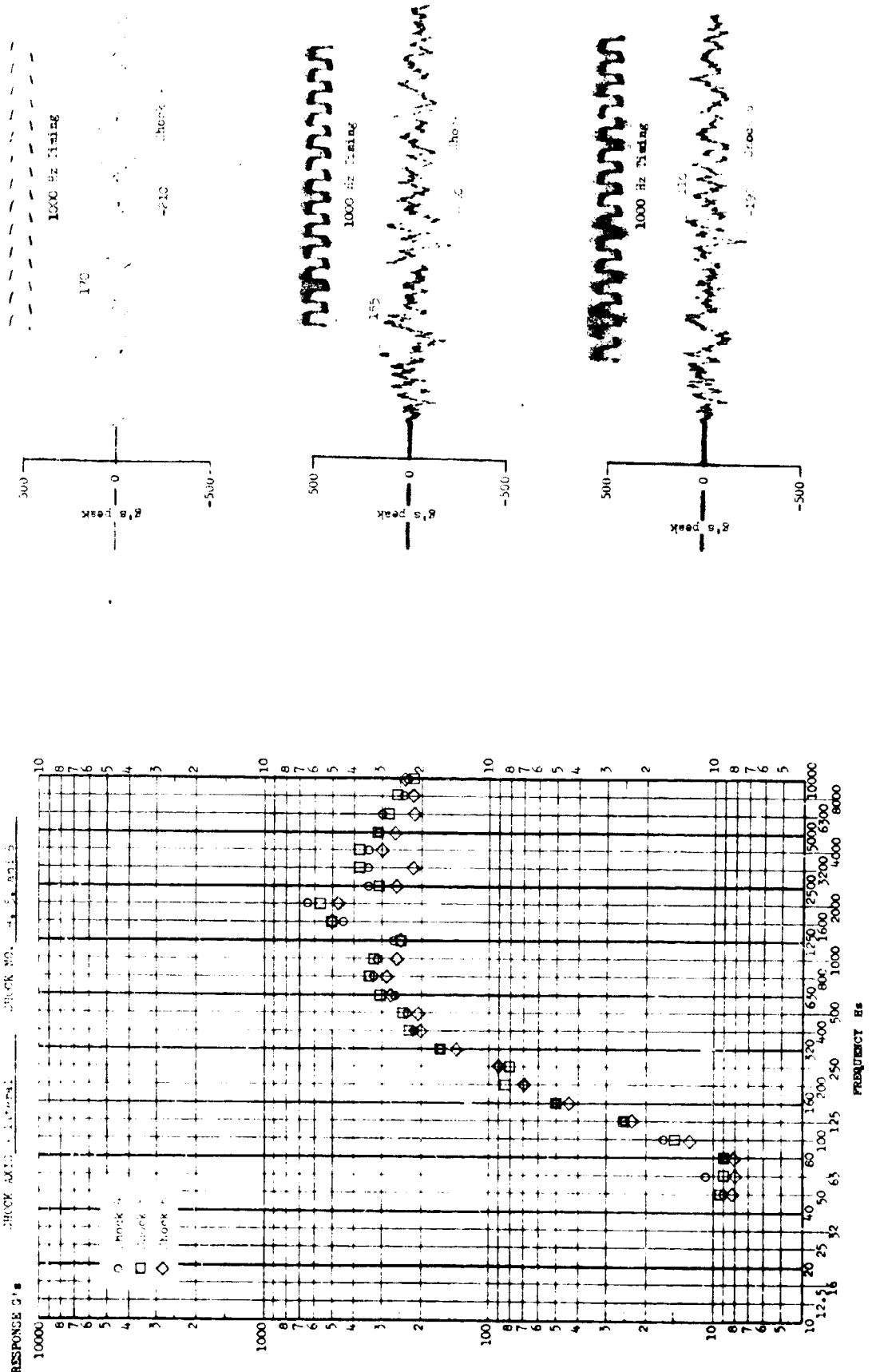


FIGURE 11.B.1-96

TEST ITEM Configuration: IIB PART NO. _____
 SERIAL NO. _____ TEST DATE September 10-11, 1968
 SHOCK AXIS - vertical SHOCK NO. 1, 2, and 6

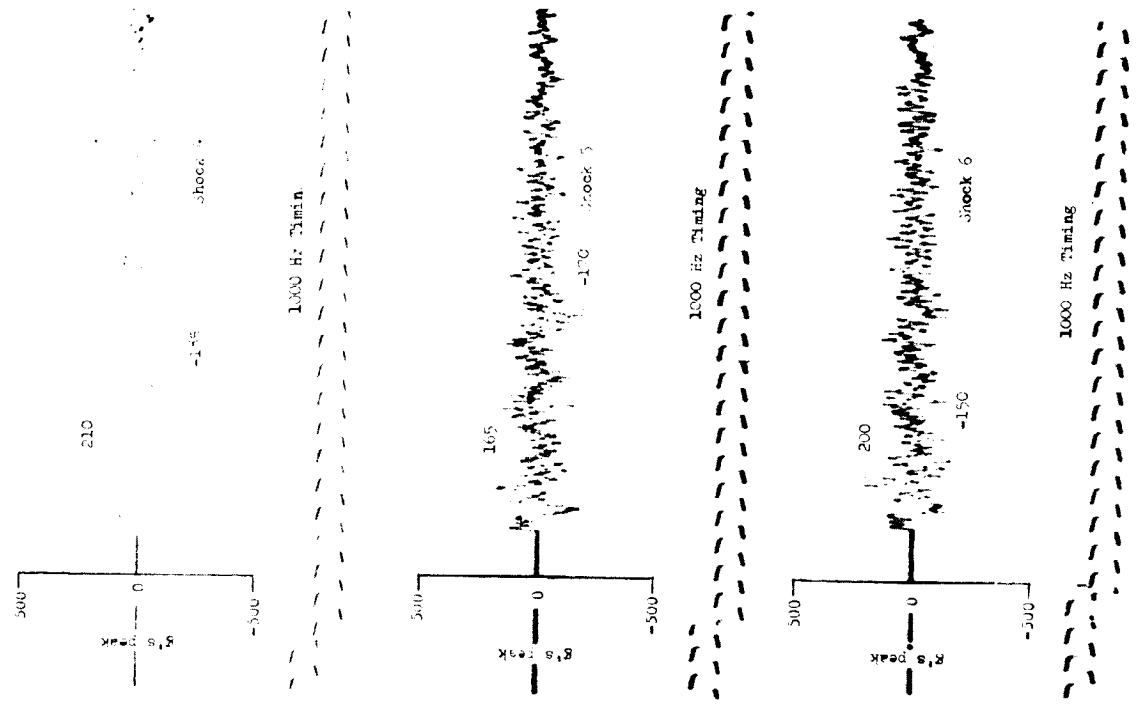
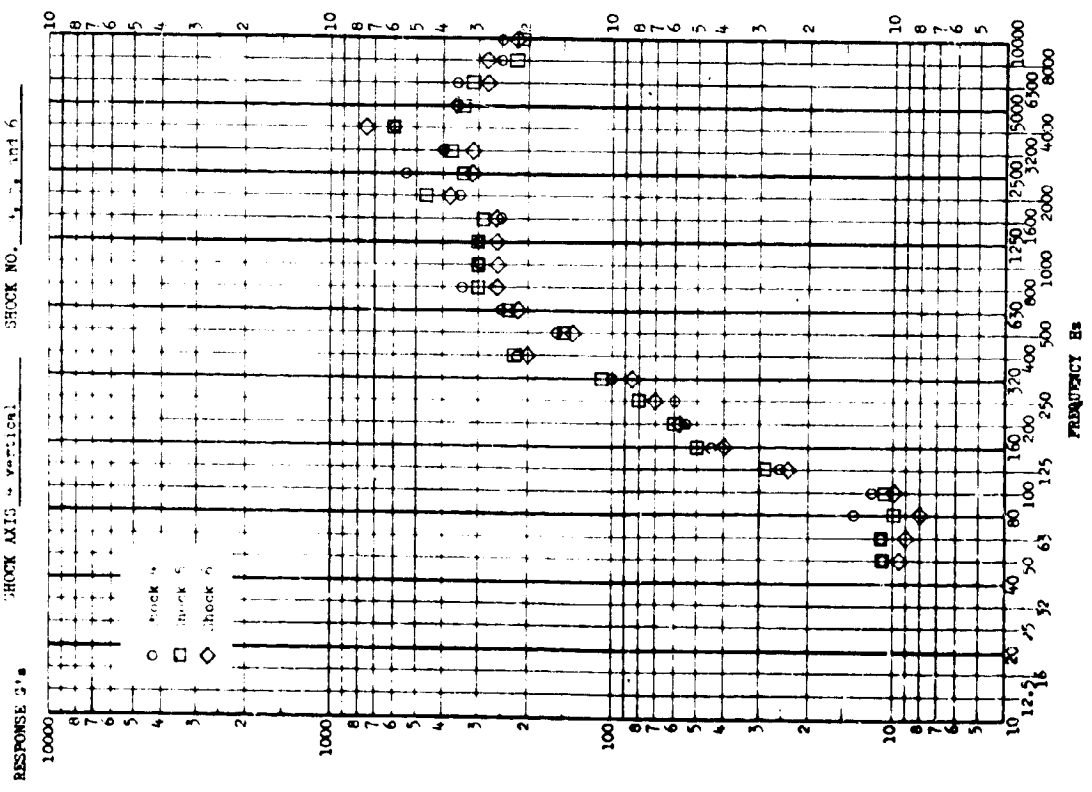


FIGURE 11.B.1-97

TEST ITEM Configuration IIB PART NO.
 SERIAL NO. TEST DATE September 10-11, 1968
 SHOCK AXIS 5 lateral SHOCK NO. 4, 5, and 6

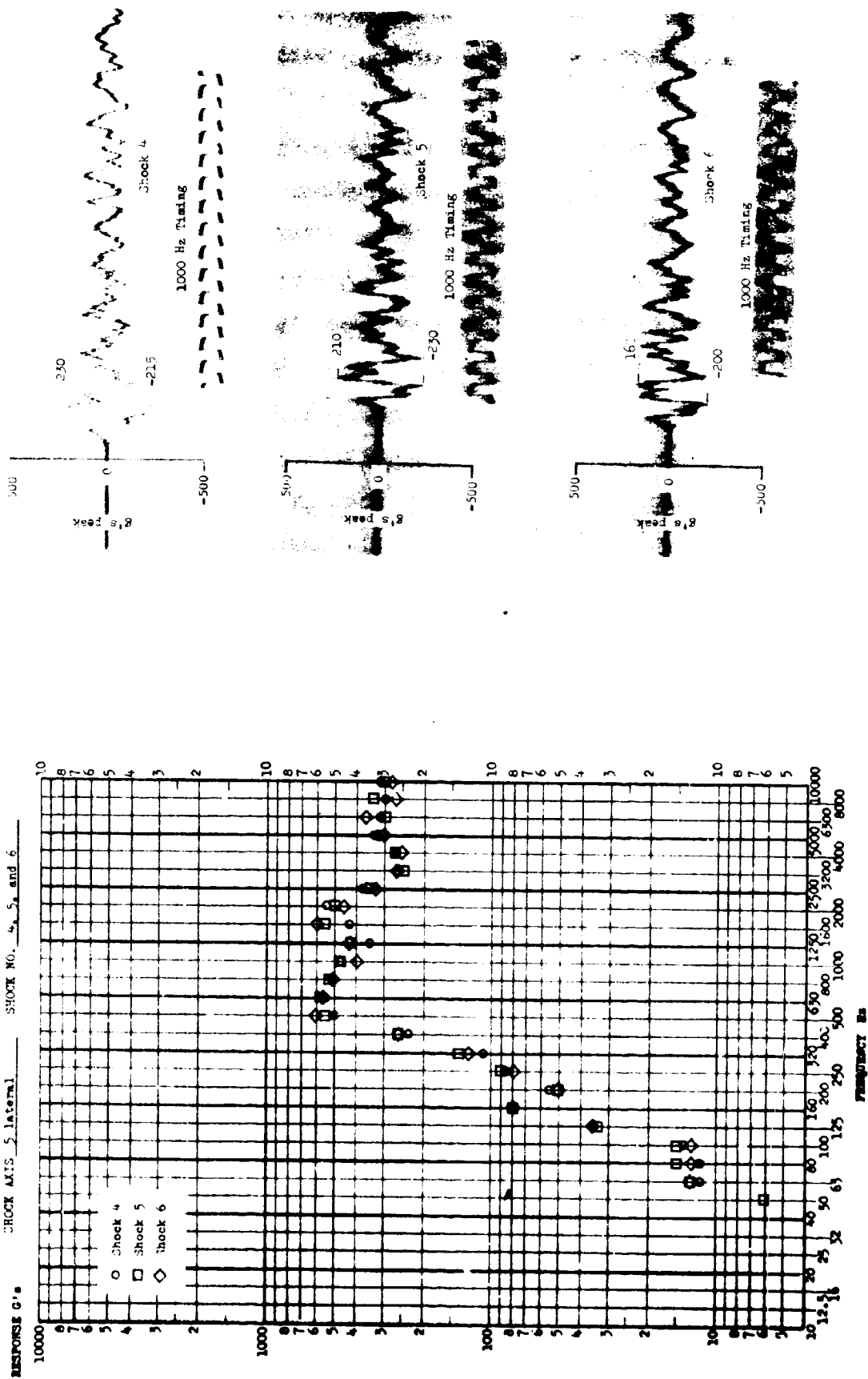


FIGURE 11.B.1-99

TEST ITEM: COMPARISON IN AEC No. _____
 SERIAL NO. _____ Date: _____
 CHECK AXES: 5 vertical CHECK NO. 1 SET 5

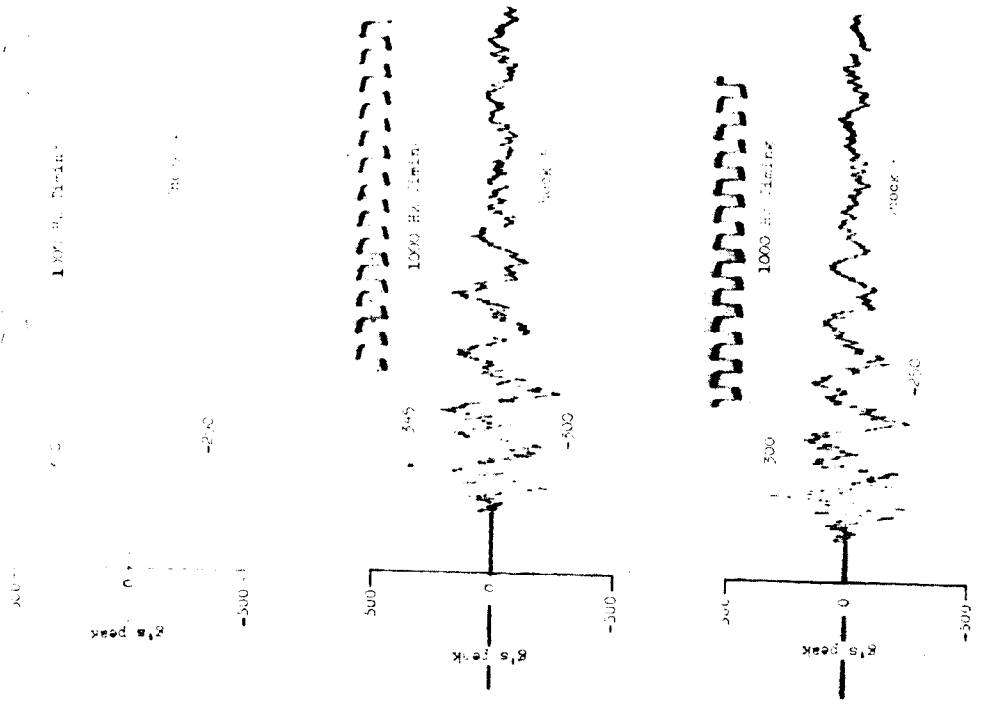
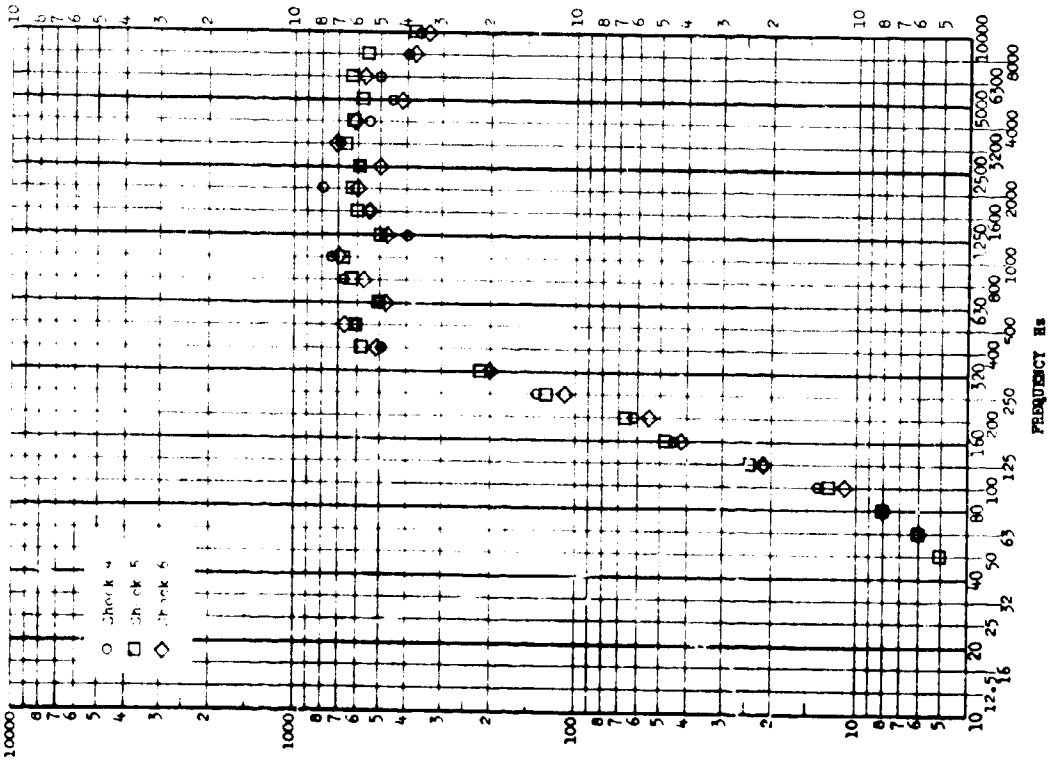


FIGURE II.B.1-100

TEST ITEM Configuration 376 PART NO. _____
 SERIAL NO. _____ TEST DATE September 10-11, 1968
 SHOCK AXIS 6 longitudinal SHOCK NO. 4, 5, 6, 1, 6

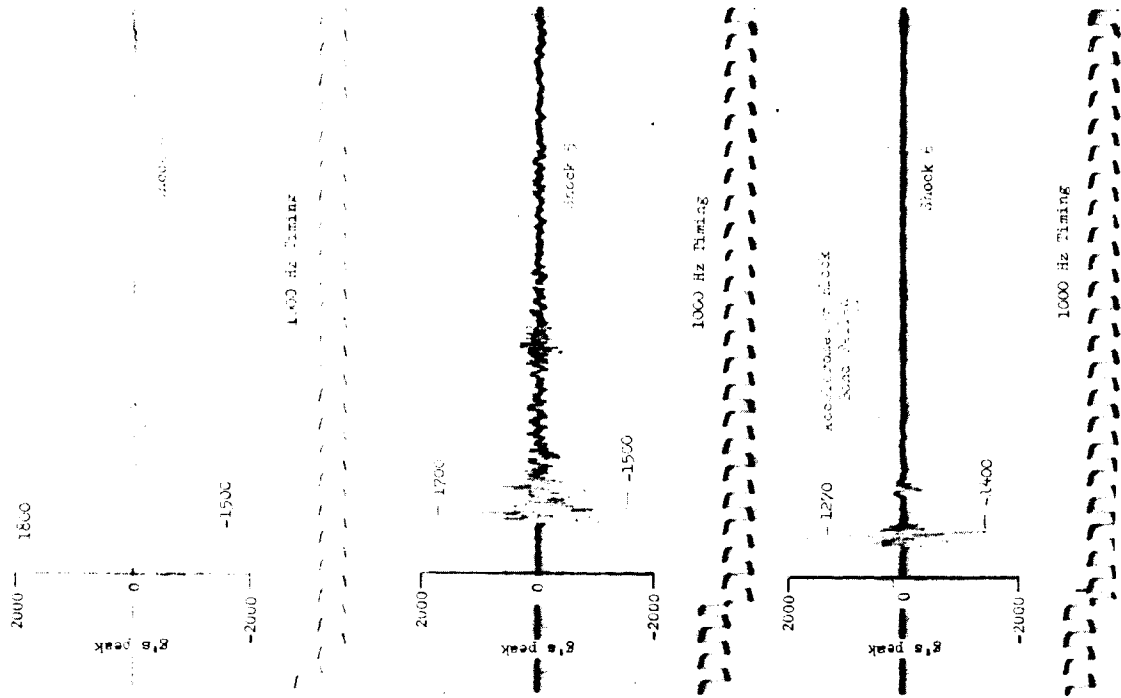
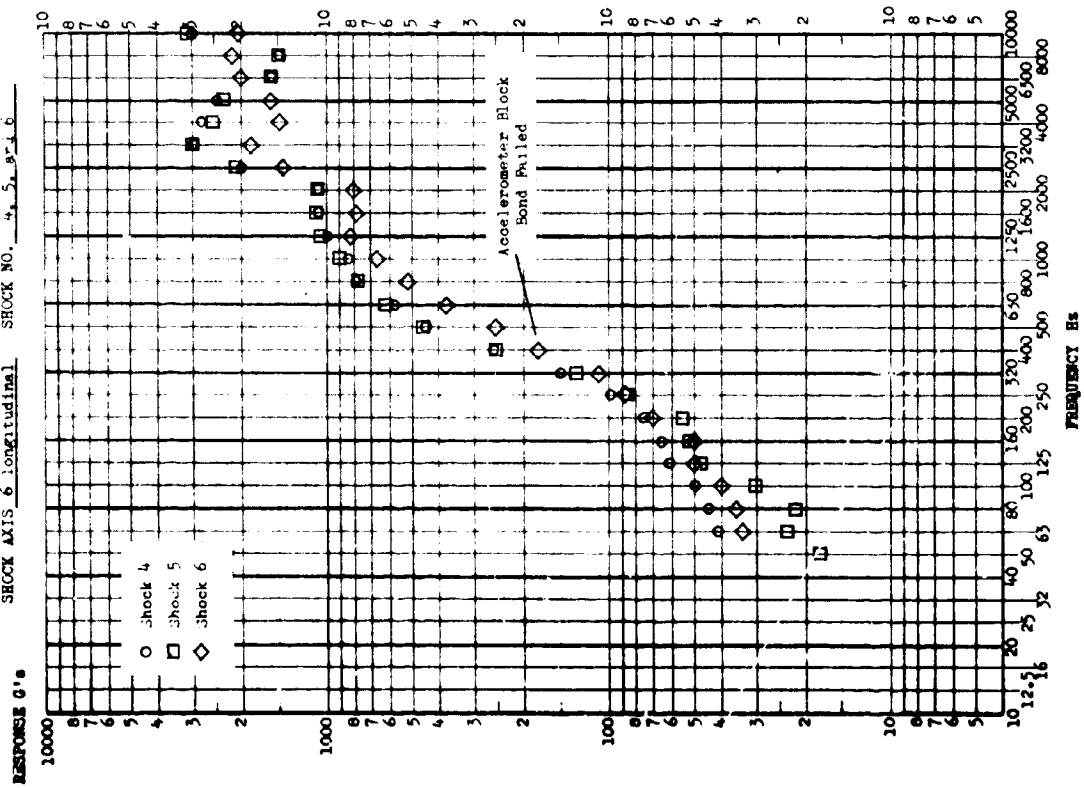


FIGURE 11.B.1-101

TEST ITEM: OPERATOR TRAINING II, 1950-5
 SERIAL NO.: 100-1000-1000-1000
 REPORT NO.: 100-1000-1000-1000

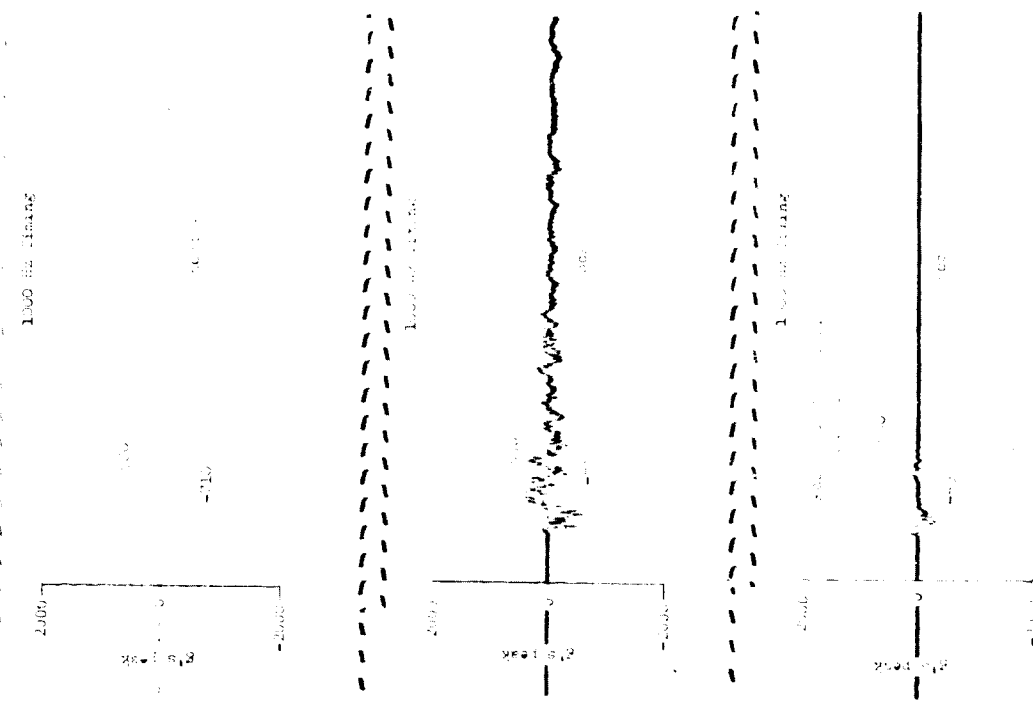
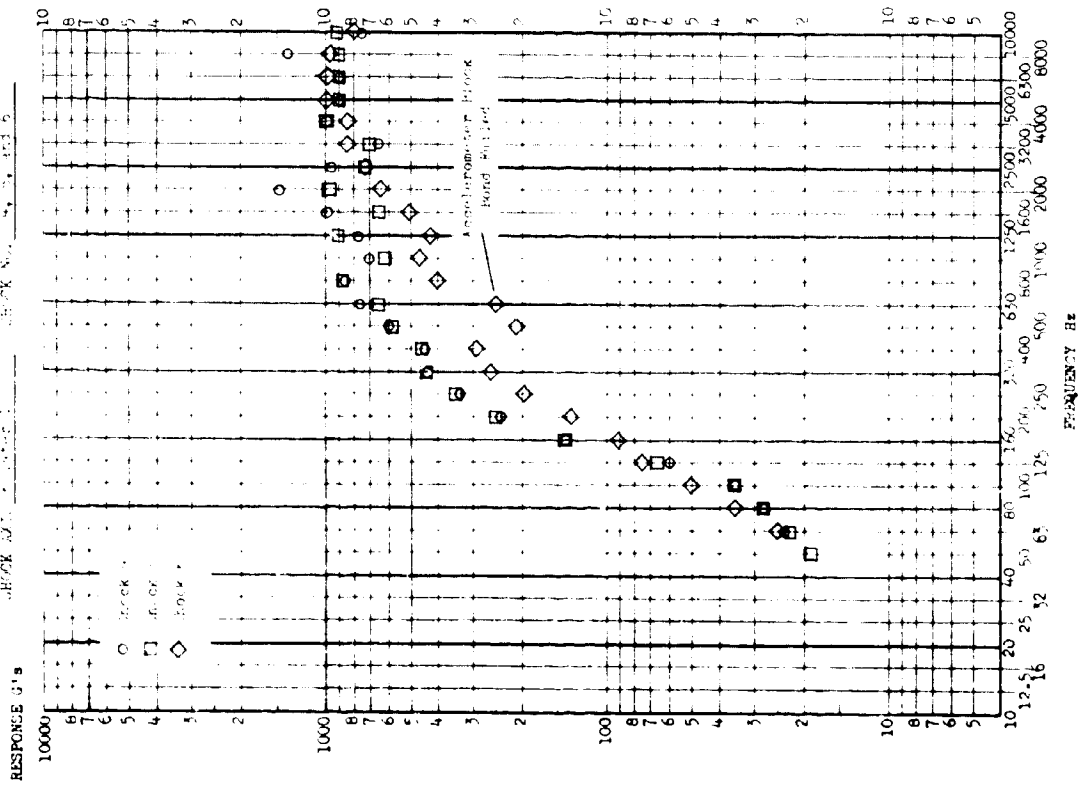


FIGURE II.B.1-102

TEST ITEM: Configuration IIb PART NO. _____
 SERIAL NO. _____ TEST DATE: September 10-11, 1968
 SHOCK AXIS: Vertical SHOCK NO.: 4, 5, and 6

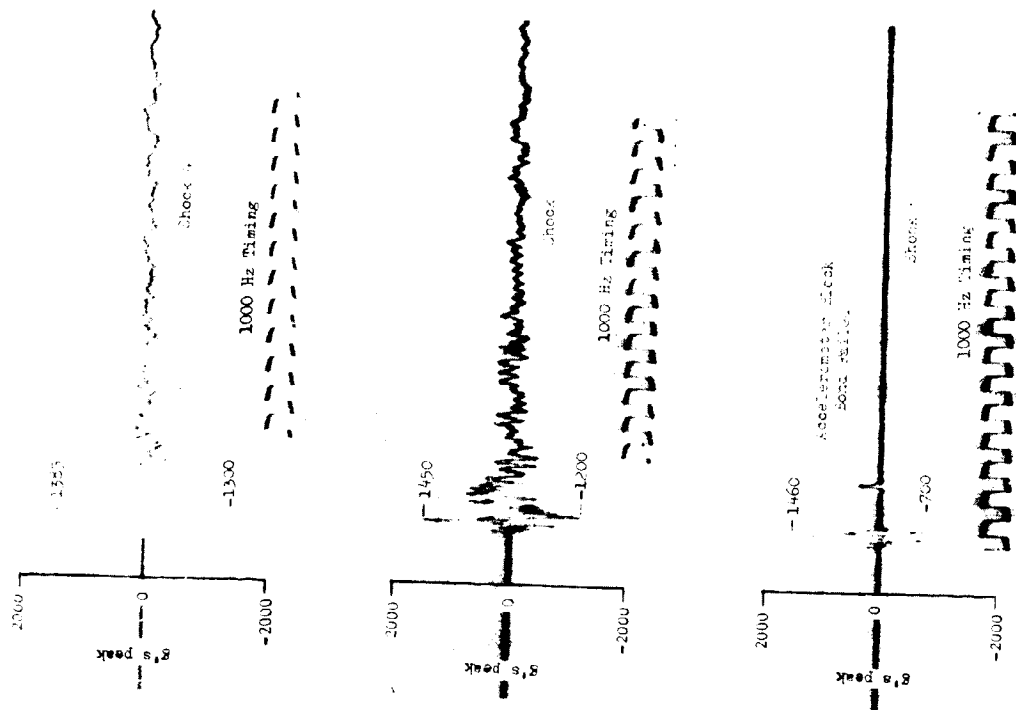
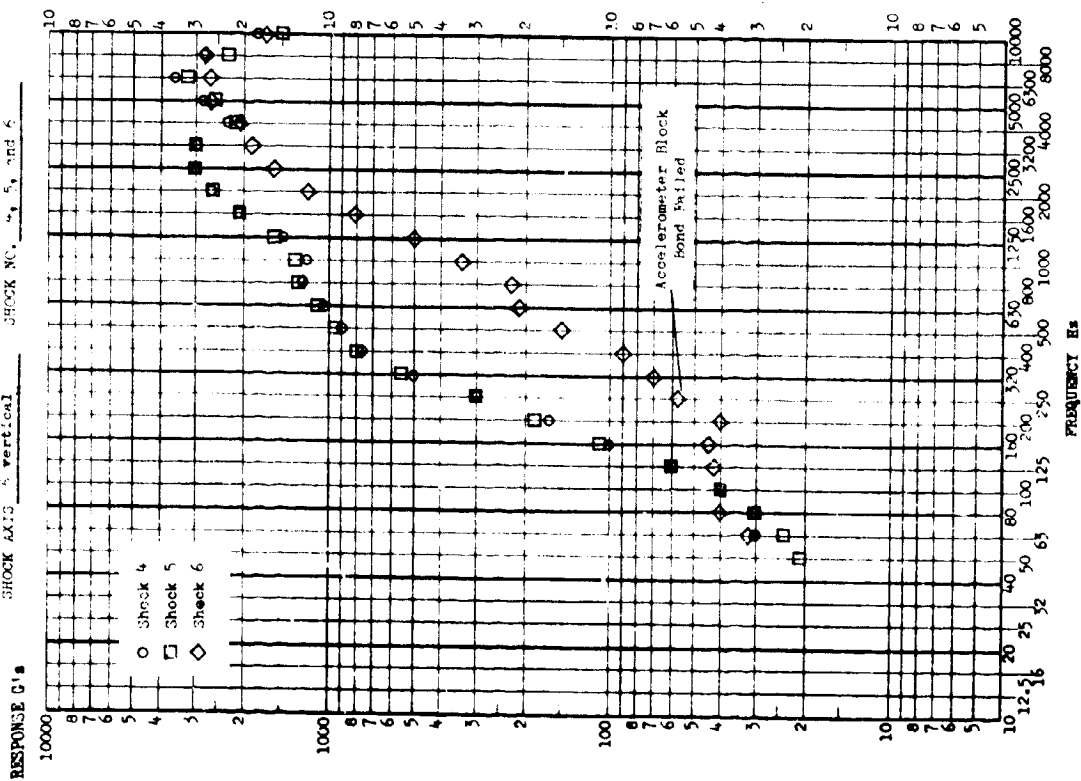


FIGURE II.B.1-103

TEST ITEM Configuration IIB PART N
 SERIAL NO. 10-11-1968
 SHOCK AXIS 7 Internal SHOCK NO. 7, 5, and 6

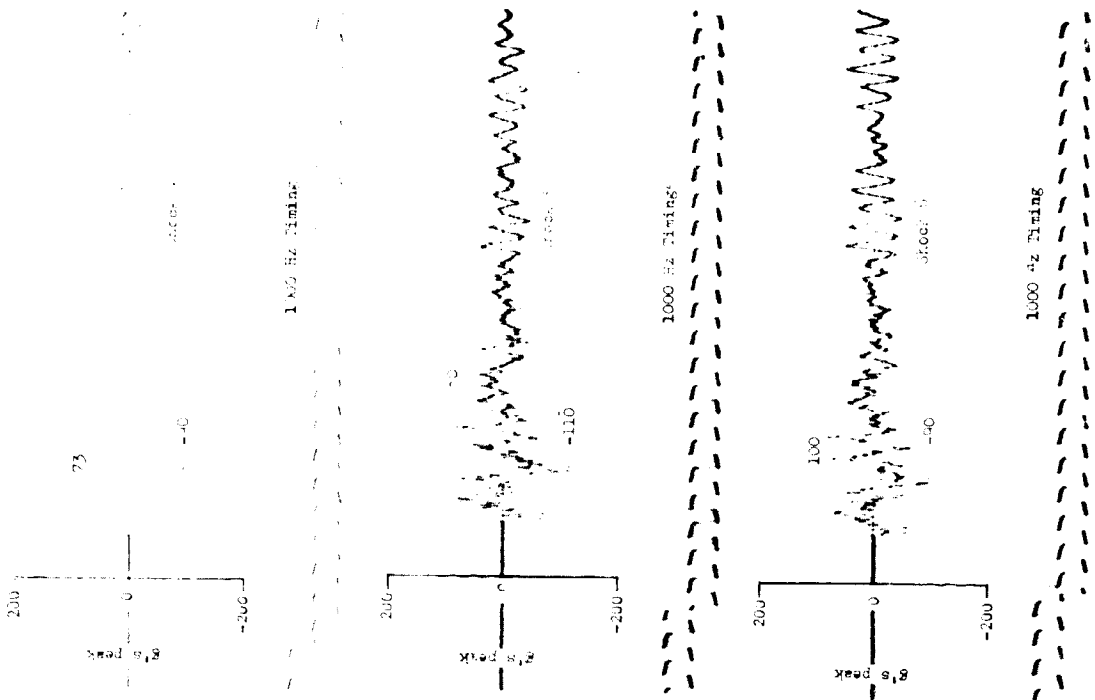
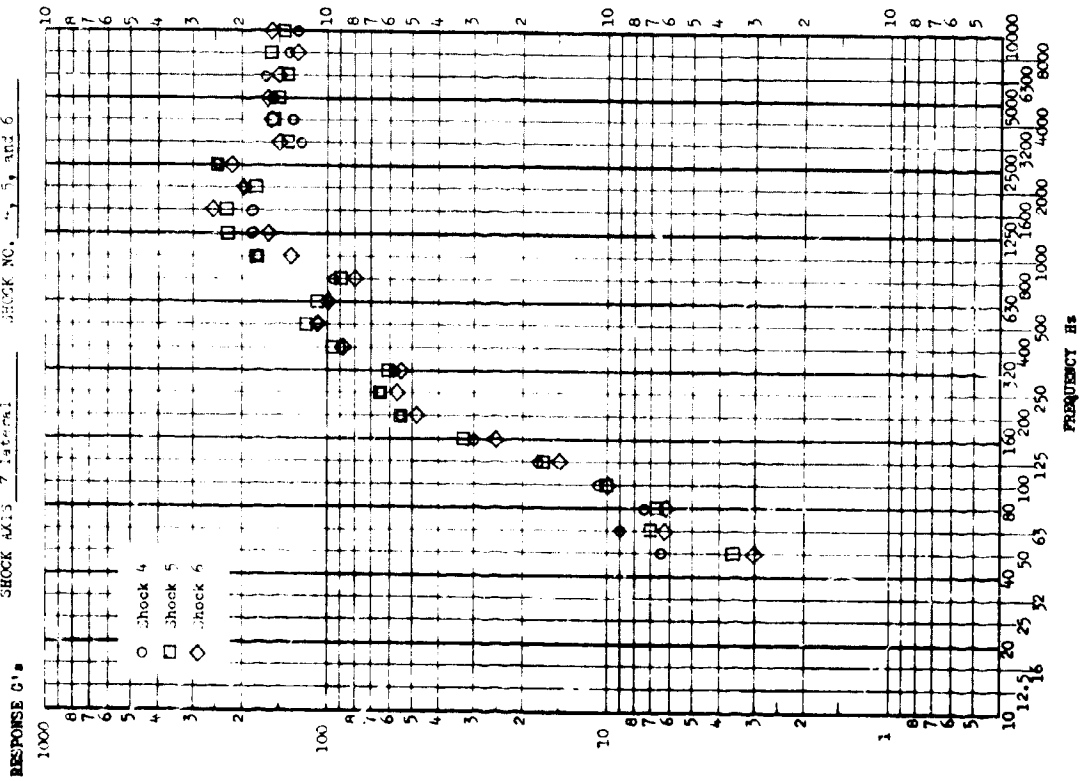


FIGURE 11.B.1-105

UNIT TEST CONTINUED on II-107-108
 SERIAL NO. 100-100-100-100-100-100
 CHECK DATE: 10/10/100-100-100-100-100-100
 CHECK NO. 100-100-100-100-100-100

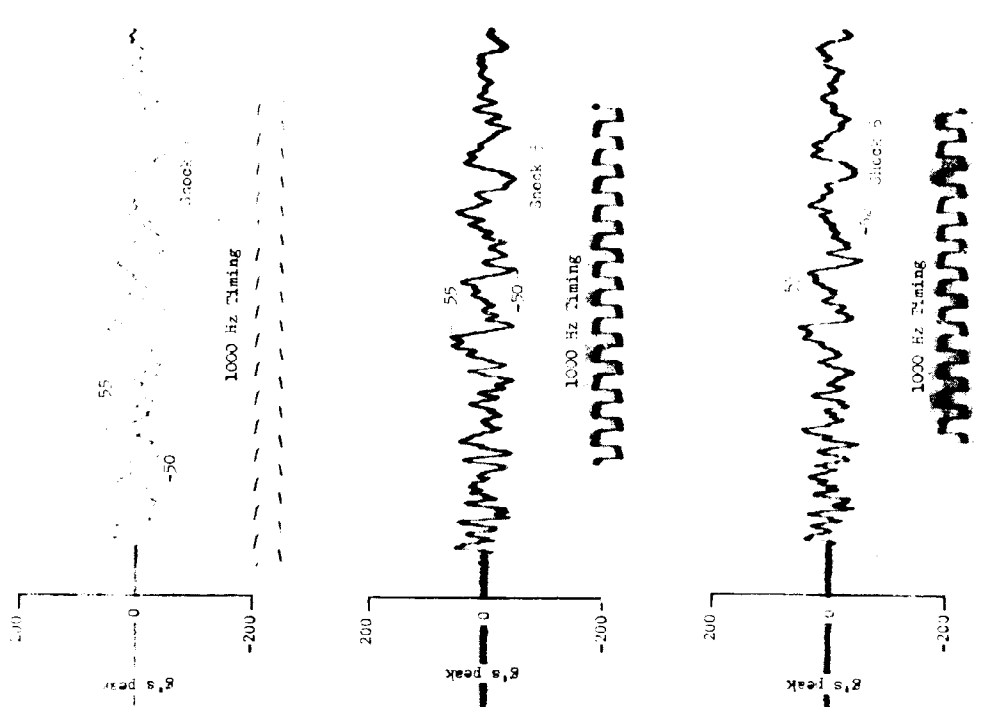
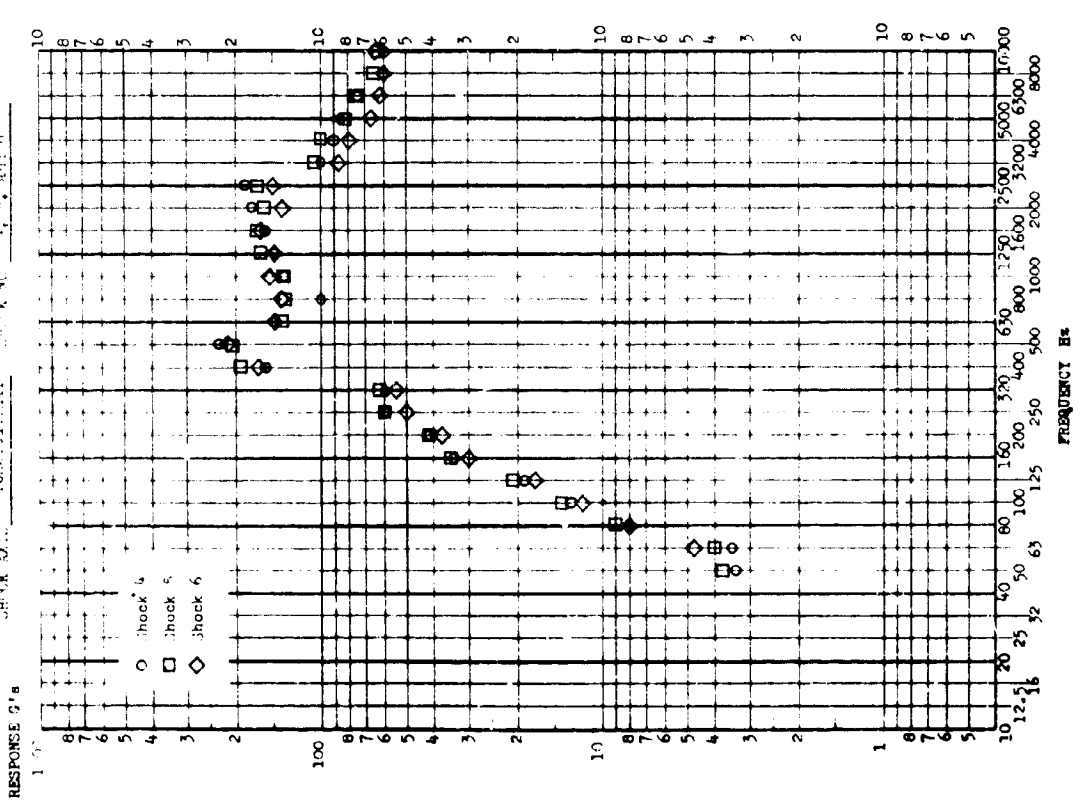


FIGURE II.B.11-107

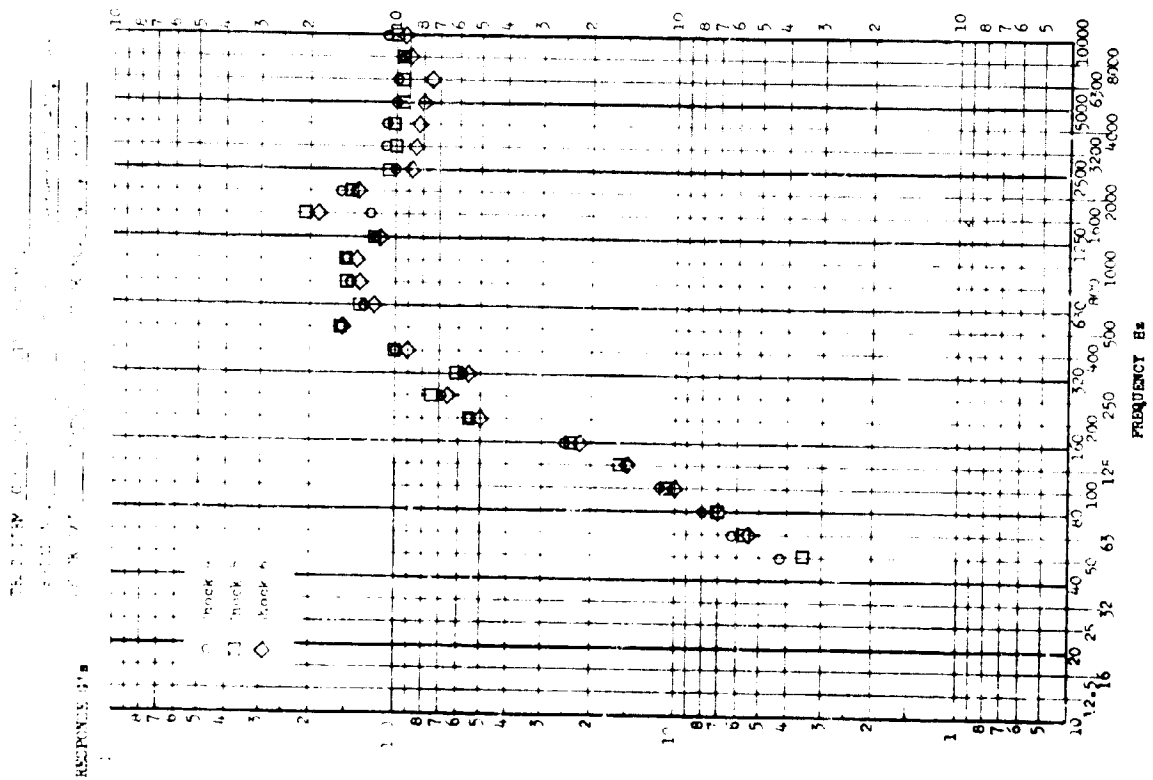


FIGURE 11.8.1-108

TEST ITEM: Configuration II, Part No. 1
 SERIAL NO.: TEST DATA Subassembly 1, Item
 SHOCK AXIS: Vertical SHOCK NO.: 1, 2, 3, 4, 5, 6

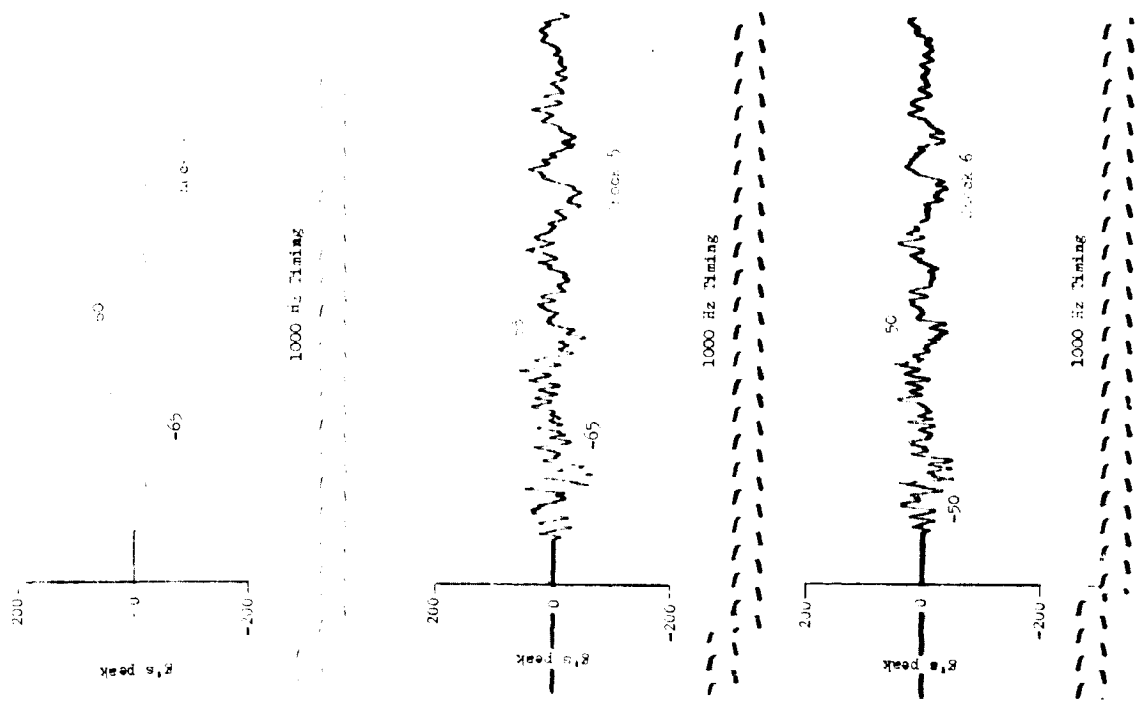
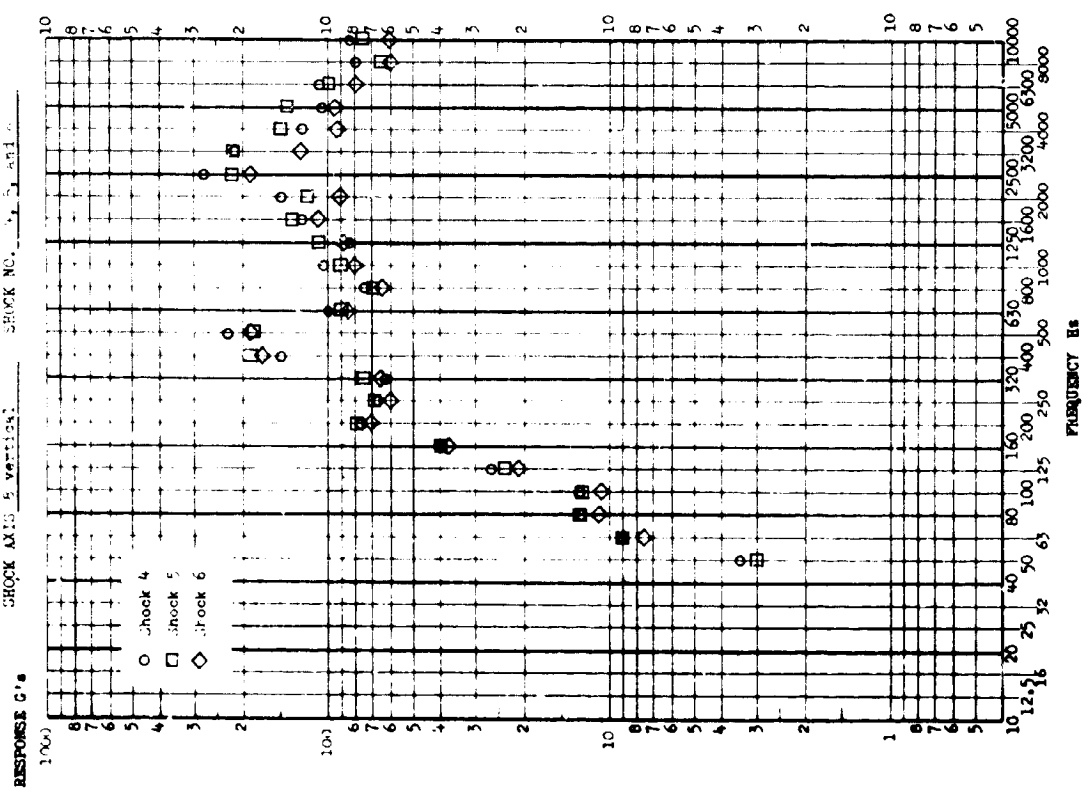


FIGURE 11.B.1-109

Test Item Configuration: 14AC 5
 SERIAL N.: 20-7-14-2, Sep ember 20-21, 1962
 SHOCK SPECTRA: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15

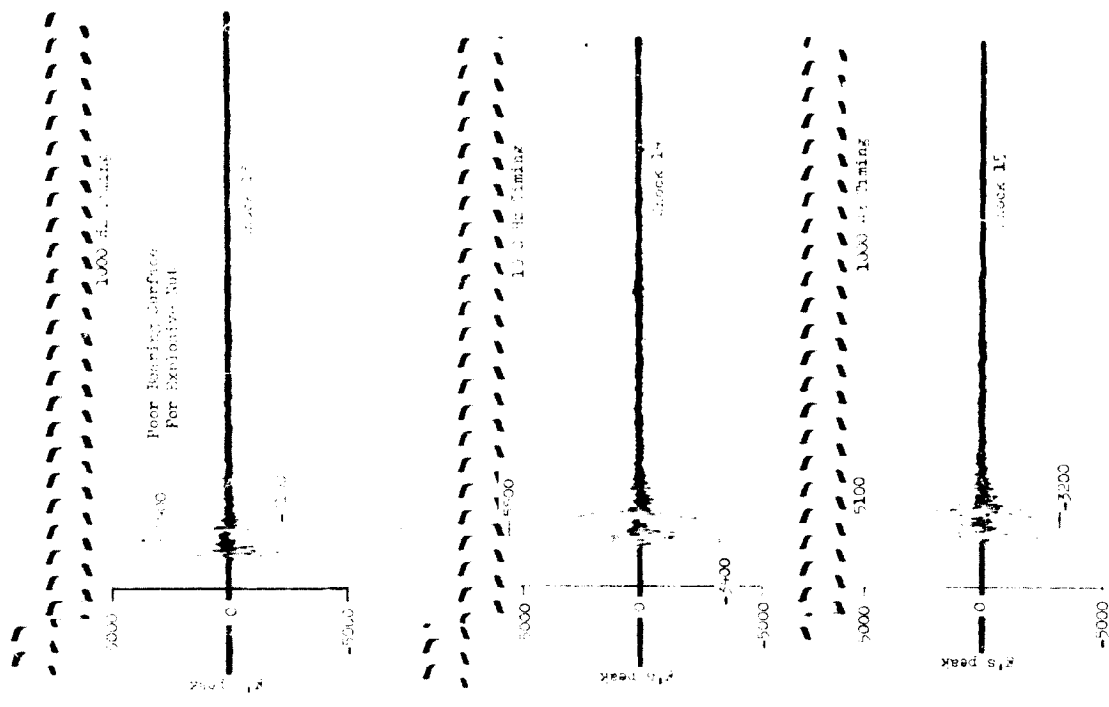
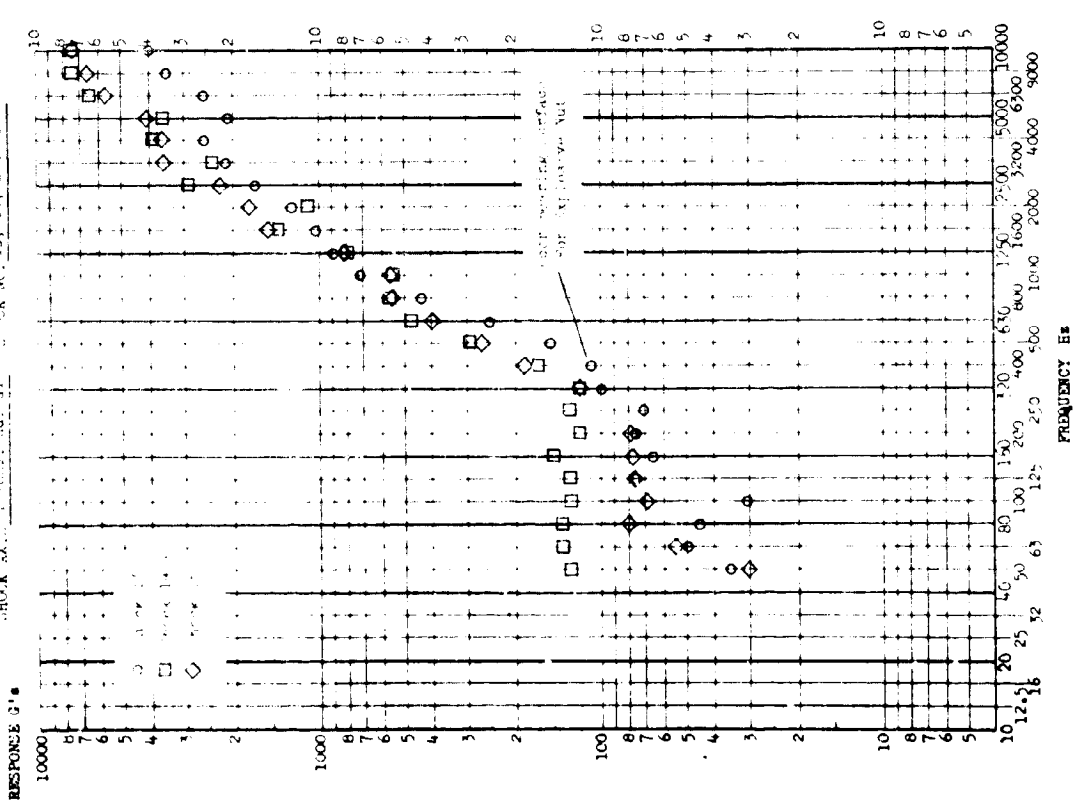


FIGURE 11.B.1-110

TEST ITEM Configuration: II; PART 5.

SERIAL NO. TEST DATE September 20-23, 1968

SHOCK AXIS: 1 (later) SHOCK NO. 13, 14, and 15

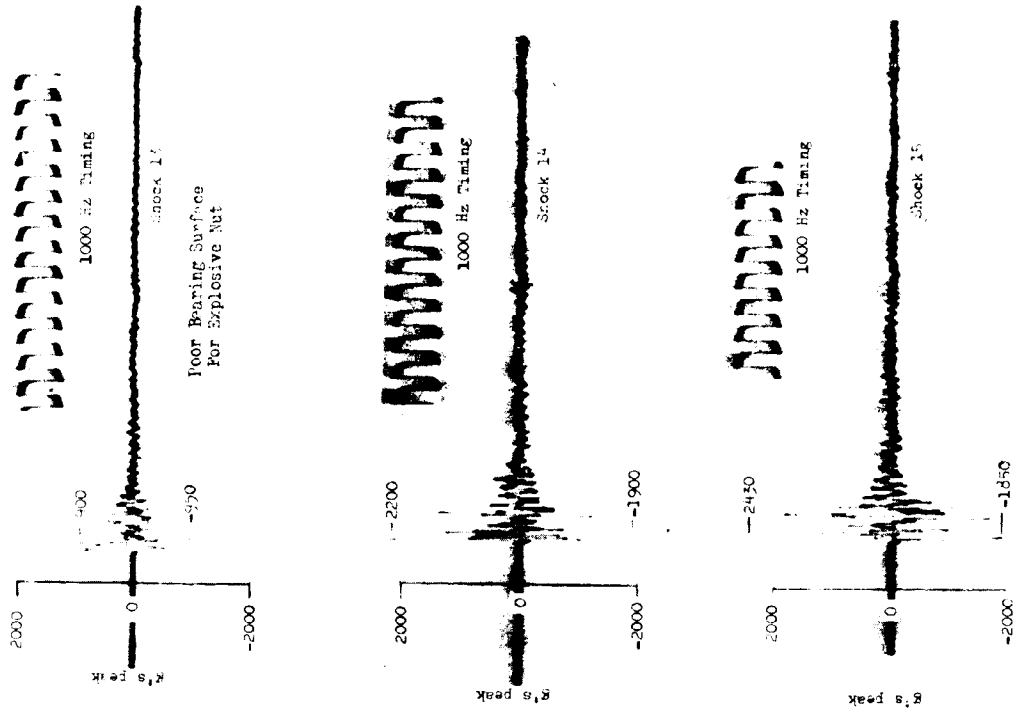
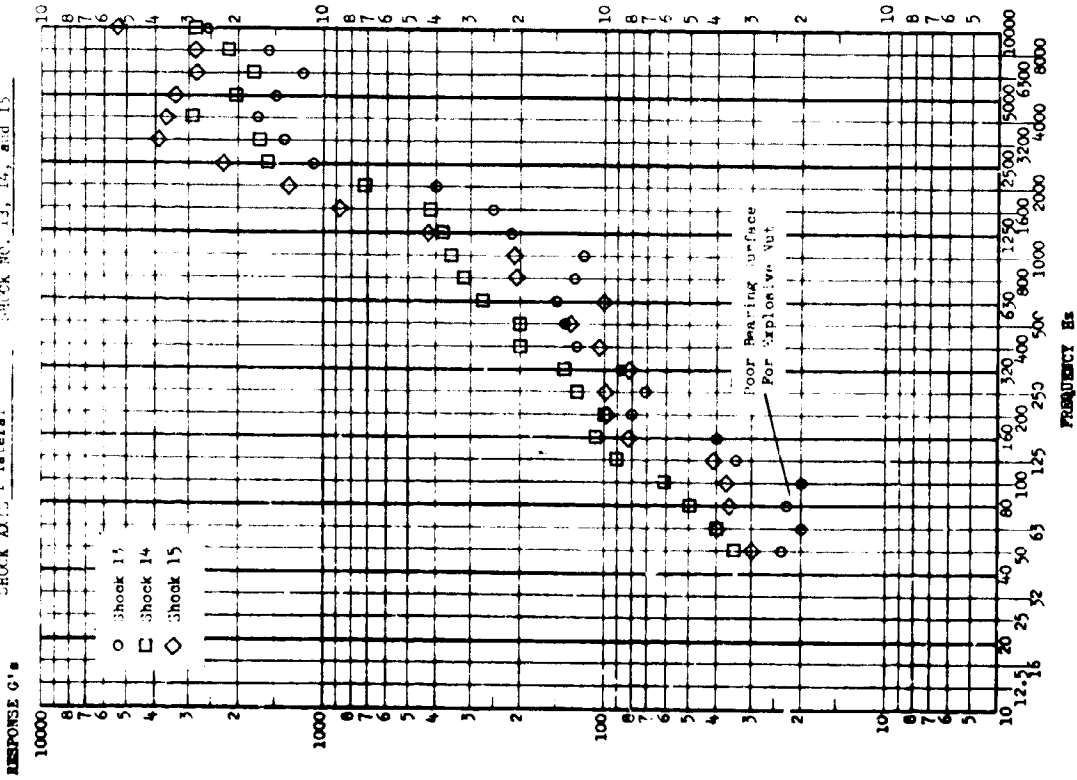


FIGURE II.B.1-111

TEST ITEM: No. 1, ratio 1:1, 1000 Hz
 SERIAL NO.: 75-7, Date: September 20-23, 1958
 CHECK NO.: 131, 134, & 135

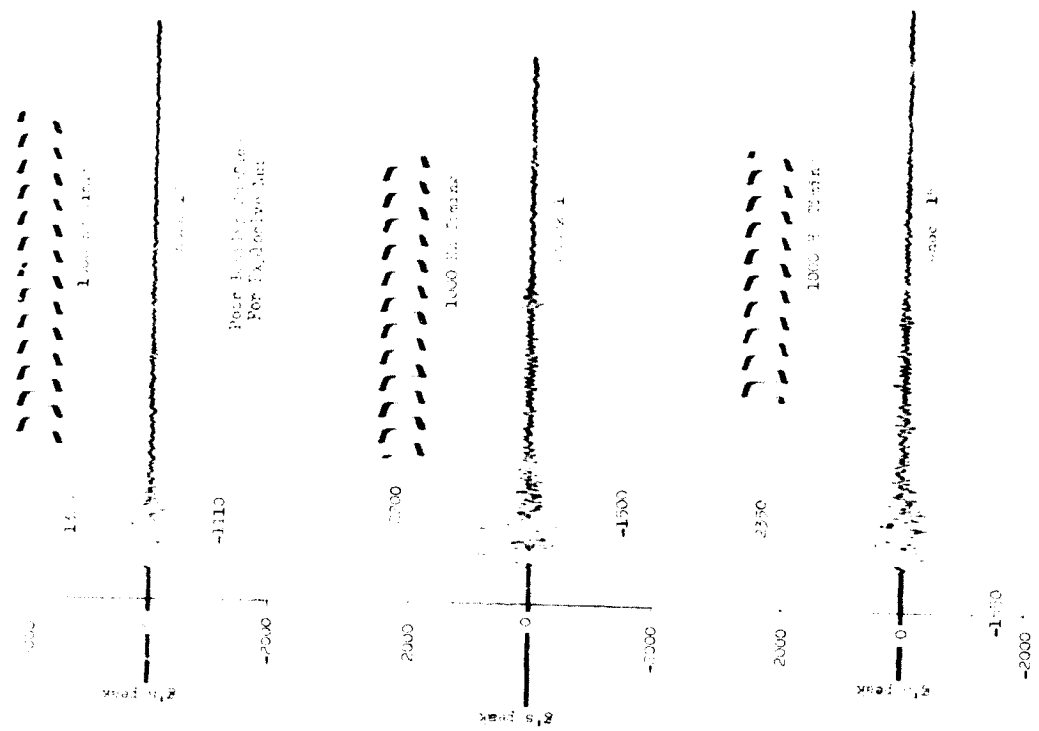
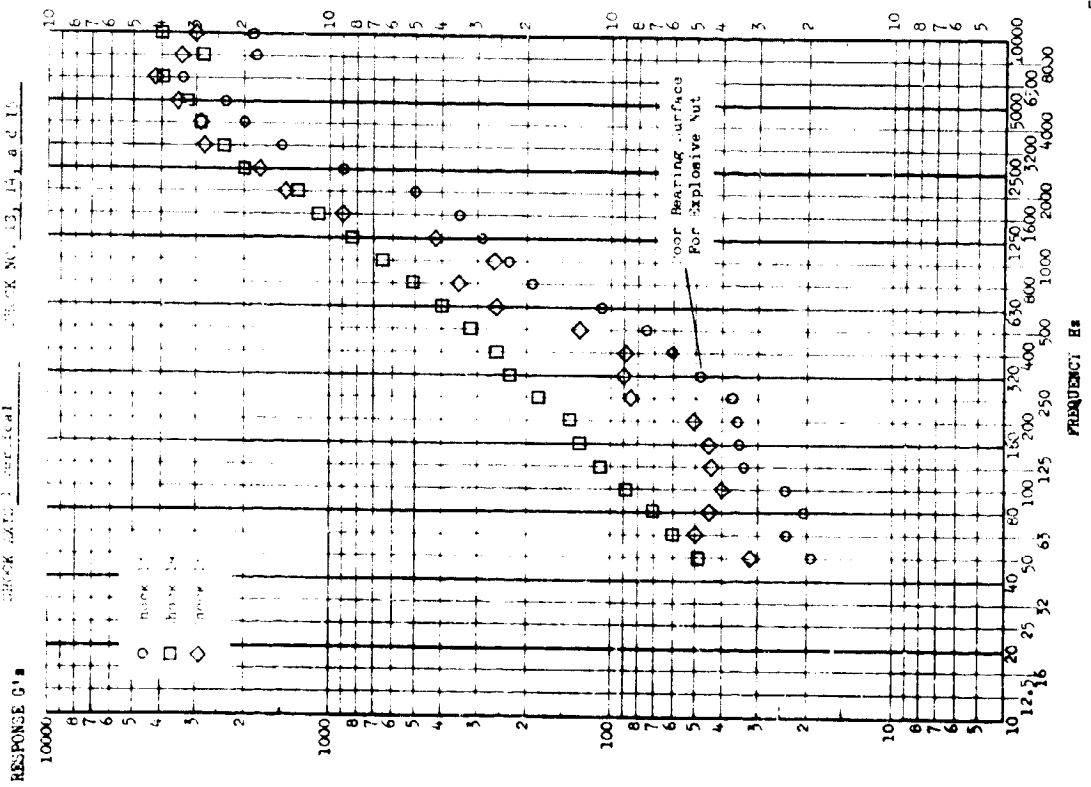


FIGURE II.B.1-112

TEST ITEM Configuration III PAR. NO. _____
 SERIAL NO. _____ TEST DATE September 20-23, 1968
 SHOCK AXIS 2 longitudinal SHOCK NO. 13, 14, and 15

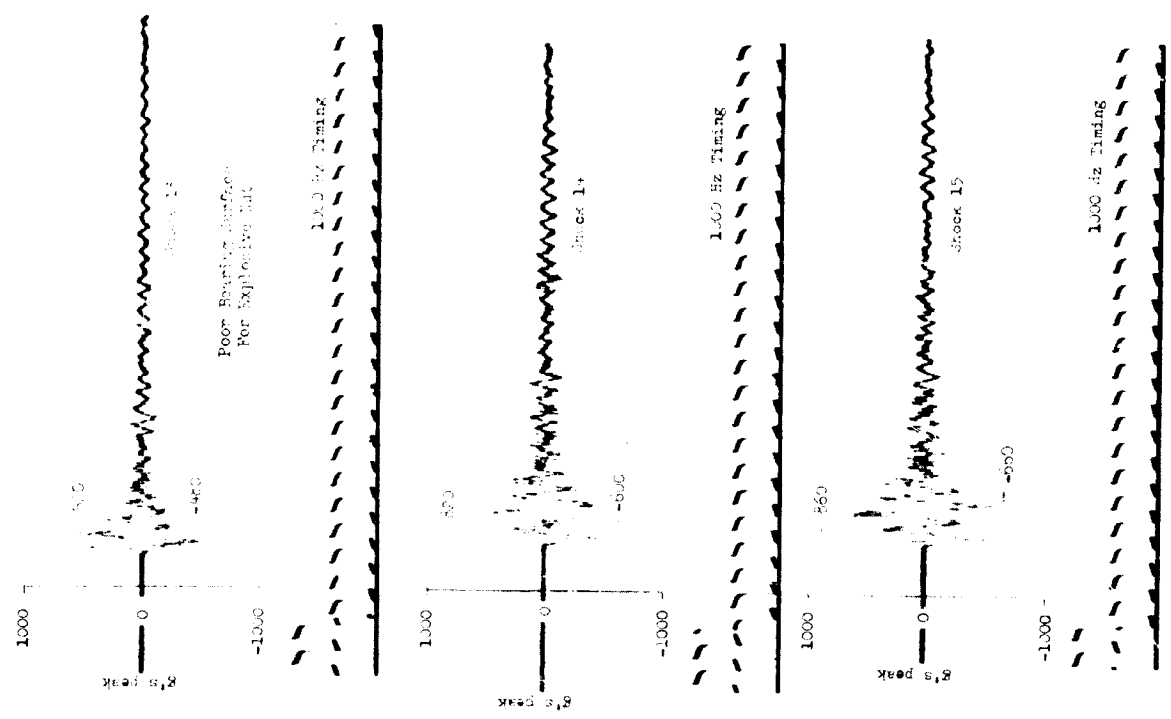
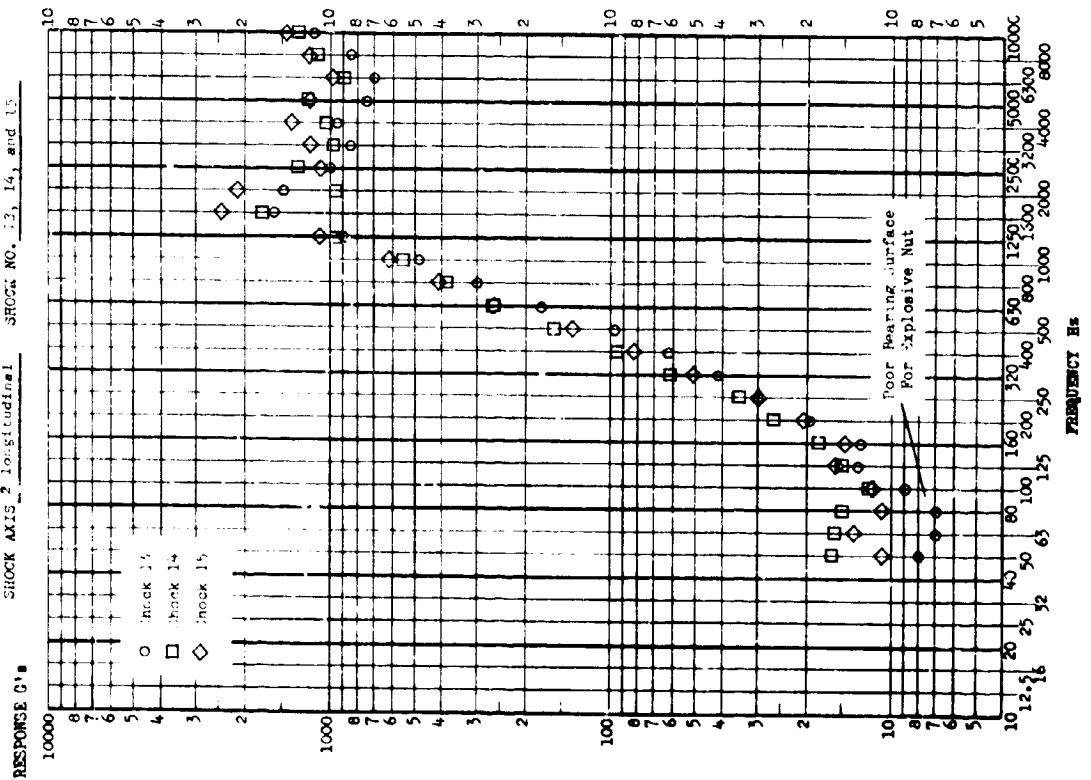


FIGURE II.B.1-113

TEST ITEM: Configuration II: PART NC.
 SERIAL NO.: TEST DATE: September 20-23, 1968
 SHOCK AXIS 2: Lateral SHOCK NO. 13, 14, and 15

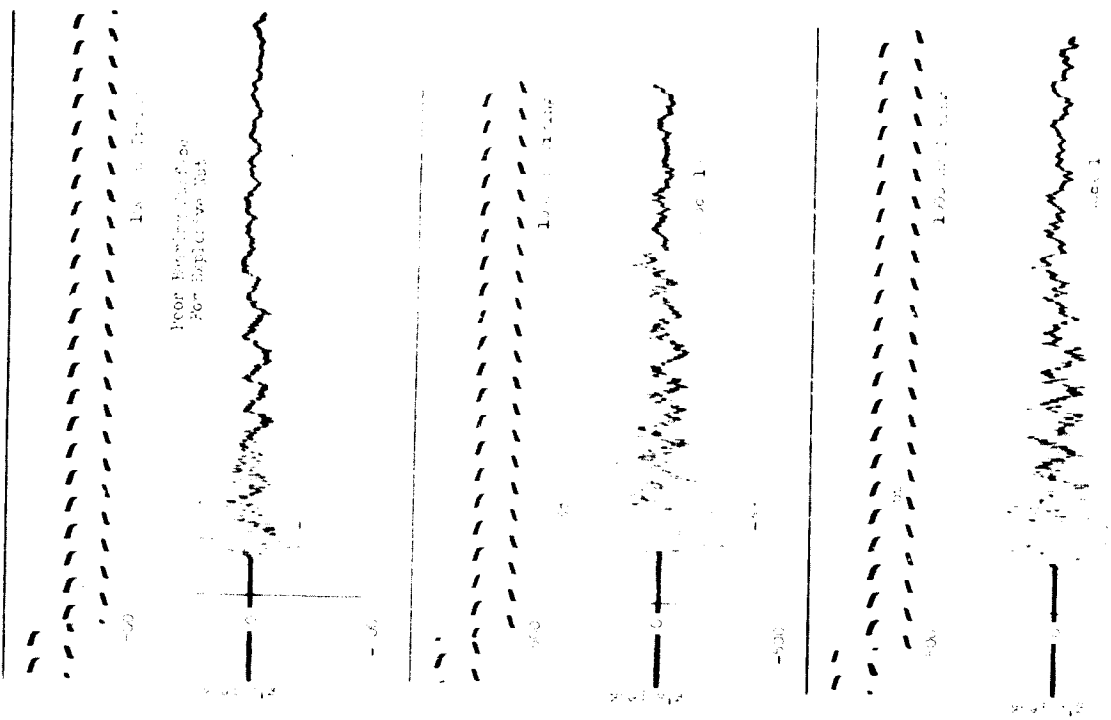
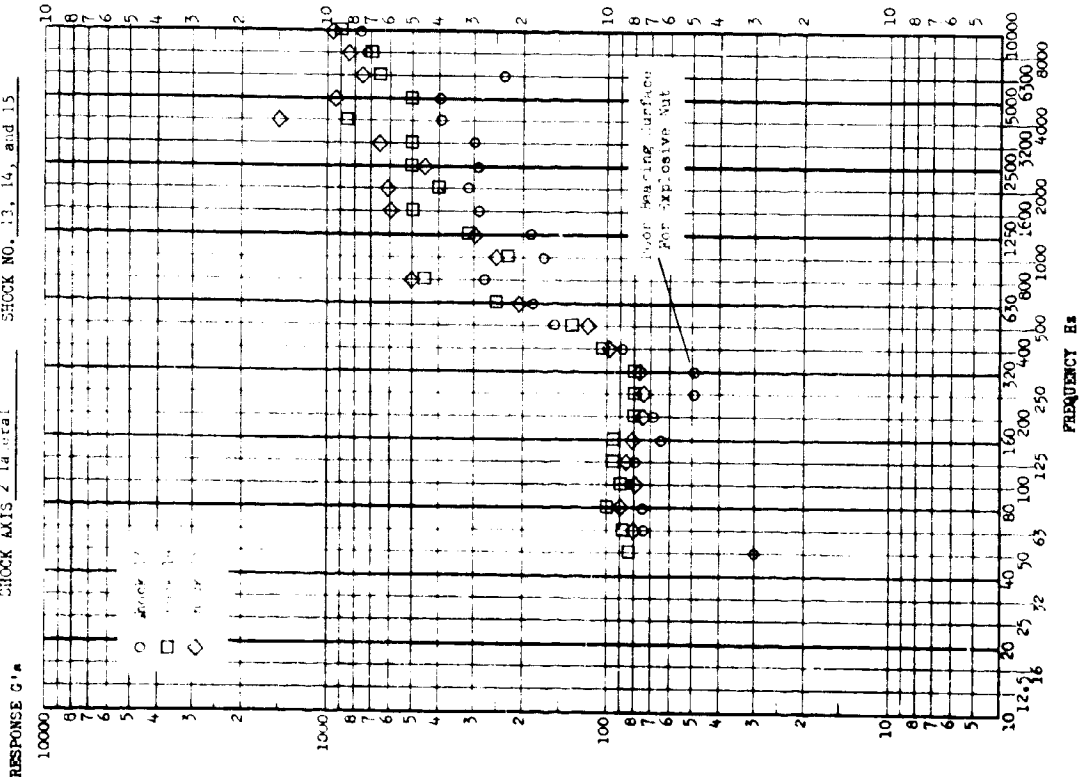


FIGURE 11.B.1-114

TEST ITEM Configuration II: PART NO. _____
 SERIAL NO. _____ TEST DATE September 20-23, 1968
 SHOCK AXIS 2 vertical SHOCK NO. 13, 14, and 15

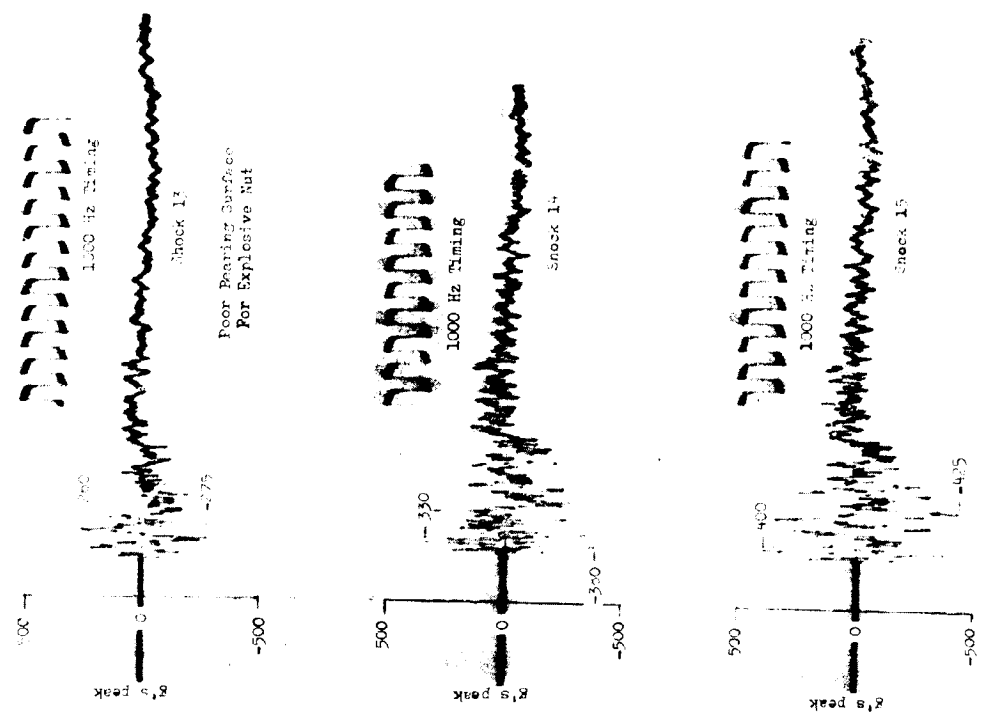
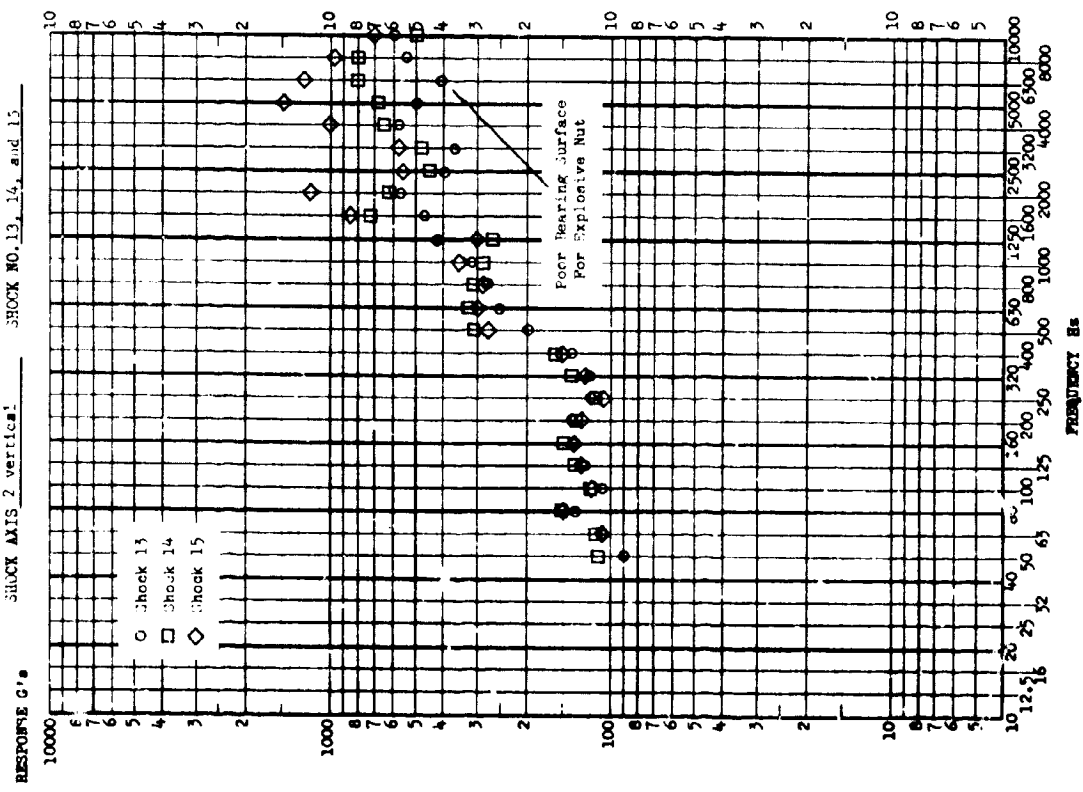
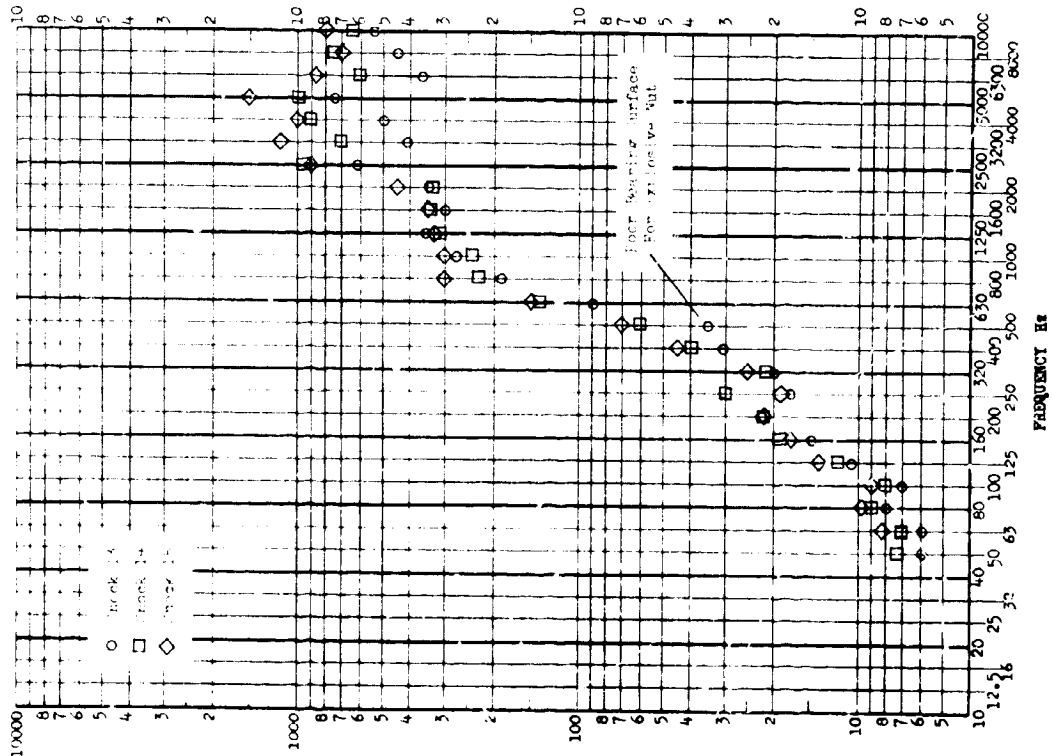


FIGURE II.B.1-115

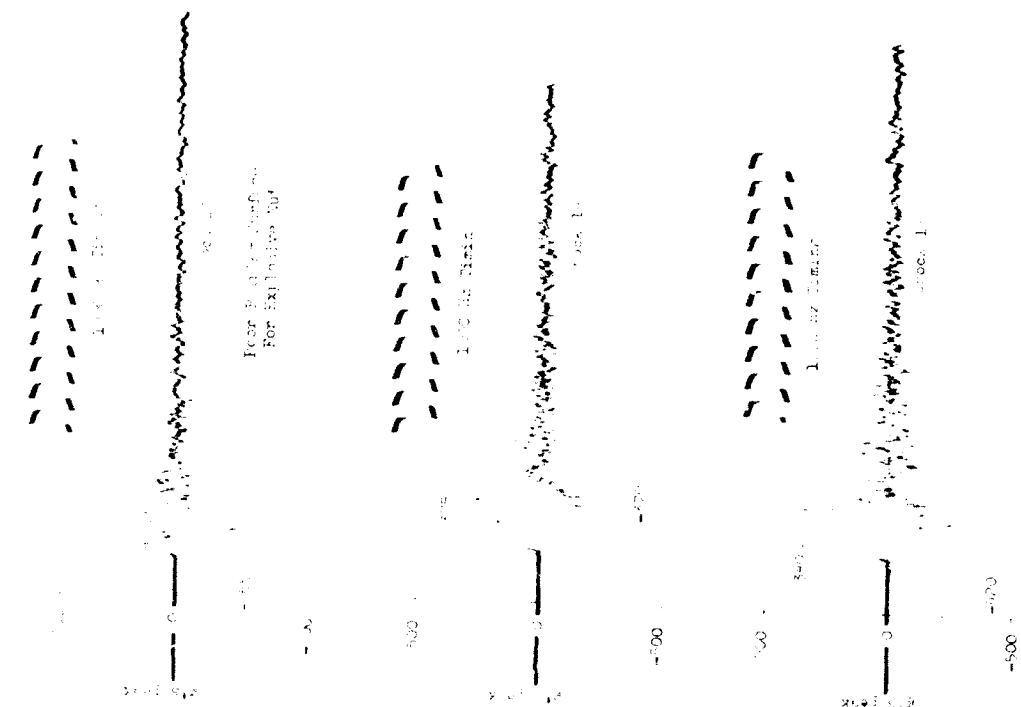
TEST ITEM: PART NO. _____
 SERIAL NO. _____
 CHECK DATE: 11/14/61
 CHECK NO. 11-14-116

RESPONSE (dB)



FREQUENCY Hz

FIGURE II.B.1-116



TEST ITEM Configuration III Part No.
 SERIAL NO. TEST DATE September 20-23, 1968
 SHOCK AXIS 3 (vertical) SHOCK NO. 13, 14, and 15

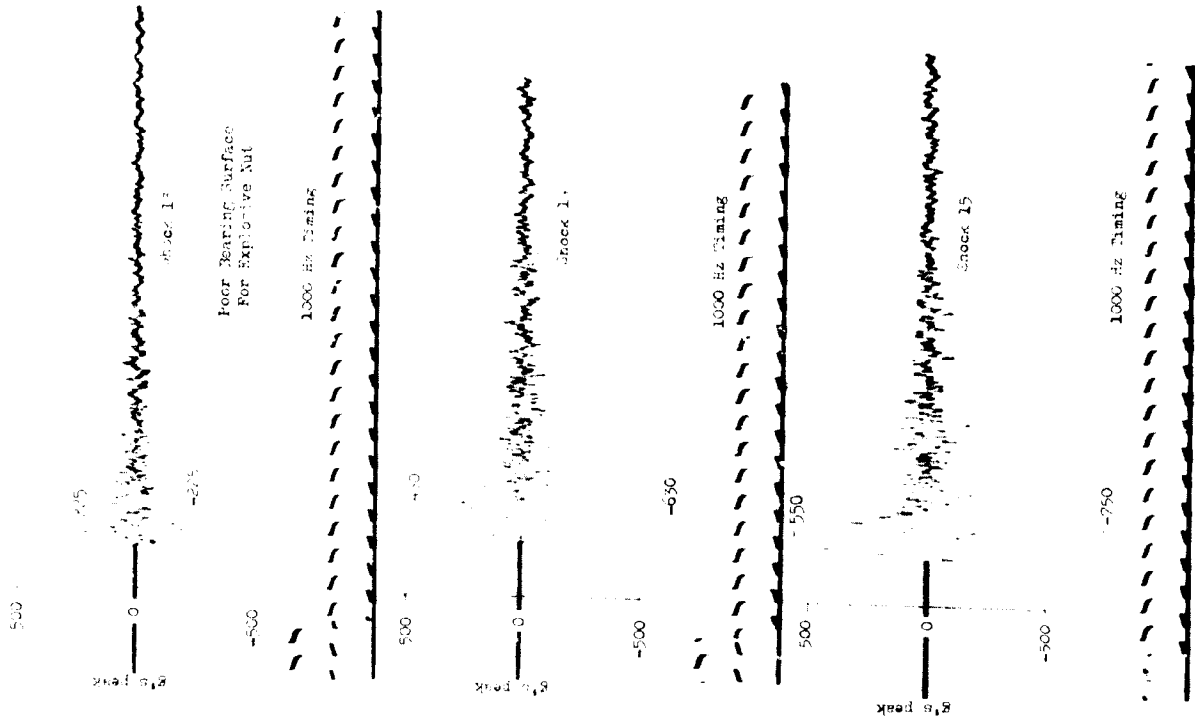
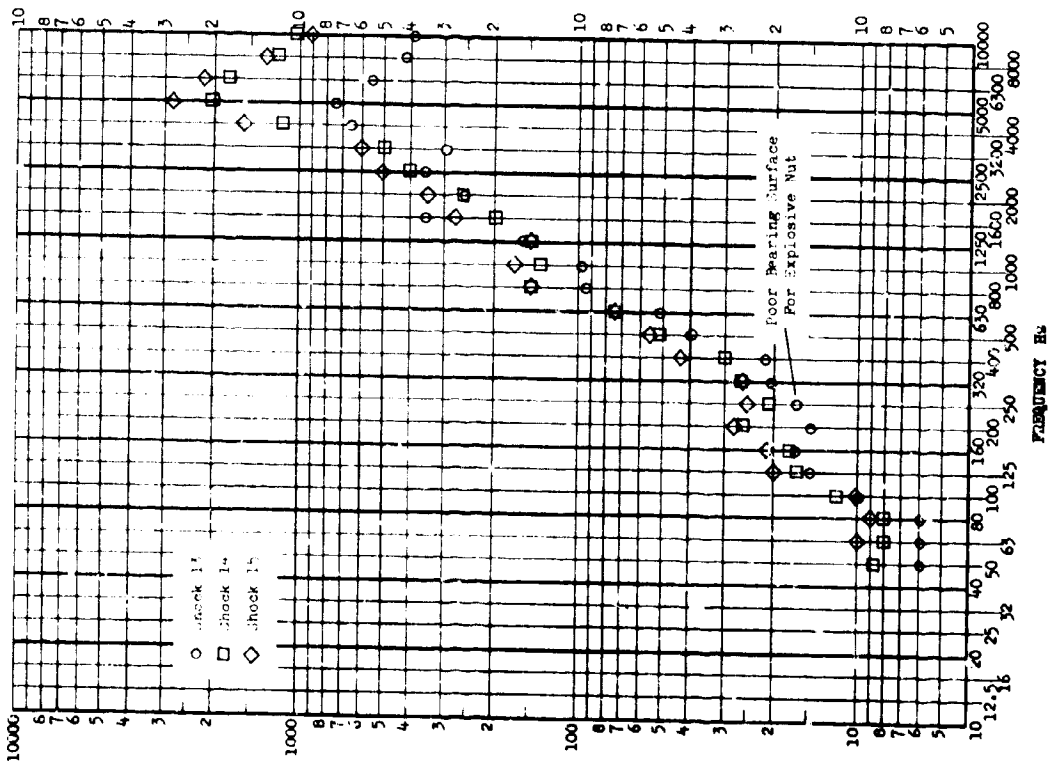


FIGURE 11.B.1-117

TEST ITEM Confidential Item 111 PART NO. _____
 SERIAL NO. _____ TEST DATE September 20-24, 1968
 SHOCK AXIS 3 random SHOCK NO. 13, 14, and 15

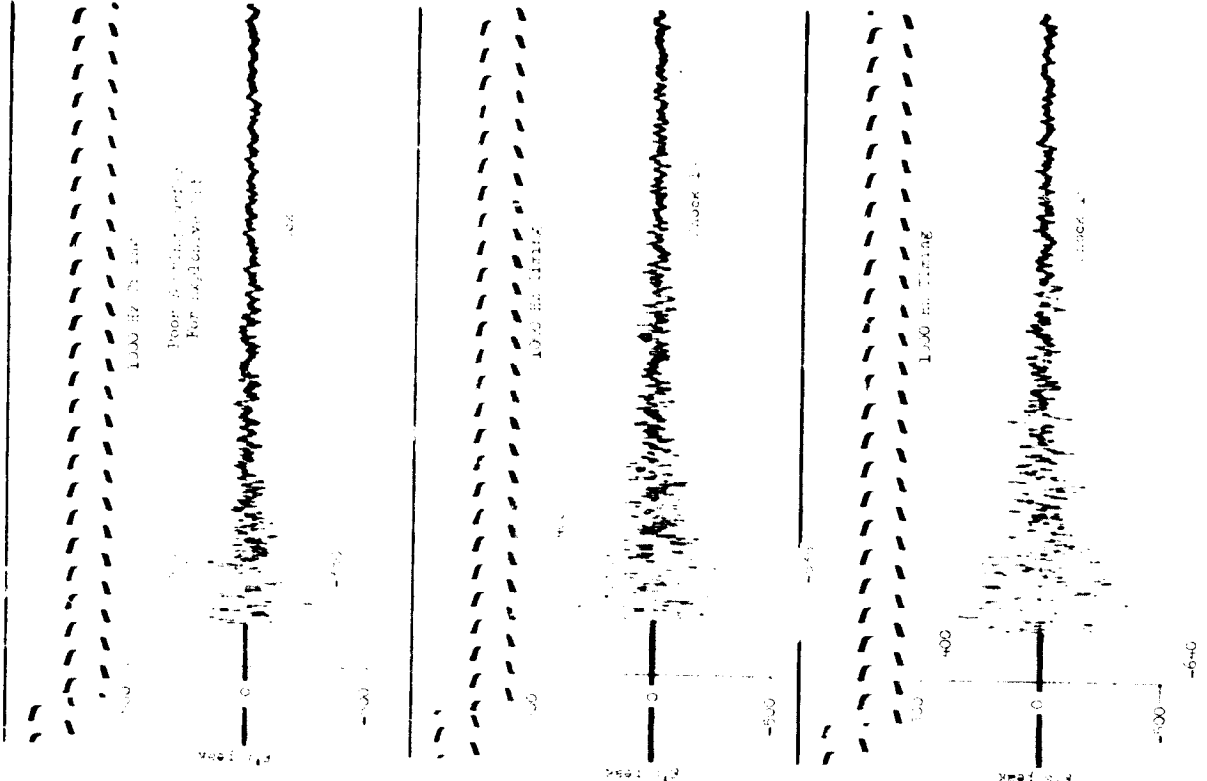
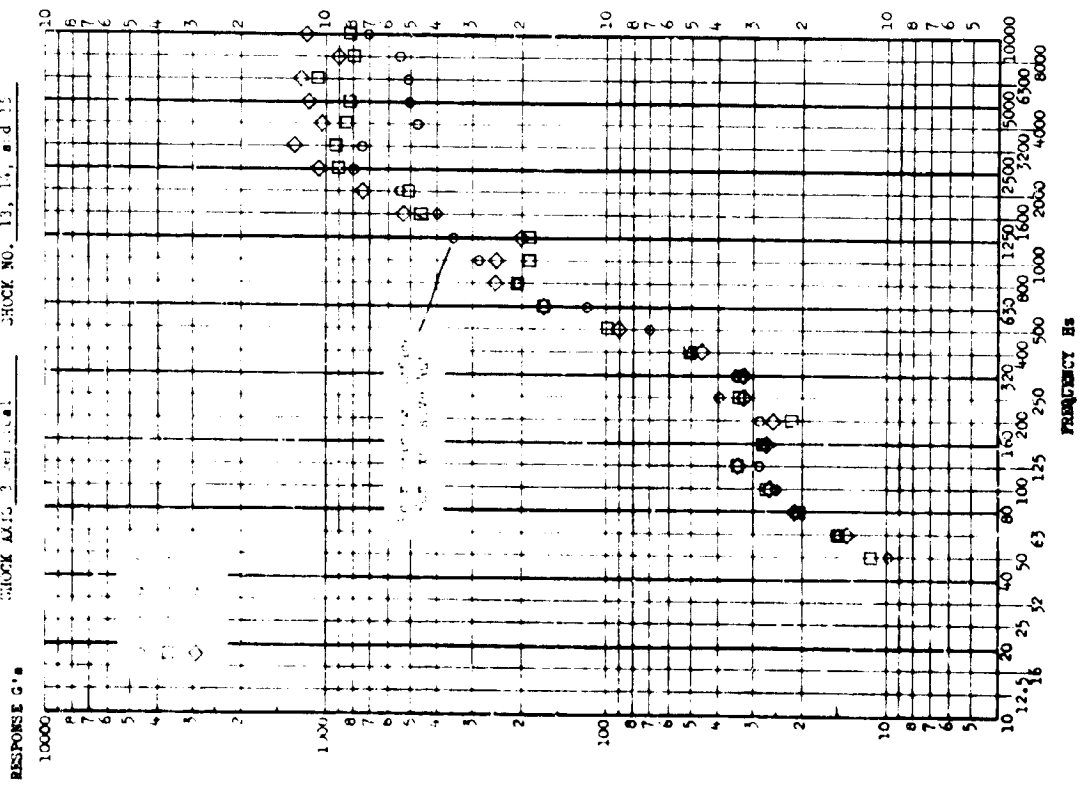


FIGURE 11.B.1-118

TSP ITEM Co-Integration 11. PART NO. _____
 SERIAL NO. _____
 SHOCK AXIS longitudinal SHOCK NO 13, 14, and 15

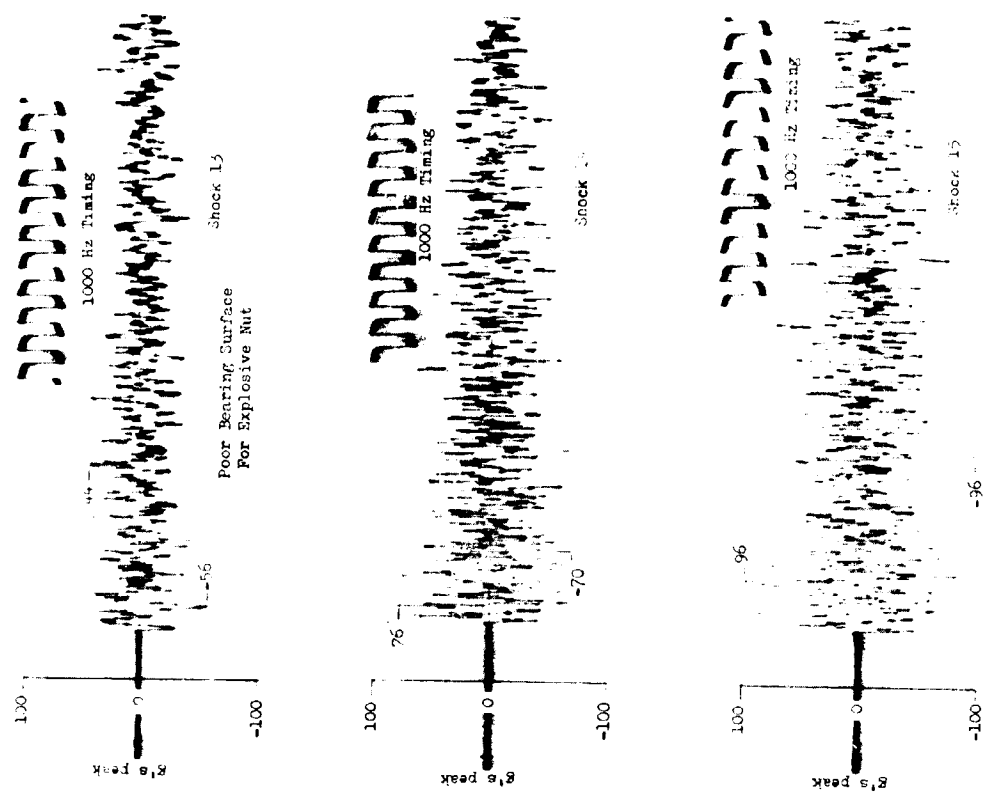
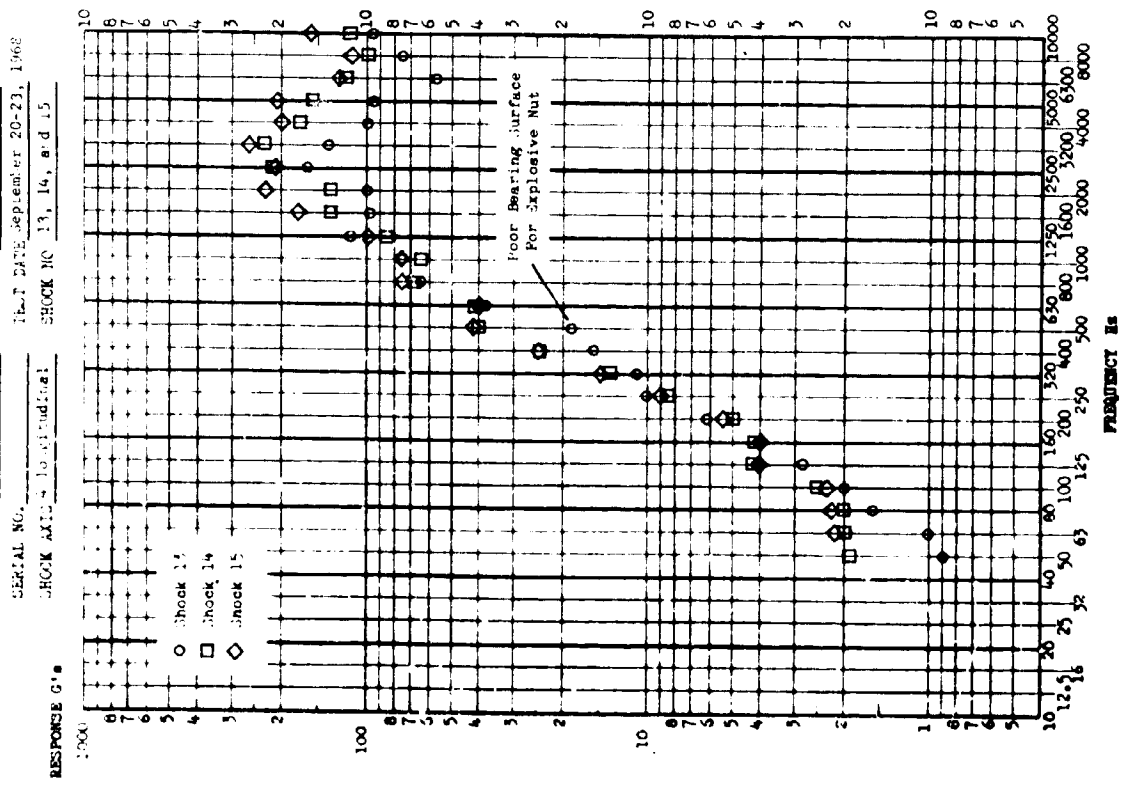


FIGURE 11.B.1-119

REPORT NUMBER: 11-11-11
 TITLE: Comparison of 100 Hz and 1000 Hz
 AUTHOR: W. W. 11, 11, 11, 11

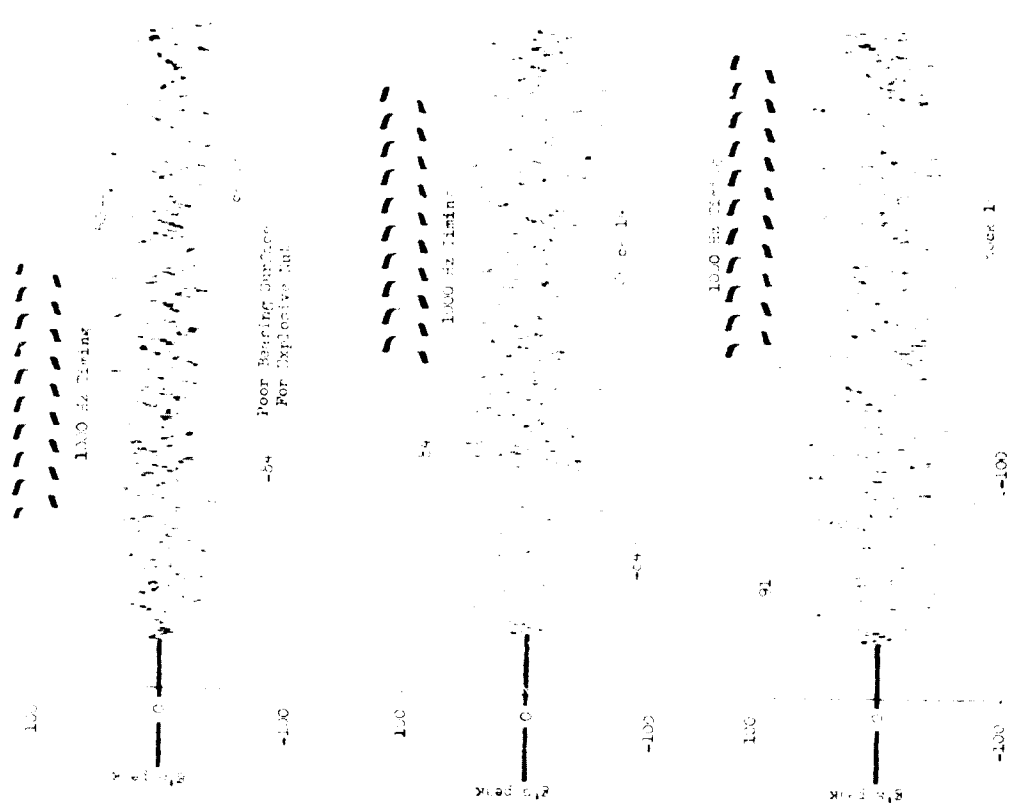
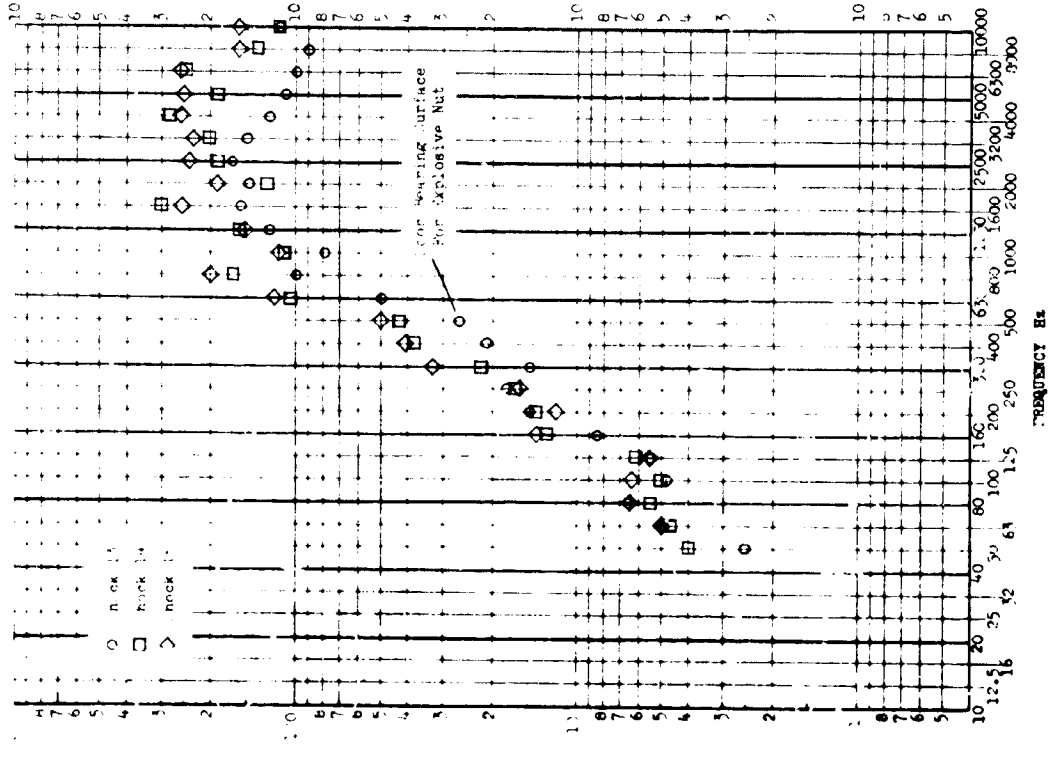


FIGURE 11.8.1-120

TEST ITEM: Conductor 1070 PART W.
 SERIAL NO.: 1070-23, 1070-24, 1070-25
 CHECK DATE: 13, 14, and 15

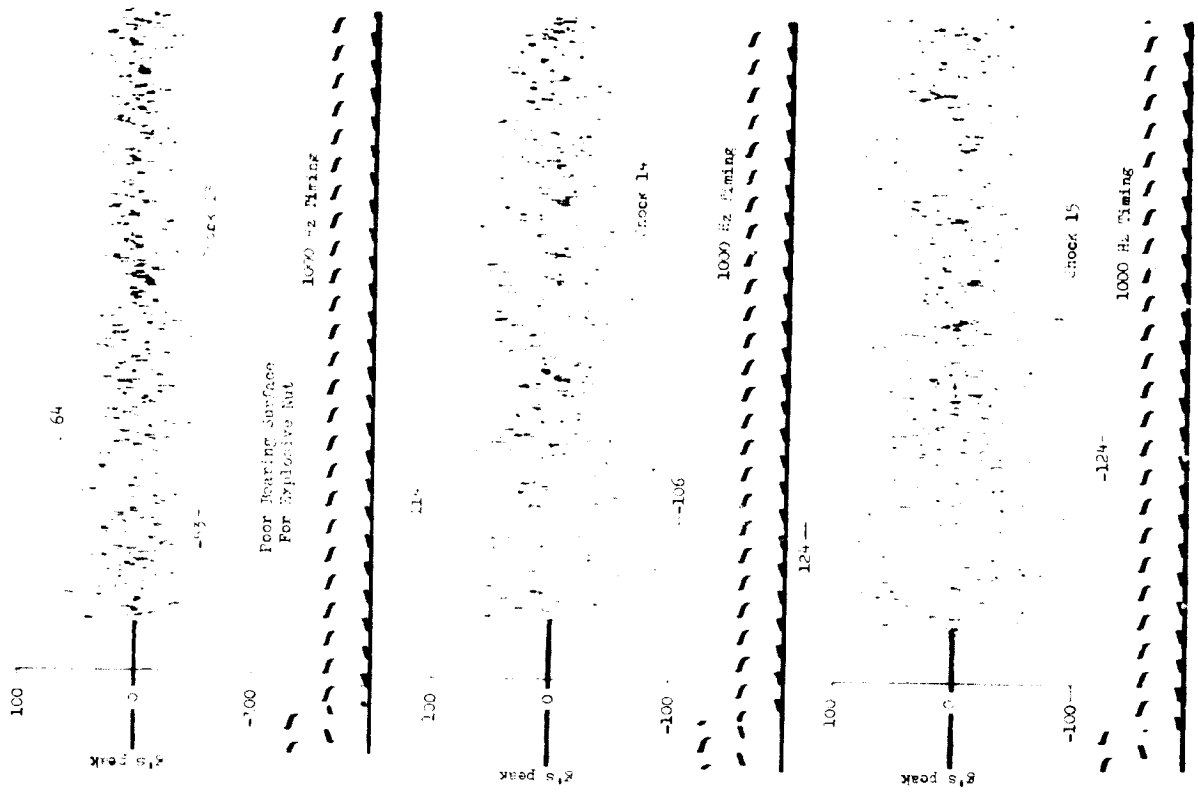
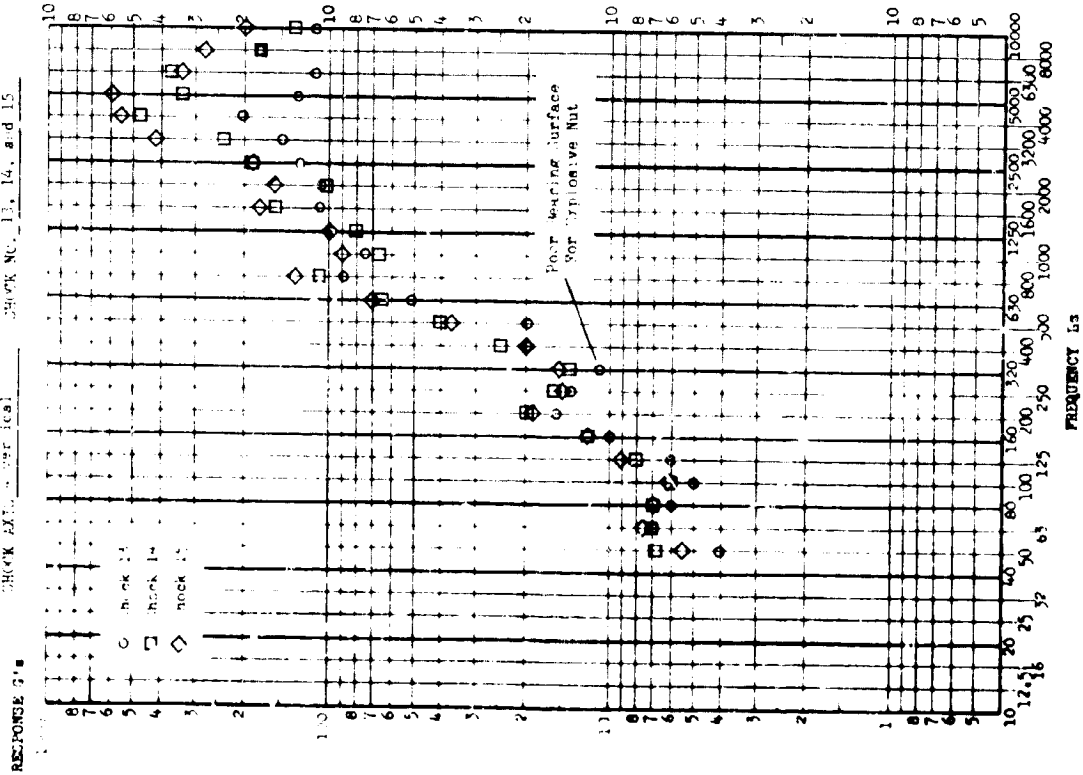


FIGURE 11.B.1-121

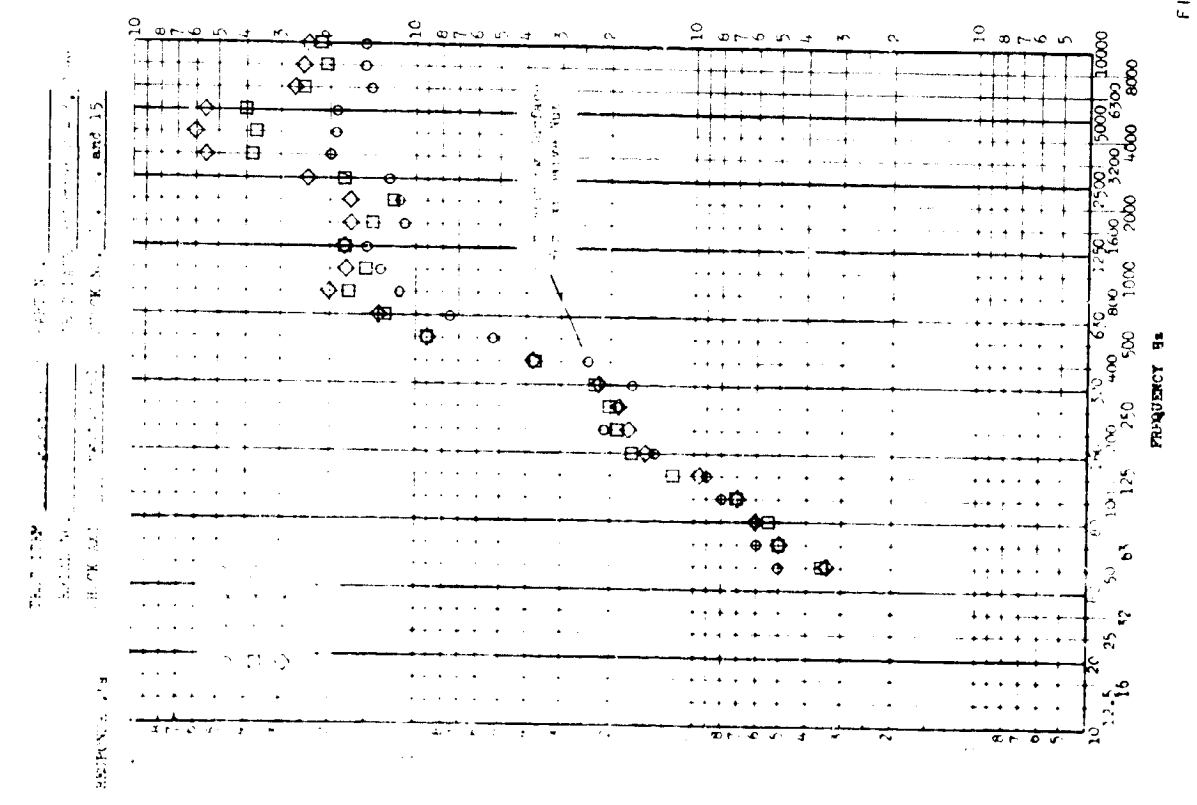
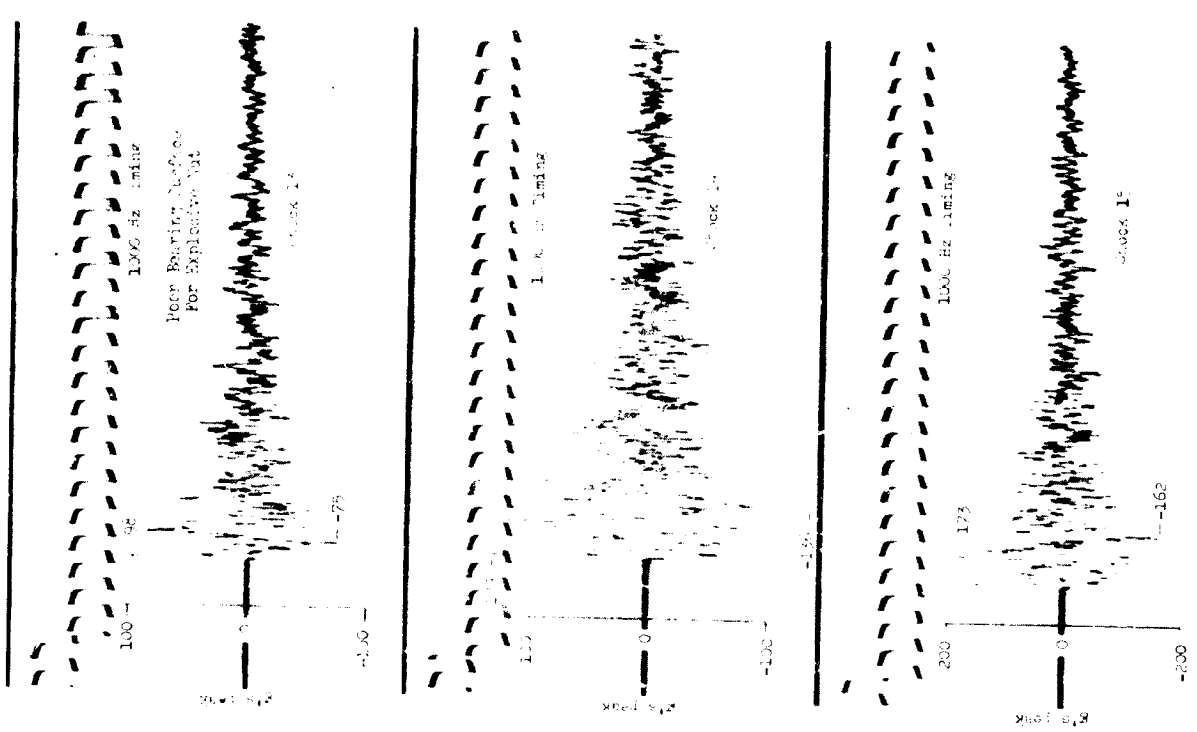


FIGURE II.B.1-122

TEST ITEM: EXPLOSIVE NUT PART NO.
 SERIAL NO. TEST DATE: September 20-21, 1966
 SHOCK AMPLITUDE: SHOCK NO. 13, 14, and 15

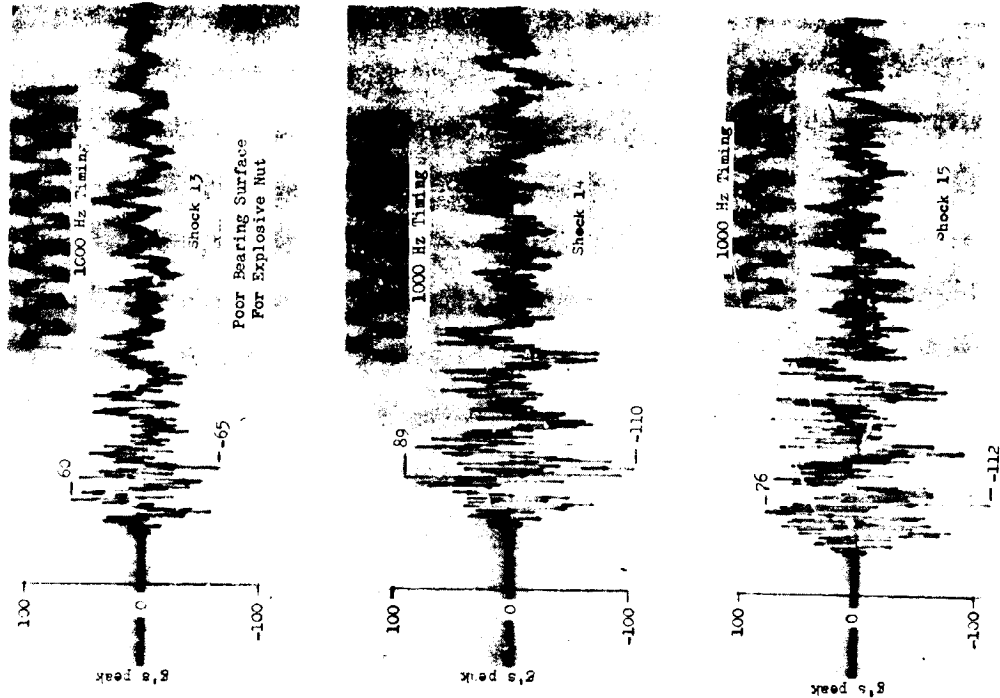
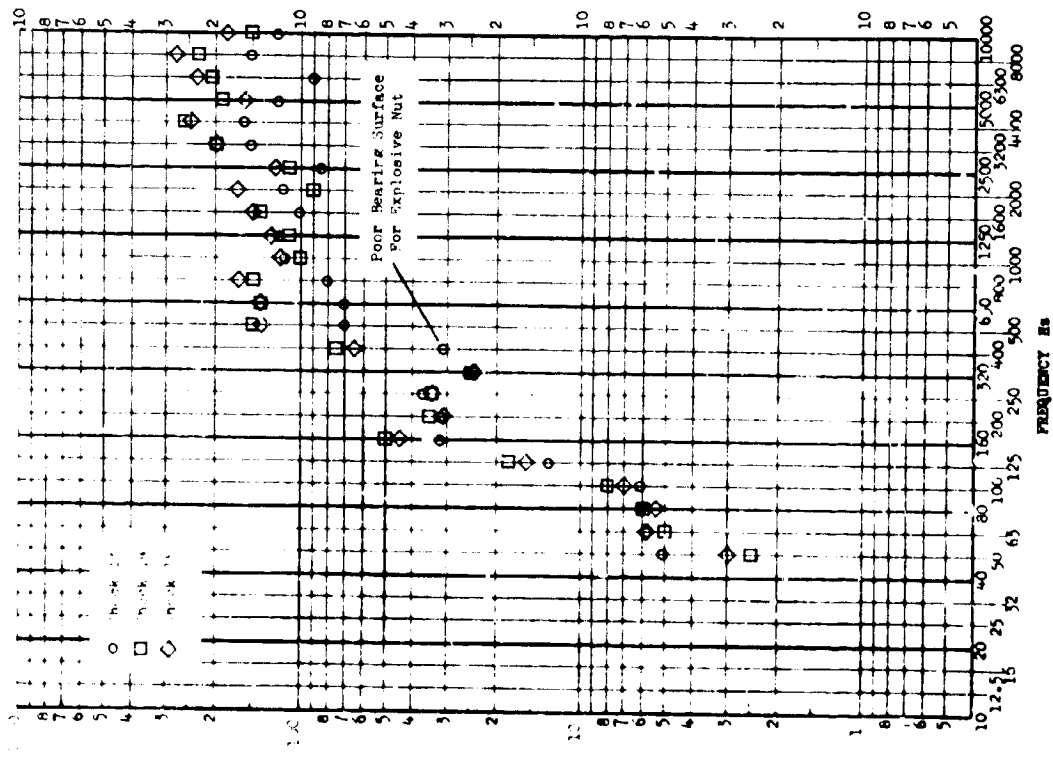


FIGURE 11.B.1-123

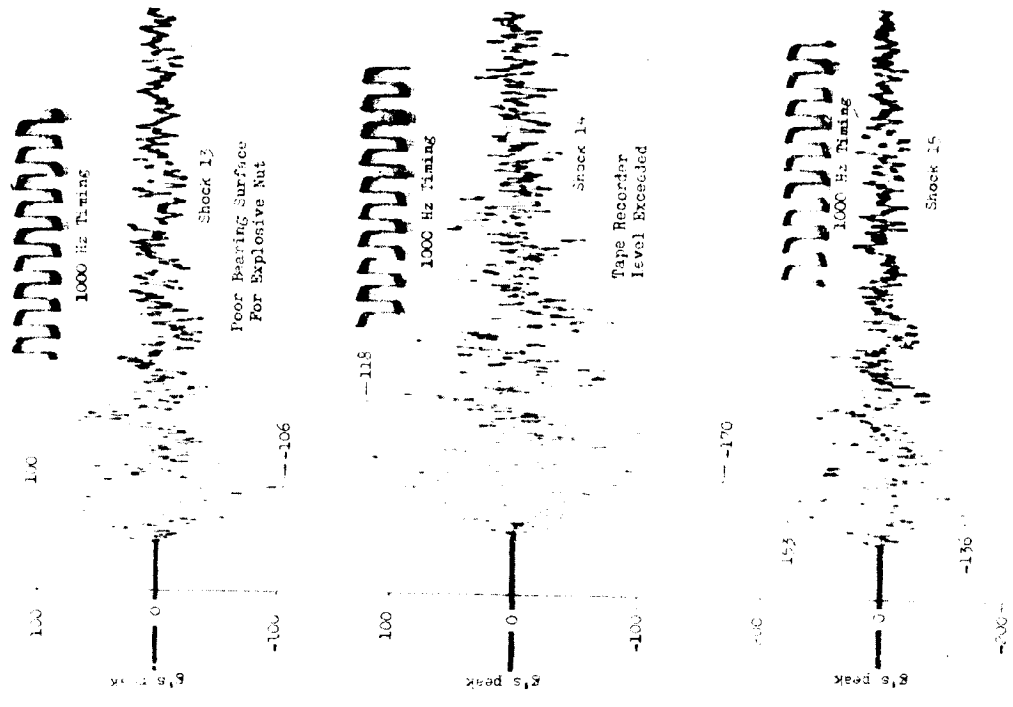
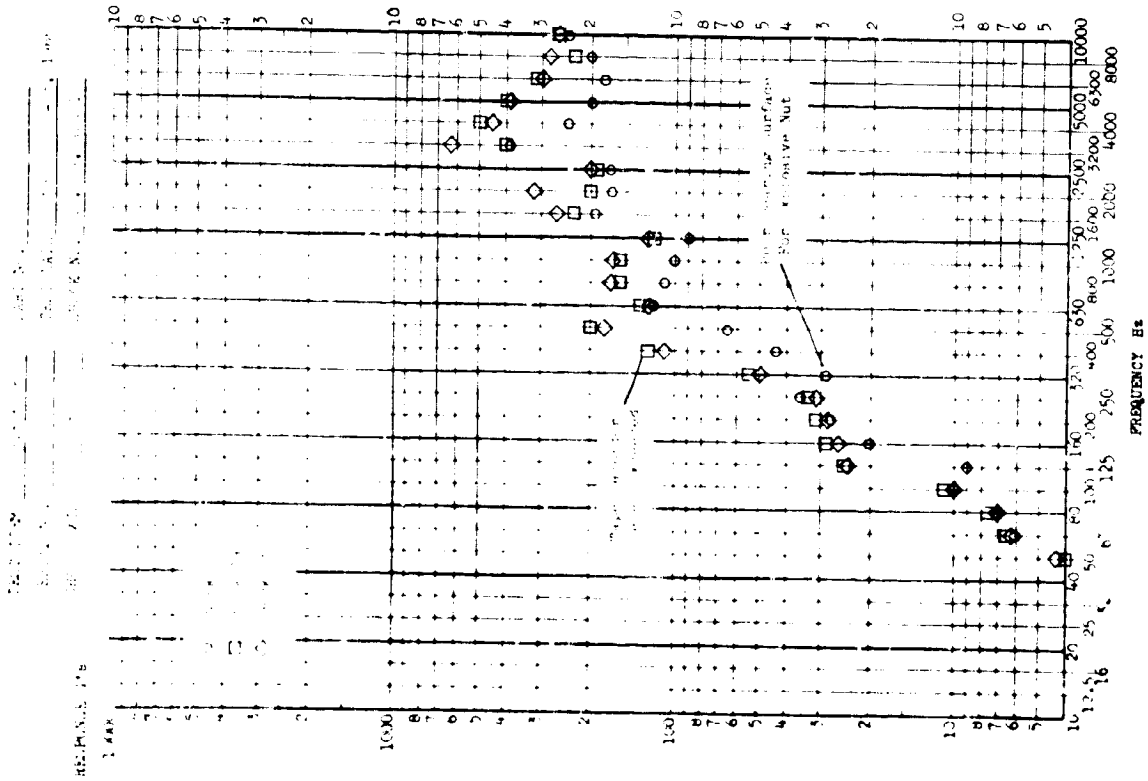
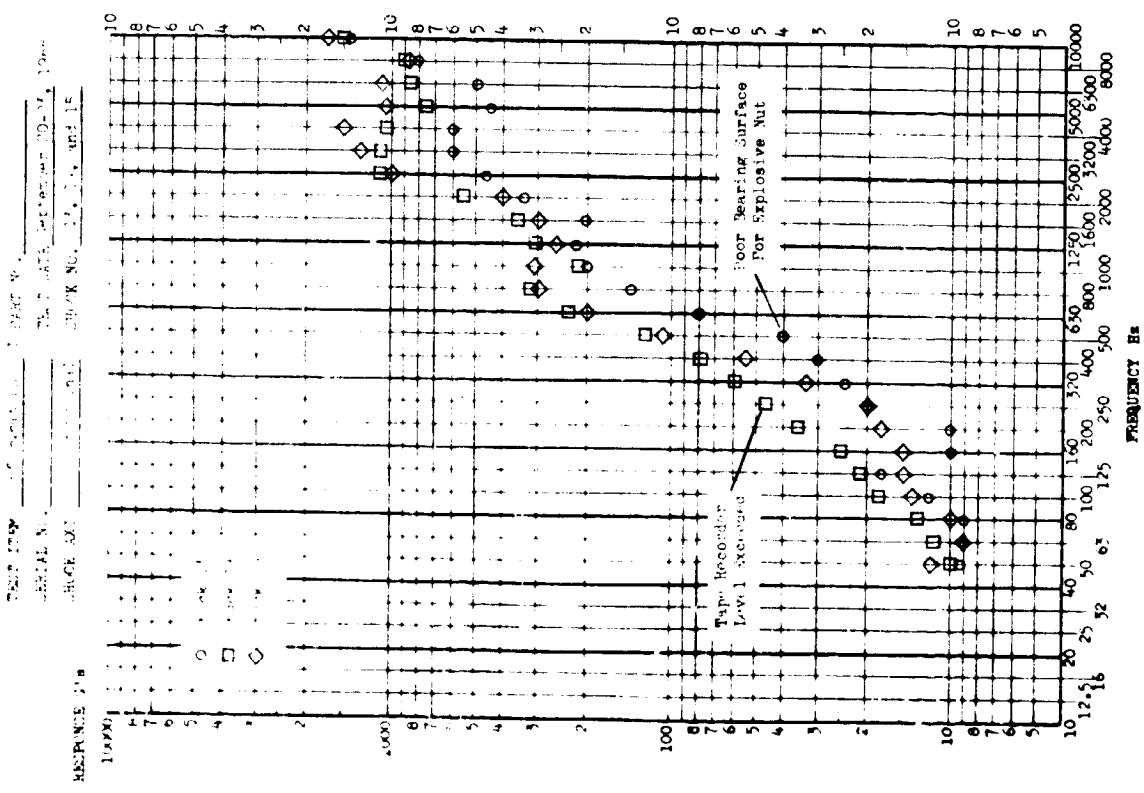
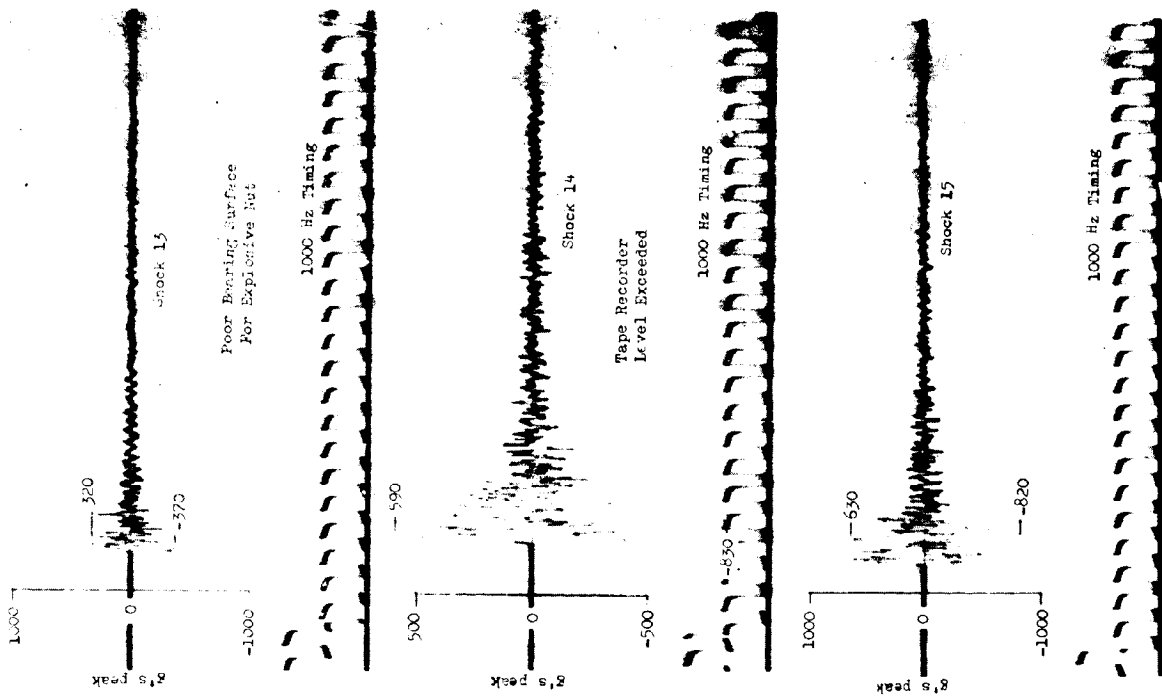


FIGURE 11, B.1-124



TEST NO. _____

SERIAL NO. _____

SHOCK NO. 13, 14, and 15

FIGURE 11.B.1-125

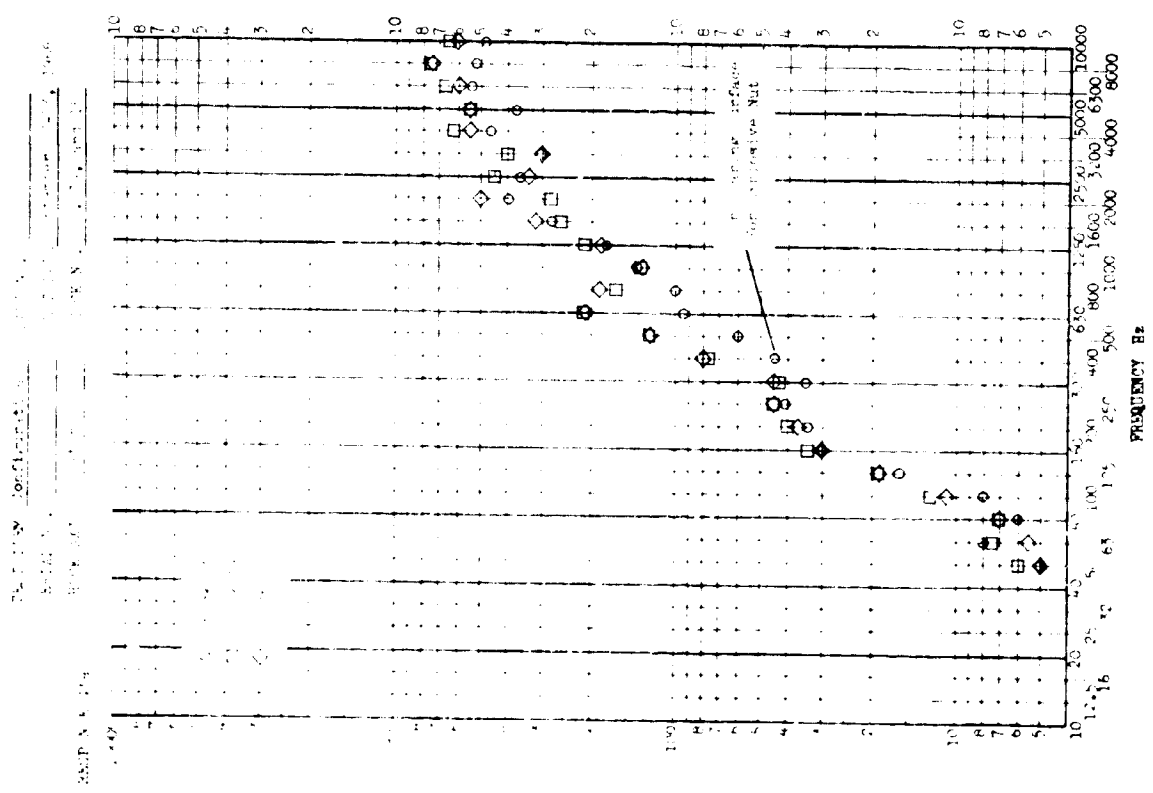
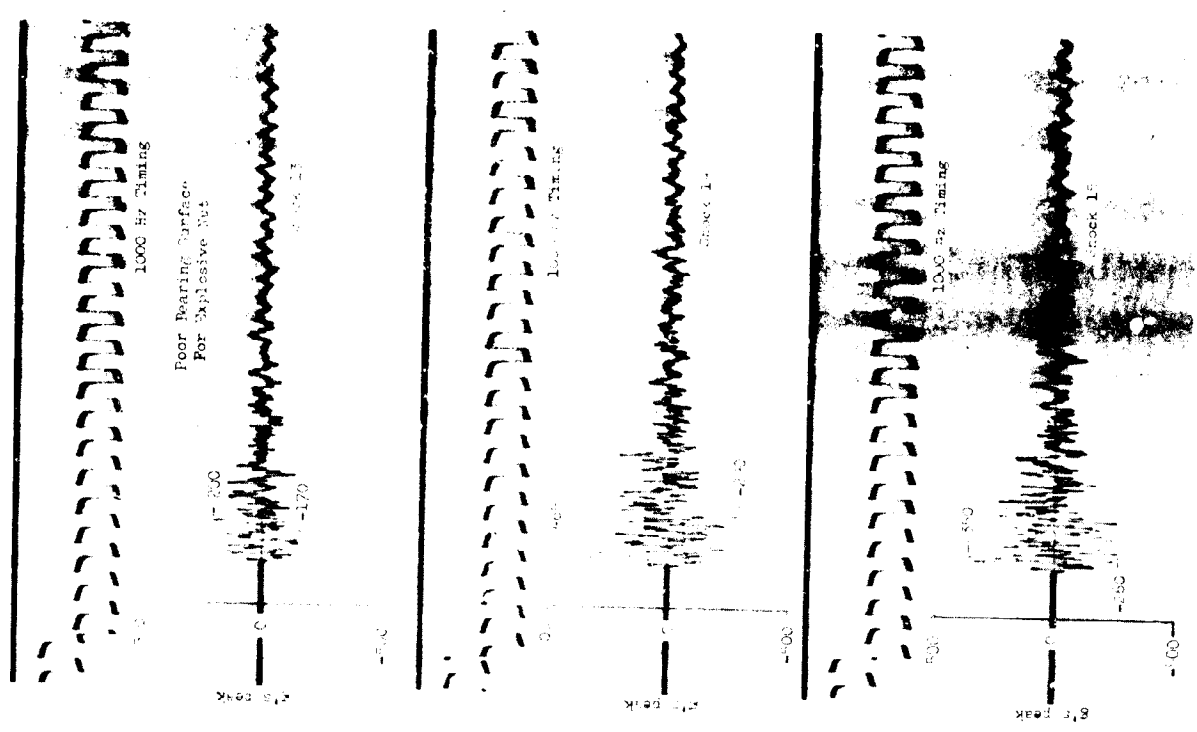


FIGURE 11.8.1-126

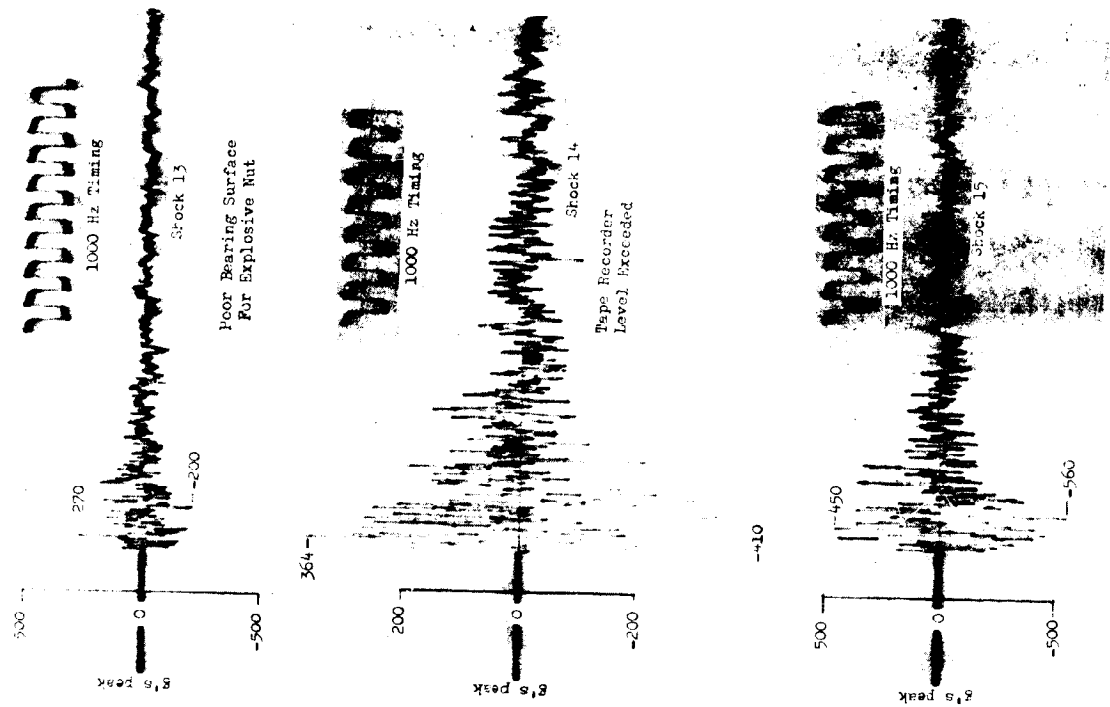
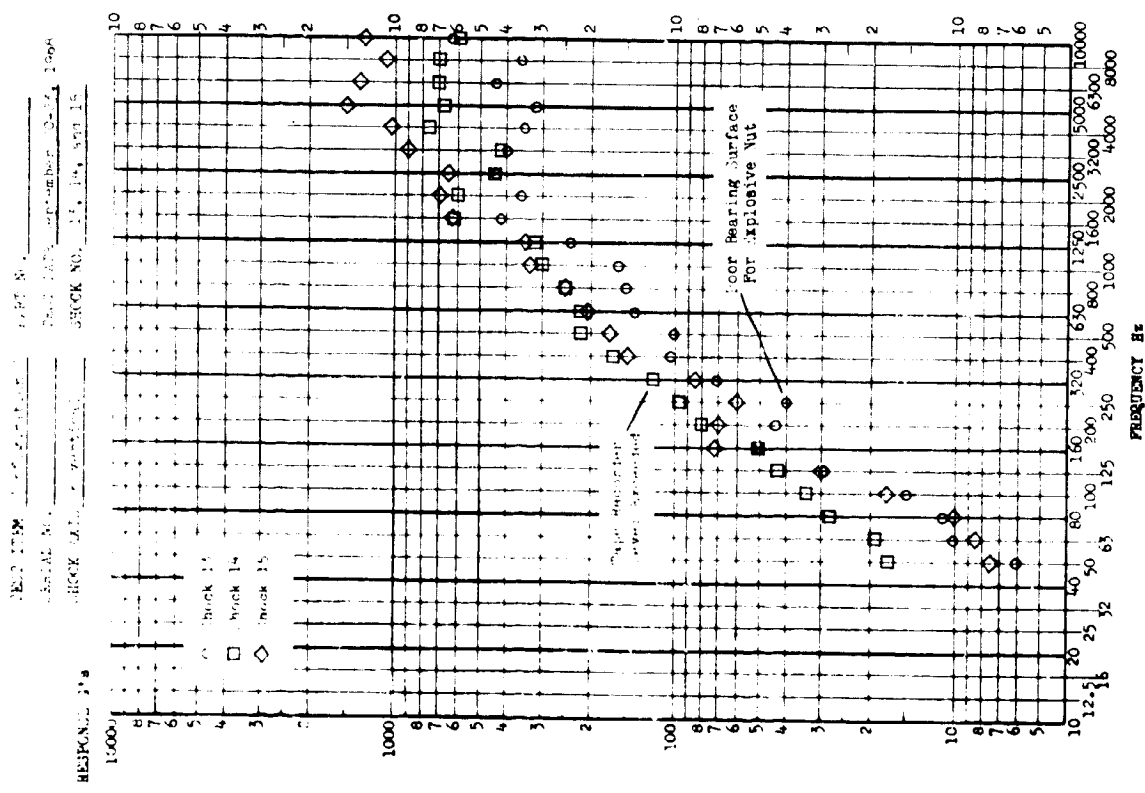


FIGURE II.B.1-127

TEST ITEM: EXPLOSIVE
 TEST NO: 1000
 DATE: 10/10/50
 SPEC: MIL-STD-883C
 WORK NO: 1000

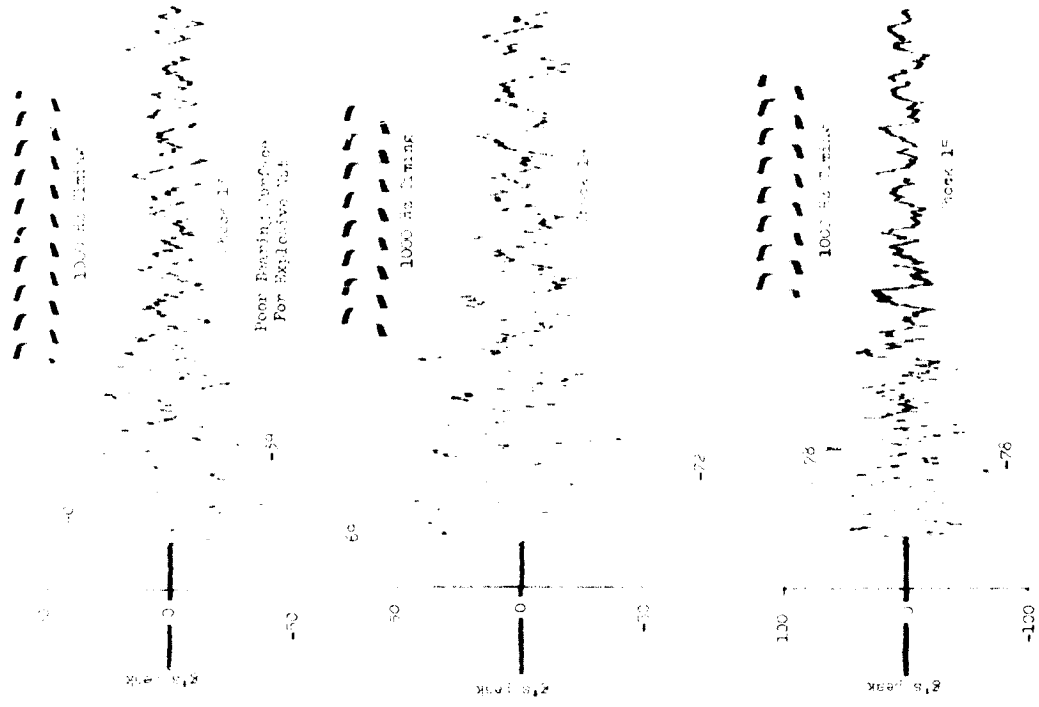
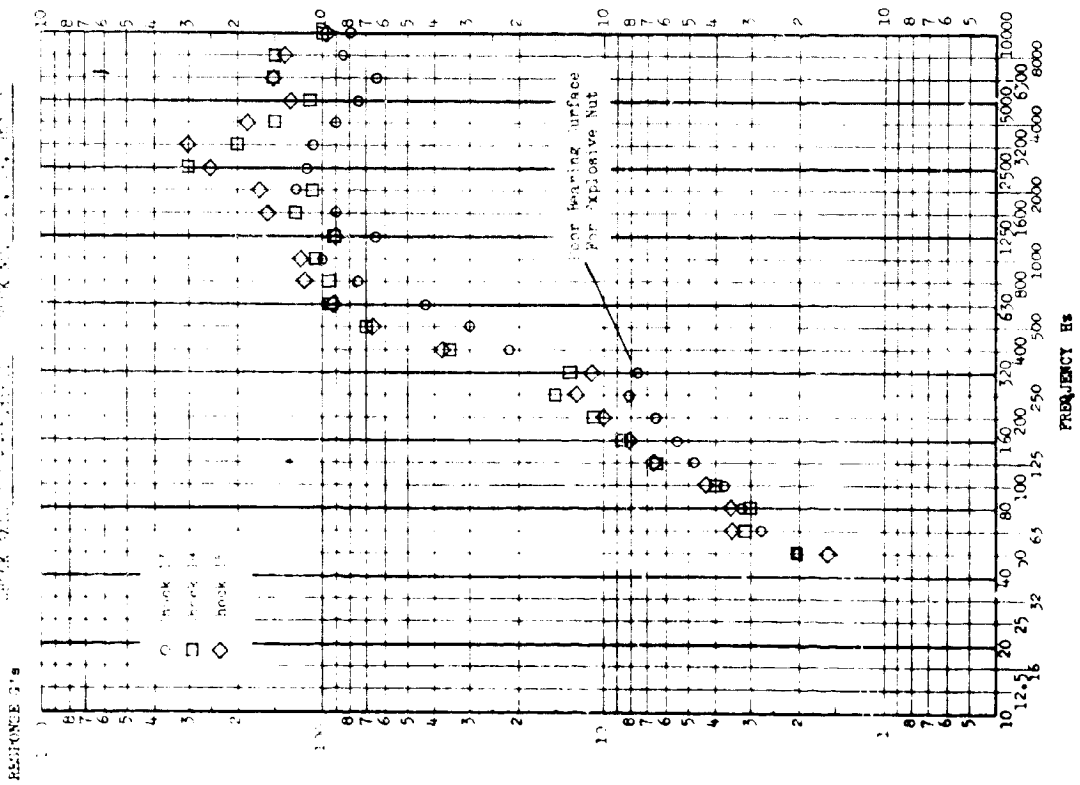


FIGURE 11.B.1-128

TEST CASE Configuration: 11-11-57
 TEST CASE: 11-11-57
 SHOCK NO.: 14, 15, 16

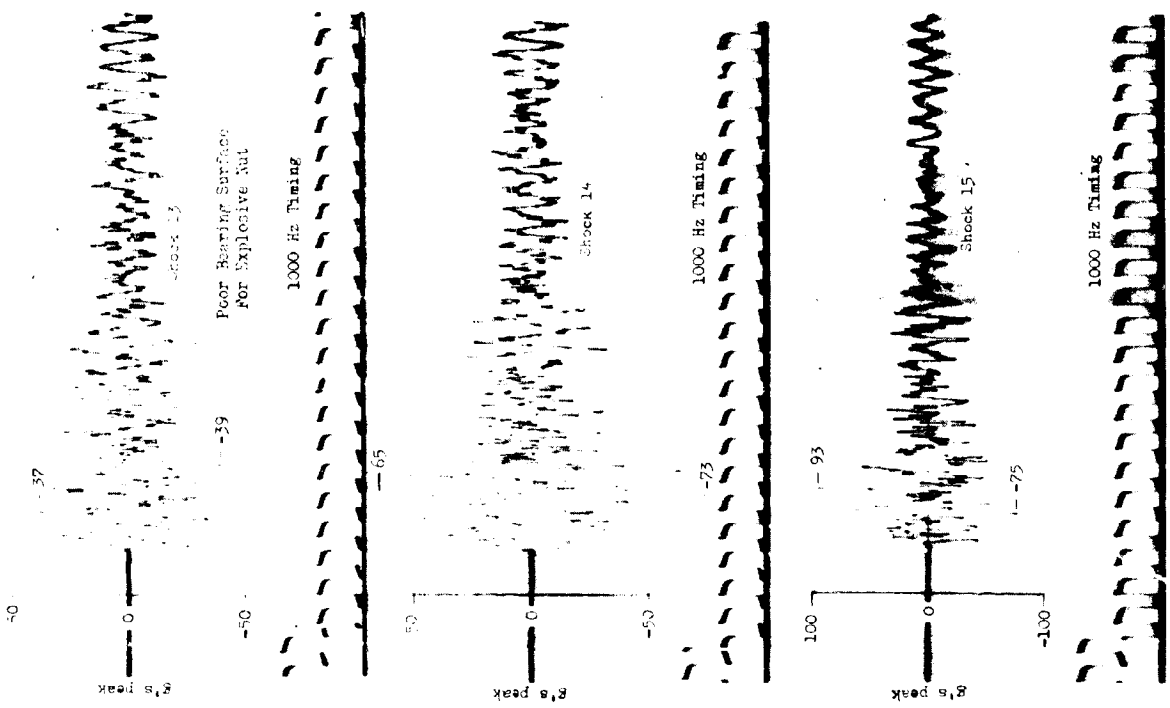
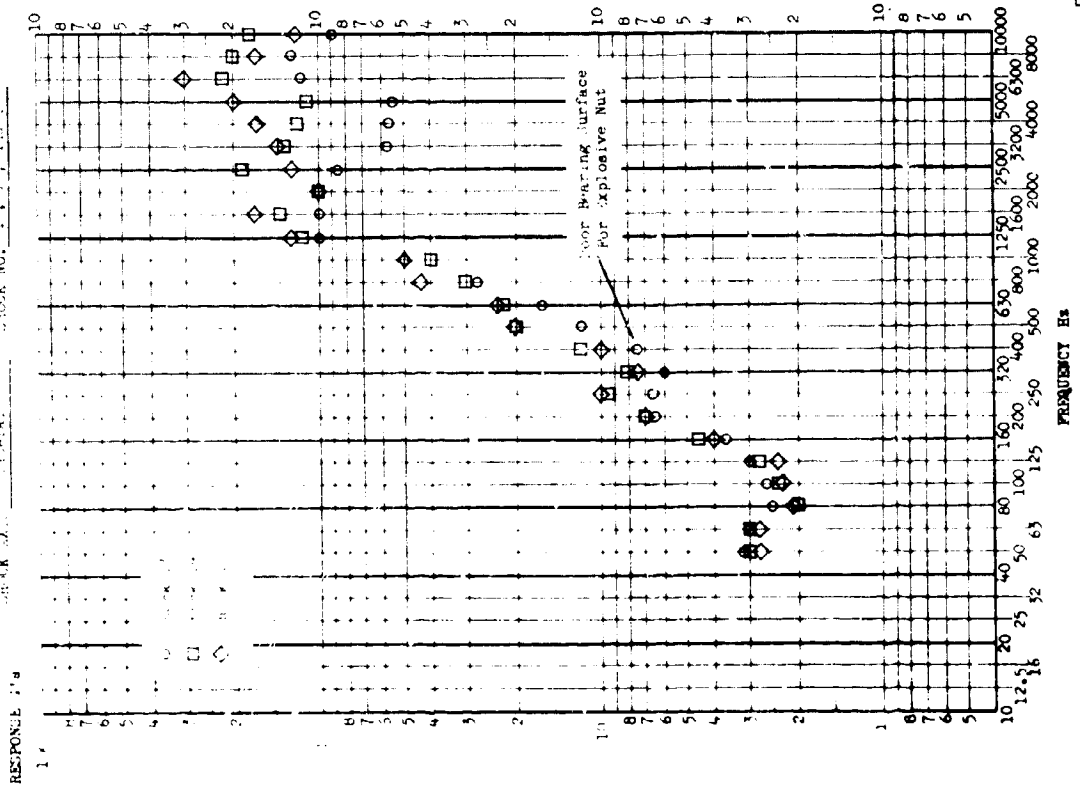


FIGURE 11.B.1-129

TEST BODY: ...
 SERIAL NO.: ...
 SHOCK NO.: ...

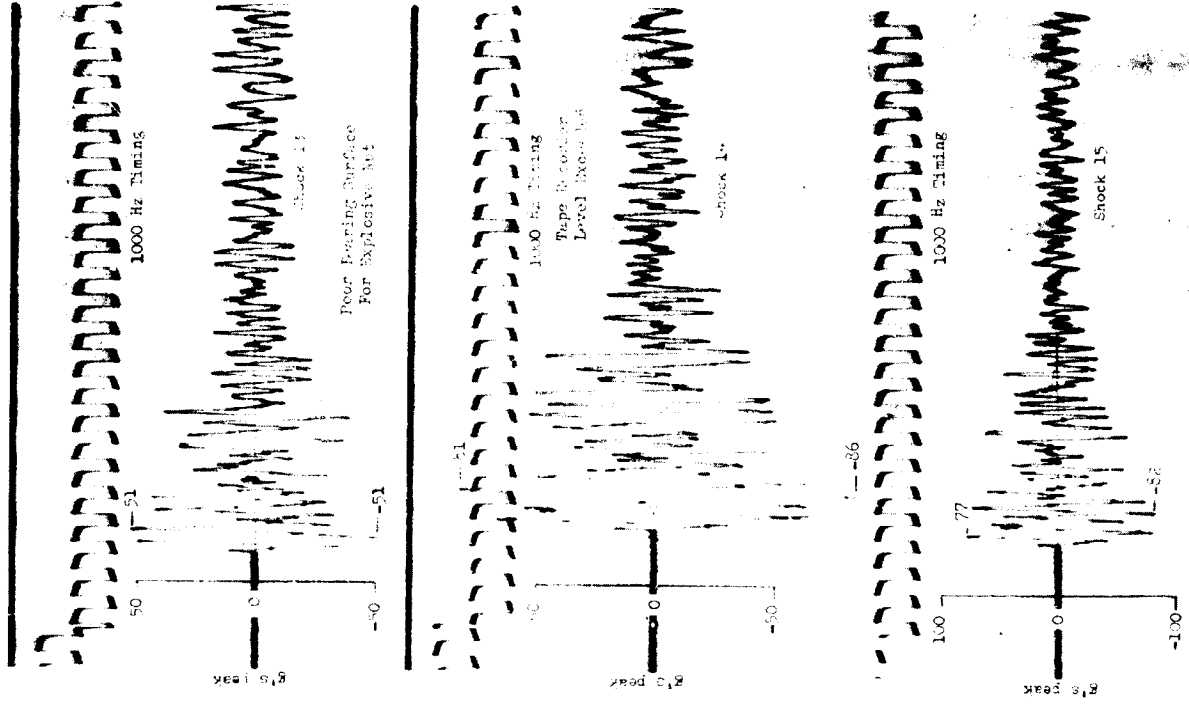
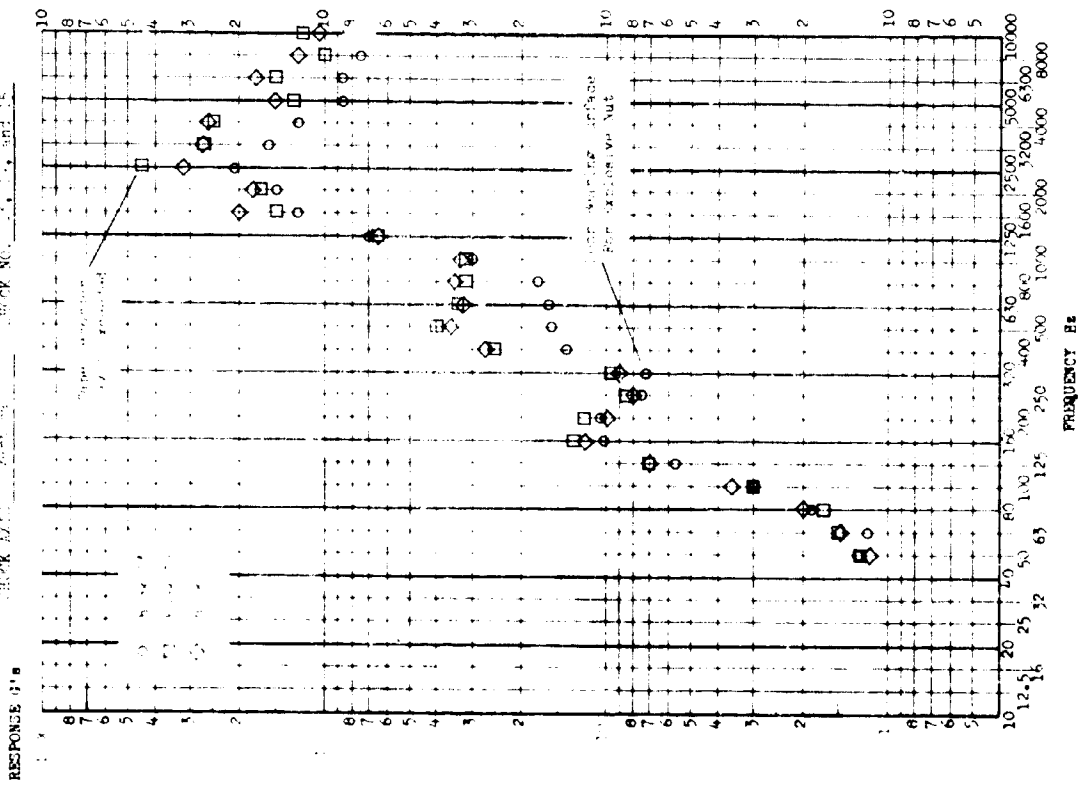


FIGURE 11.B.1-130

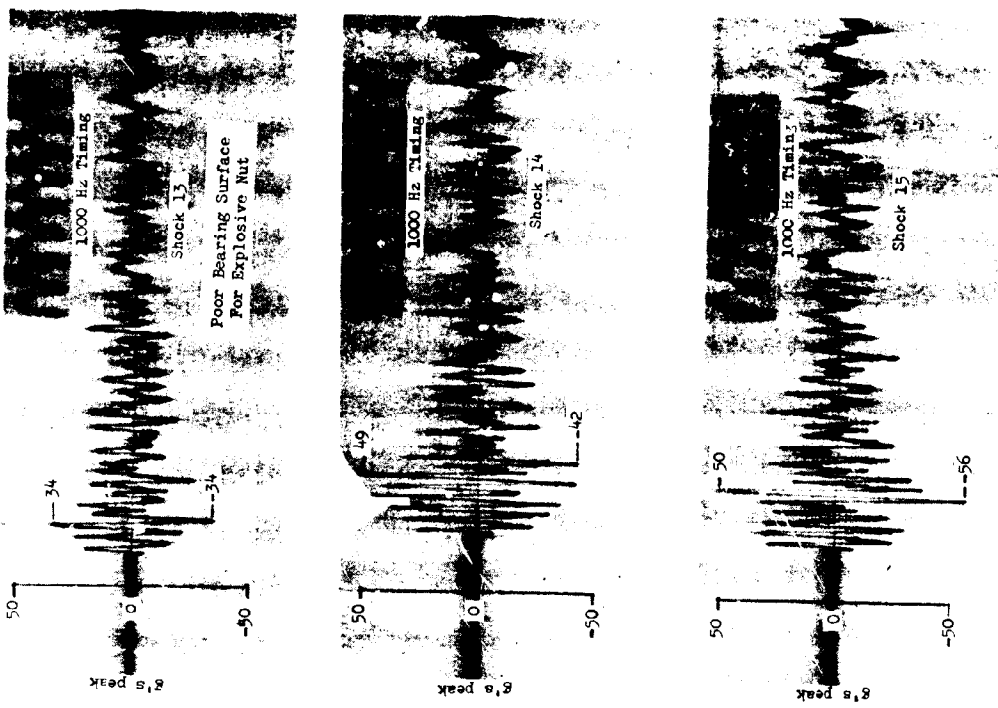
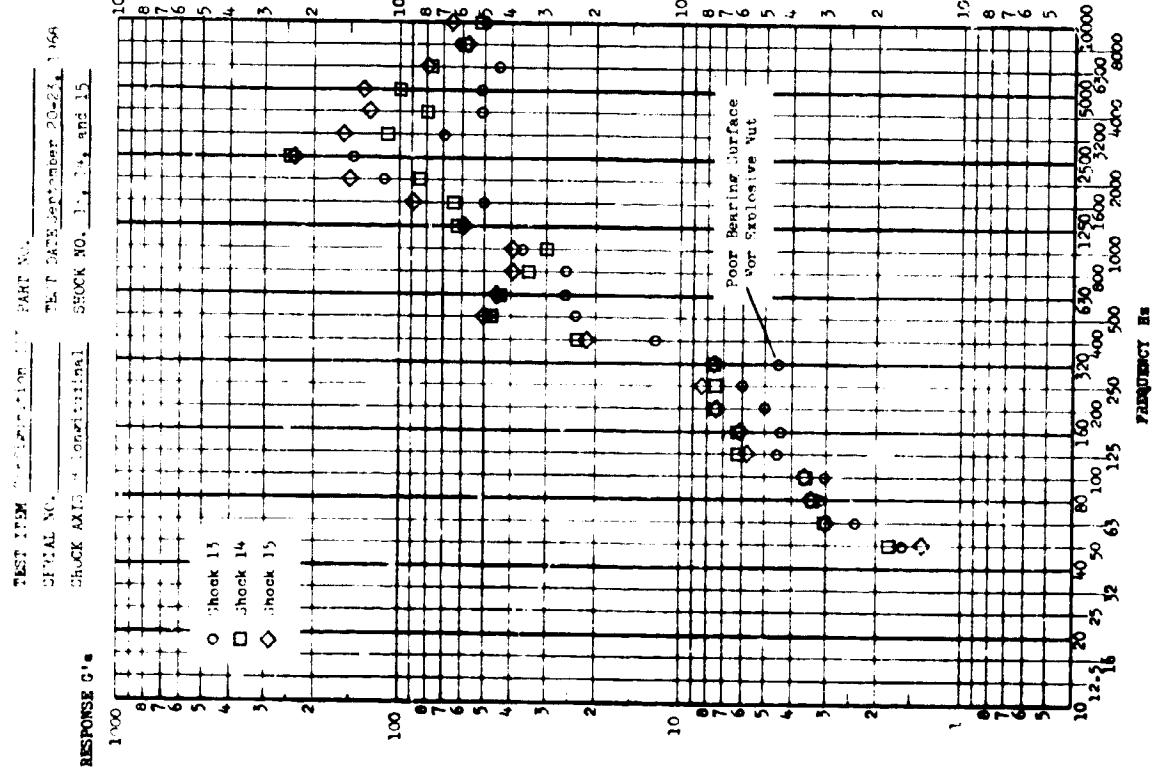
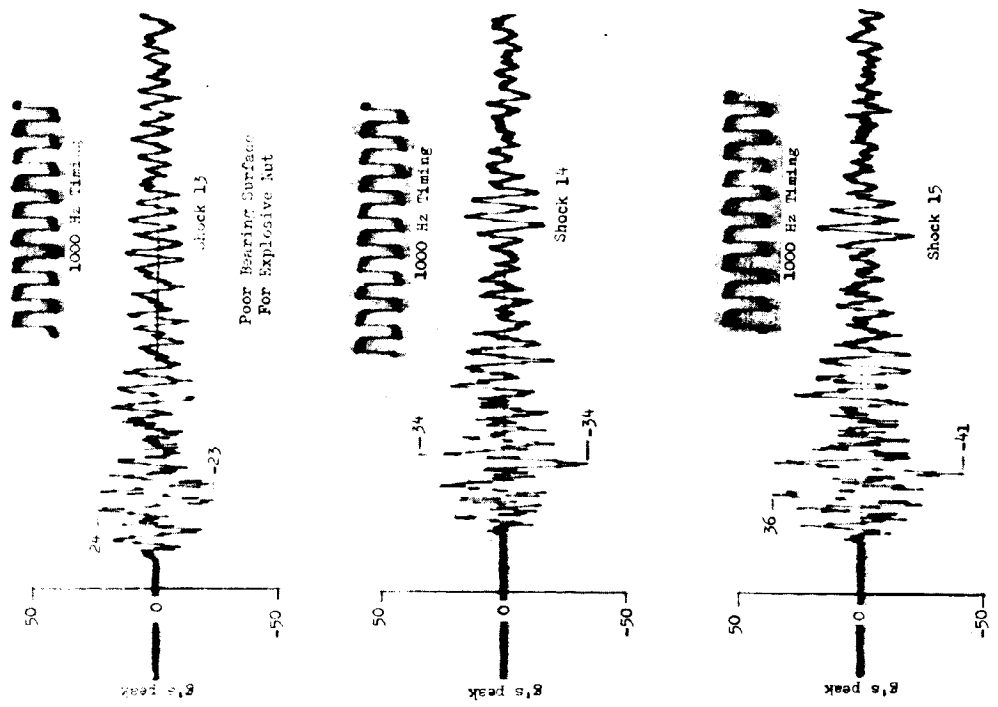
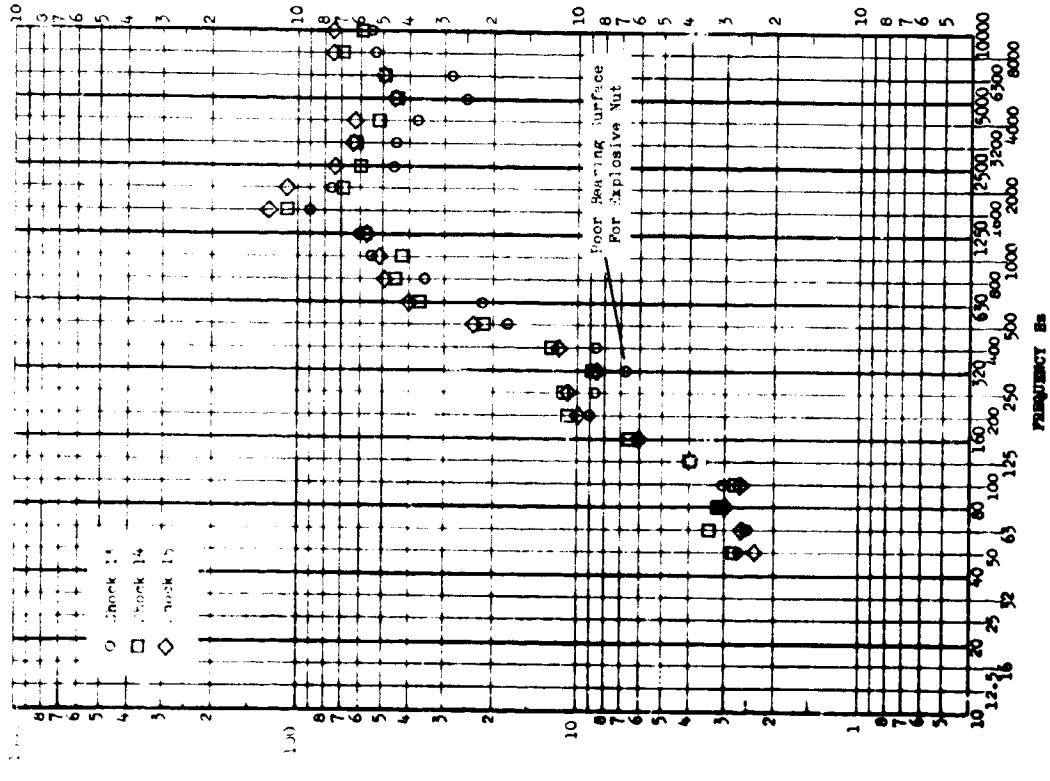


FIGURE II.B.1-131

TEST ITEM: [REDACTED] PART No. [REDACTED]
 SERIAL No. [REDACTED] TEST DATE: [REDACTED]
 SHOCK DATE: [REDACTED] SHOCK No. [REDACTED]



Poor Bearing Surface For Explosive Nut

FIGURE II.B.1-132

TEST ITEM: Configuration
 PART NO.
 SERIAL NO.
 TEST DATE: September 20-21, 1968
 SHOCK AXIS: vertical
 SHOCK NO.: 13, 14, and 15

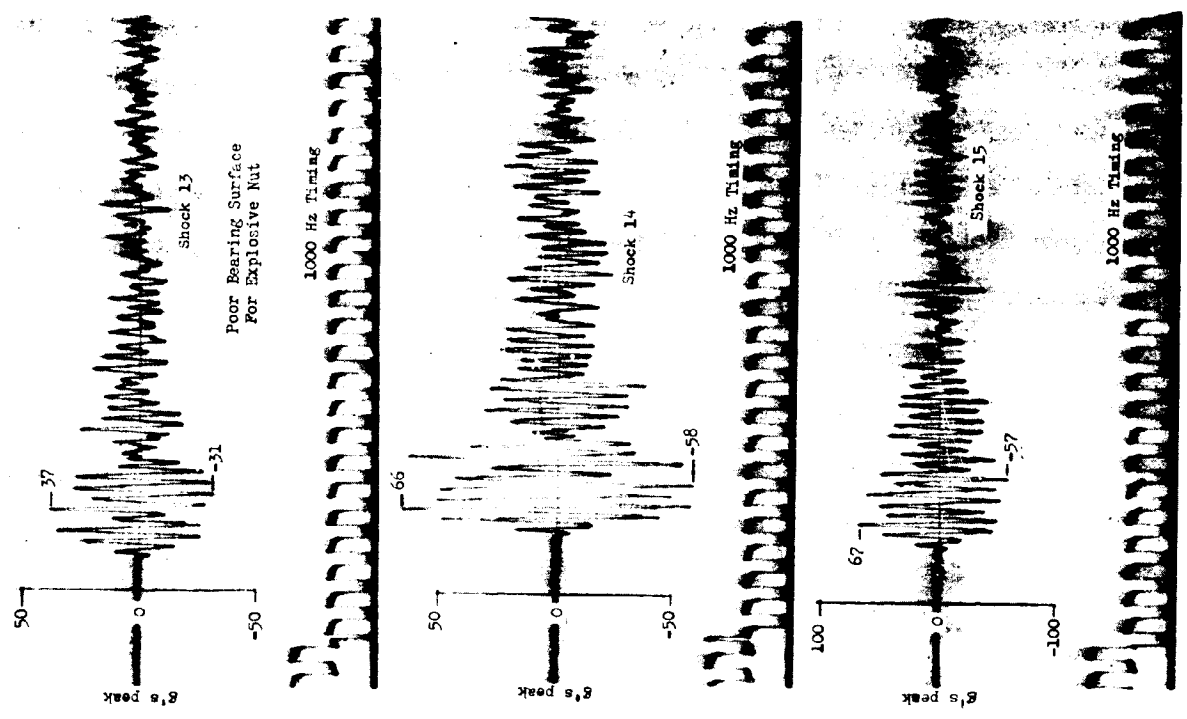
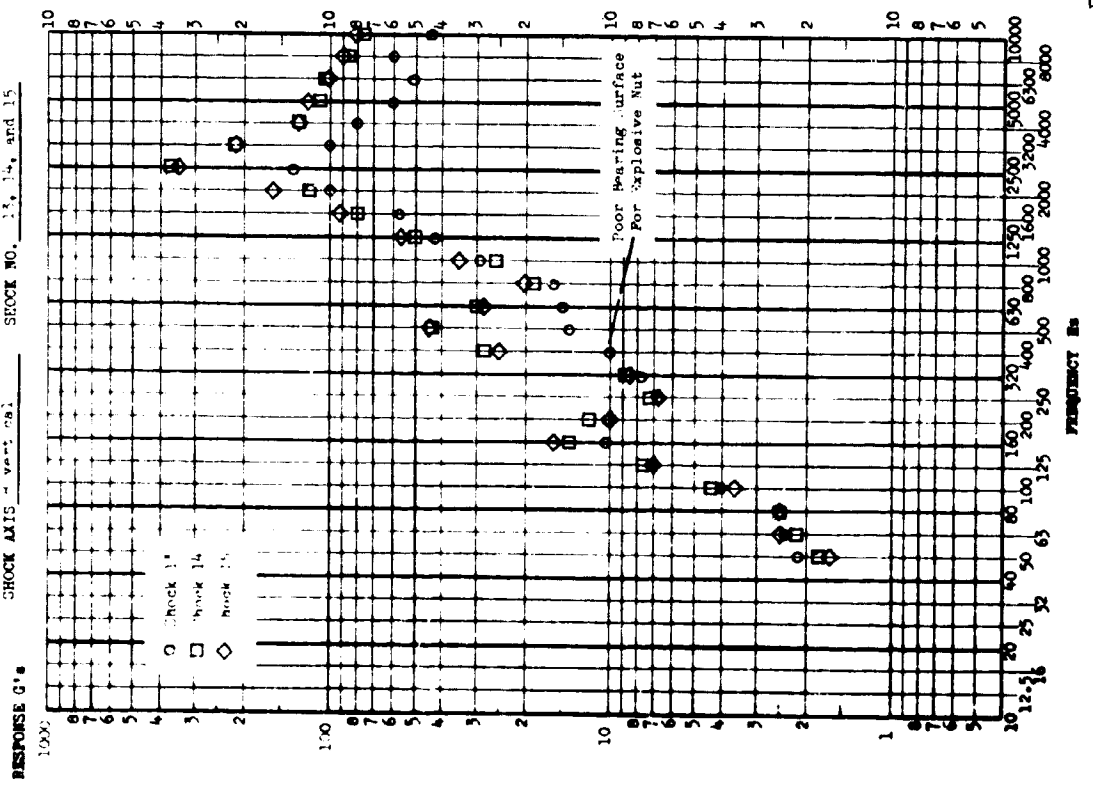


FIGURE 11.8.1-133

TEST ITEM _____ PART NO. _____
 SERIAL NO. _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

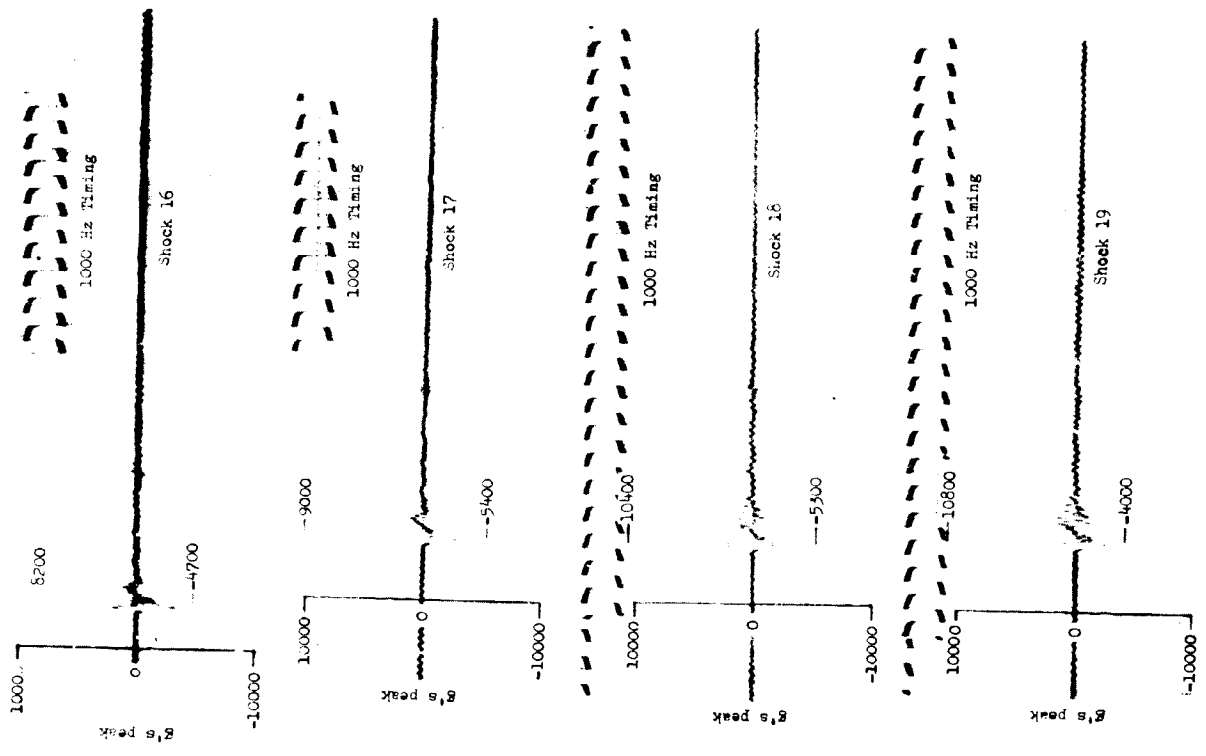
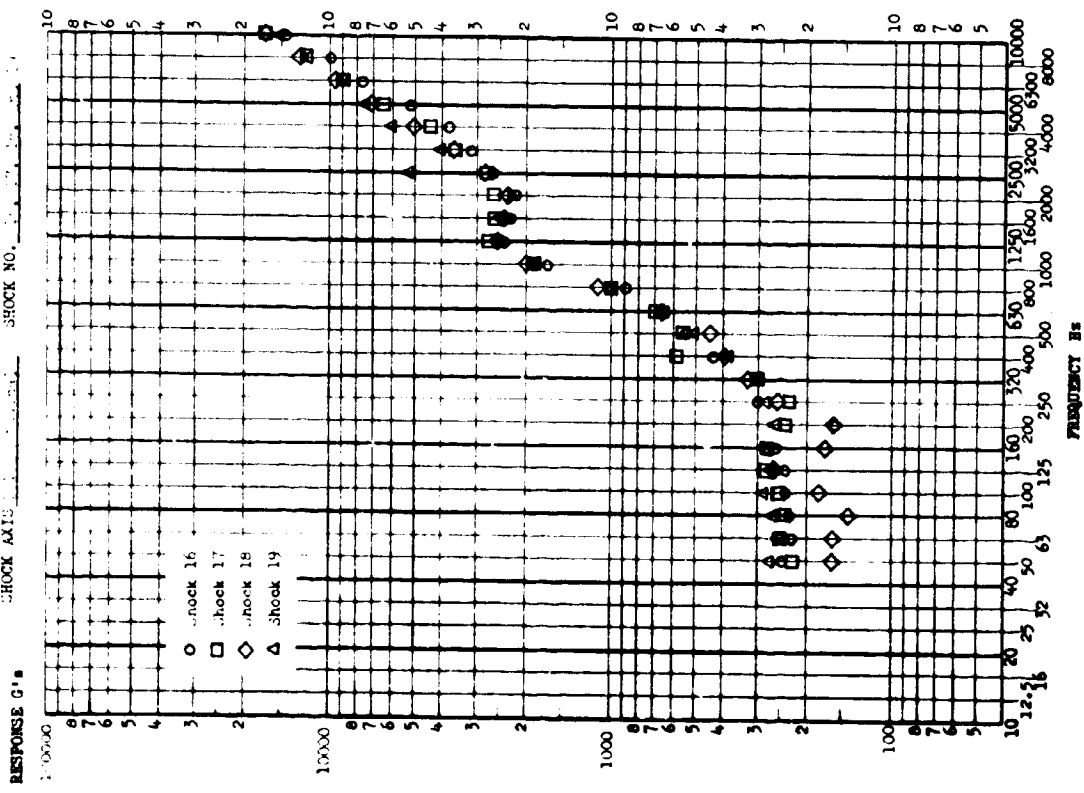


FIGURE 11.B.1-134

TEST ITEM XXXXXXXXXX PART NO. _____
 SERIAL NO. _____ TEST DATE September 24-25, 1968
 SHOCK AXIS Vertical SHOCK NO. 16, 17, 18, and 19

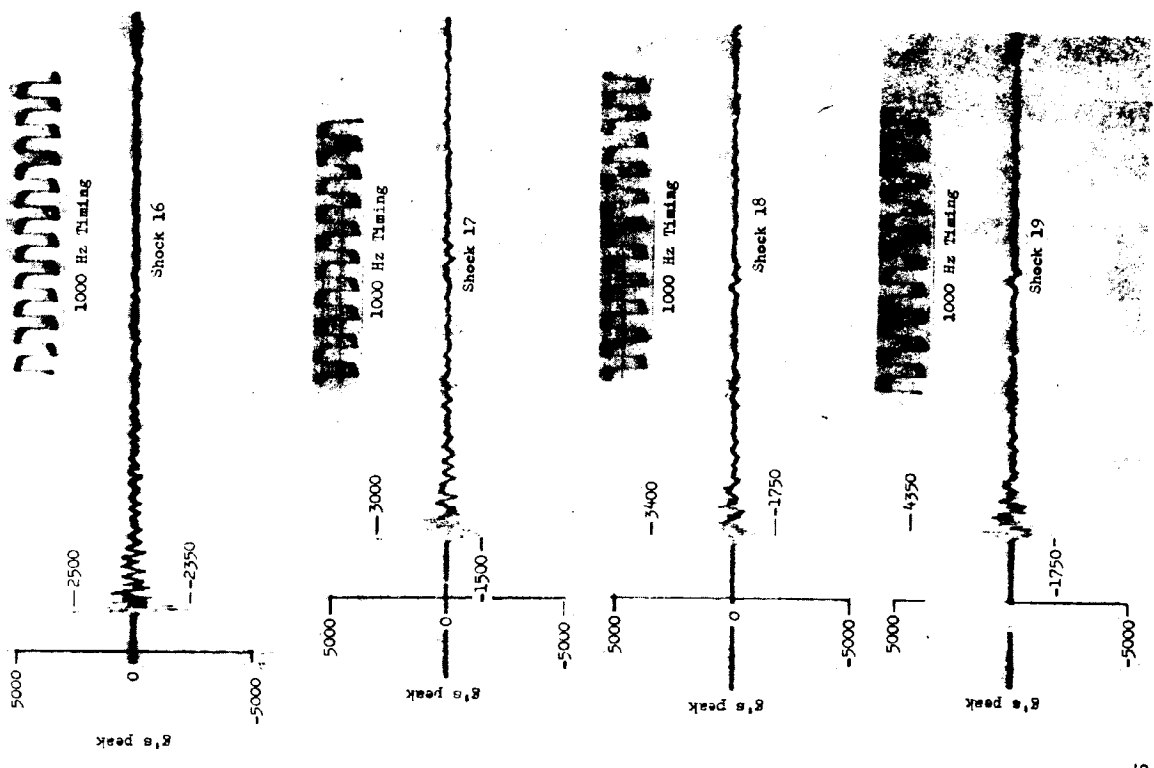
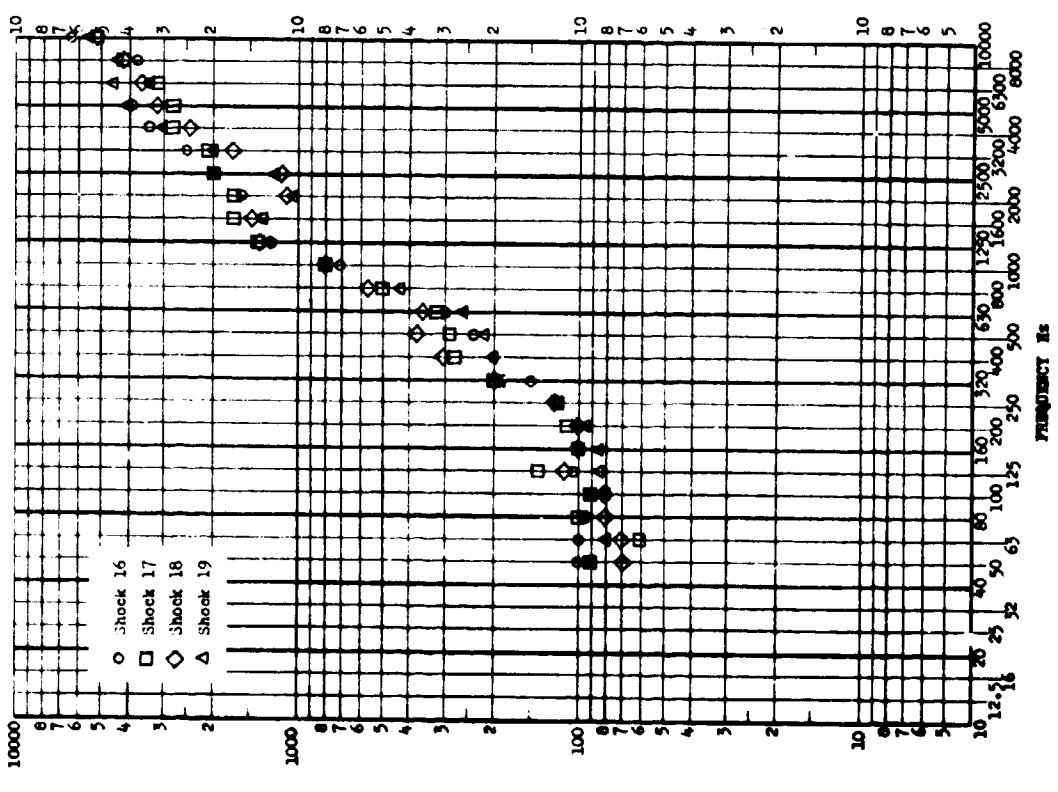


FIGURE 11.B.1-135

TEST ITEM: _____ PART NO.: _____
 SERIAL NO.: _____ TEST DATE: _____
 SHOCK AXIS: _____ SHOCK NO.: _____

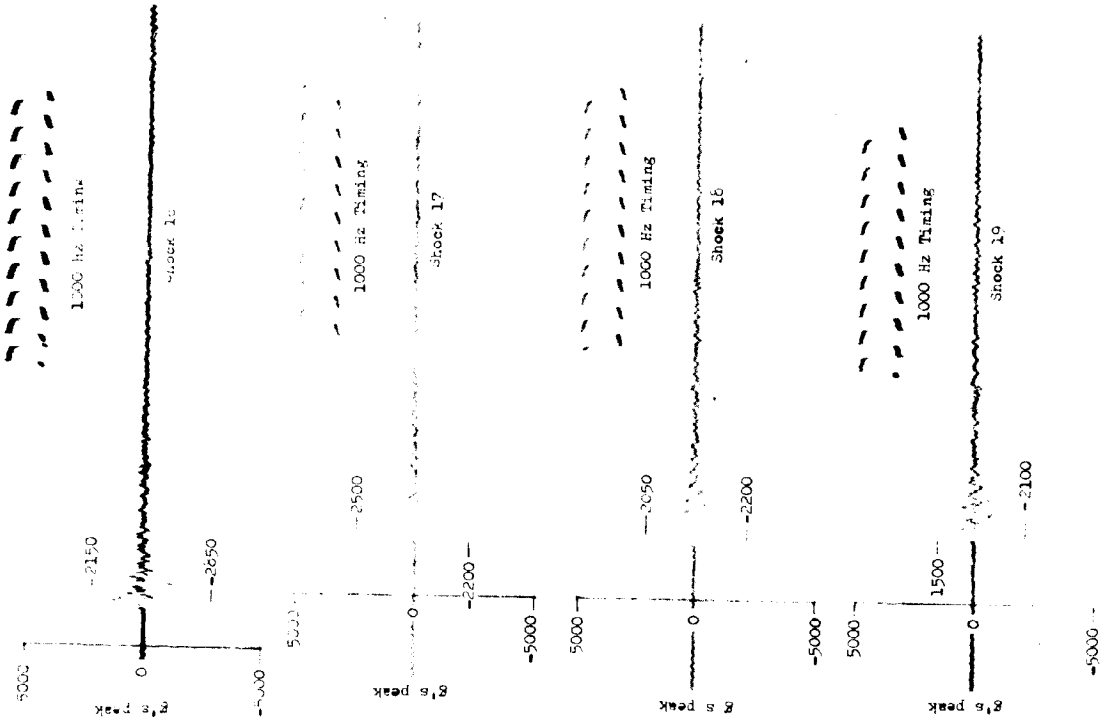
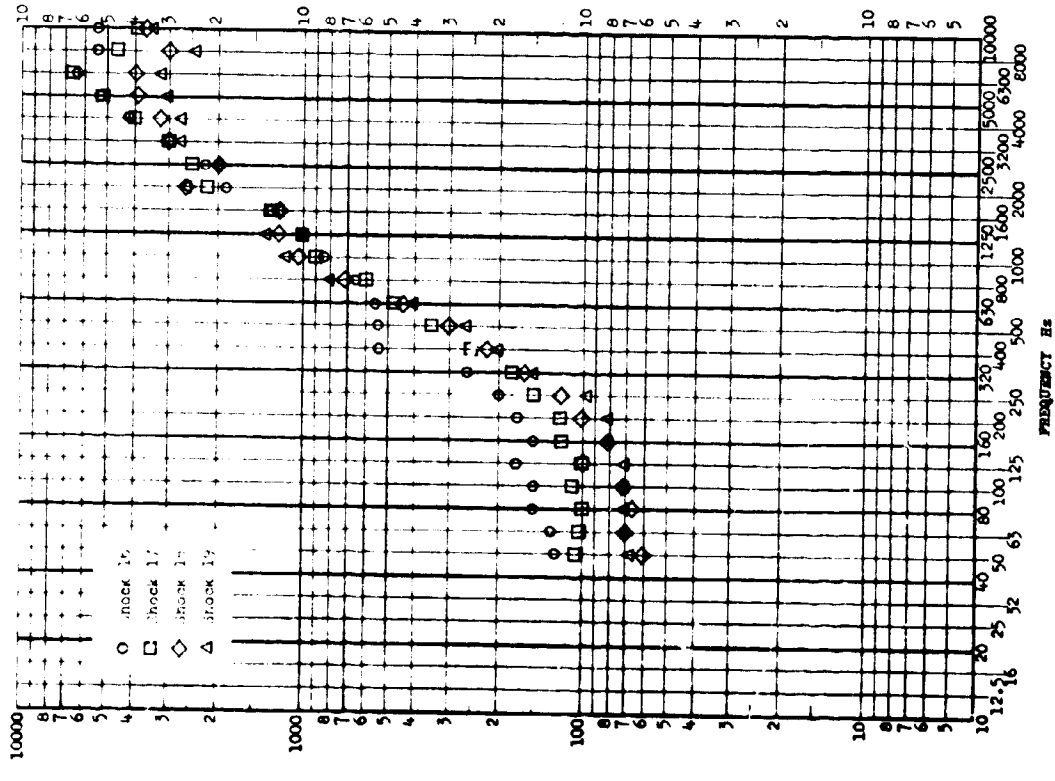


FIGURE 11.B.1-136

TEST ITEM _____ PART NO. _____
 SERIAL NO. _____ TEST DATE September 1966
 SHOCK AXIS 2 (Vertical) SHOCK NO. 16, 17, 18, and 19

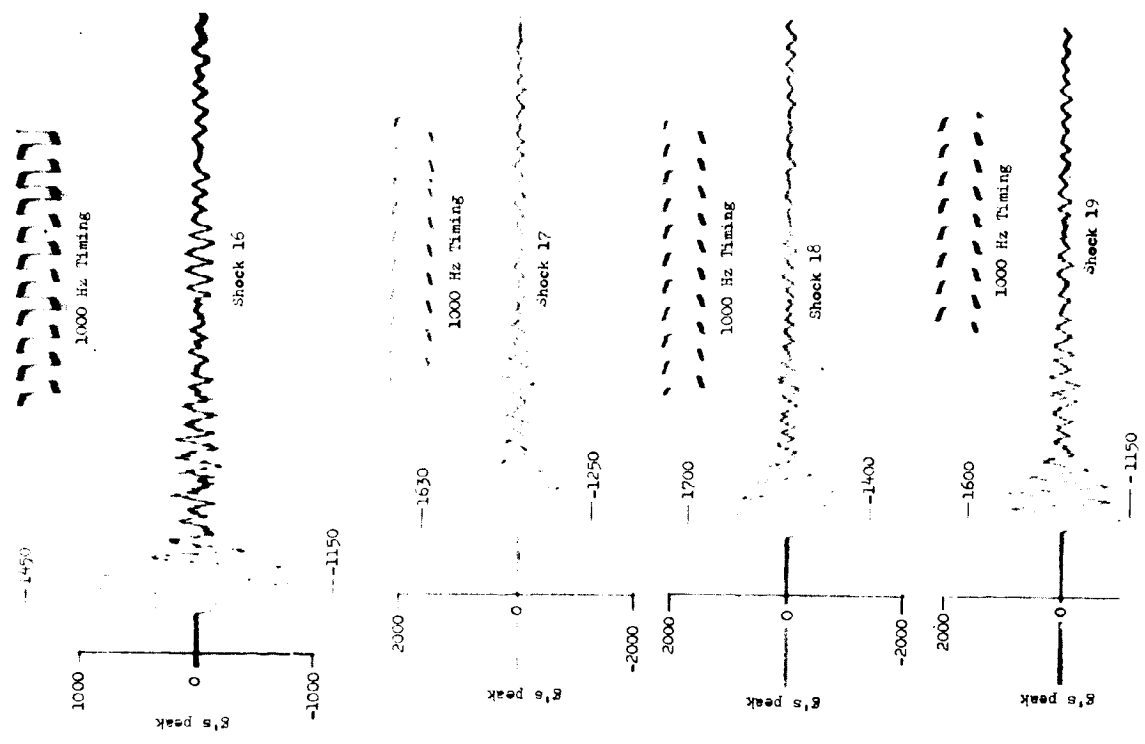
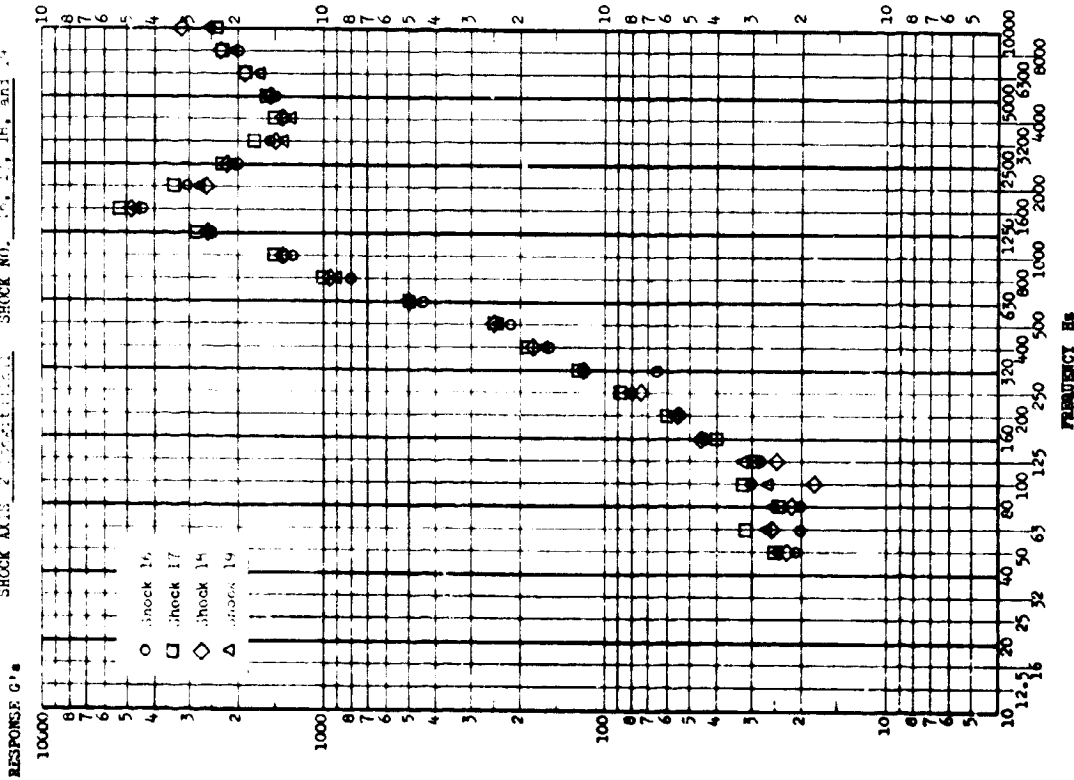


FIGURE 11.B.1-137

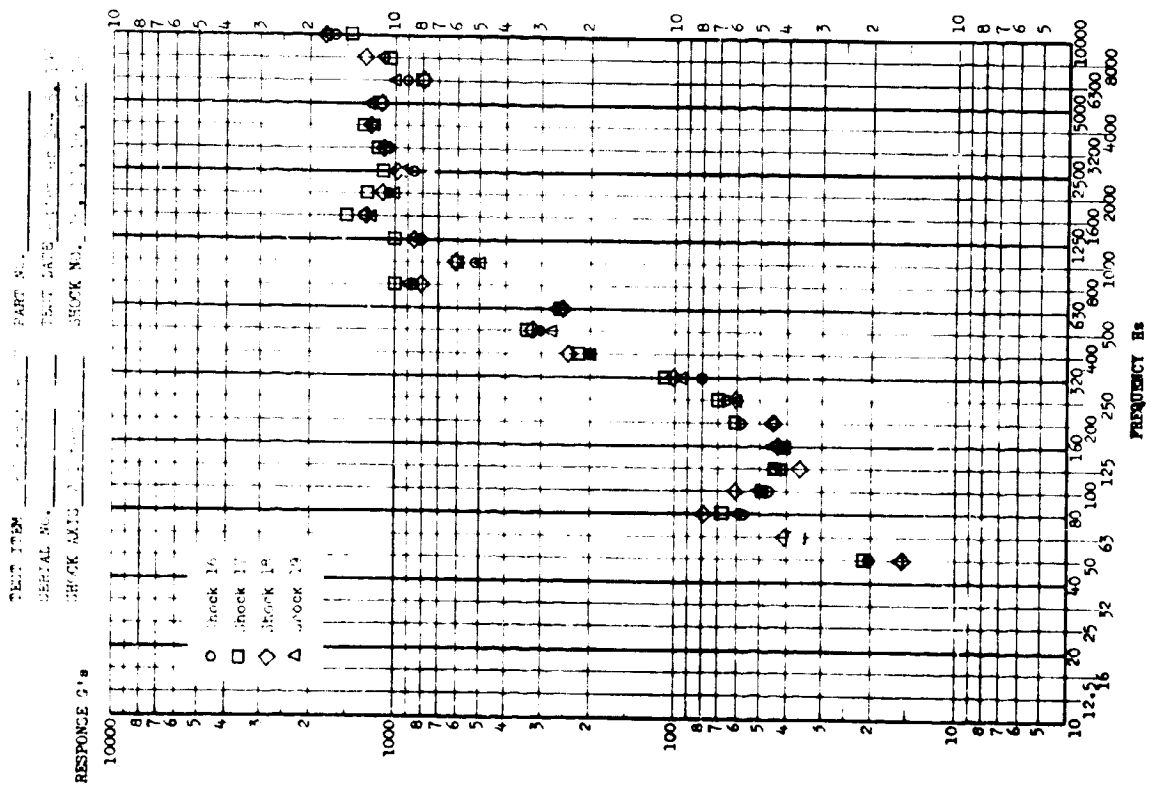
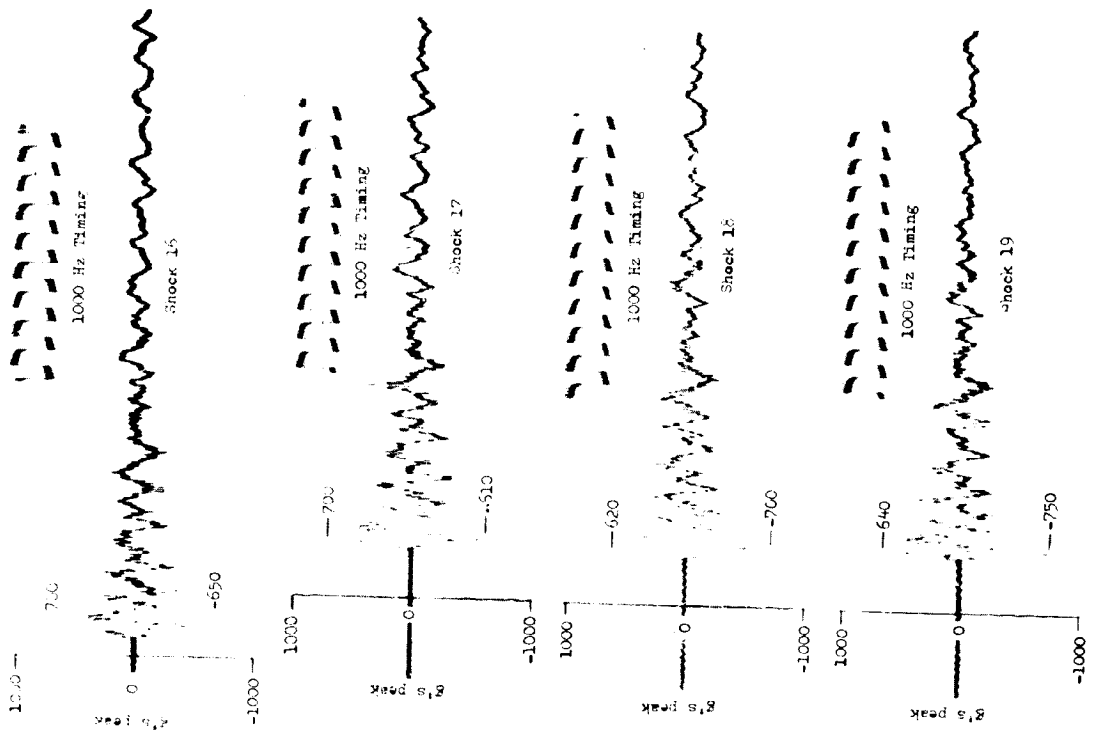


FIGURE II.B.1-138

TEST ITEM Configuration IV PART NO. _____
 SERIAL NO. _____ TEST DATE September 24-25, 1964
 SHOCK AXIS 2 vertical SHOCK NO. 16, 17, 18, and 19

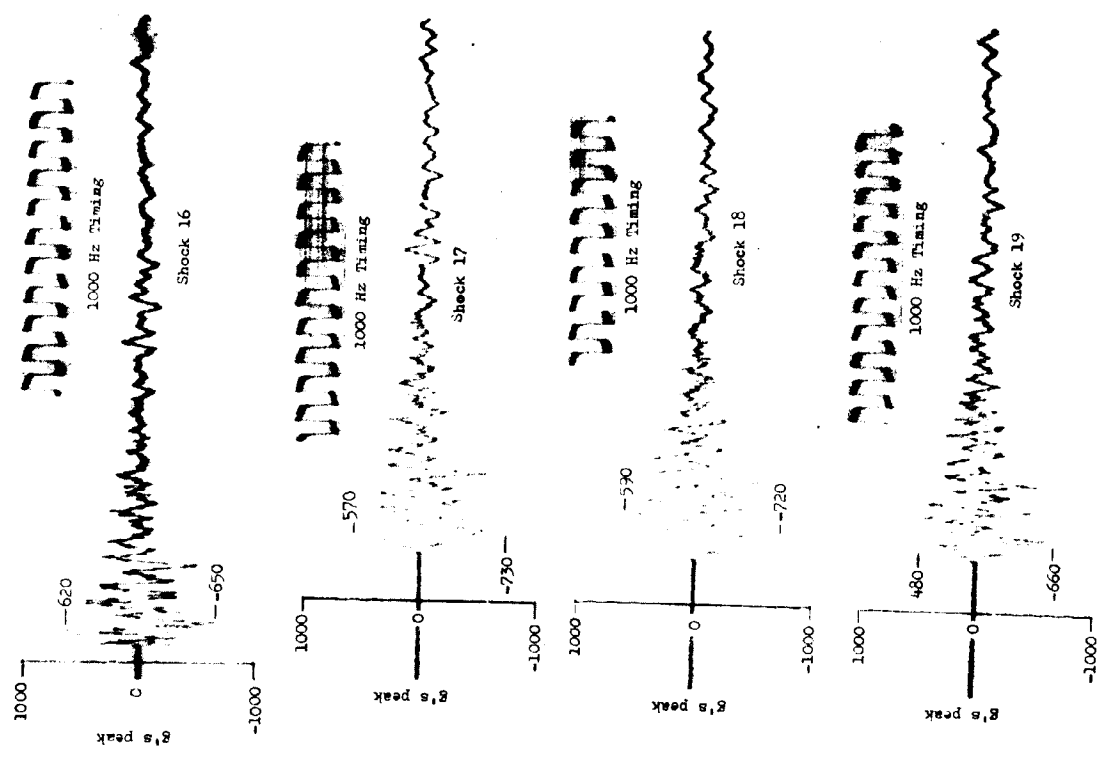
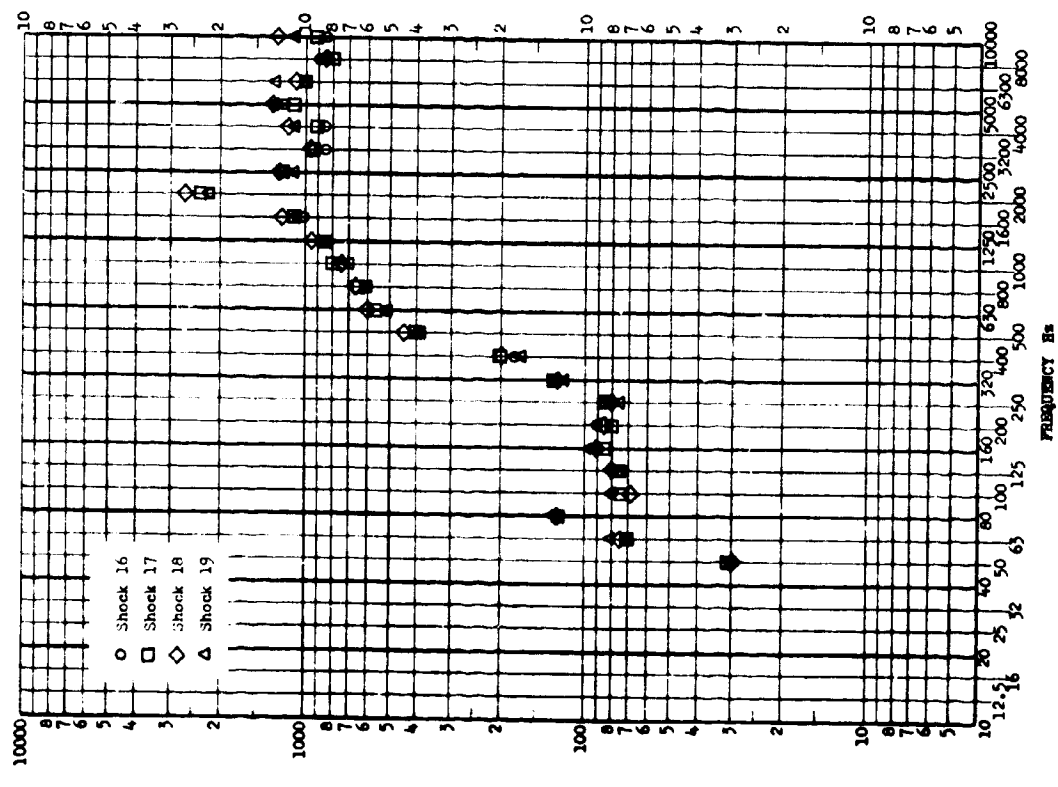


FIGURE II.B.1-139

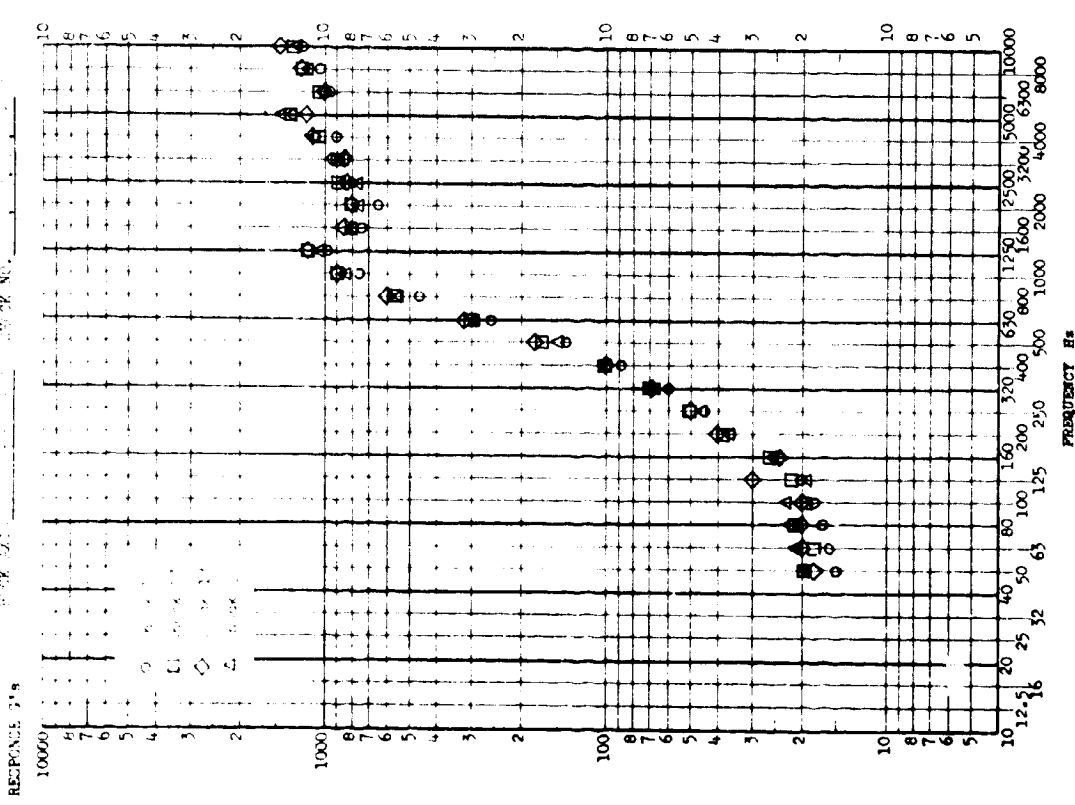
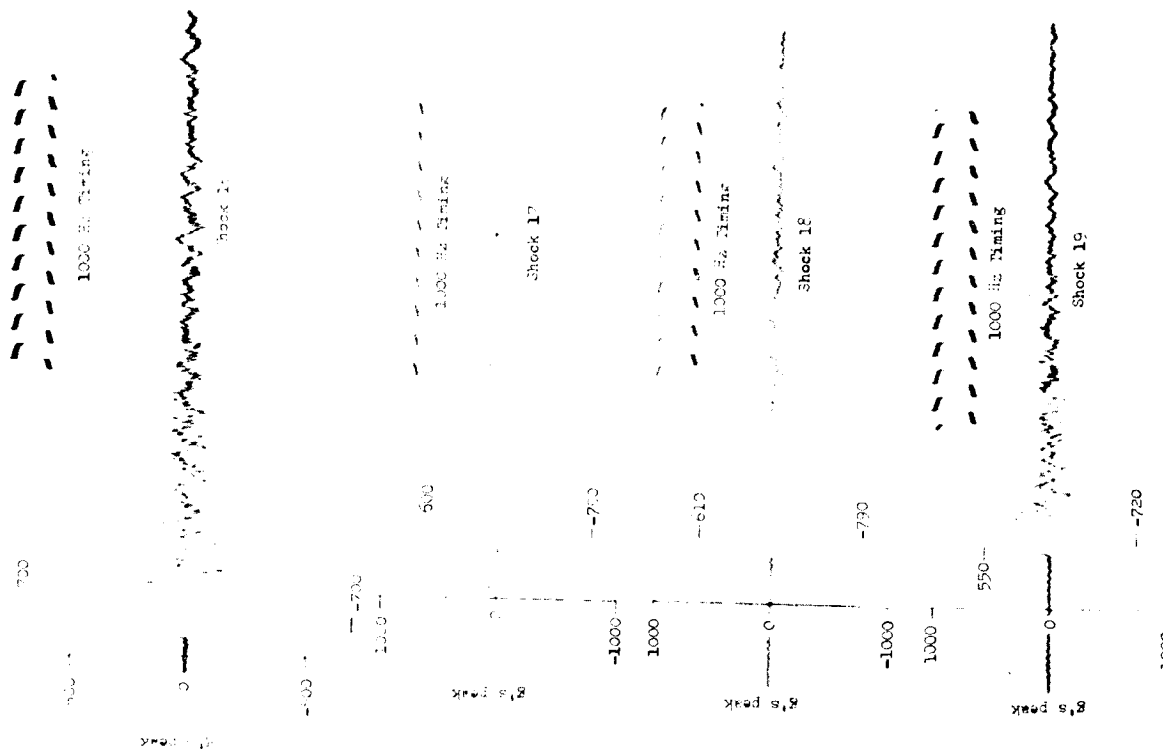


FIGURE 11.B.1-140

TEST ITEM _____ PART NO. _____
 SERIAL NO. _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

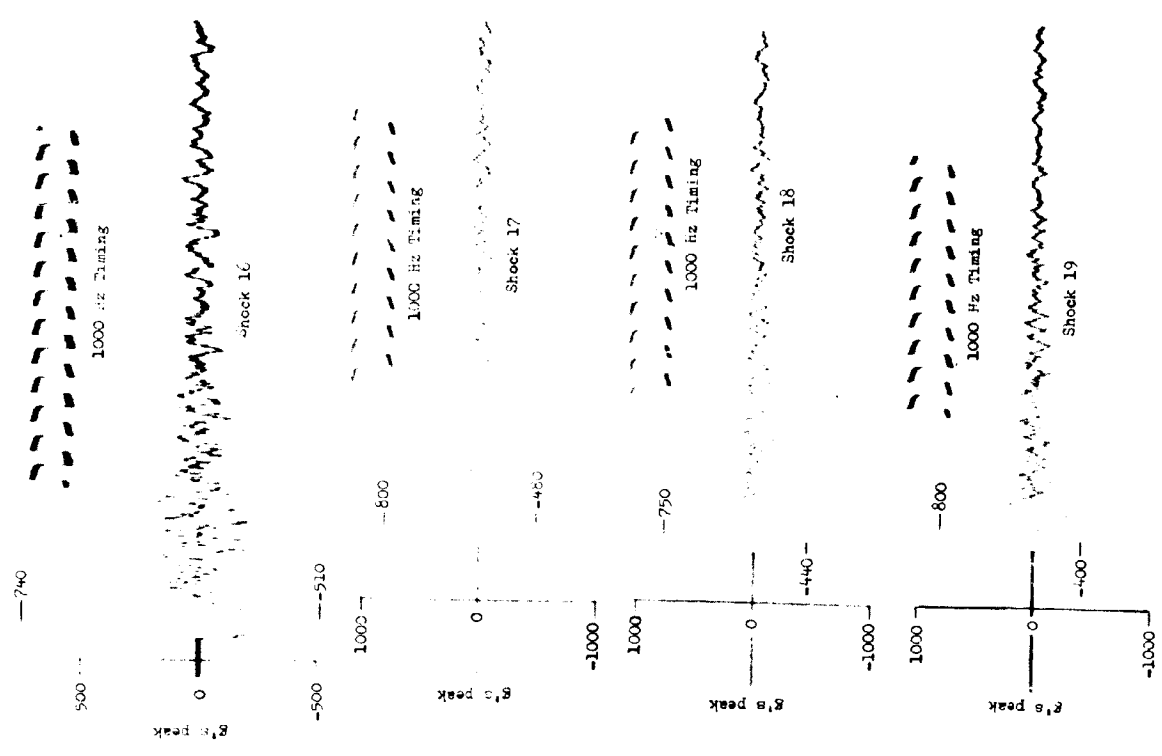
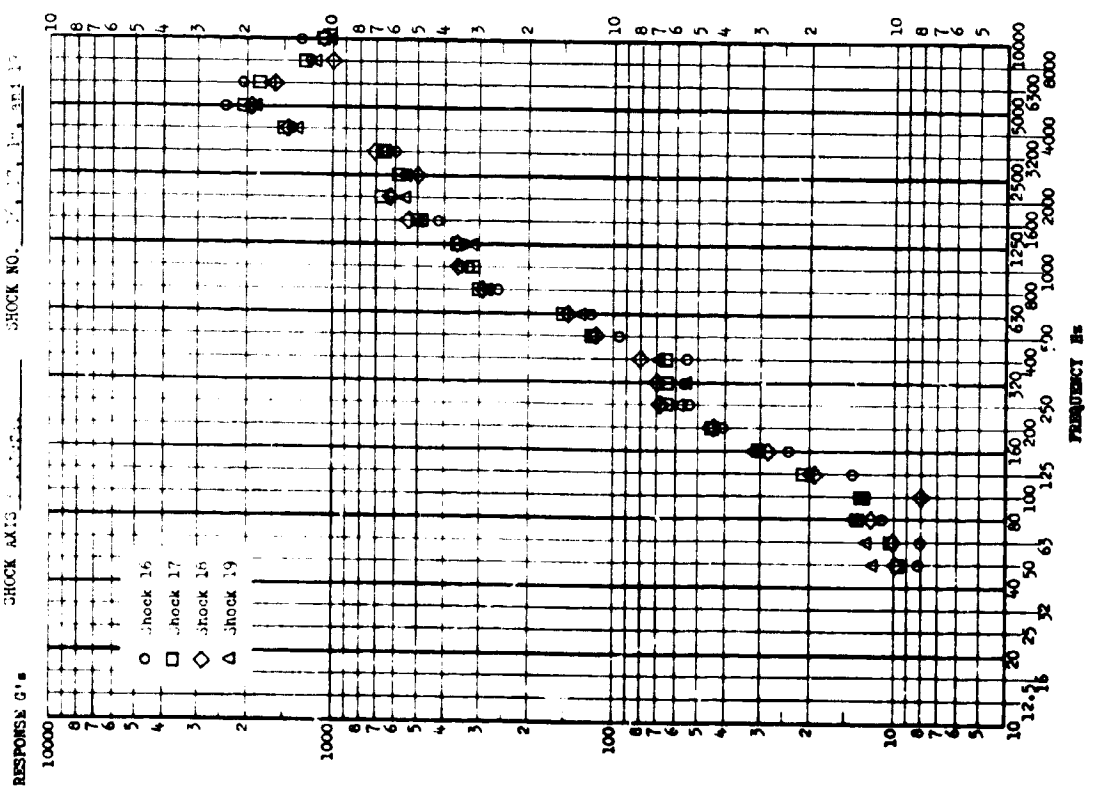


FIGURE II.B.1-141

TEST ITEM: _____ PART NO.: _____
 SERIAL NO.: _____ TEST DATE: _____
 SHOCK AXES: _____ SHOCK NO.: _____ UNIT: _____

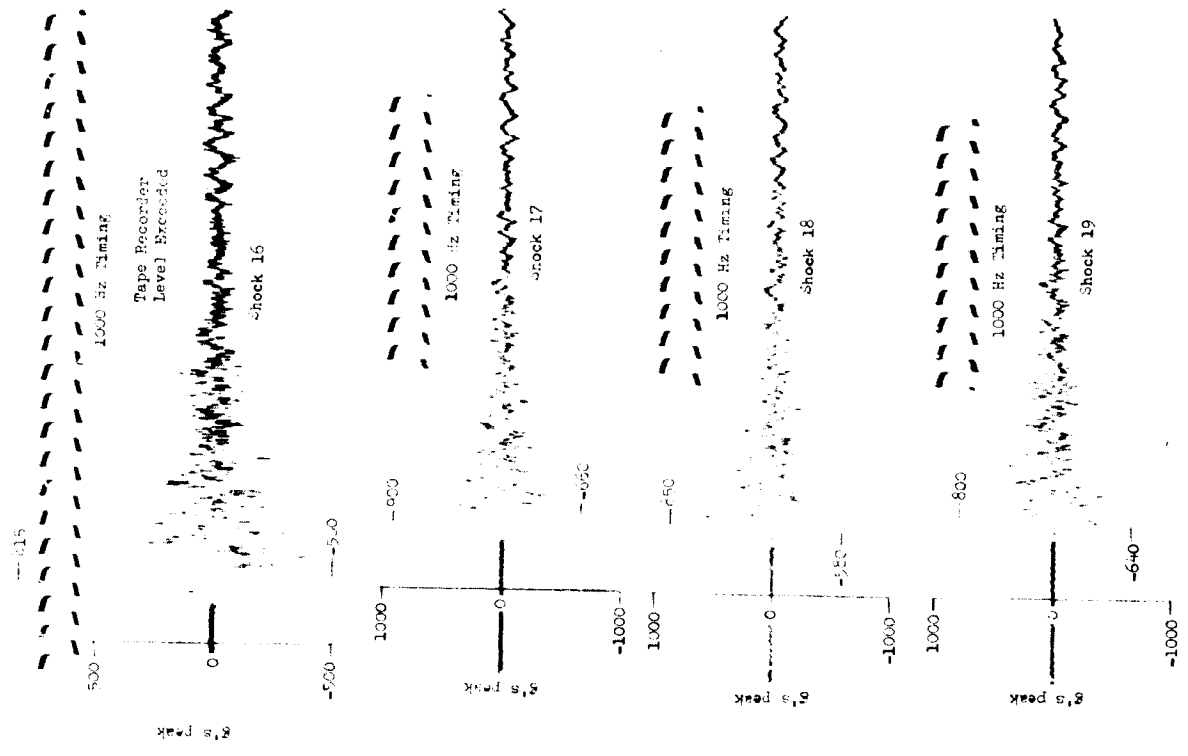
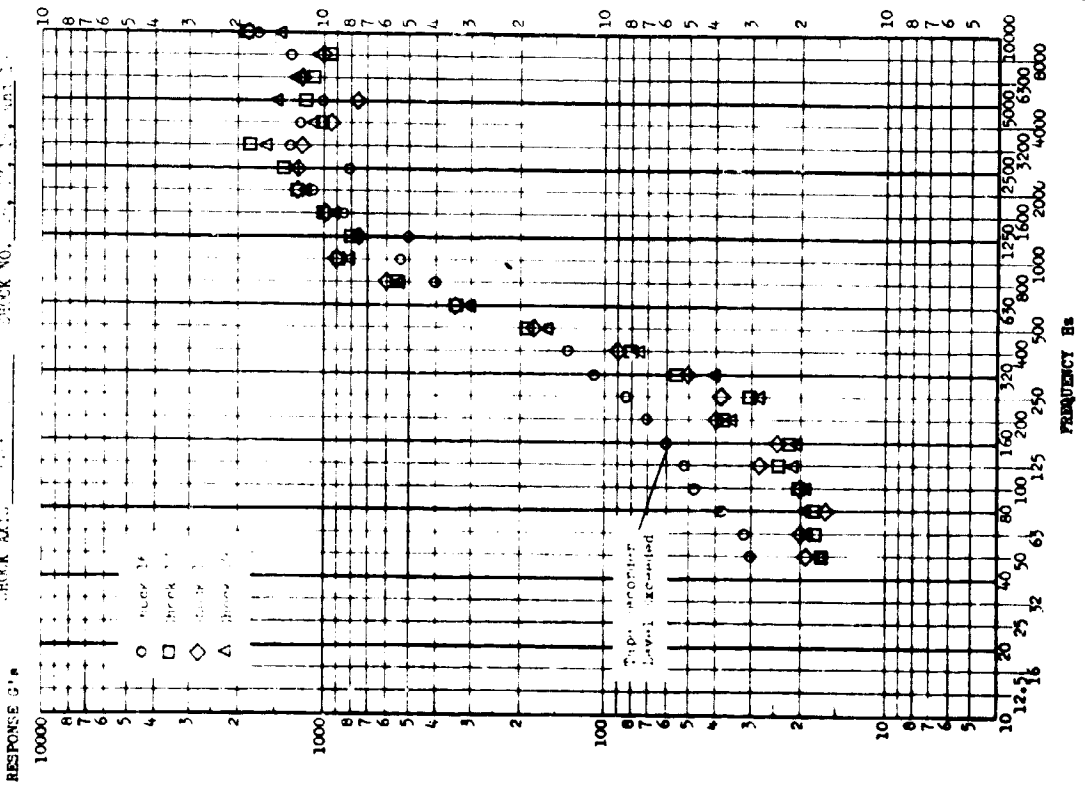


FIGURE 11.8.1-142

TEST ITEM Configuration IV PART NO. _____
 SERIAL NO. _____ TEST DATE September 24-25, 1968
 SHOCK AXIS Longitudinal SHOCK NO. 16, 17, 18, and 19

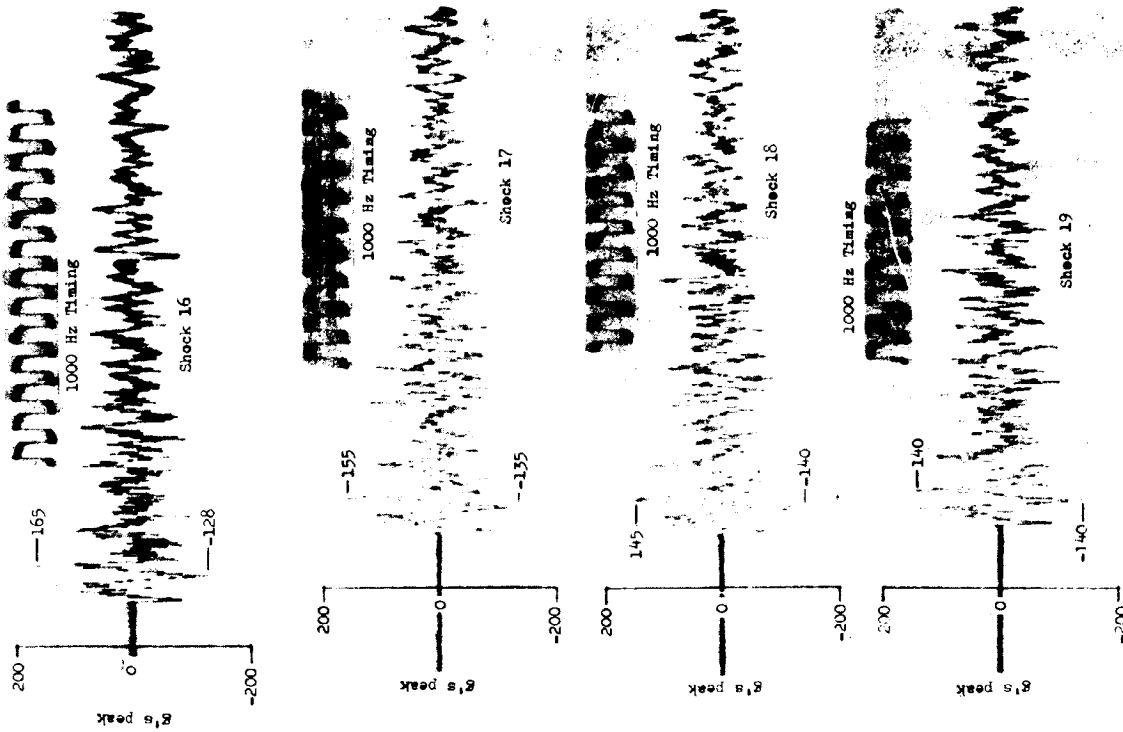
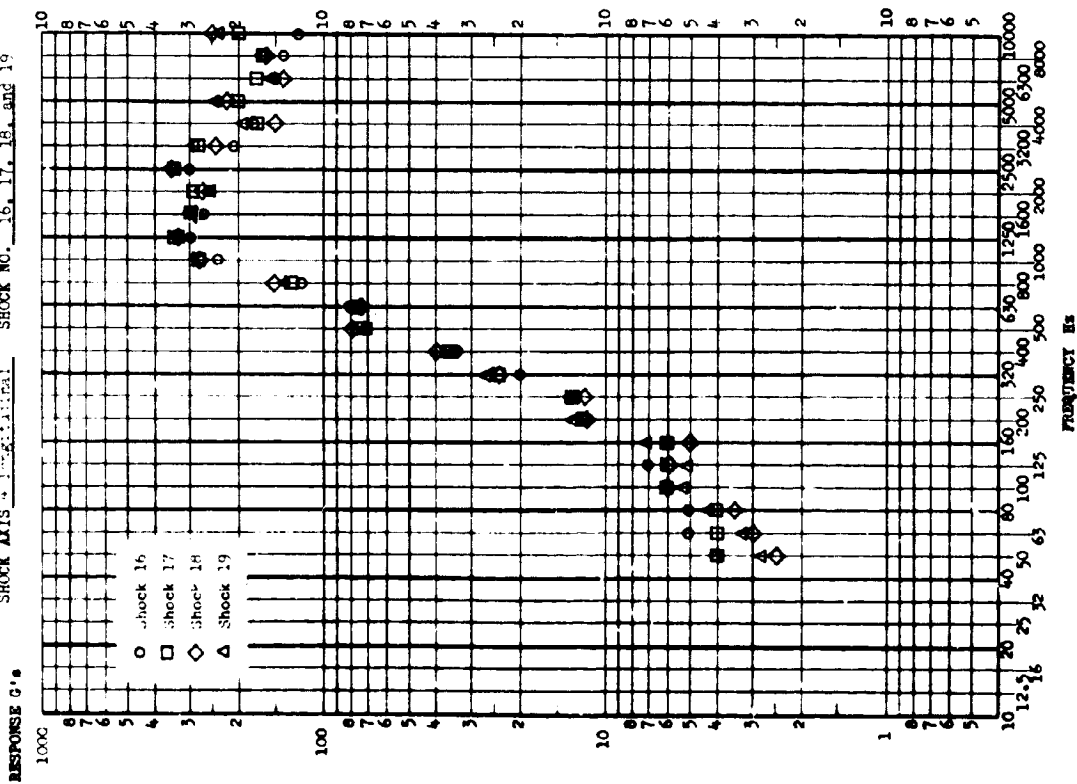


FIGURE 11.B.1-143

TEST ITEM: _____ PART NO. _____
 SERIAL NO. _____ TEST DATE _____
 SHOCK RATE: _____ SHOCK NO. _____

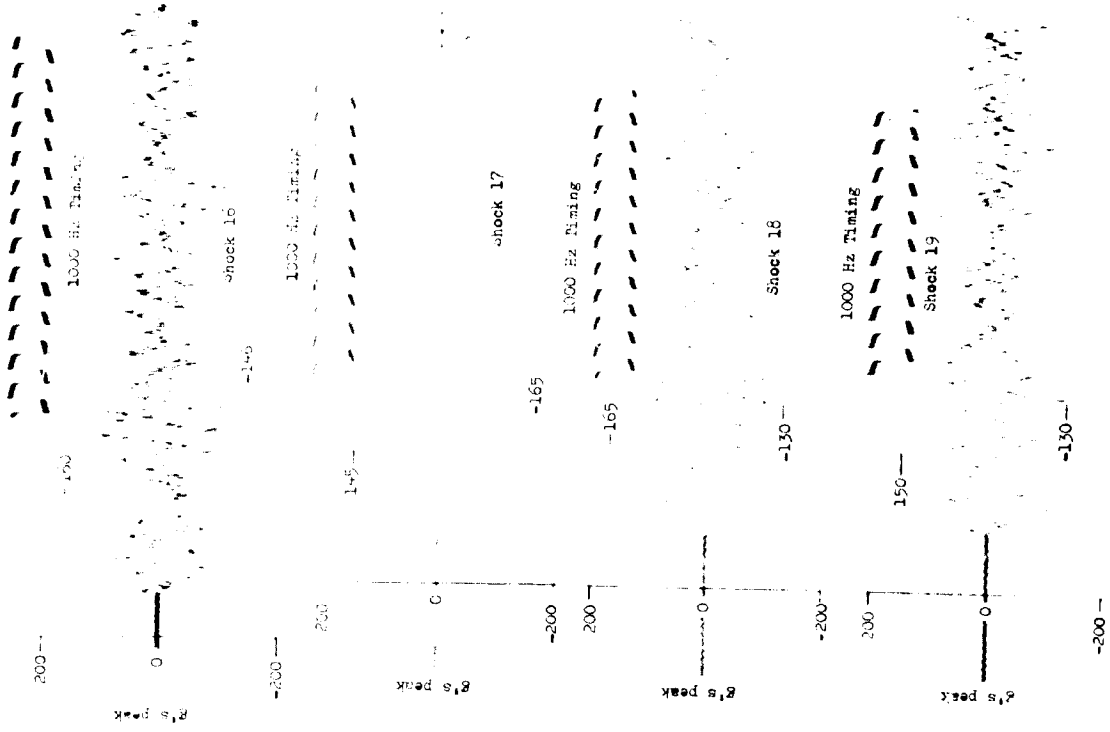
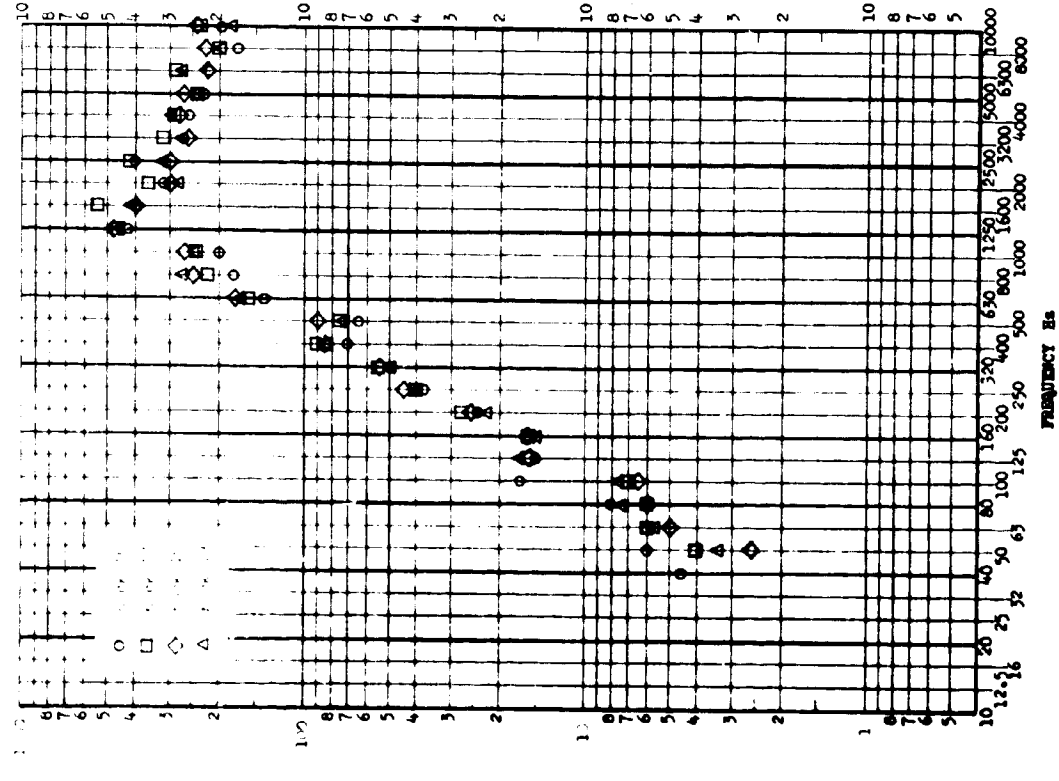


FIGURE 11.B.1-144

TEST ITEM: _____ PART NO.: _____
 SERIAL NO.: _____ TEST DATE: September 24-25, 1968
 SHOCK AXIS: _____ SHOCK NO.: 17, 16, and 19

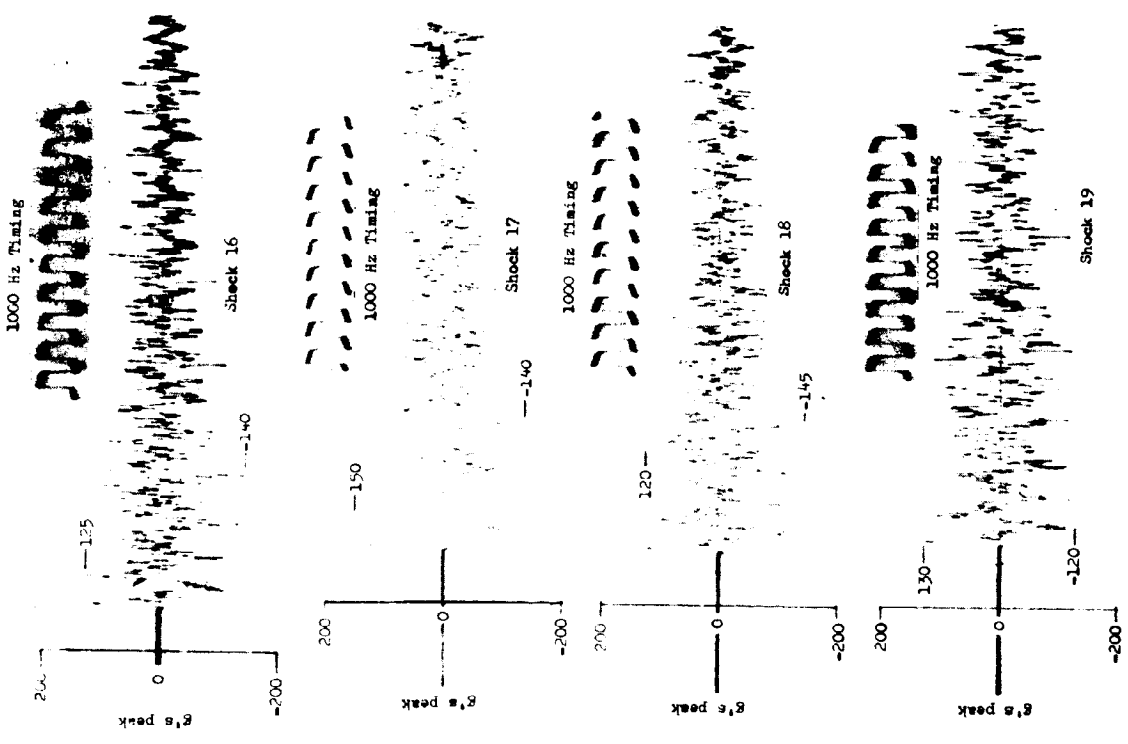
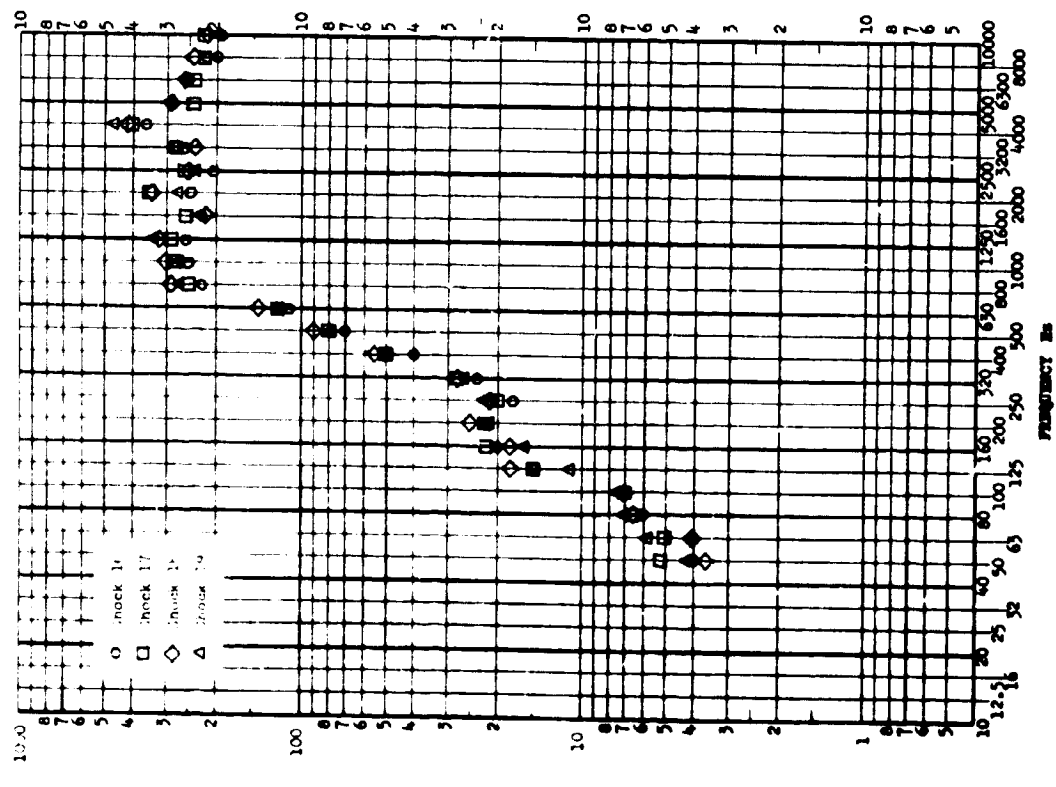


FIGURE 11.8.1-145

TEST ITEM _____ PART NO. _____
 SERIAL NO. _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

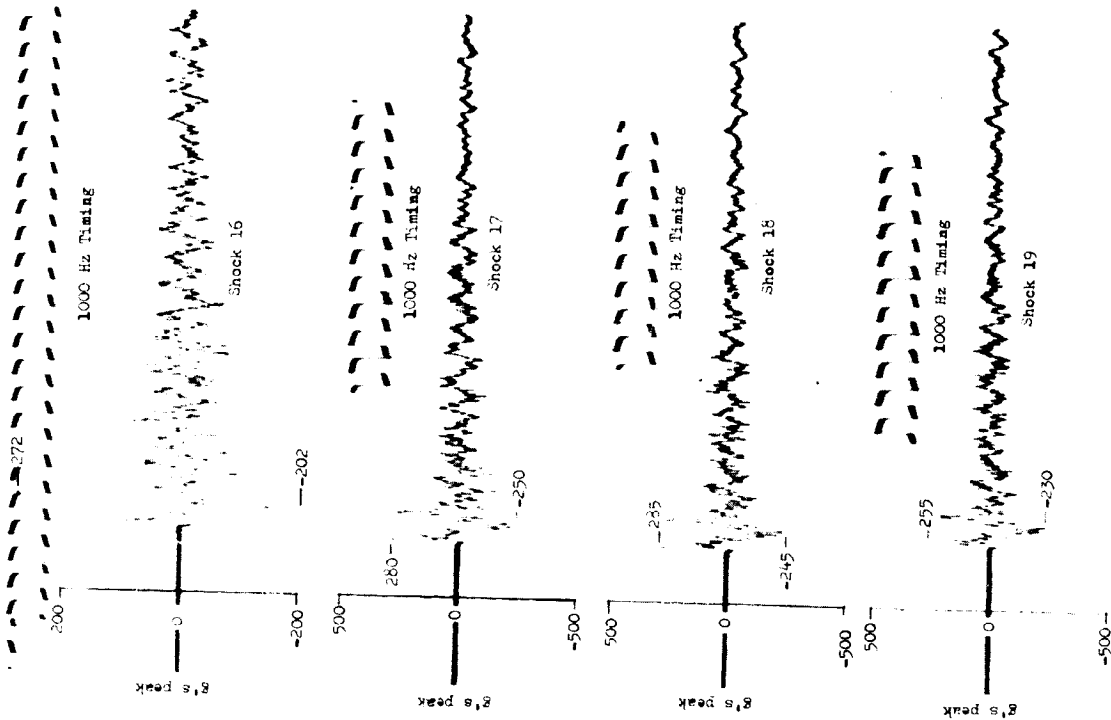
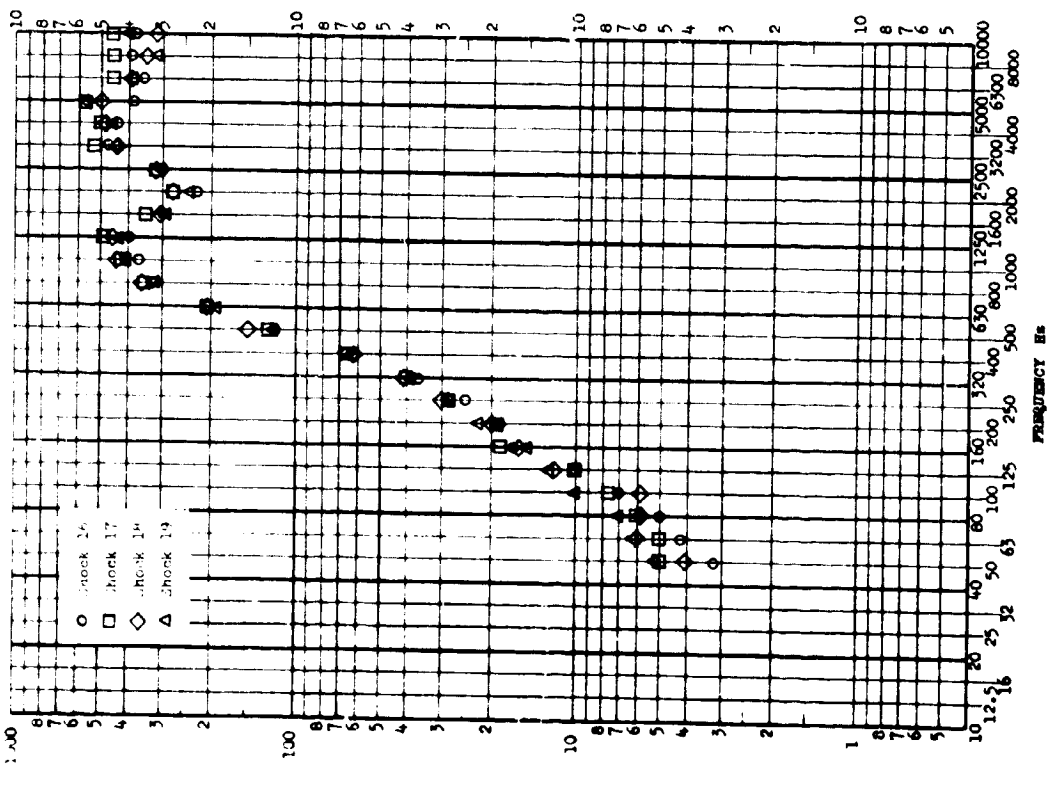


FIGURE 11.8.1-146

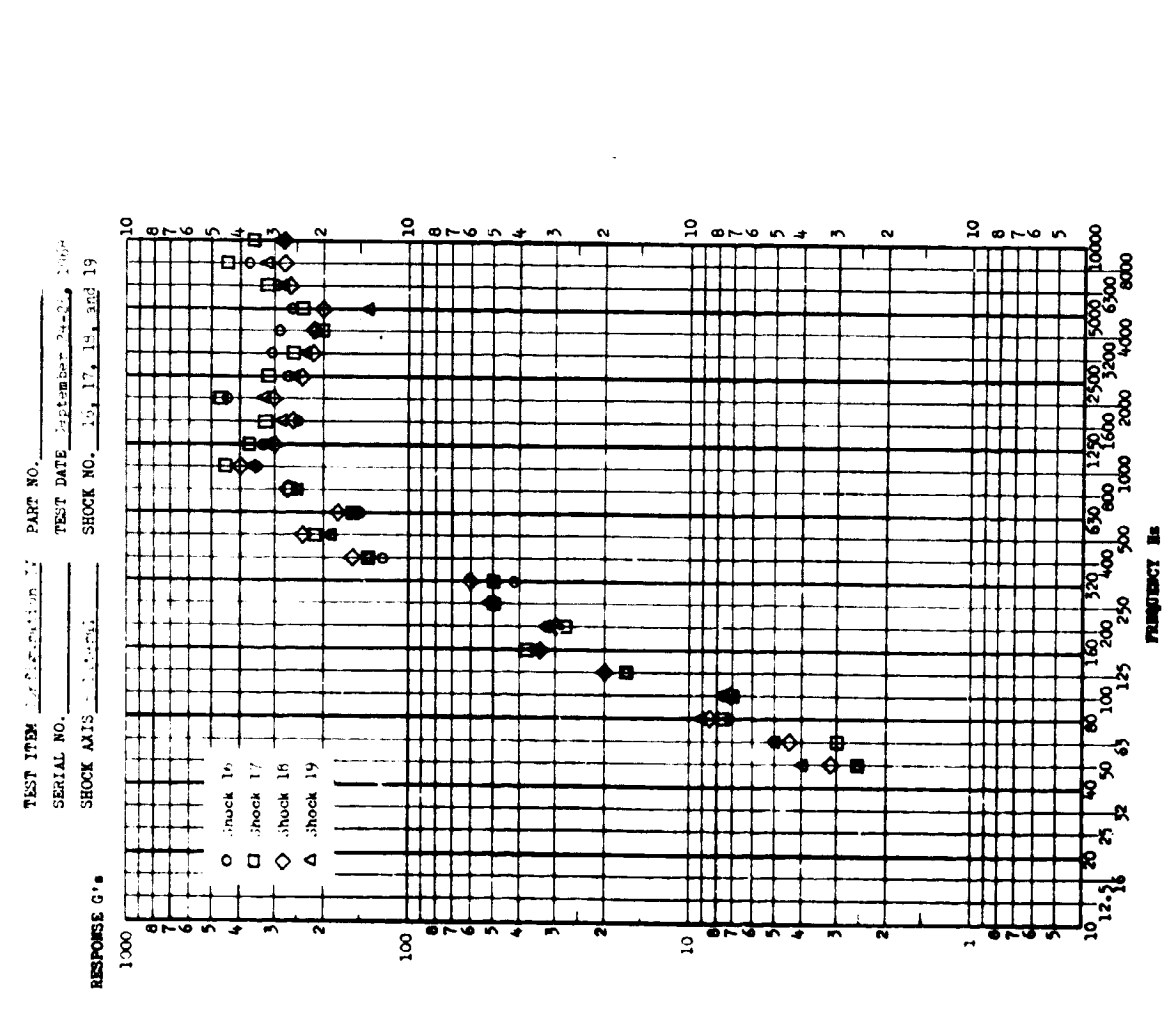
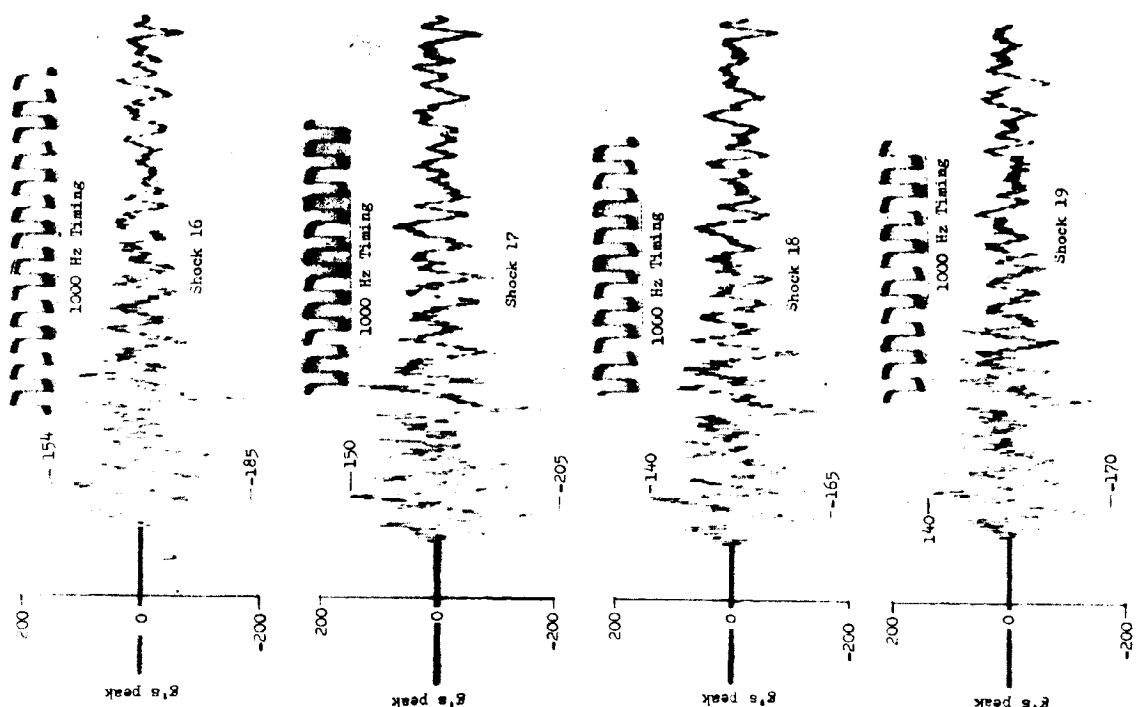


FIGURE 11.B.1-147

TEST ITEM: _____ PART NO. _____
 SERIAL NO. _____ TEST DATE: _____
 SHOCK AXIL: _____ SHOCK NO. _____

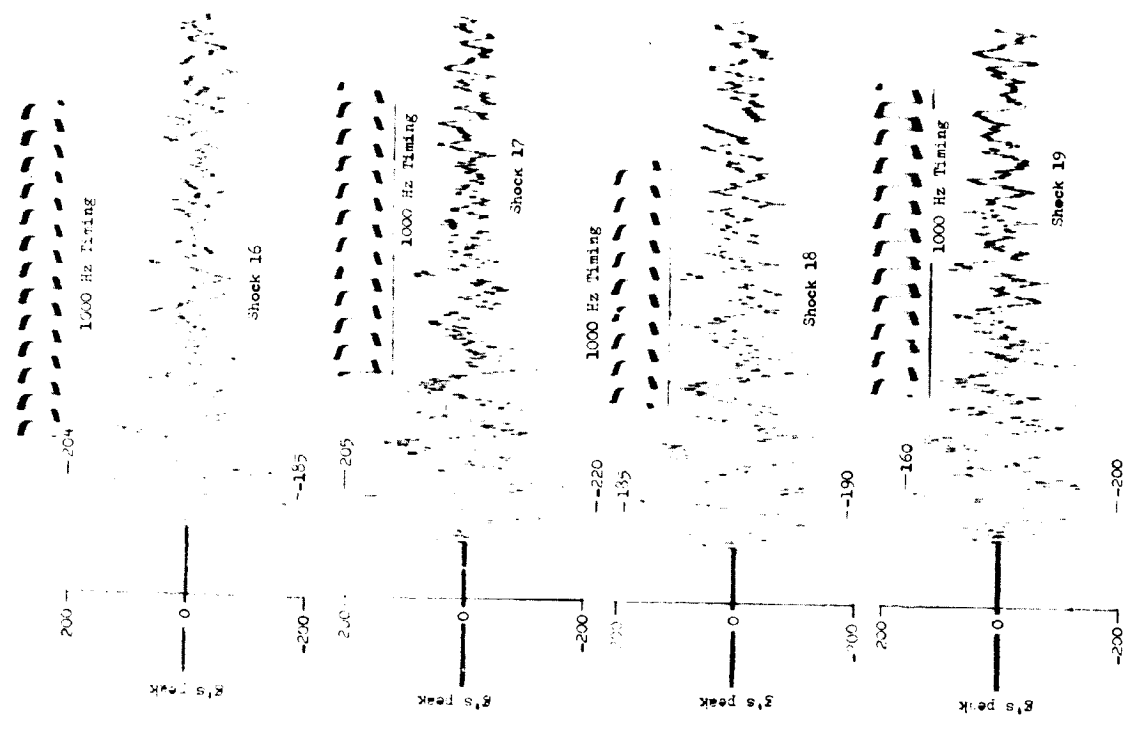
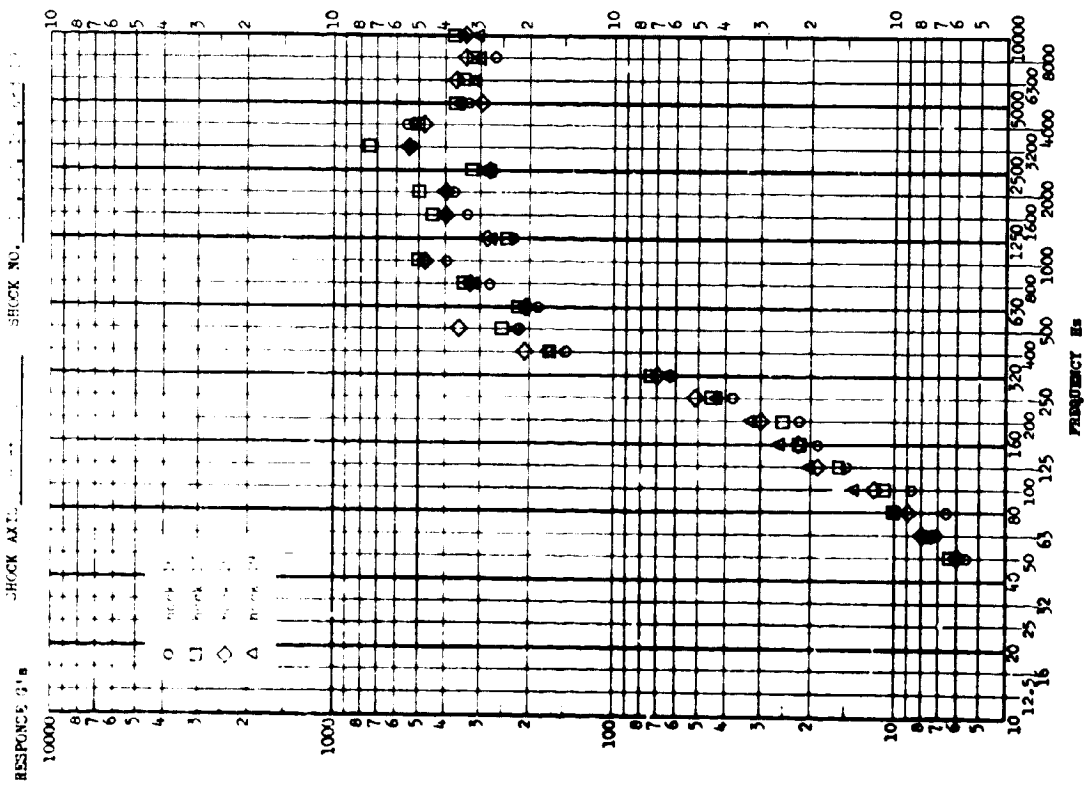


FIGURE II.B.1-148

TEST ITEM Amplification IV PART NO. _____
 SERIAL NO. _____ TEST DATE September 24, 1968
 SHOCK AXIS Vertical SHOCK NO. 16, 17, 18, and 19

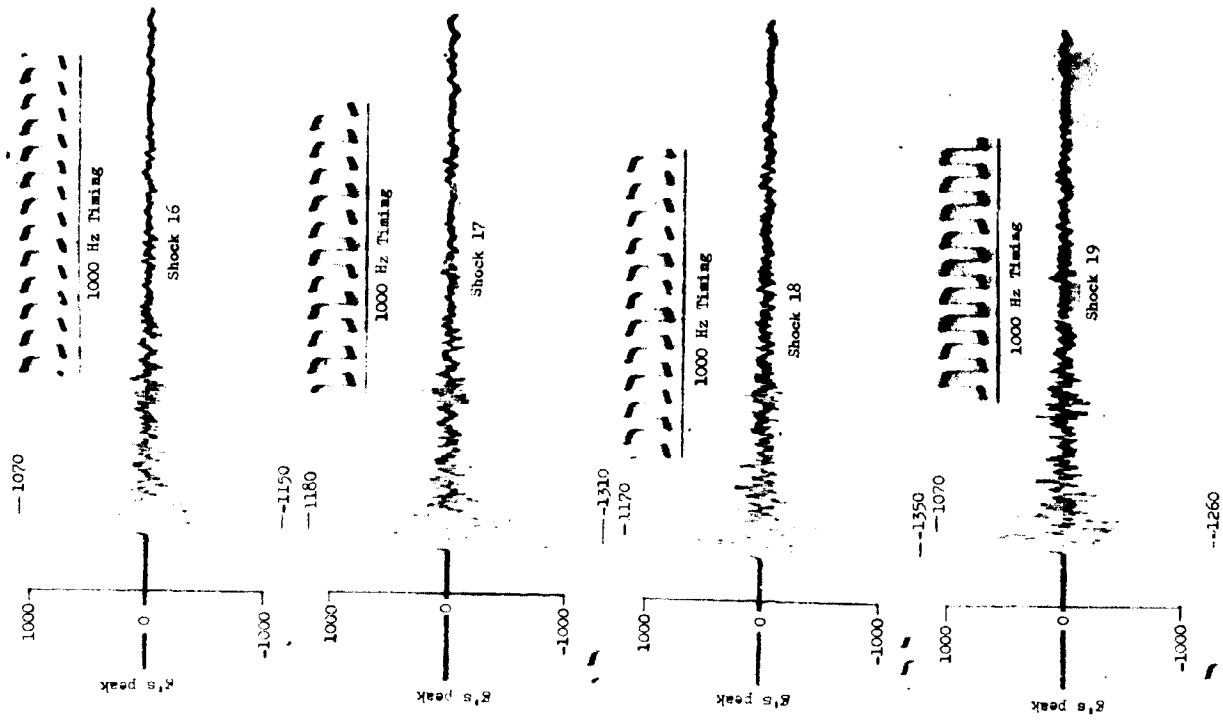
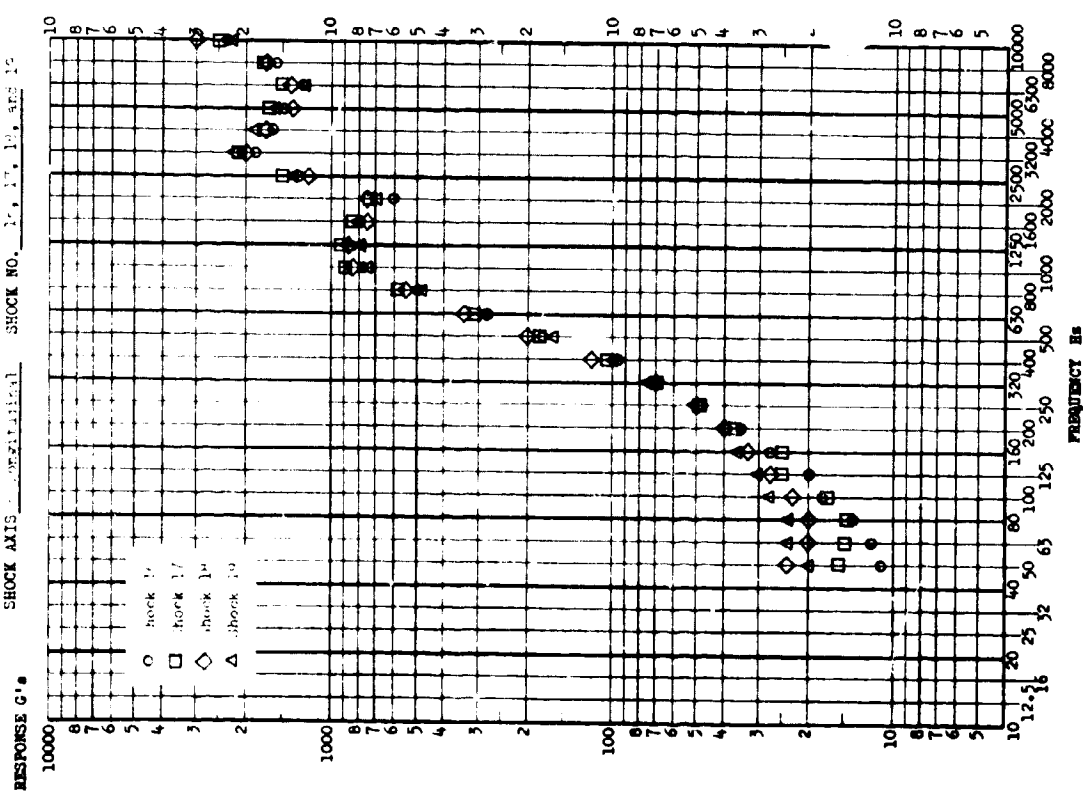


FIGURE 11.B.1-149

TEST ITEM _____ PART NO. _____
 SERIAL NO. _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

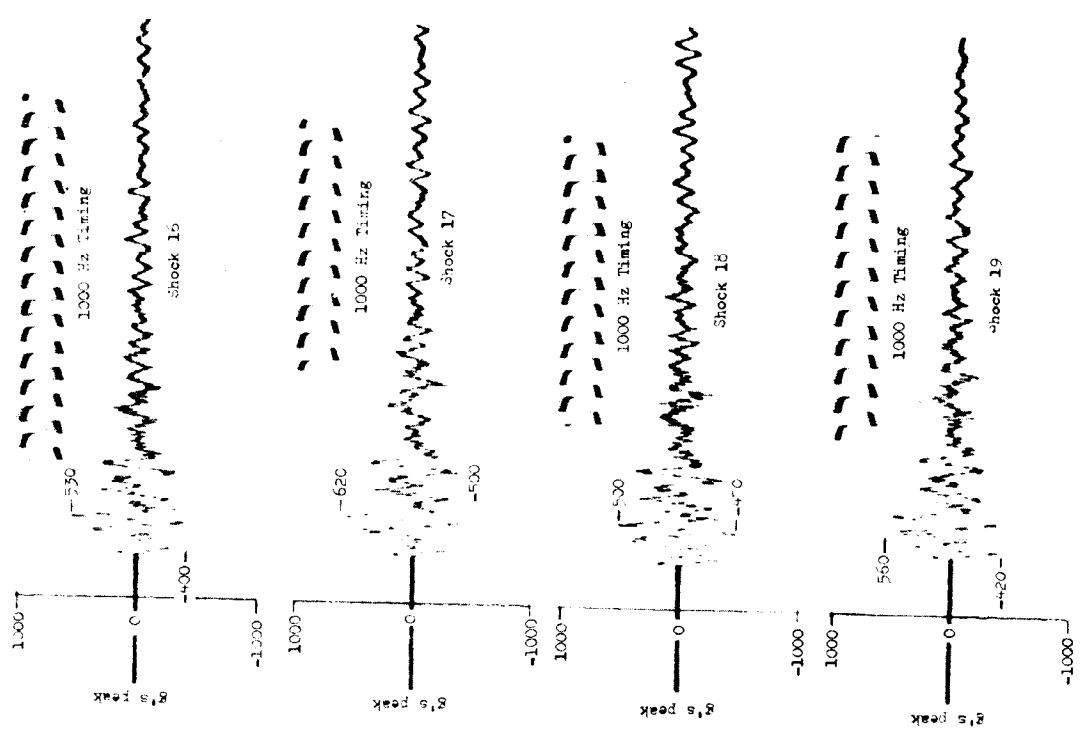
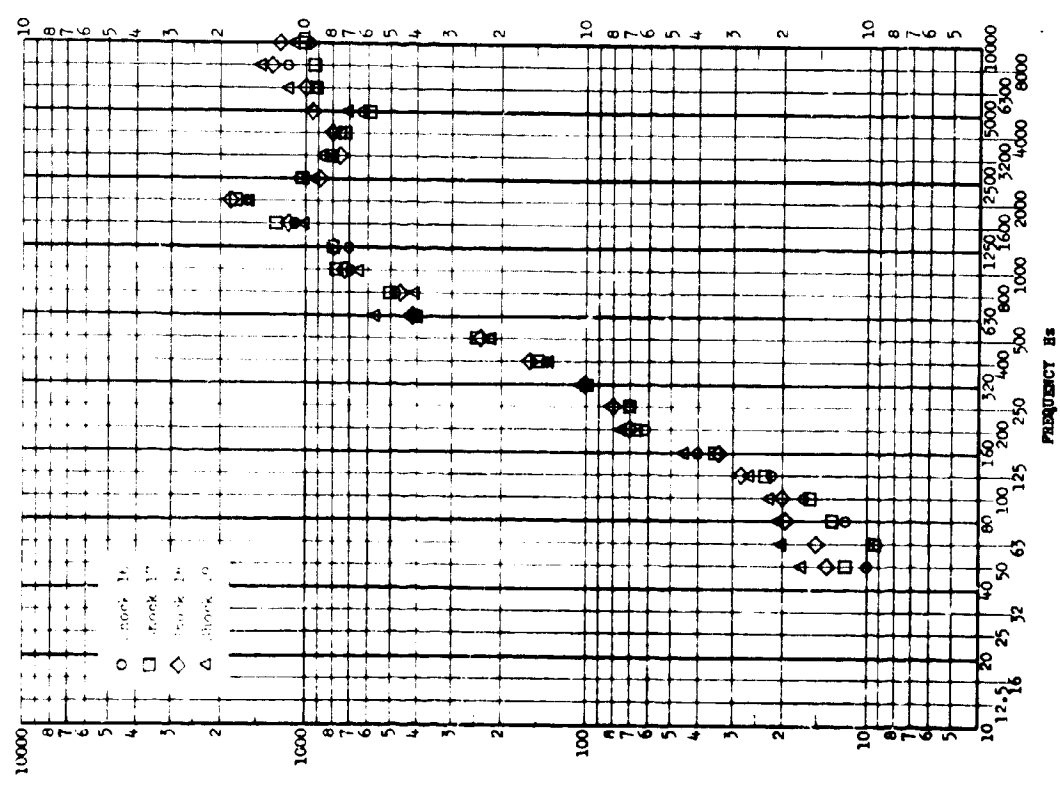


FIGURE 11.B.1-150

TEST ITEM: IV PART NO. _____
 SERIAL NO. _____ TEST DATE: _____
 SHOCK AXIS: _____ SHOCK NO. 1, 11, 12, and 13

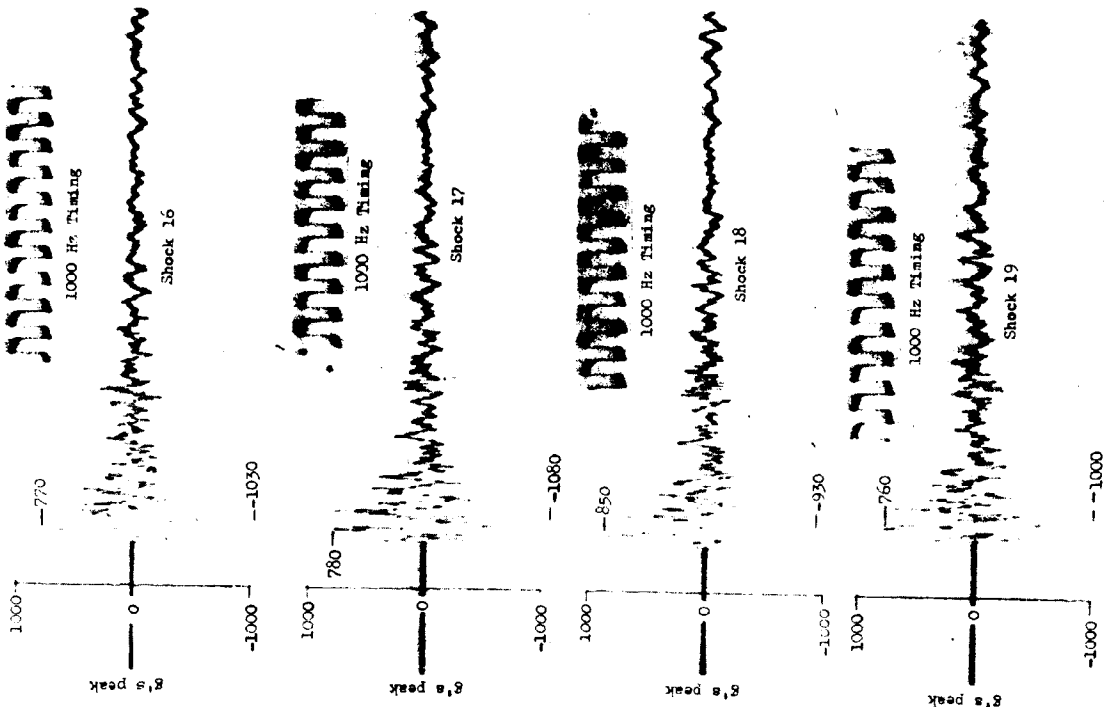
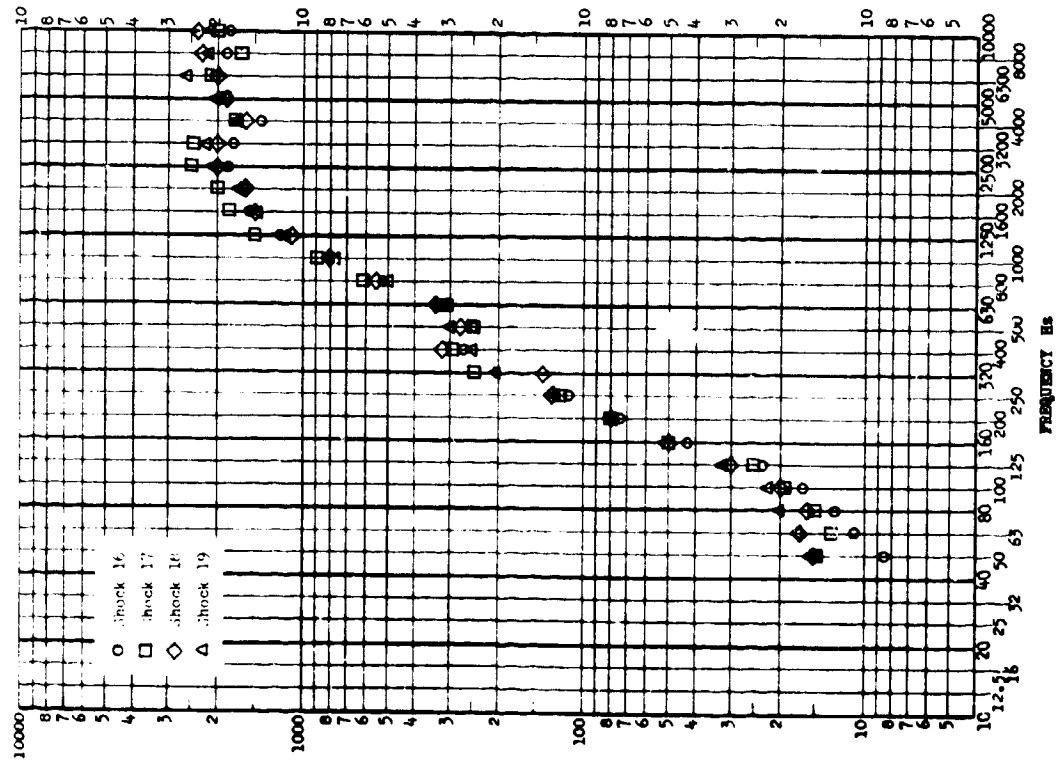


FIGURE 11.B.1-151

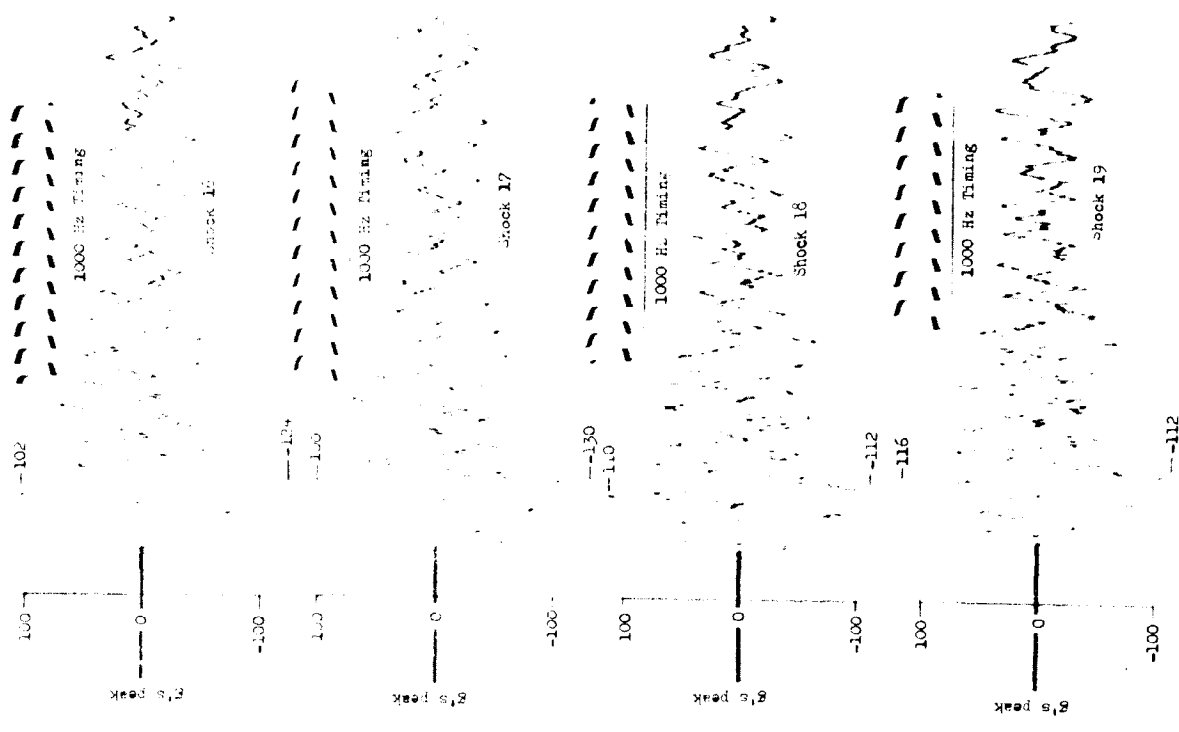
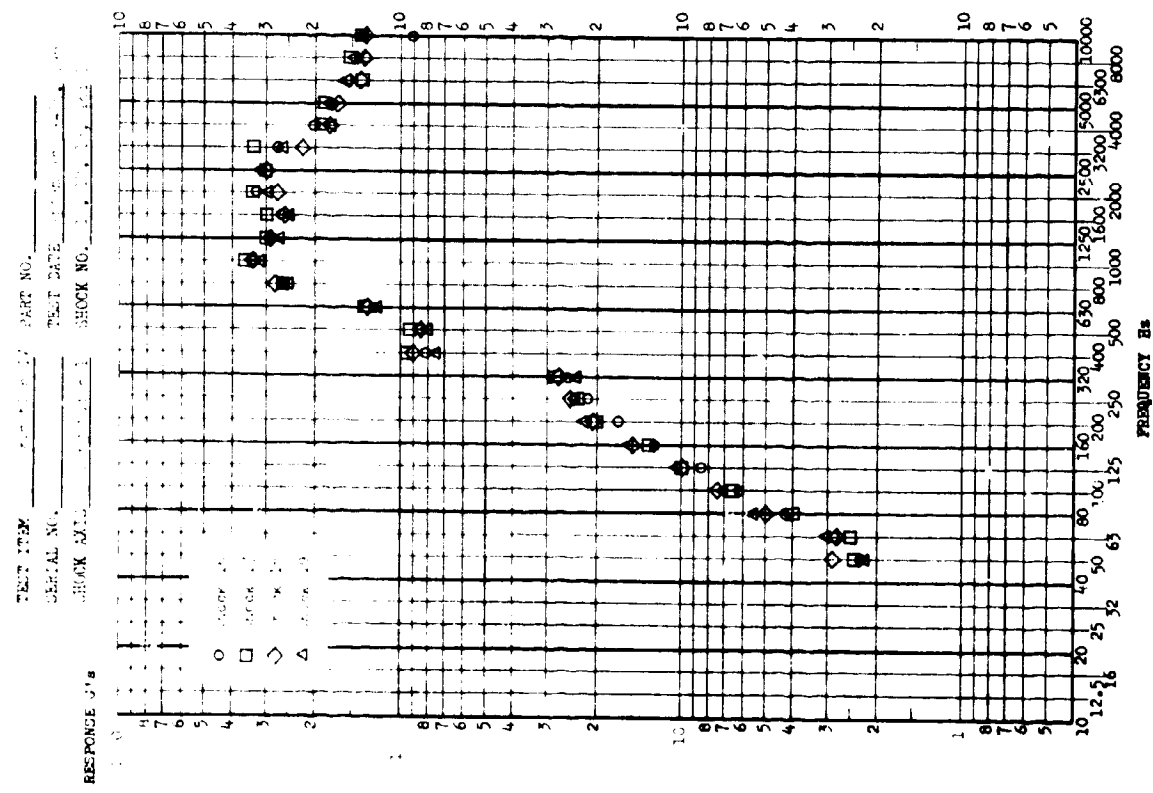


FIGURE 11.8.1-152

TEST ITEM _____ PART NO. _____
 SERIAL NO. _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

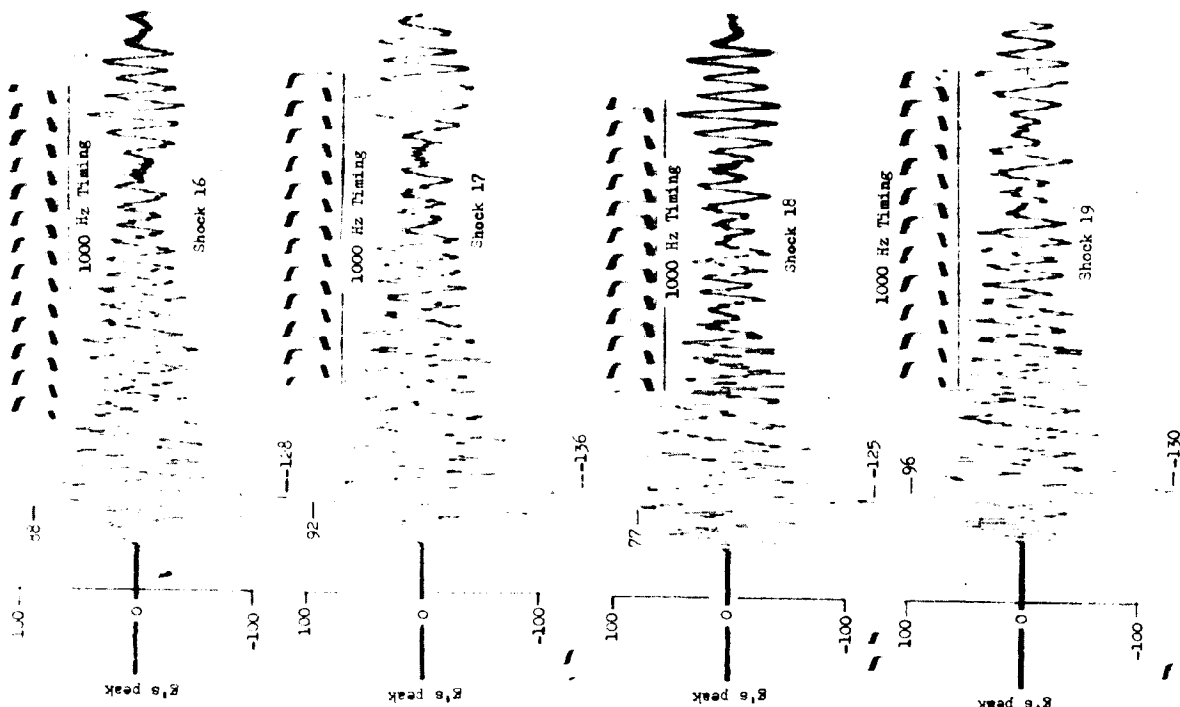
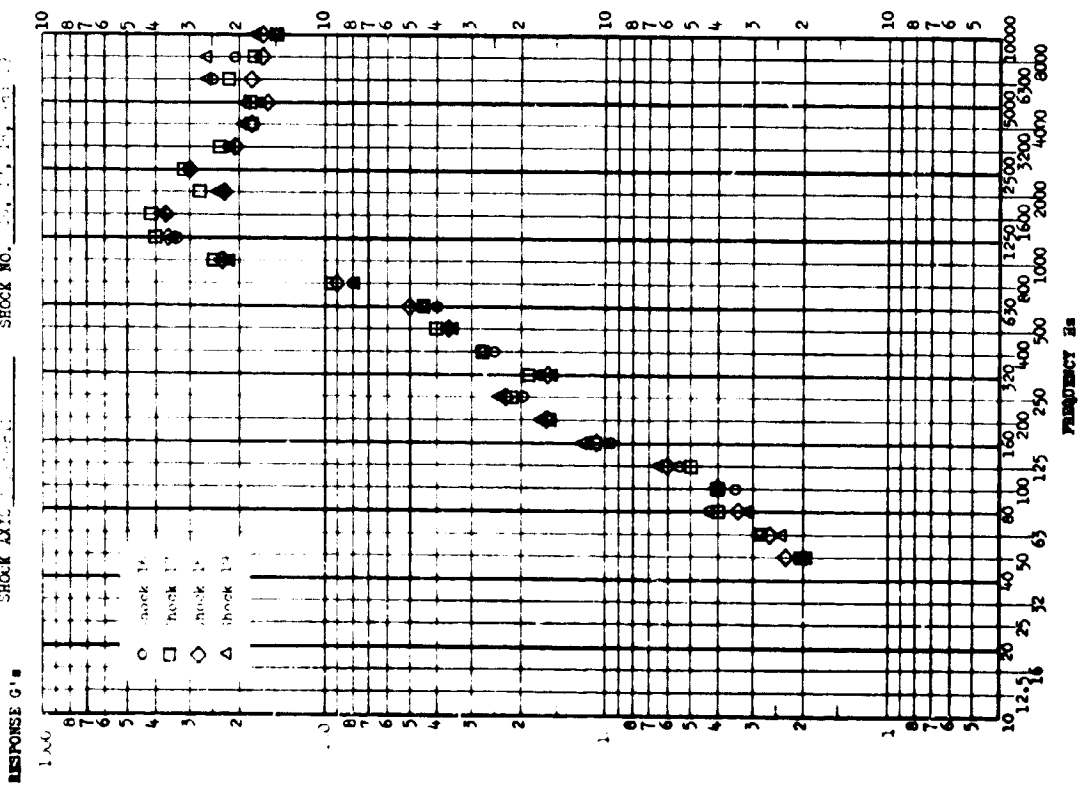


FIGURE 11.B.1-153

TEST ITEM: _____ PART NO.: _____
 SERIAL NO.: _____ TEST DATE: _____
 SHOCK AXIS: _____ SHOCK NO.: _____

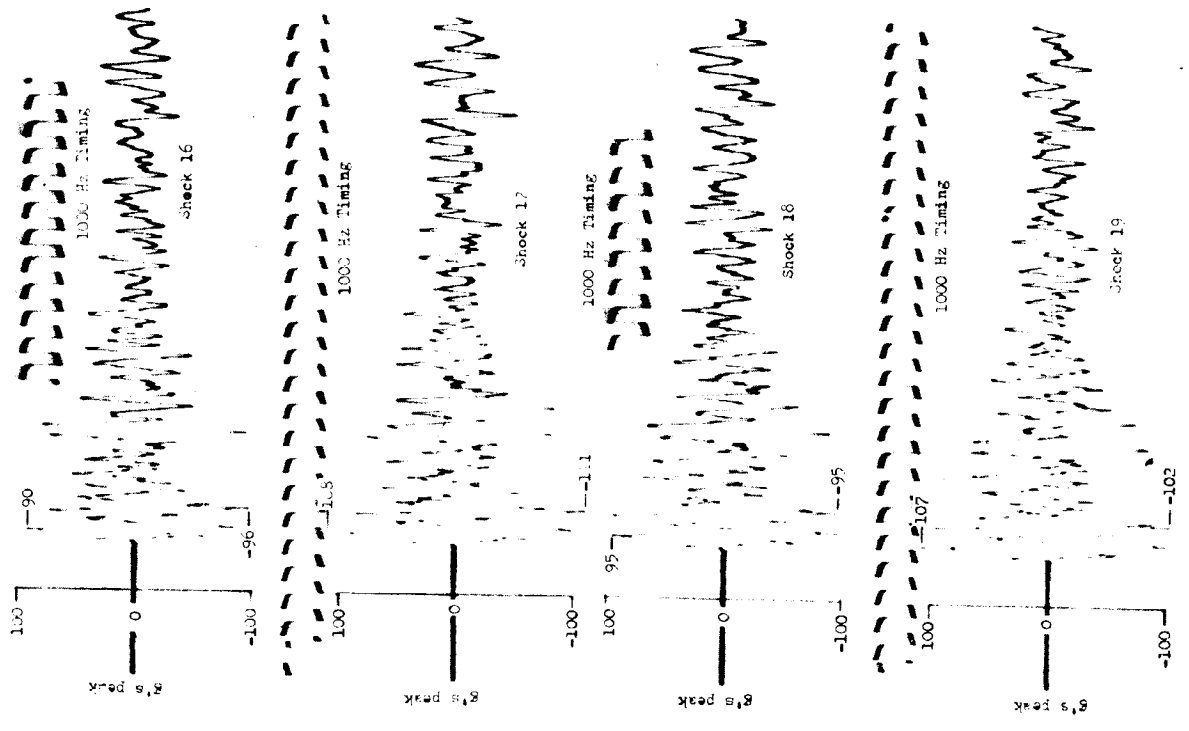
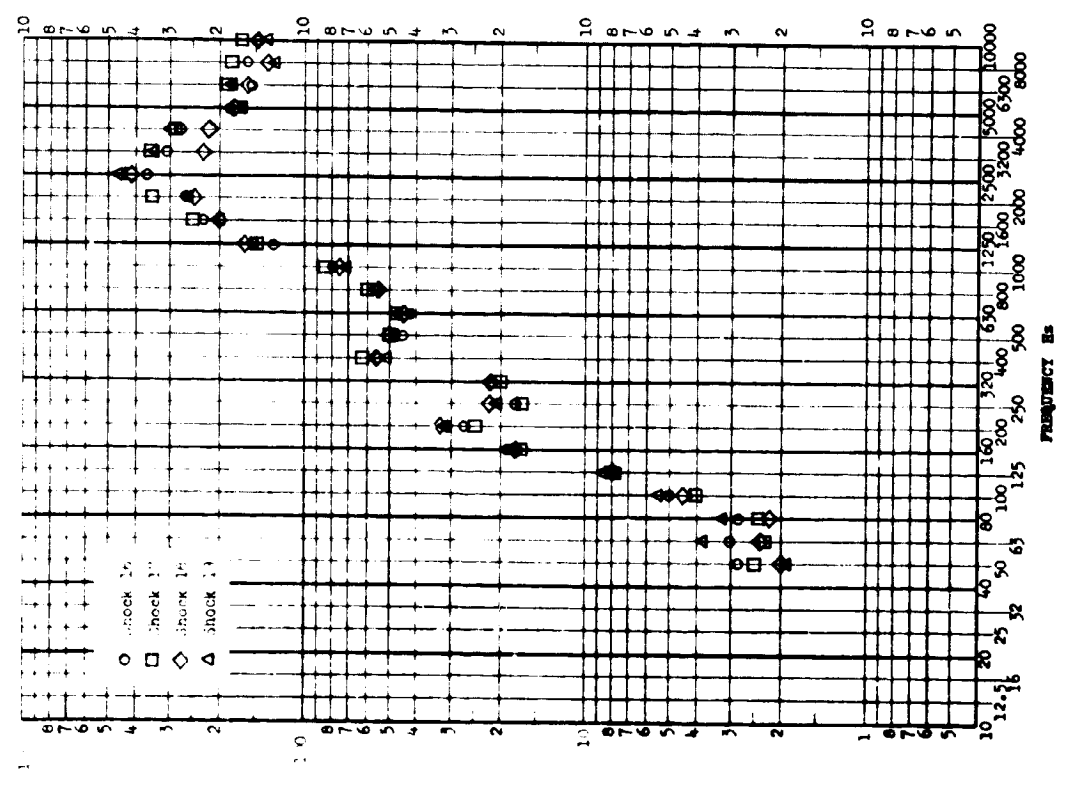


FIGURE II.B.1-154

TEST ITEM _____ PART NO. _____
 SERIAL NO. _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

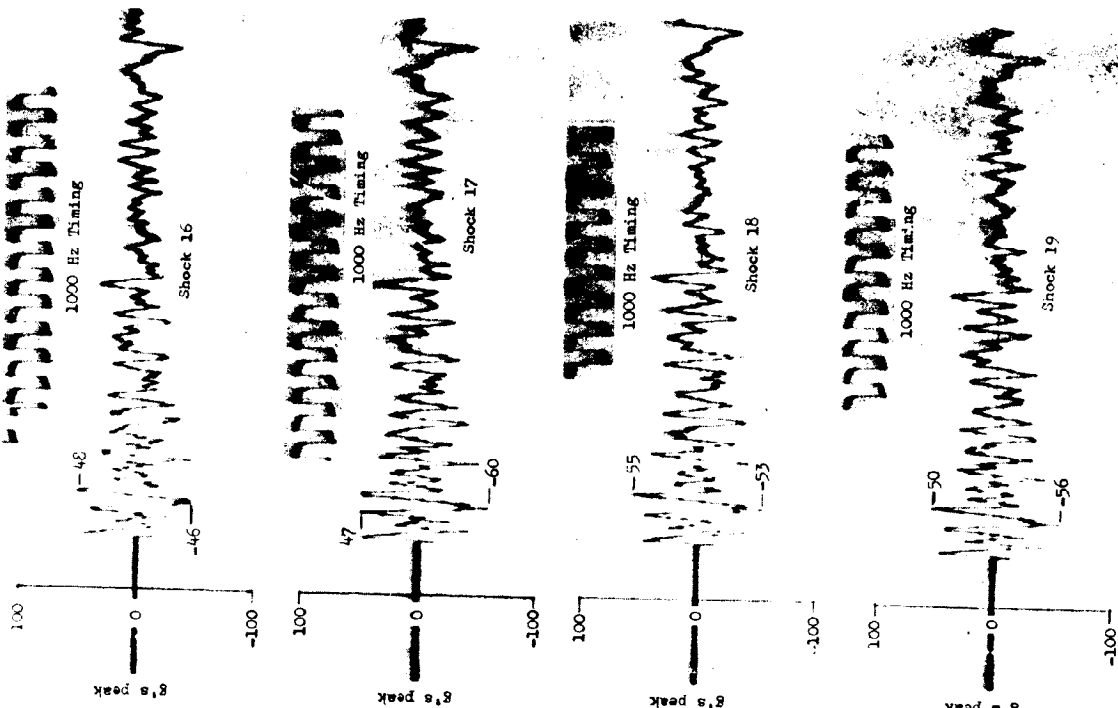
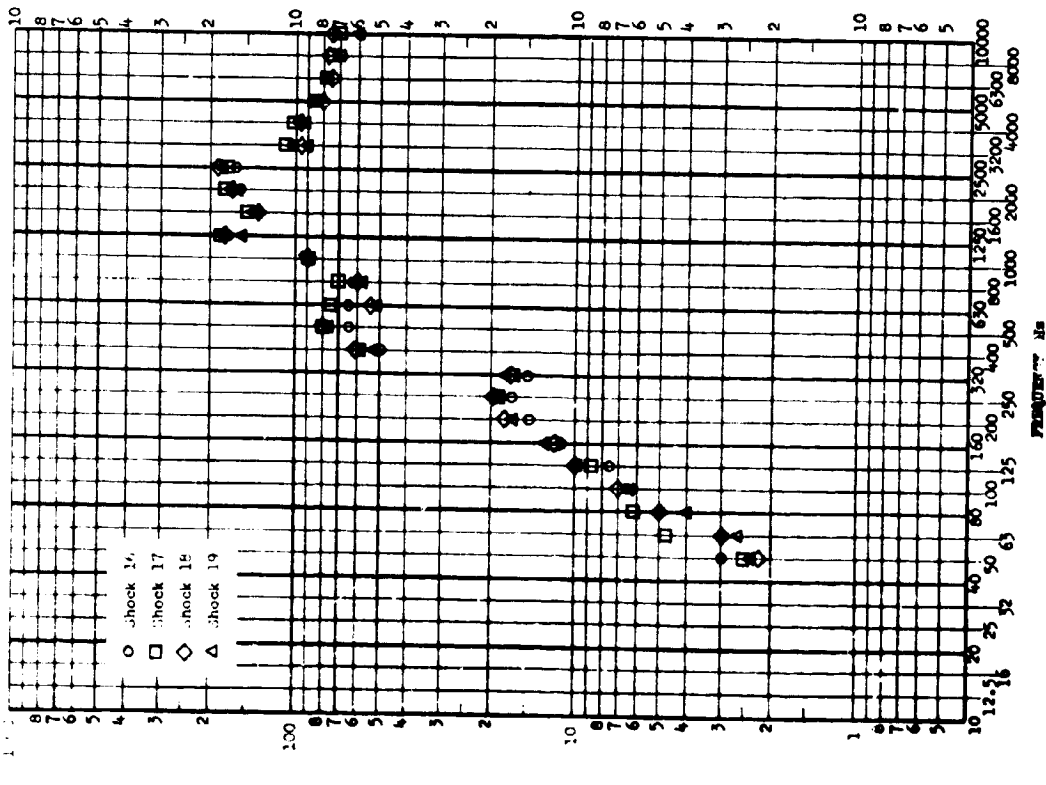


FIGURE 11.B.1-155

TEST ITEM: _____ PART NO.: _____
 SERIAL NO.: _____ TEST DATE: _____
 SHOCK AXIS: _____ SHOCK NO.: _____

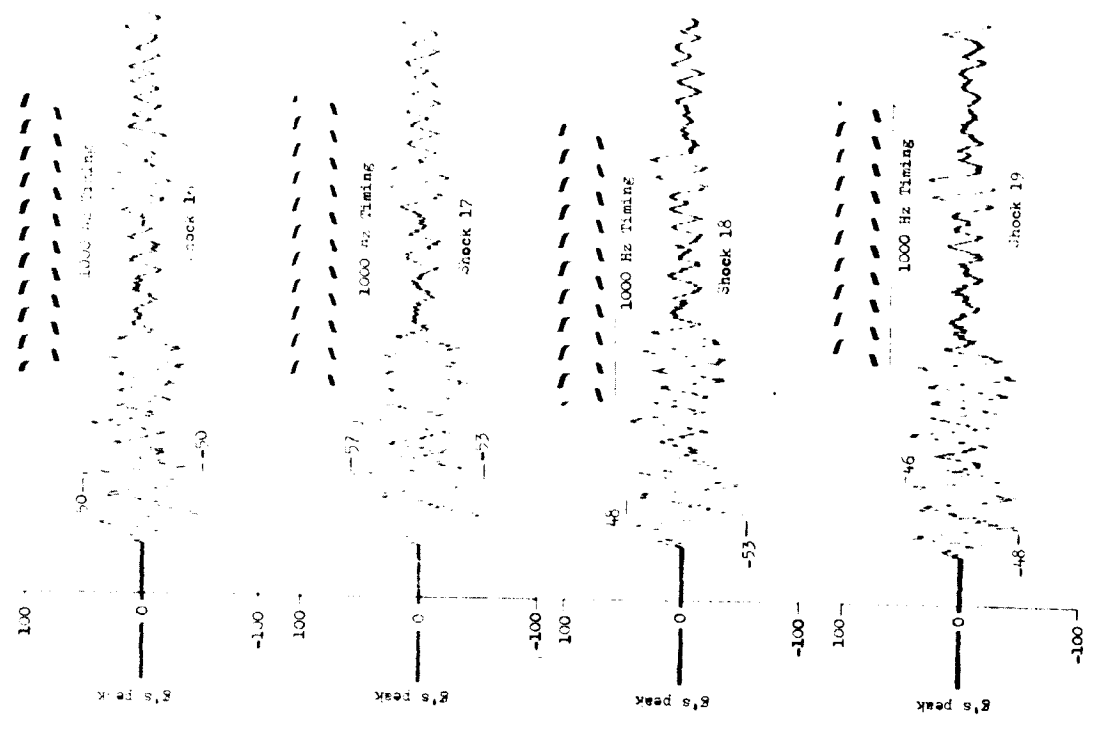
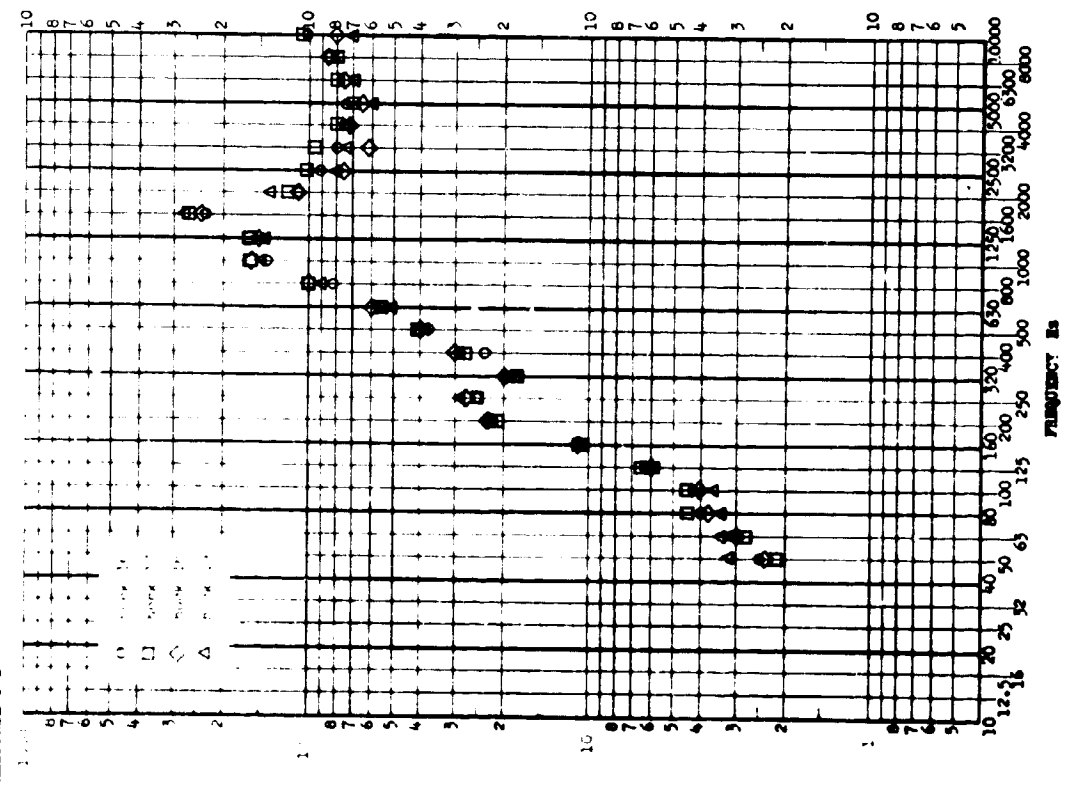


FIGURE 11.B.1-156

TEST ITEM: Part 1000 on IV PART NO. _____
 SERIAL NO. _____ TEST DATE: September 2-25, 1958
 SHOCK AXIS: vertical SHOCK NO. 14, 17, 18, 19 and 19

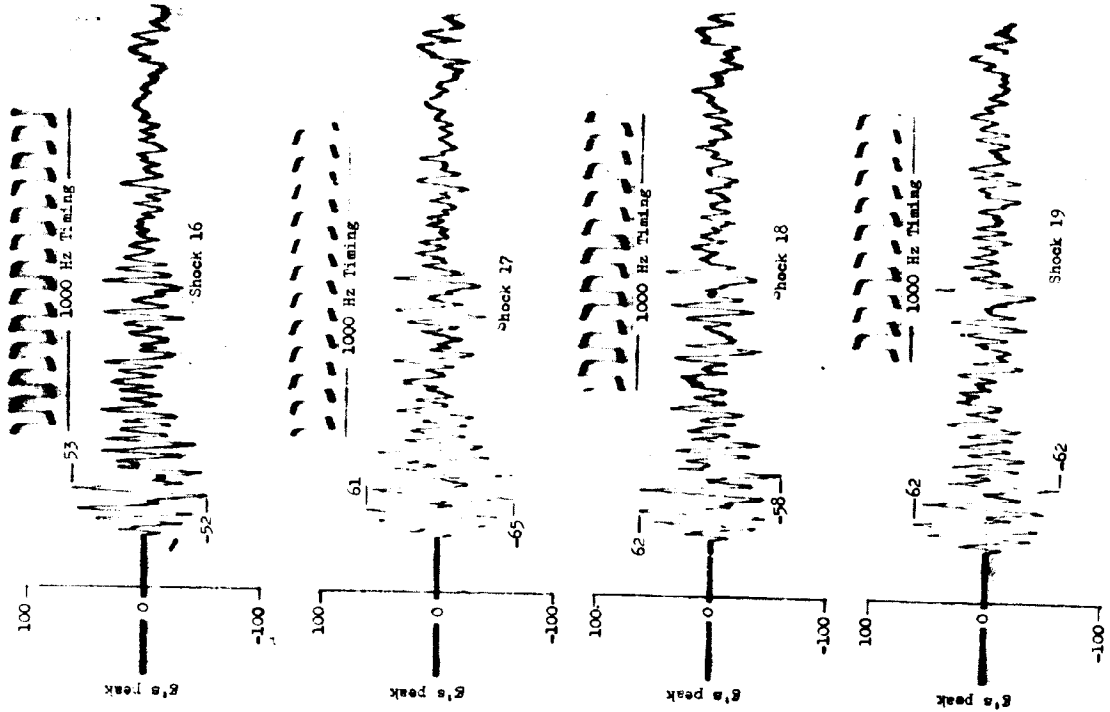
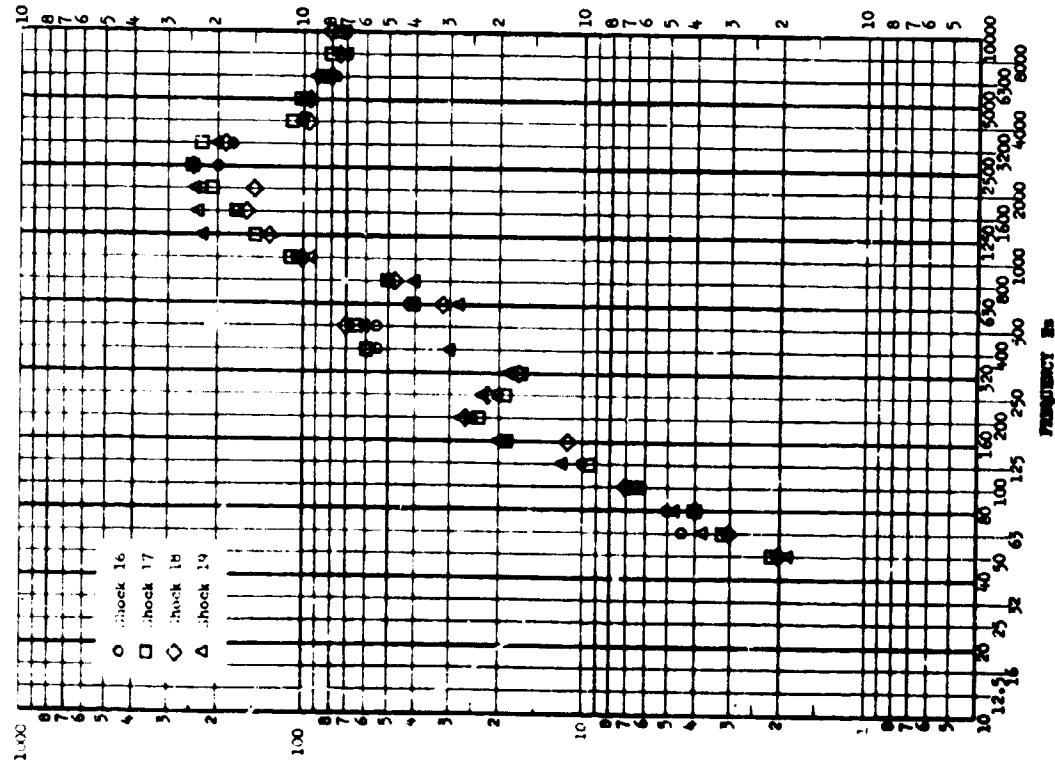


FIGURE 11.B.1-157

SECTION II.B.2

TITAN III-M SEPARATION NUT TESTS

PURPOSE OF TESTS

A series of test detonations of different types of separation hardware was conducted to compare the shock levels produced by Titan III-C separation nuts with those produced by the separation nuts proposed for use on Titan III-M.

DESCRIPTION OF EVENTS

The test installation (Figures II.B.2-1 and II.B.2-2) consisted of two Titan III-C transtage skirt sections used to simulate the separation interface. One skirt section containing guidance and instrumentation trusses was attached to a base fixture. The second skirt section was inverted and attached at each of the four matching longerons using the separation hardware applicable for each test. For each test all four separation nuts were detonated.

Three different separation nut configurations were tested, and three tests were conducted for each configuration. Table II.B.2-1 indicates the separation hardware associated with the various tests. Each nut was caused to divide into four segments by the detonation and pressure

build up of the attached pressure cartridge(s). The nut/pressure cartridge configurations are shown schematically in Figures II.B.2-3 and II.B.2-4.

DESCRIPTION OF DATA

No. of time histories	204
No. of shock spectra	202
Type of analysis	analog
Analog machine	Ling SSA-100
Frequency range	50-10,000Hz
Frequency increments	3 points per octave
Damping	Q=10

These shock spectra are presented with their corresponding time histories as Figures II.B.2-8 through II.B.2-79.

DESCRIPTION OF PYROTECHNIC

Pressure cartridges actuate separation nuts. A description of pressure cartridge charge follows:

Prime charge: 90 mg pressed zirconium

Base Charge: 346 mg boron and potassium nitrate

Booster charge: 86 mg boron and potassium nitrate

Sustainer charge: 193 mg ammonium nitrate and rubber

Locations: Nuts located 4 place symmetrically around specimen. Figures II.B.2-1 and II.B.2-2.

Configuration at each location: Table II.B.2-1 and Figures II.B.2-3 and II.B.2-4.

DESCRIPTION OF STRUCTURE

Longeron: aluminum, Figure II.B.2-7

Skin: aluminum, 0.028 inch thick

Ring-frame: aluminum, Figure II.B.2-7

Truss members: aluminum, 1.5 inch square section,
0.0625 inch wall thickness

Figures II.B.2-2, II.B.2-5 and II.B.2-6 for overall picture.

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225

Locations: Table II.B.2-2 and Figures II.B.2-5 and
II.B.2-6

Axis of sensitivity: Table II.B.2-2 and Figures
II.B.2-5 and II.B.2-6.

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorder: Ampex ES-100 (0-20,000Hz frequency
response)

Amplifiers: Kistler 504A (0-100,000Hz frequency
response)

COMMENTS

The following shock spectra show a lack of correlation between the time history peak accelerations and shock spectra peak accelerations and are questionable data:

	<u>Shot No.</u>	<u>Acc. No.</u>
Figure II.B.2-20	2	3A 13
2-21	2	3A 14
2-22	2	3A 15
2-24	1,2	3A 17
2-25	1,2	3A 18
2-28	1	3A 21
2-31	1	3A 24

TABLE II.B.2-1

DESCRIPTION OF SEPARATION NUTS TESTED

<u>Test Run Numbers</u>	<u>Nut Diameter</u>	<u>Number of Nuts at Each Location</u>	<u>Description of Nuts</u>	<u>Number of Pressure Cartridges for Each Nut</u>	<u>Description of Pressure Cartridges</u>
1-3	3/4 inch	2	single nut PD3350007-005 (mfg.: Hi Shear Corp.)	1	PD6050129-505 (mfg.:McCormick-Selph Associates)
4-6	3/4 inch	1	dual nut PD3350007-003 (mfg.: Hi Shear Corp.)	2	Same as above
7-9	1 inch	1	dual nut PD3350008-001 (mfg.: Hi Shear Corp.)	2	Same as above

TABLE II.B.2-2

<u>Accelerometer Number</u>	<u>Measurement Location</u>	<u>Sensitive Axis</u>
1	Stringer 3C on longeron at station 114 near guidance truss attach point	longitudinal
2		radial
3		tangential
4	Guidance truss	longitudinal
5		vertical
6		lateral
7	Guidance truss	longitudinal
8		vertical
9		lateral
10	Guidance truss	longitudinal
11		vertical
12		lateral
13	Guidance truss	longitudinal
14		vertical
15		lateral
16	Stringer 3C on longeron at station 97	longitudinal
17		radial
18		tangential
19	On ring-frame at target at station 97	longitudinal
20		radial
21		tangential
22	Stringer 26C on longeron at station 97	longitudinal
23		radial
24		tangential

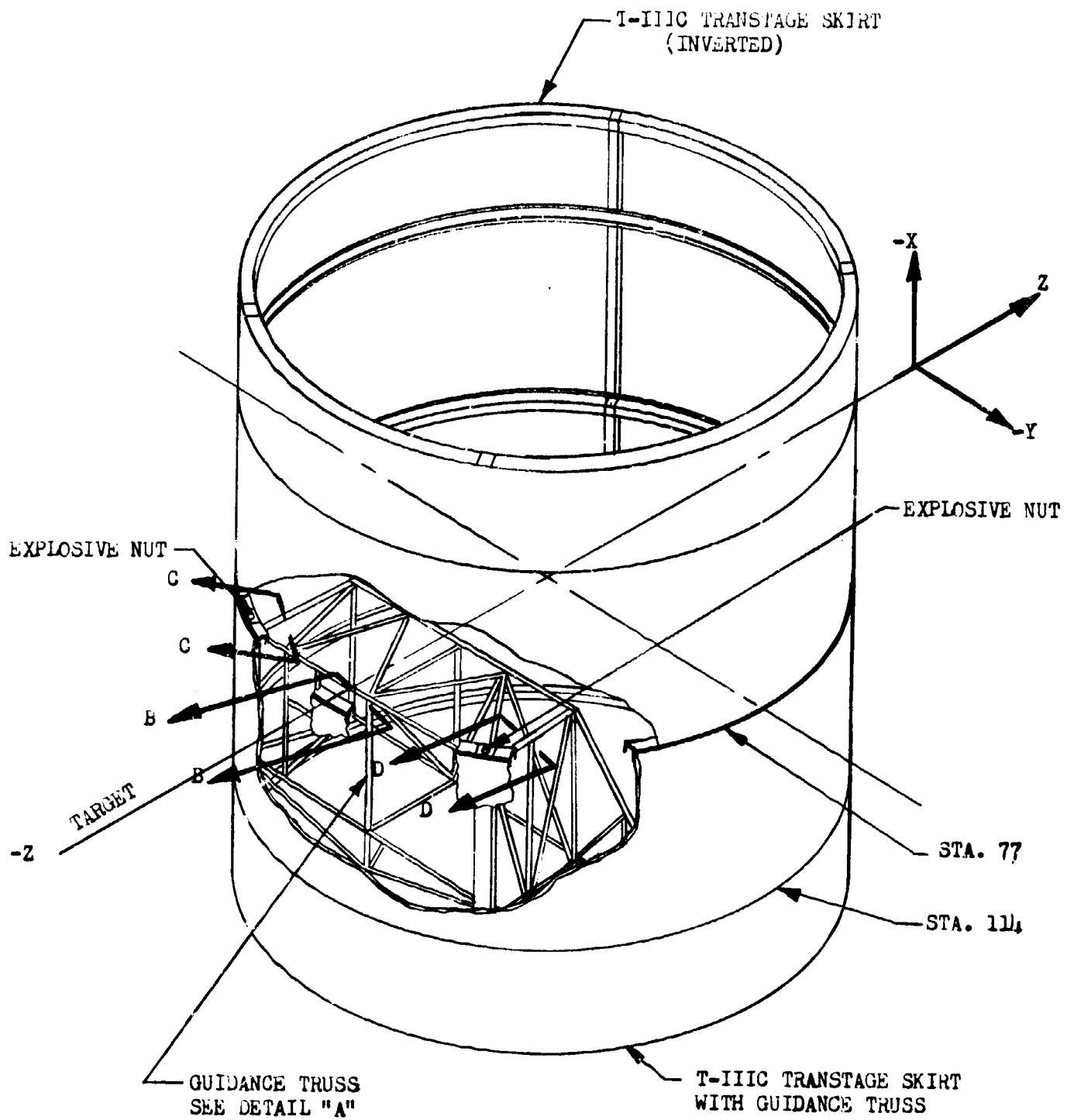


FIGURE II.P.2-1
T-IIIM SEPARATION NUT TEST

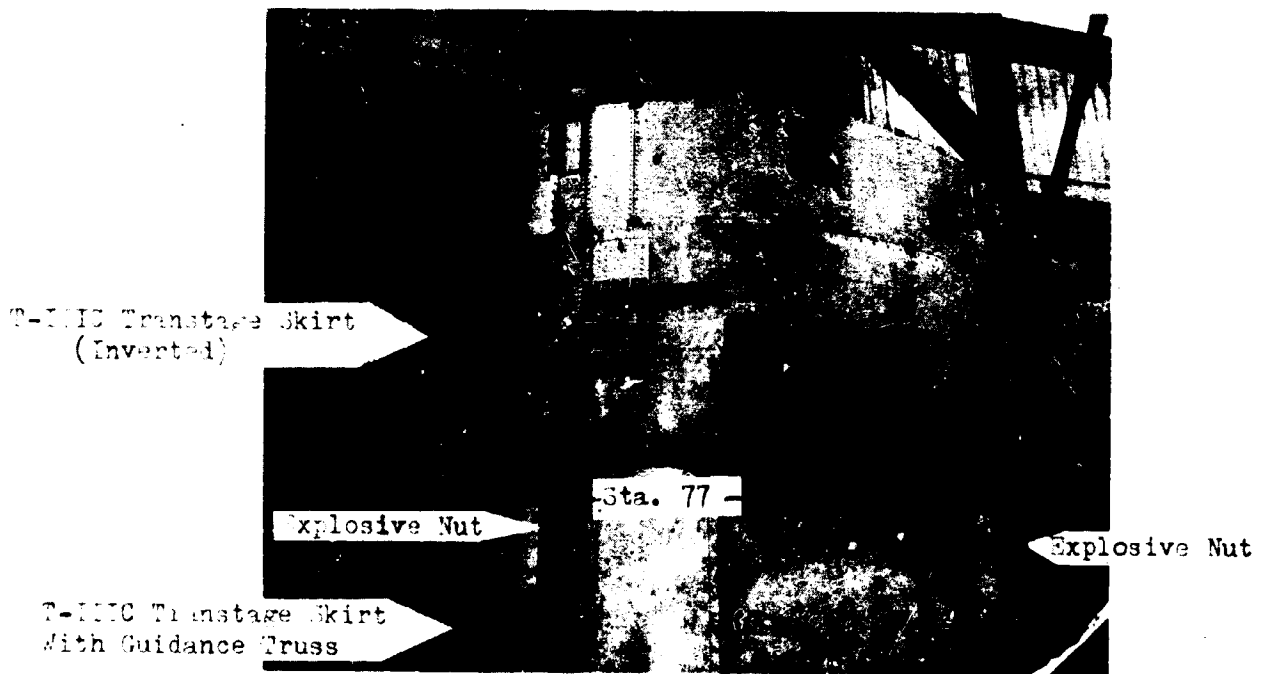


FIGURE II.B.2-2
TEST INSTALLATION

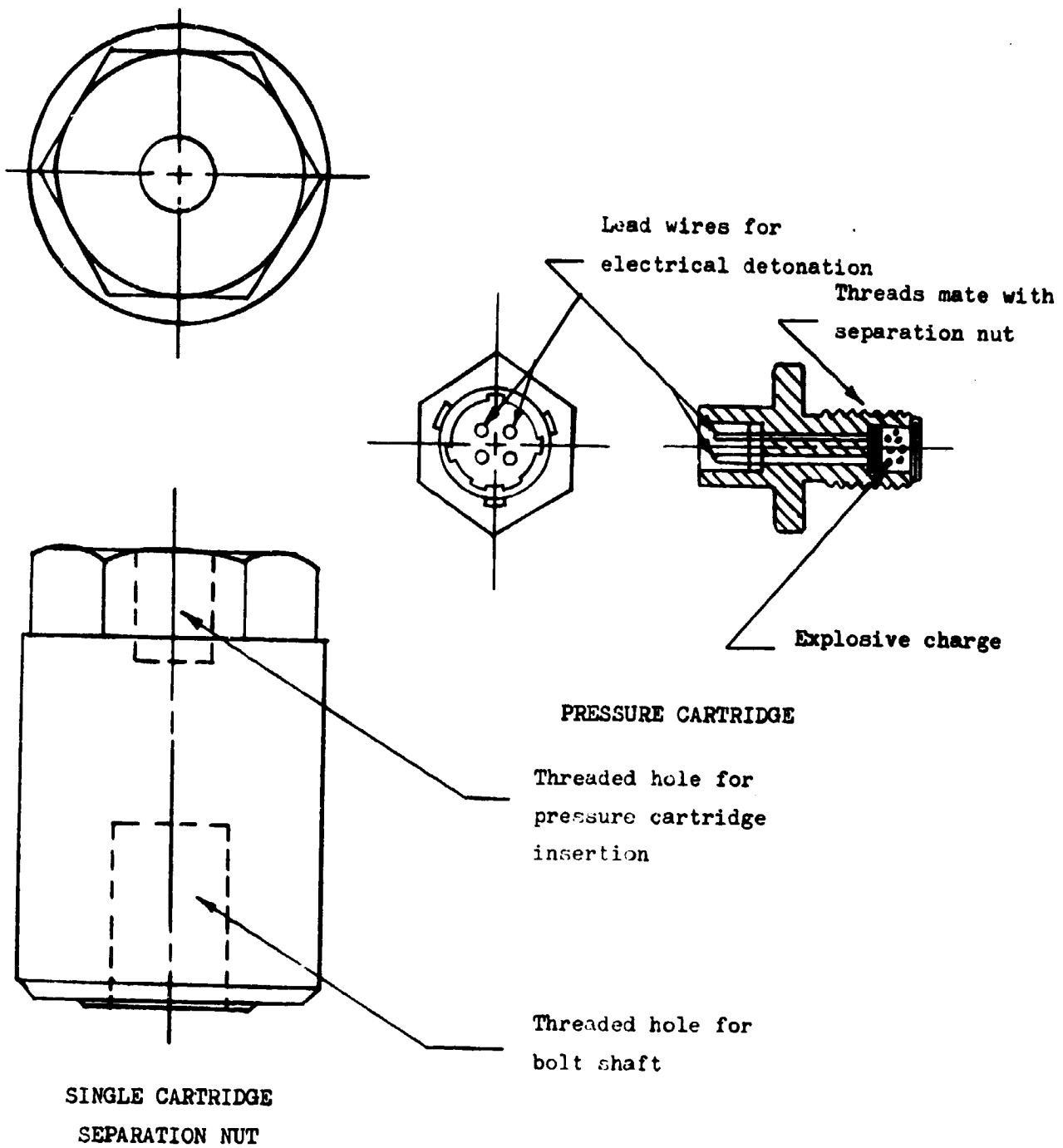


FIGURE II.B.2-3
 SINGLE CARTRIDGE SEPARATION NUT

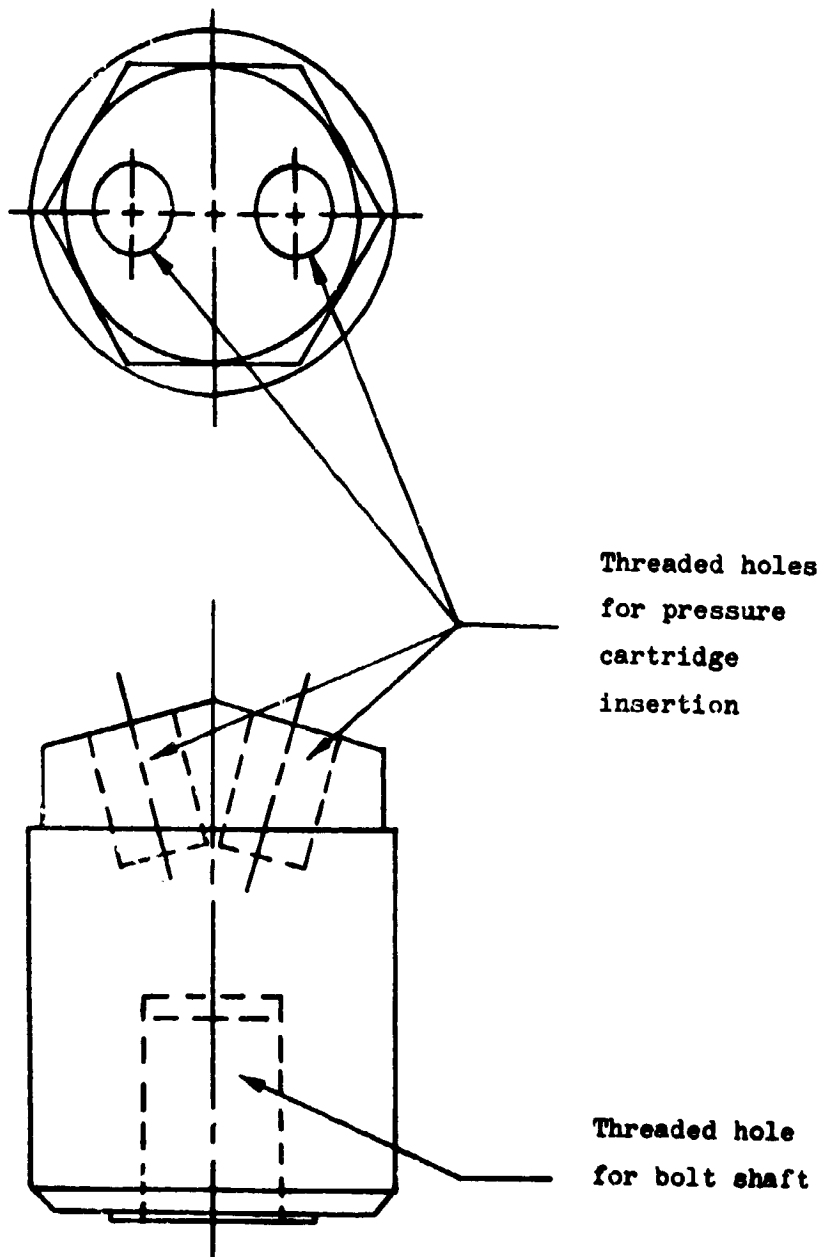
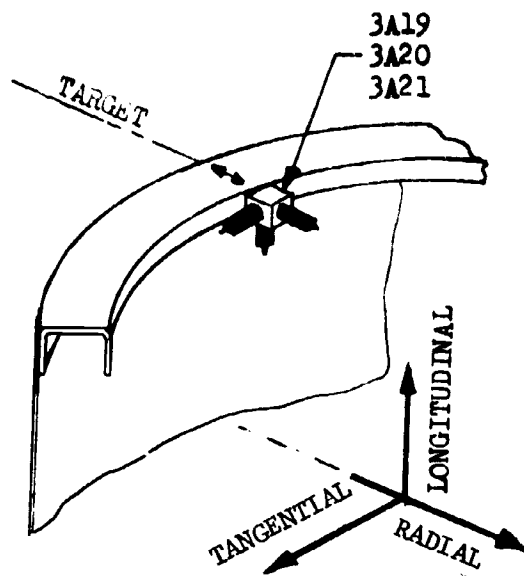
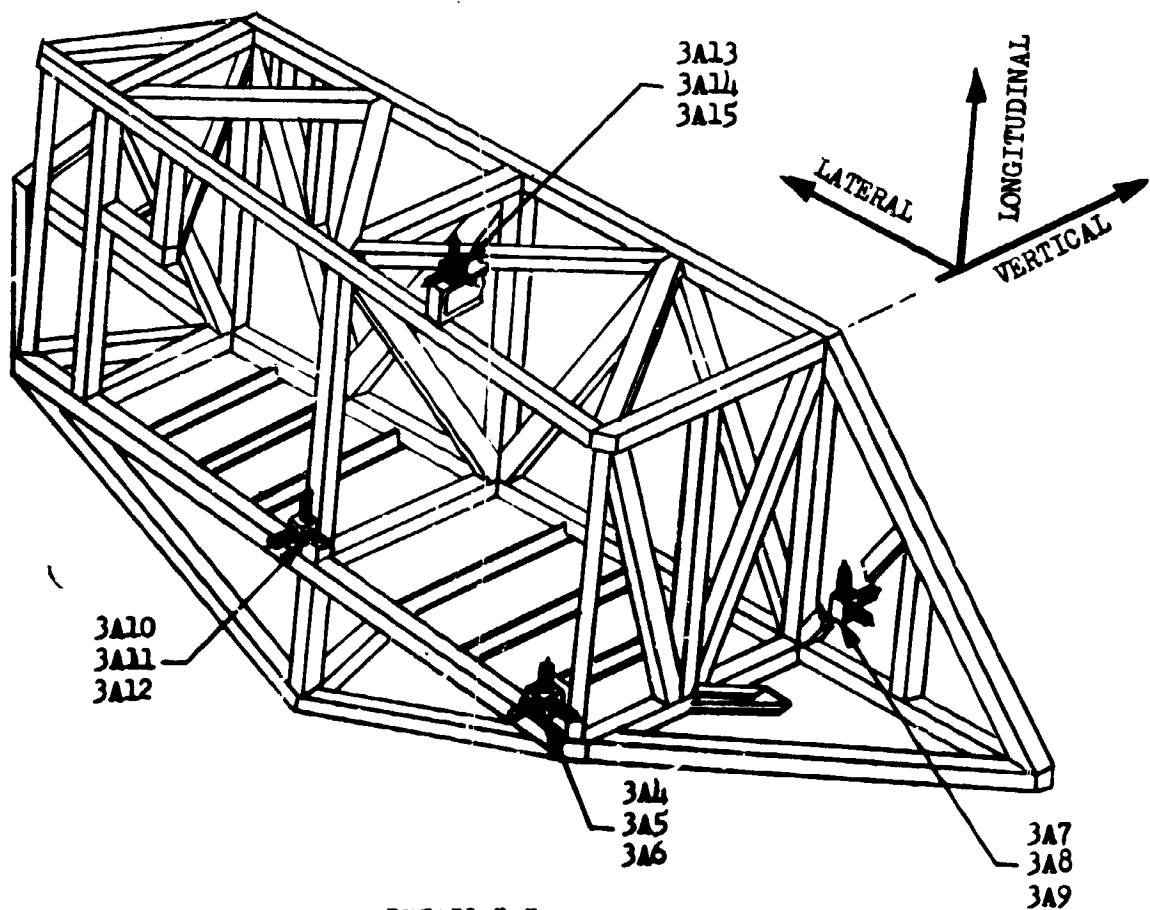


FIGURE II.B.2-4
DUAL CARTRIDGE SEPARATION NUT

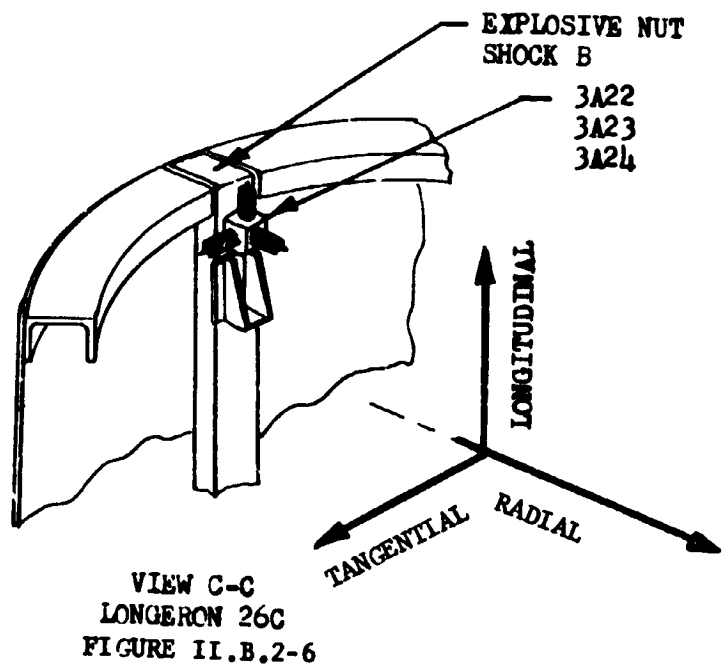
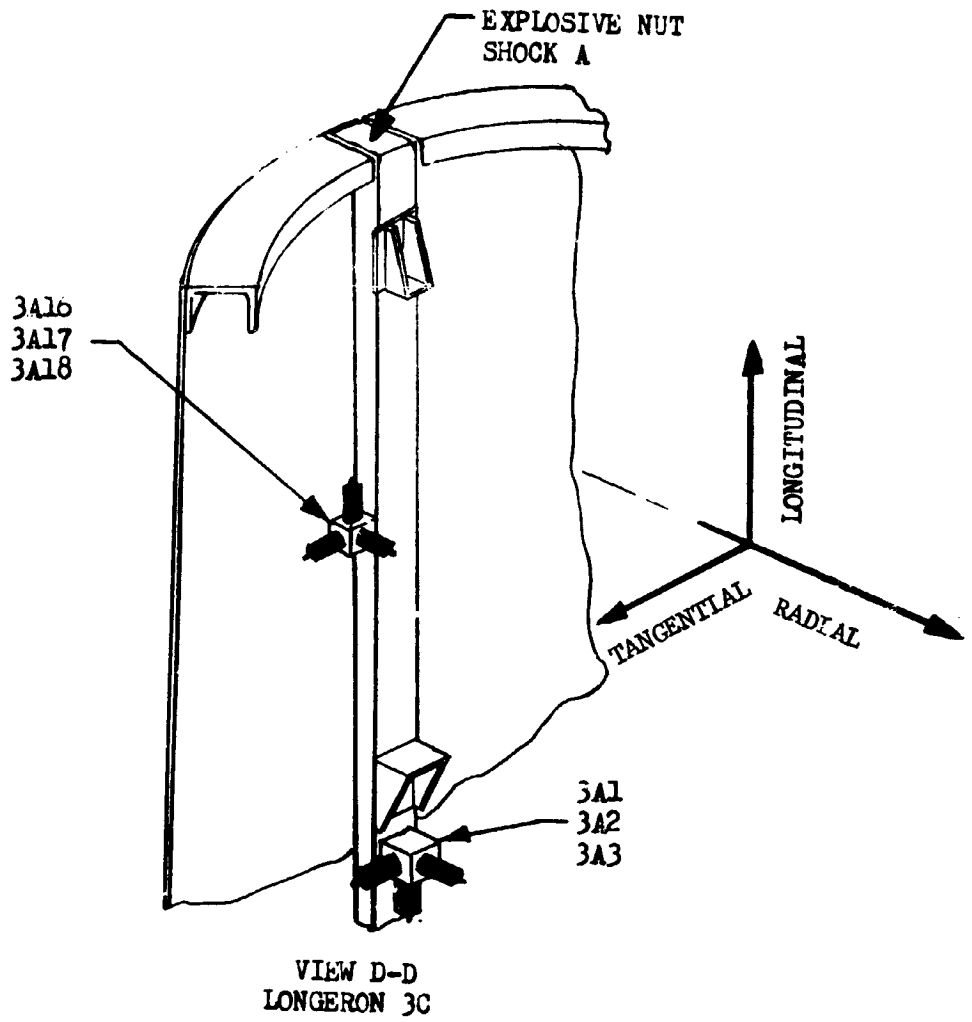


VIEW B-B
RING FRAME AT TARGET

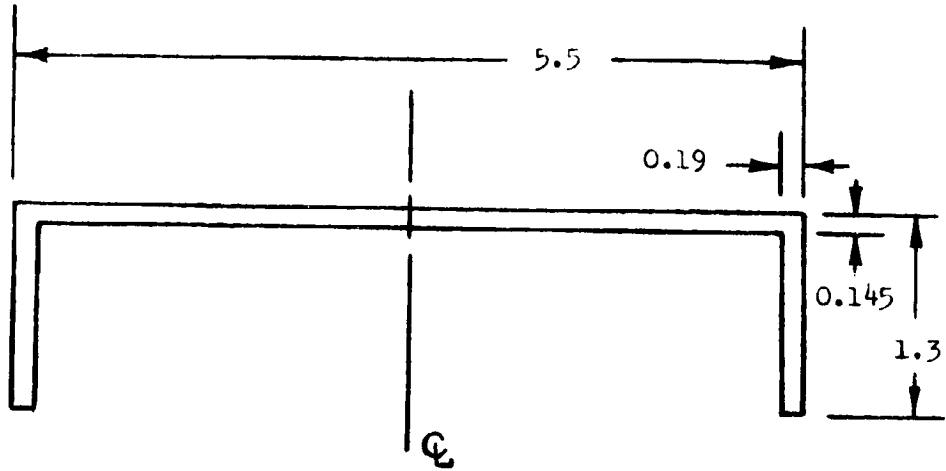


DETAIL "A"
GUIDANCE TRUSS
FIGURE II.3.2-5

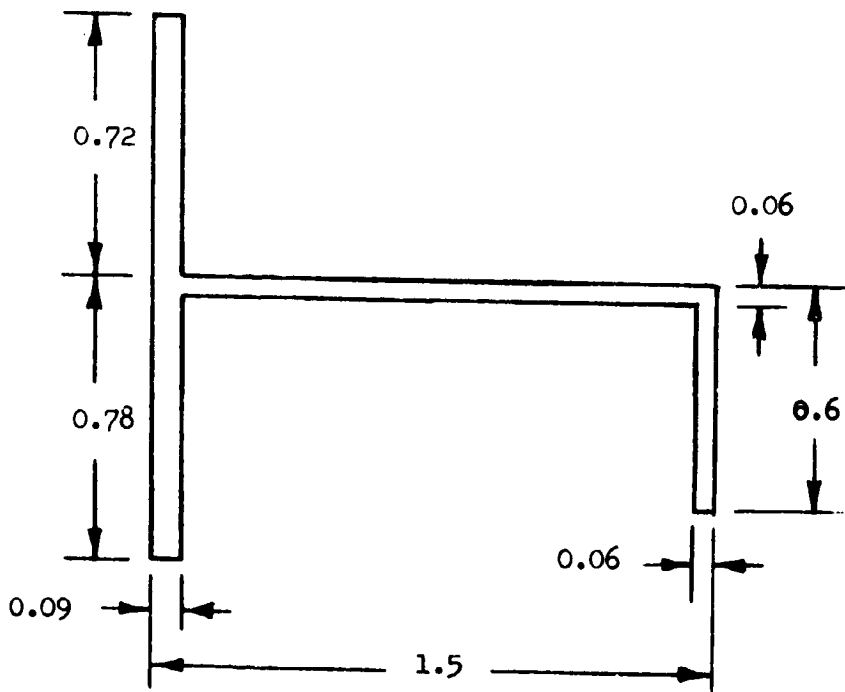
ACCELEROMETER LOCATIONS FOR T-IIIM SEPARATION NUT TEST



ACCELEROMETER LOCATIONS FOR T-IIIM SEPARATION NUT TEST



RING-FRAME
 DIMENSION OF SECTION AT STATION 77



DIMENSIONS OF LONGERON SECTION

FIGURE II.B.2-7
 SECTIONAL DIMENSIONS

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Dual Nut
 Accel. No.: 3A1
 Test Date: Aug., 1968
 Shock Axis: Longitudinal
 Shock No.: 1, 2, 3

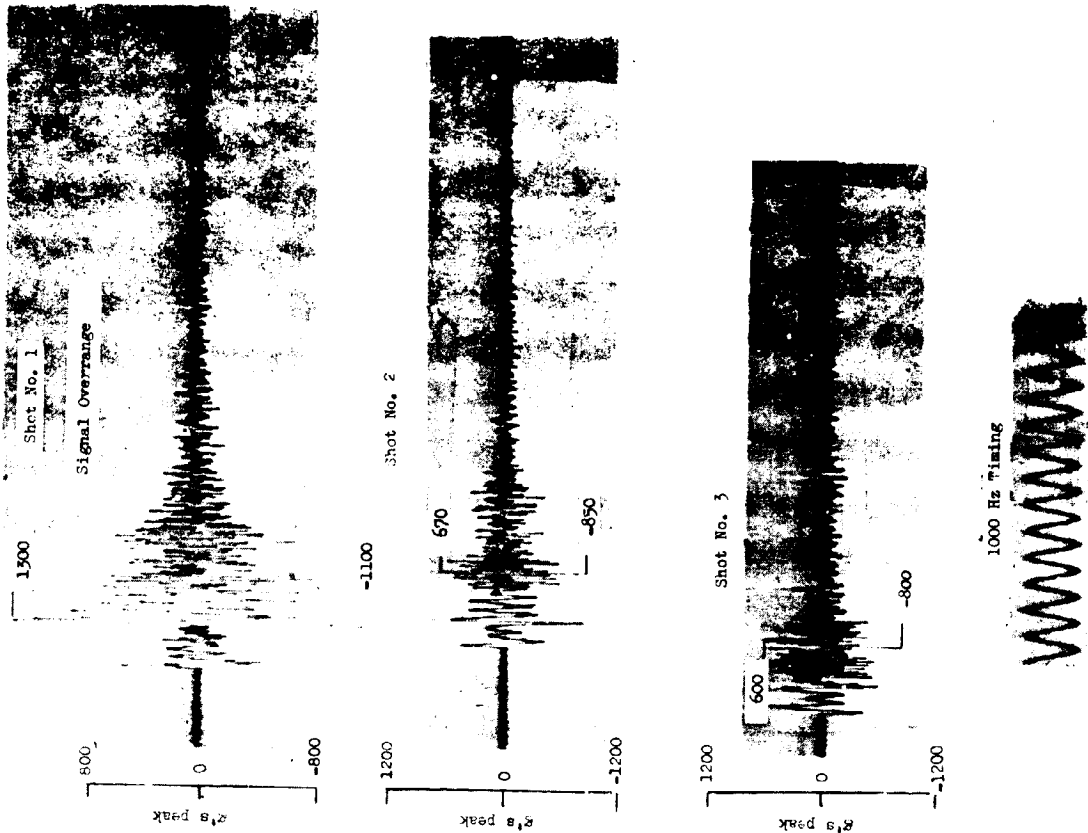
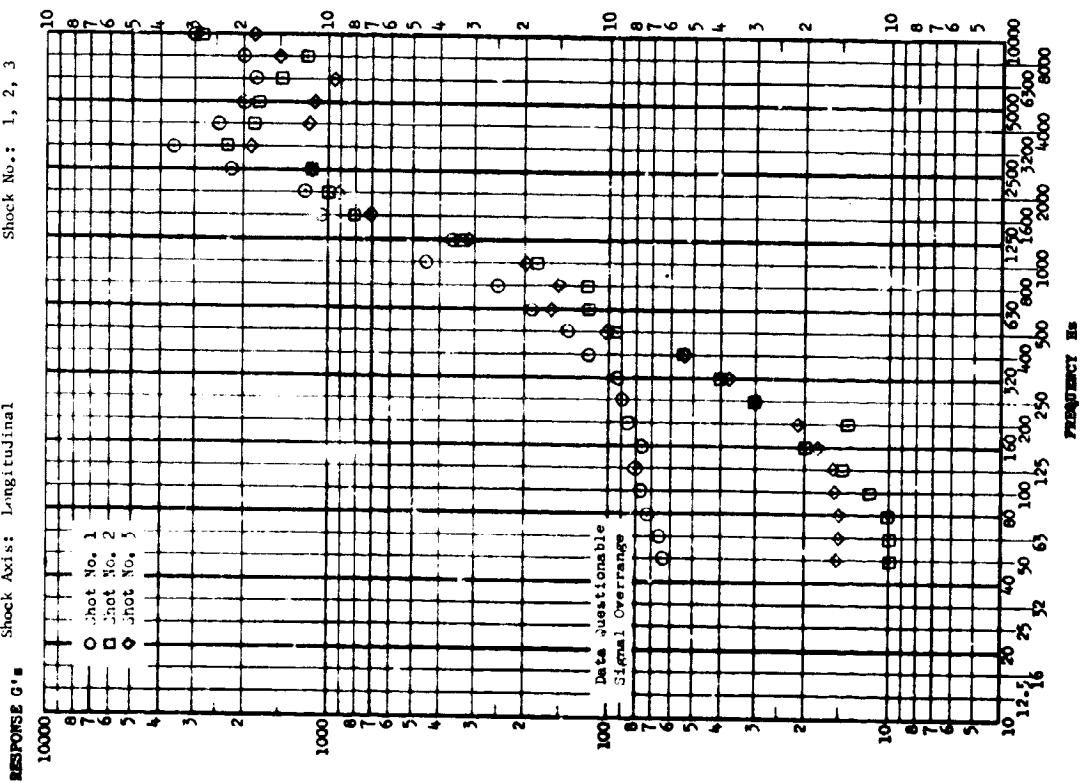


FIGURE 11.B.2-8

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Dual Nut

Accel. No.: 3A2

Test Date: Aug., 1968

Shock Axis: Radial

Shock No.: 1, 2, 3

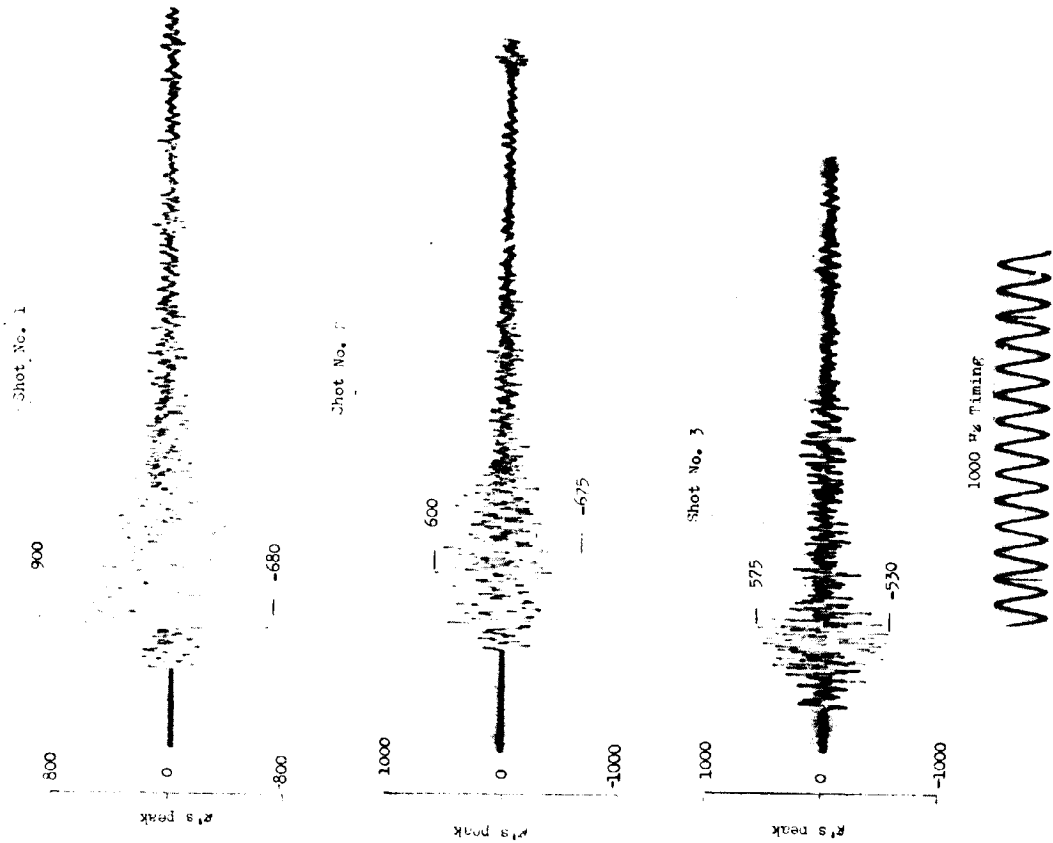
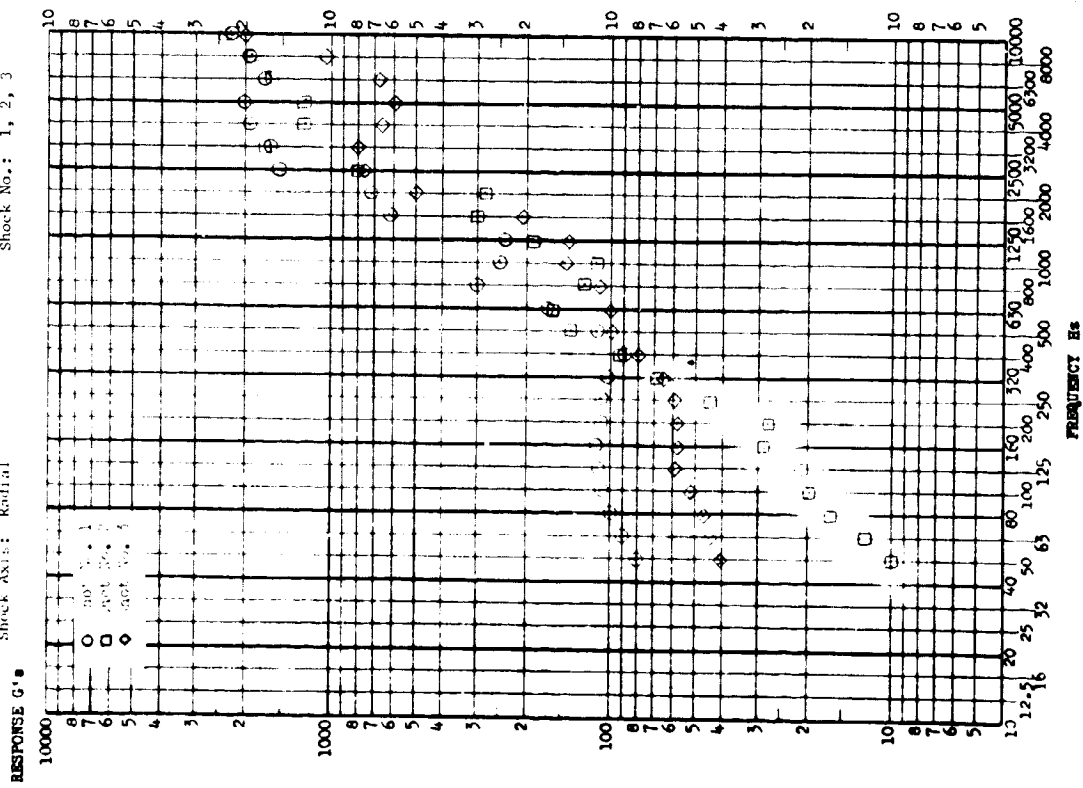


FIGURE II.B.2-9

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Dual Nut

Avi I. No.: NAJ

Test Date: Aug., 1968

Shock Axis: Tangential

Shock No.: 1, 2, 3

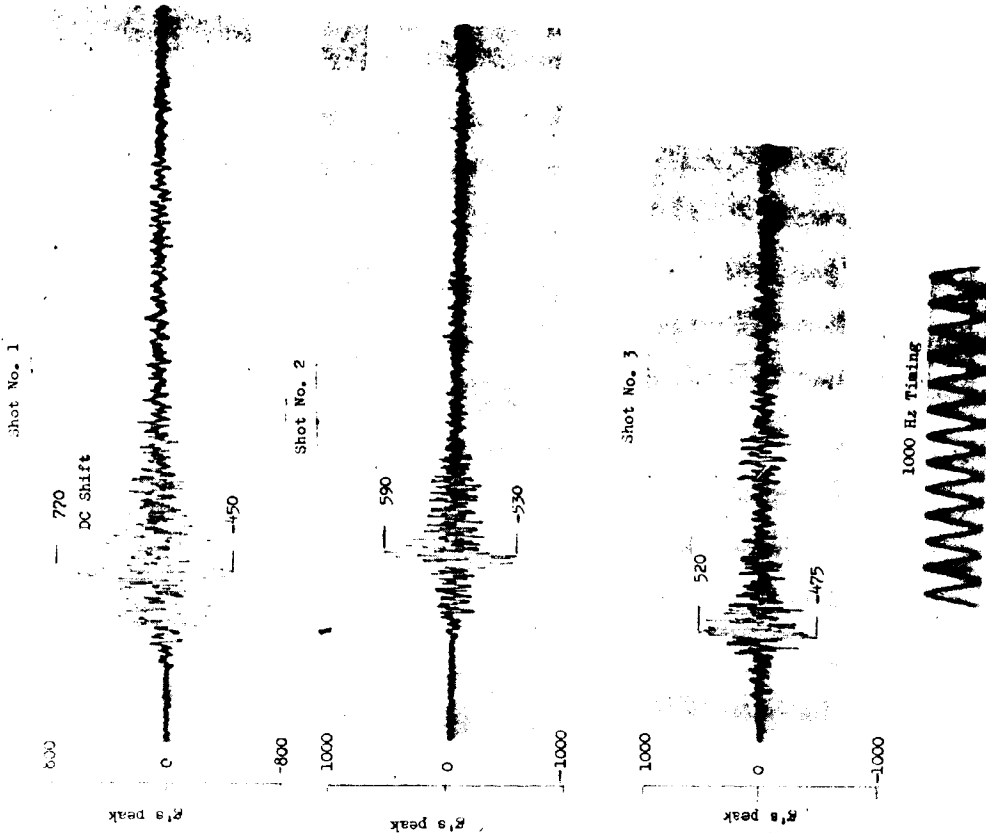
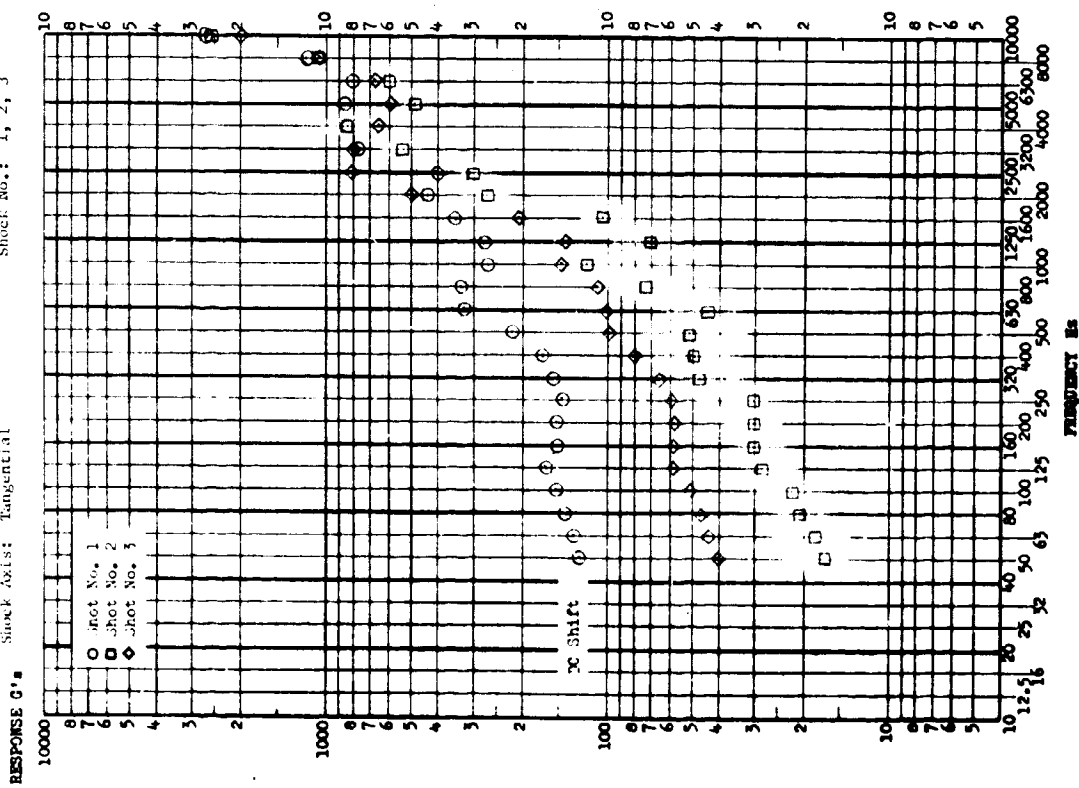


FIGURE II.R.2-10

Test Item: 1-1000 Separation Nut Tests, 3/4 Inch Dial Nut
 Accel. Dev.: DAV
 Test Date: Aug., 1968
 Shock Axis: Longitudinal
 Shock No.: 1, 2, 3

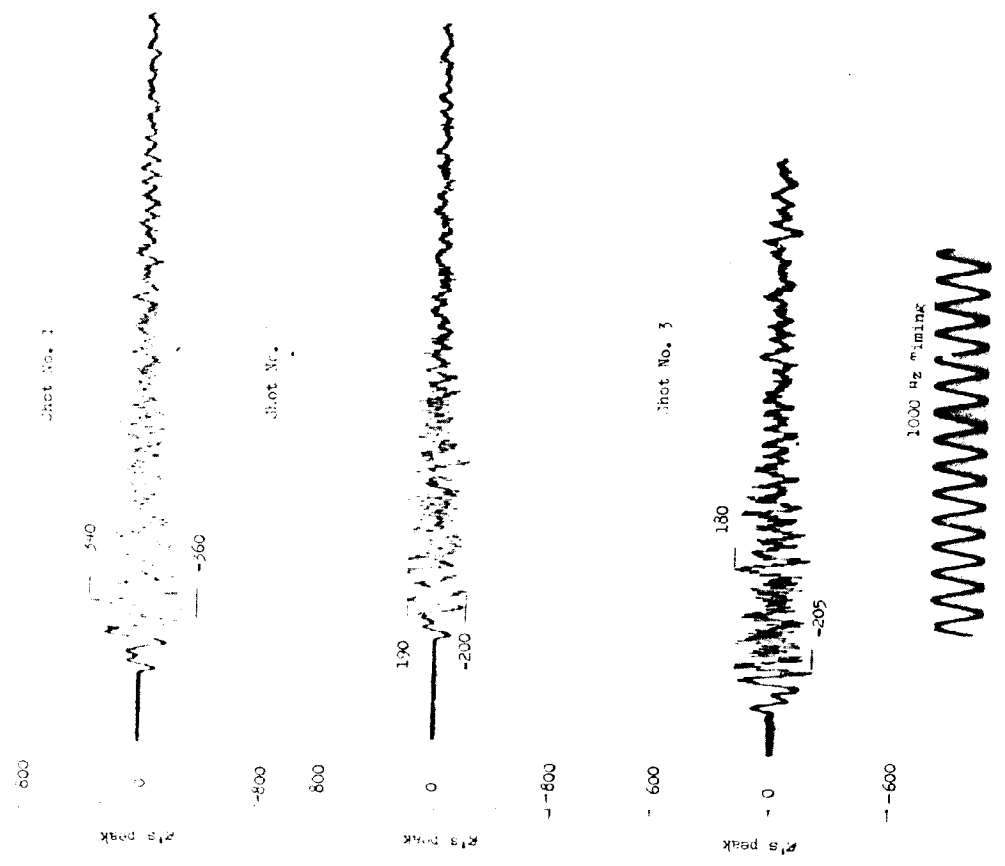
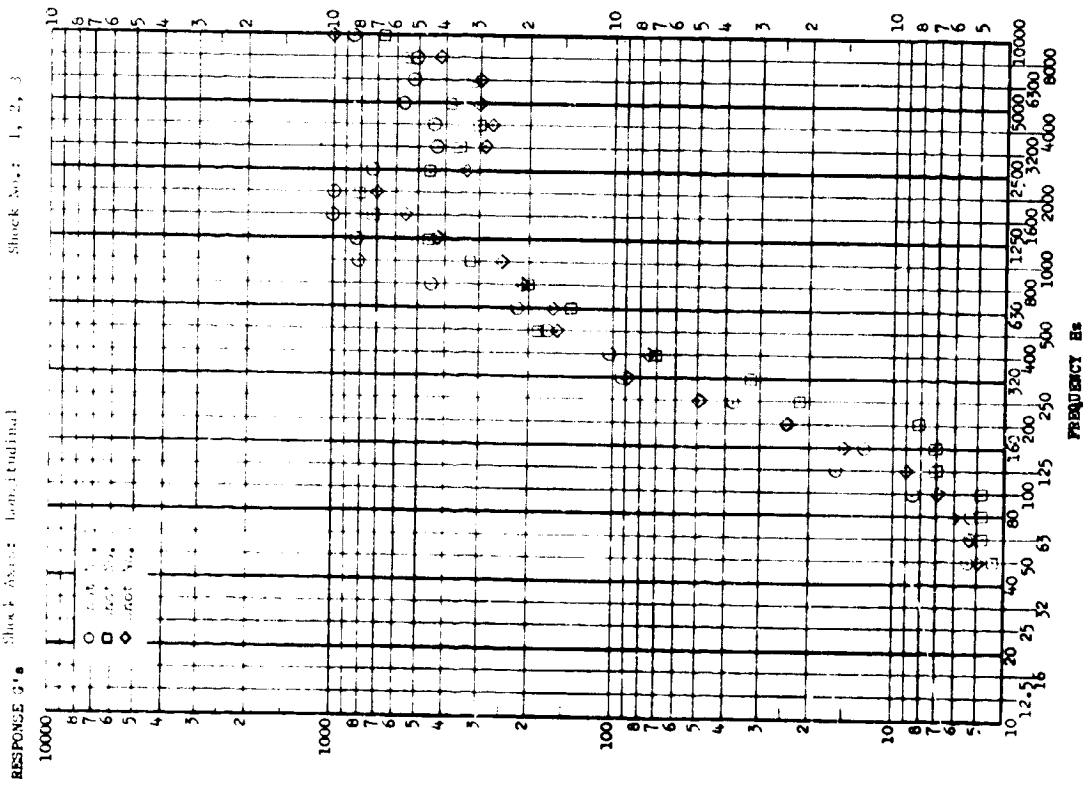


FIGURE 11.B.2-11

Test Item: Titan III-M Separation Mt. Tests, 3/4 Inch Dial Nut
 Accel. No.: 365
 Test Date: Aug., 1968
 Shock Axis: Vertical
 Shock No.: 1, 2, 3

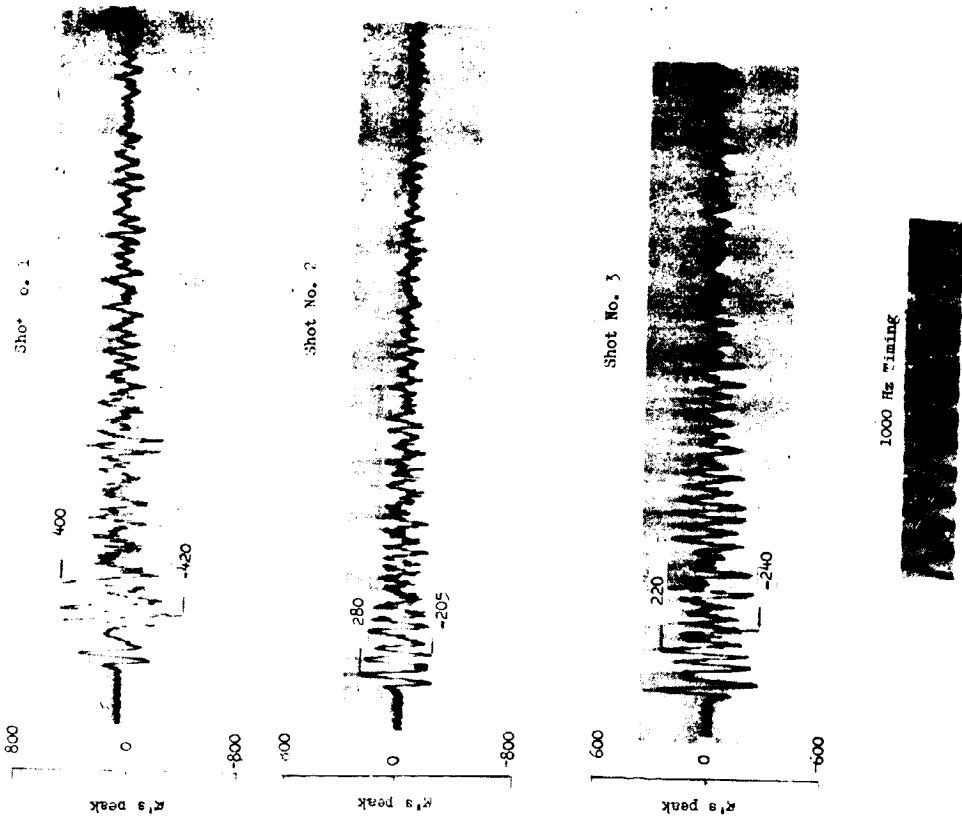
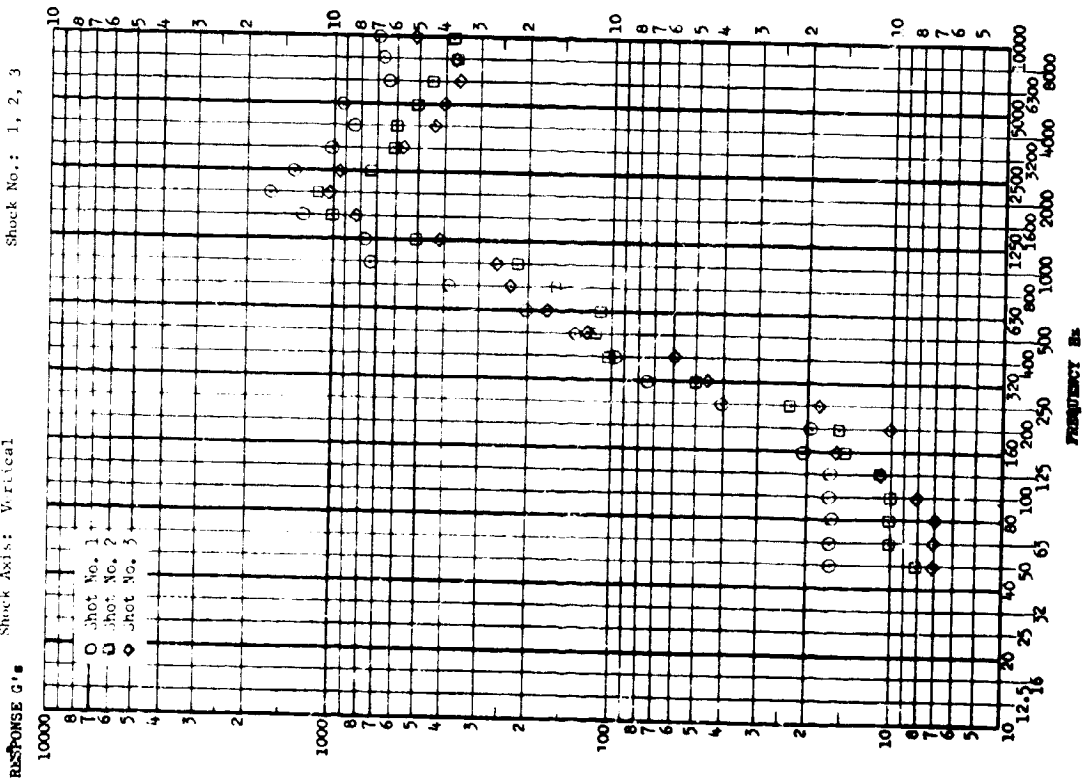


FIGURE 11.3.2-12

Test Item: Titan III-S Separation Nut Tests, 3/4 Inch Dam Nut

Acct. No.: 306

Test Date: Aug., 1968

Shock Axis: Lateral

Shock No.: 1, 2, 3

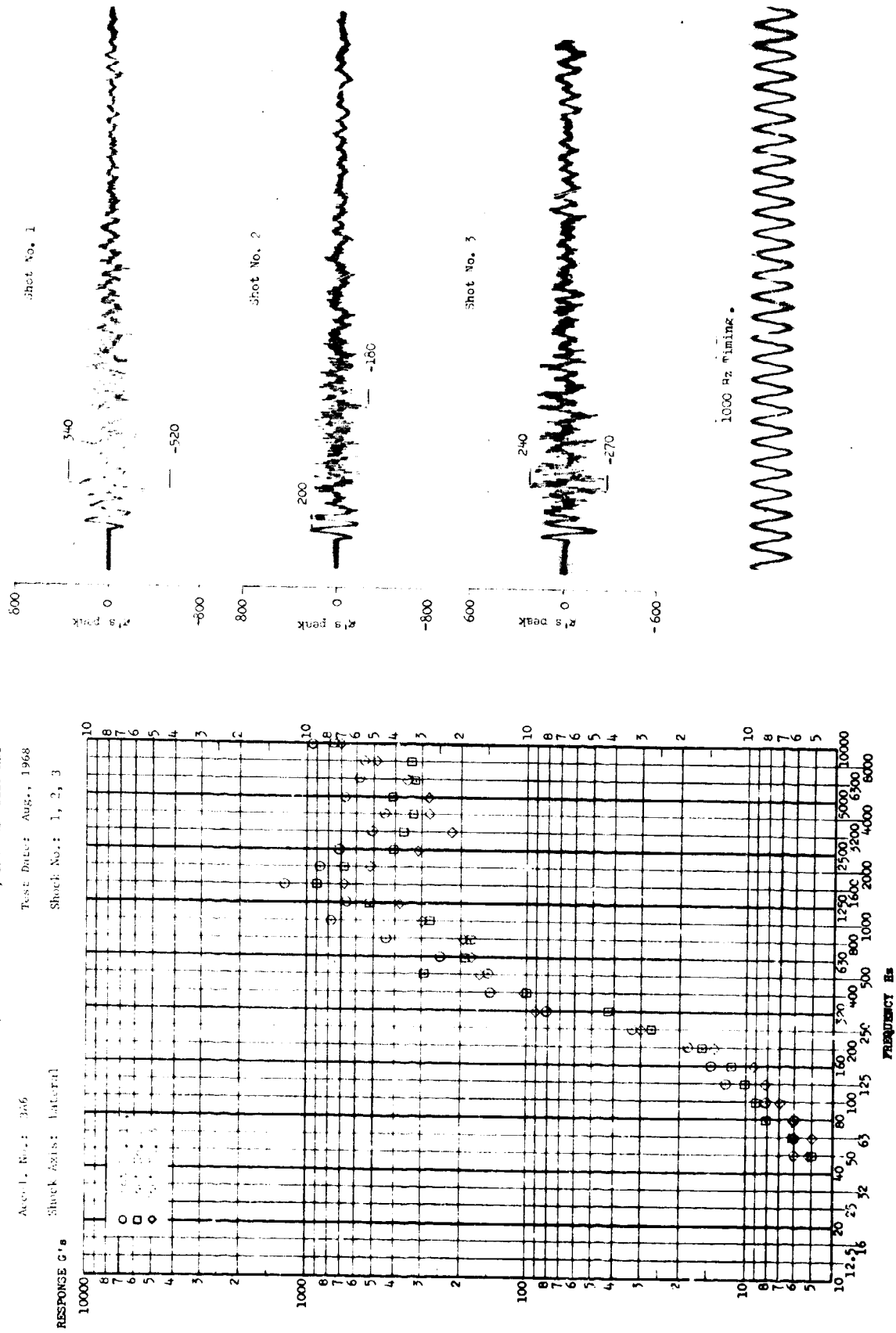


FIGURE 11.B.2-13

Test Item: Titan III-3 Separation Air Testes, 3/4 Inch Dual Mar
 Accel. Axis: XZ
 Test Date: Aug., 1968
 Shock Axis: Longitudinal
 Shock No.: 1, 2, 3

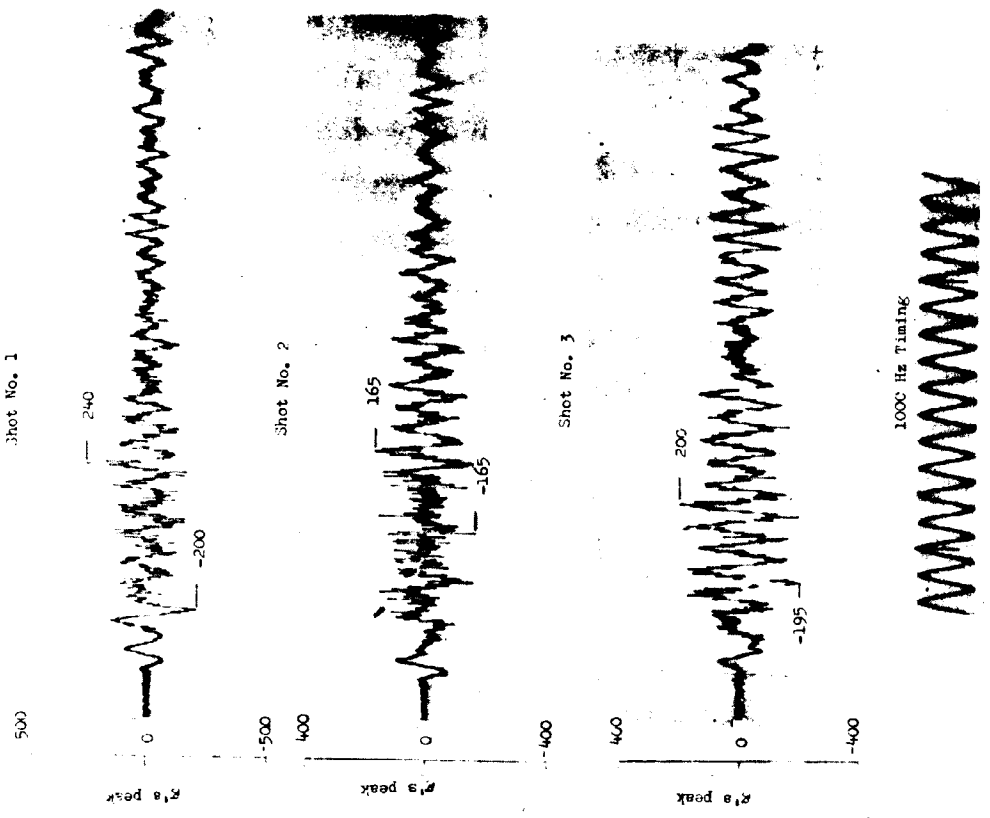
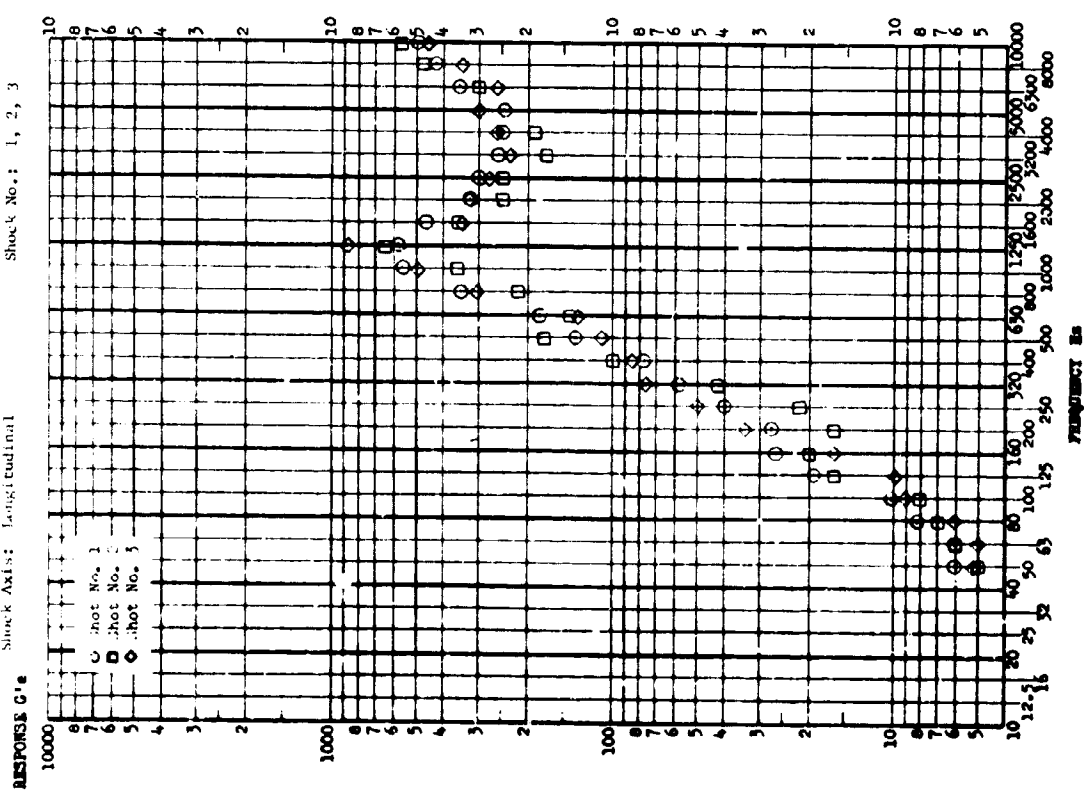


FIGURE 11.B.2-14

Test Item: Item III-M Separation Nut Tests, 3/4 inch Dual Nut
 accel. level: 10g
 Test Date: Aug., 1968
 Shock No.: 1, 2, 3

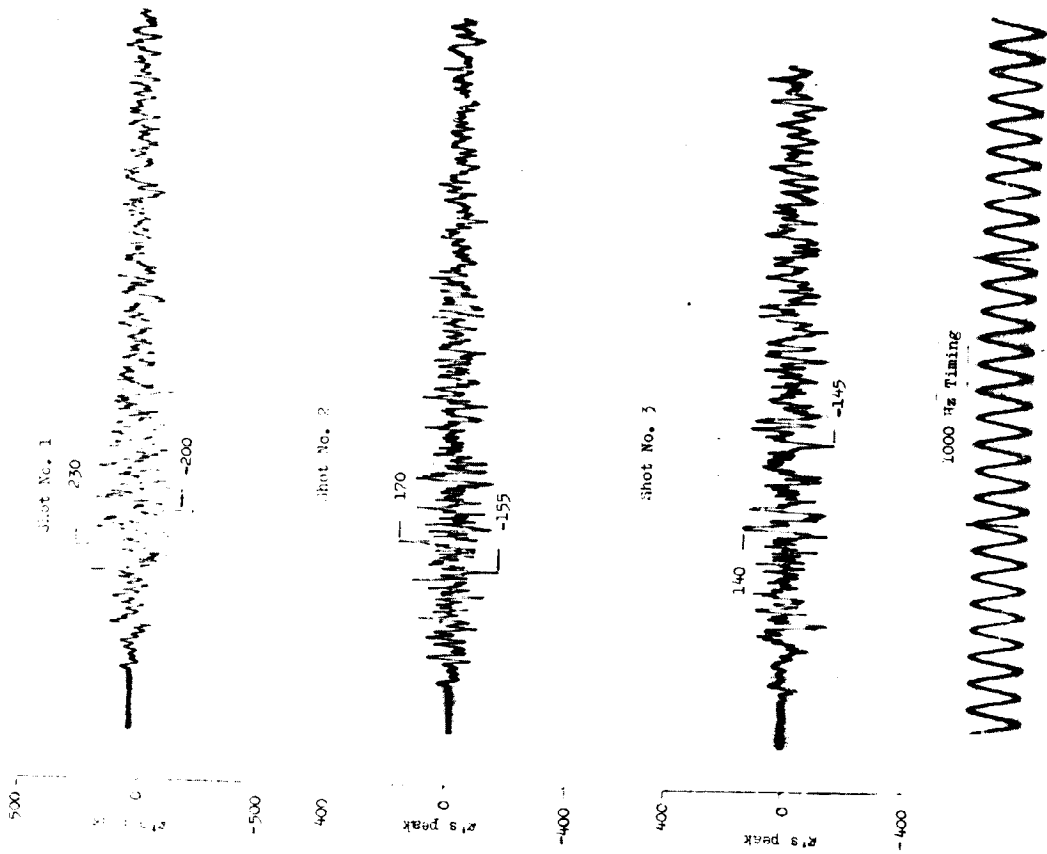
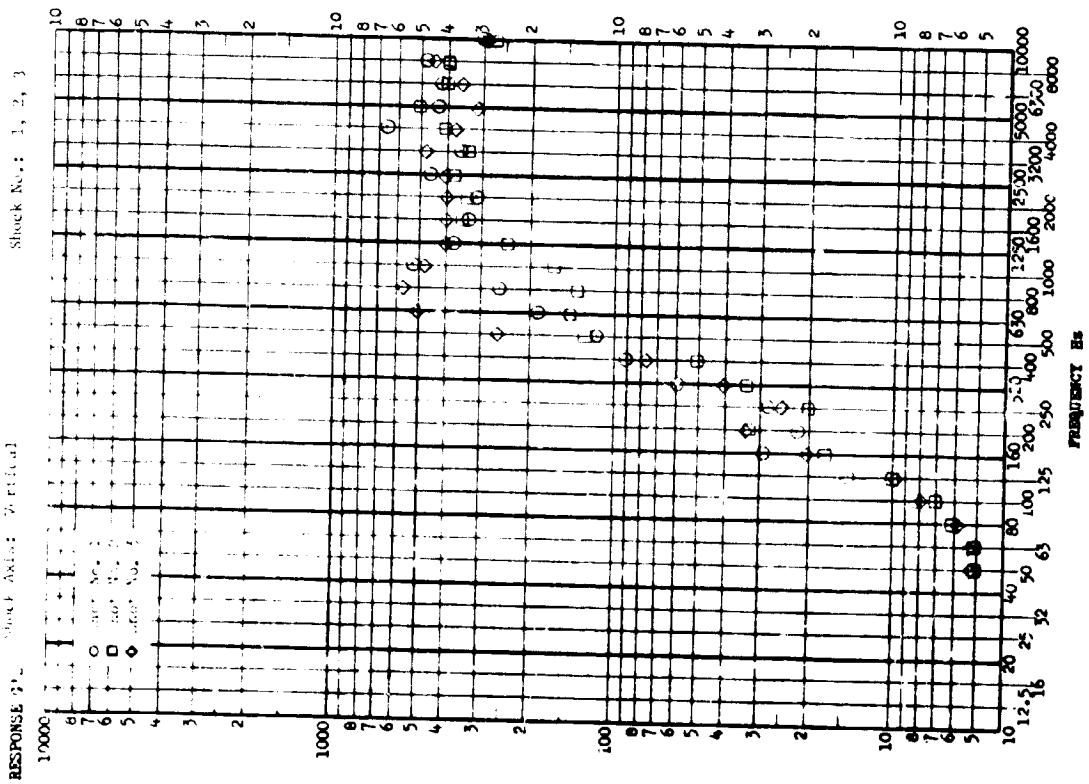


FIGURE II.B.2-15

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Dial Nut
 Acc'l. No.: 349 Test Date: Aug., 1968
 Shock axis: Lateral Shock No.: 1, 2, 3

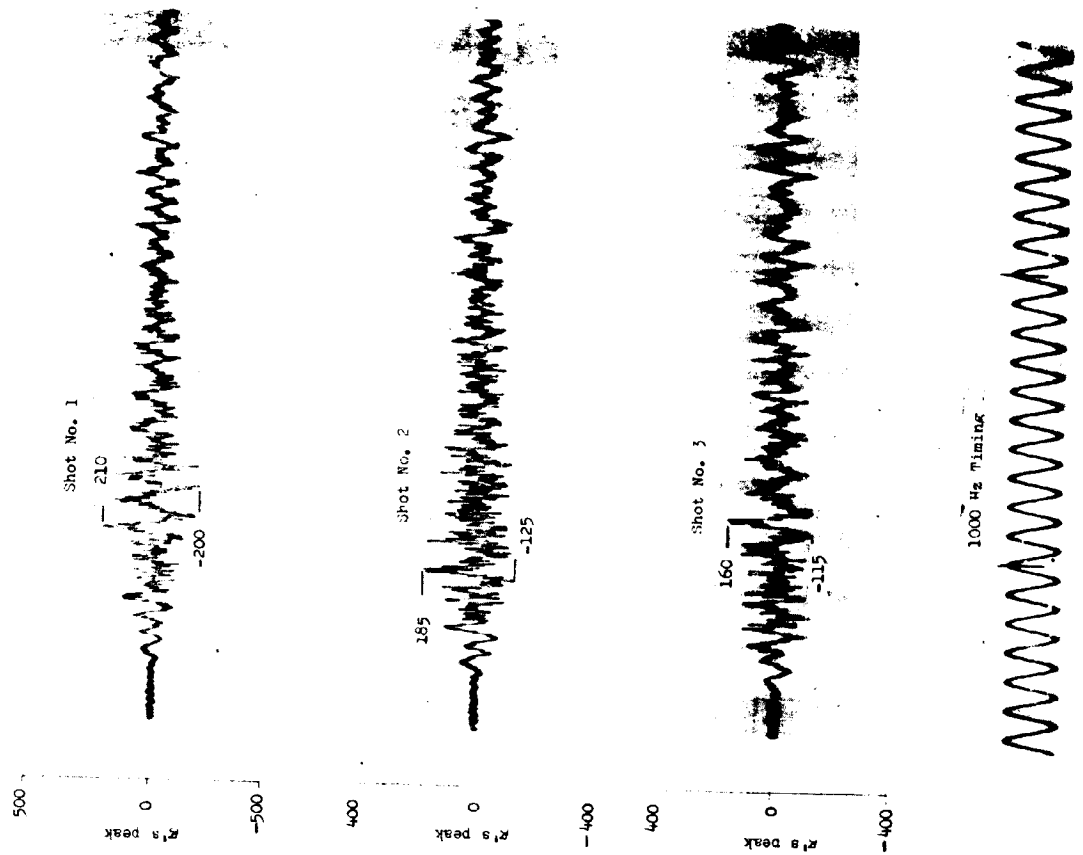
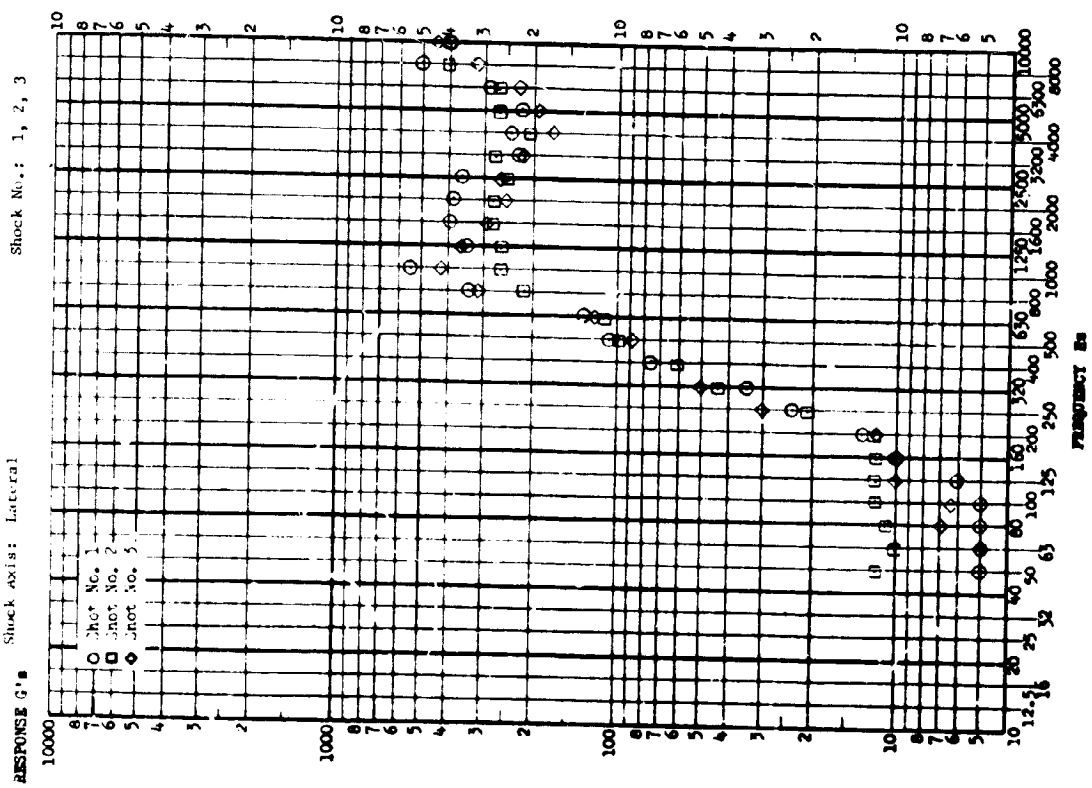


FIGURE II.8.2-16

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Dual Nut
 Accel. No.: 3A10 Test Date: Aug., 1968
 Shock Axis: Longitudinal Shock No.: 1, 2, 3

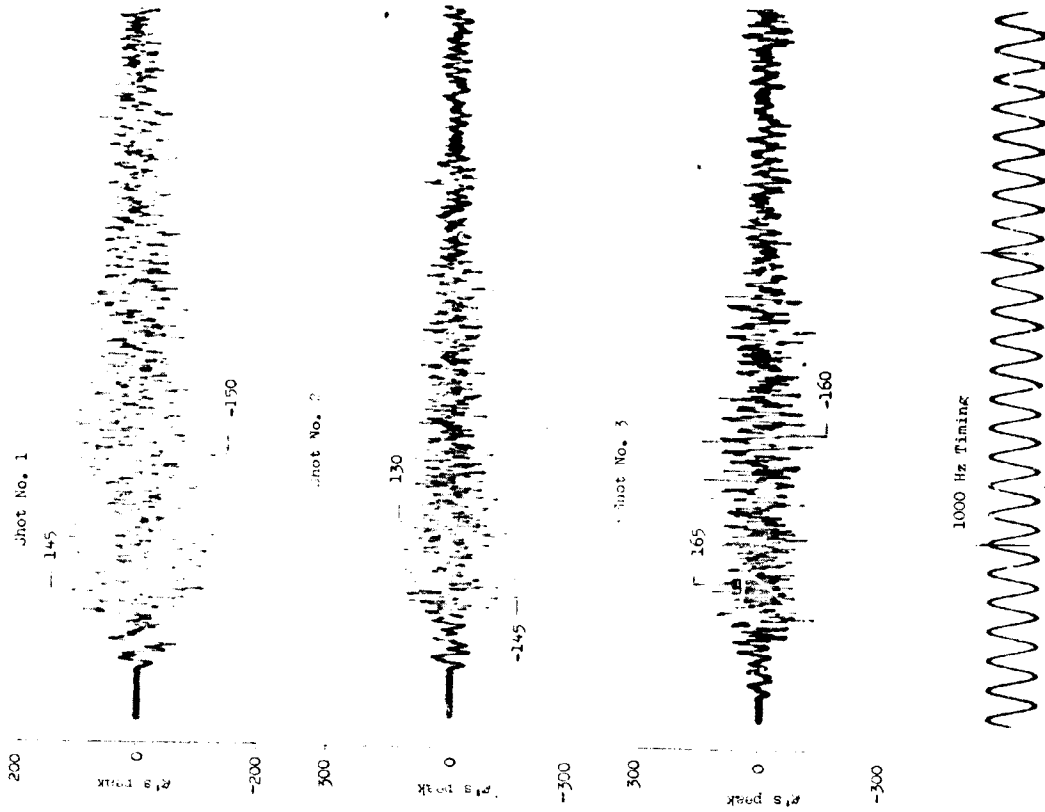
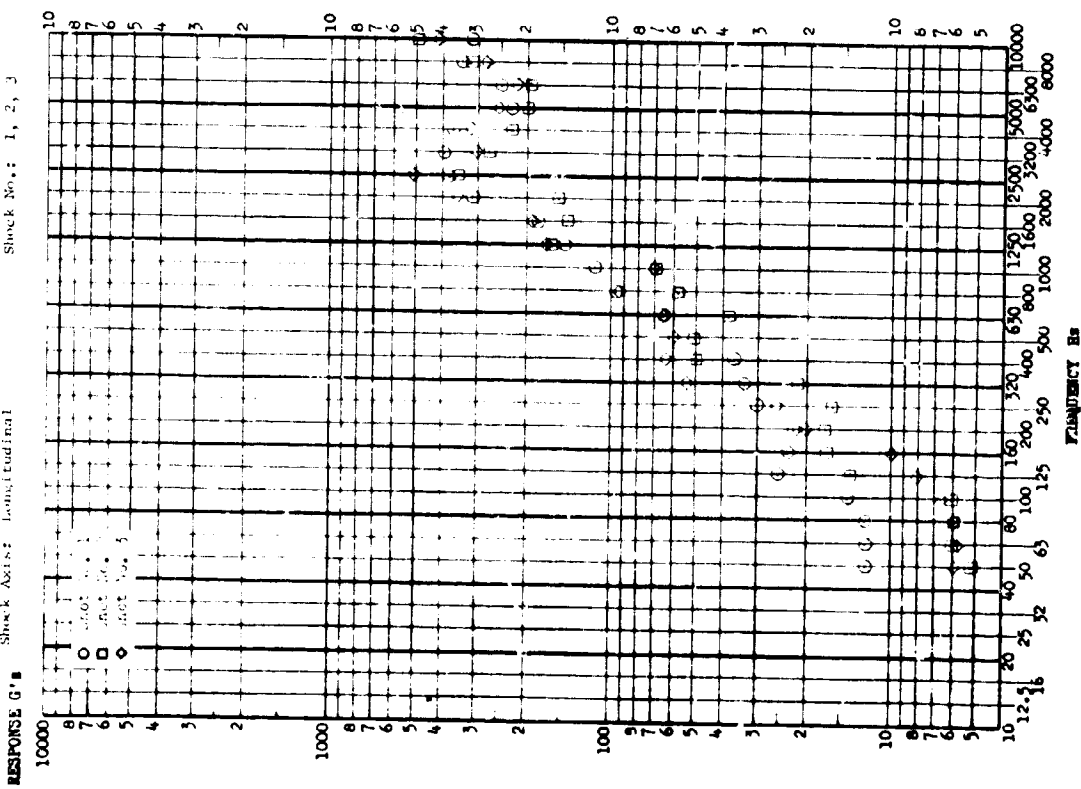


FIGURE 11.B.2-17

Test Item: Titan H-H-N Separation Nut Tests, 3/4 Inch Dual Nut
 Accl. No.: DALL
 Test Date: Aug., 1968
 Shock Axis: Vertical
 Shock No.: 1, 2, 3

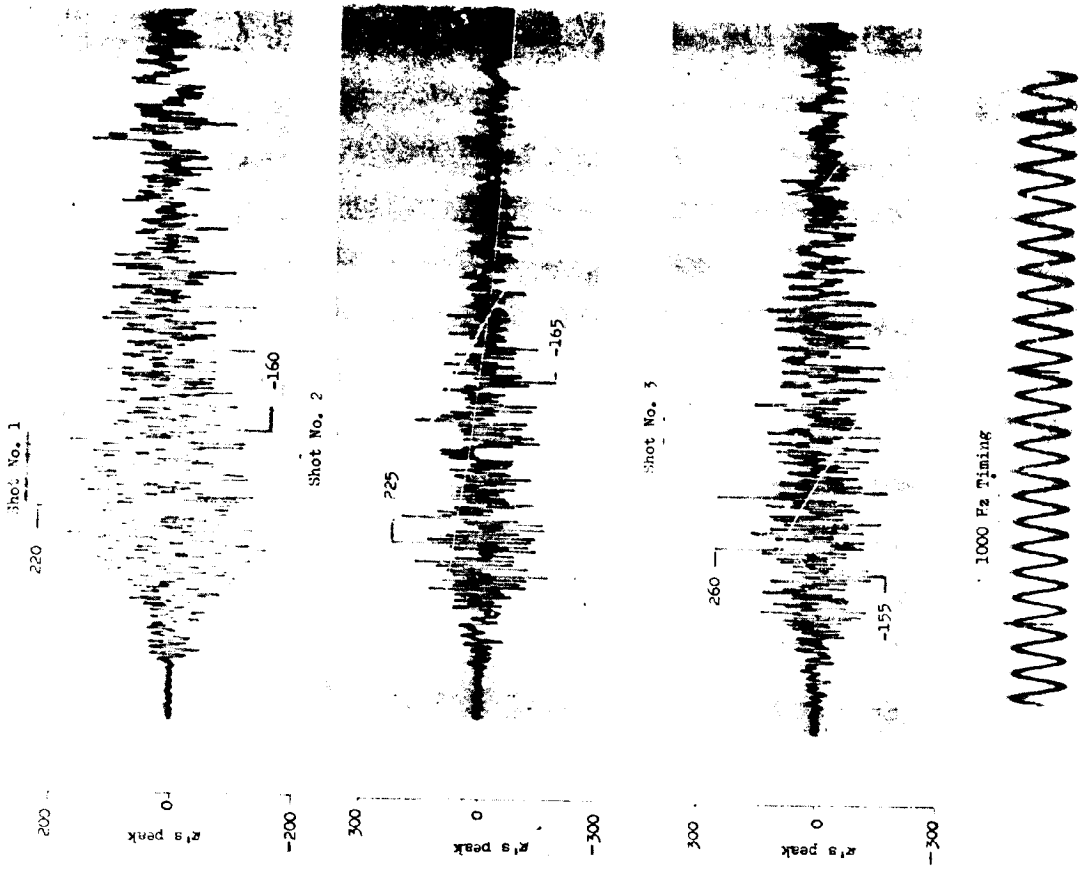
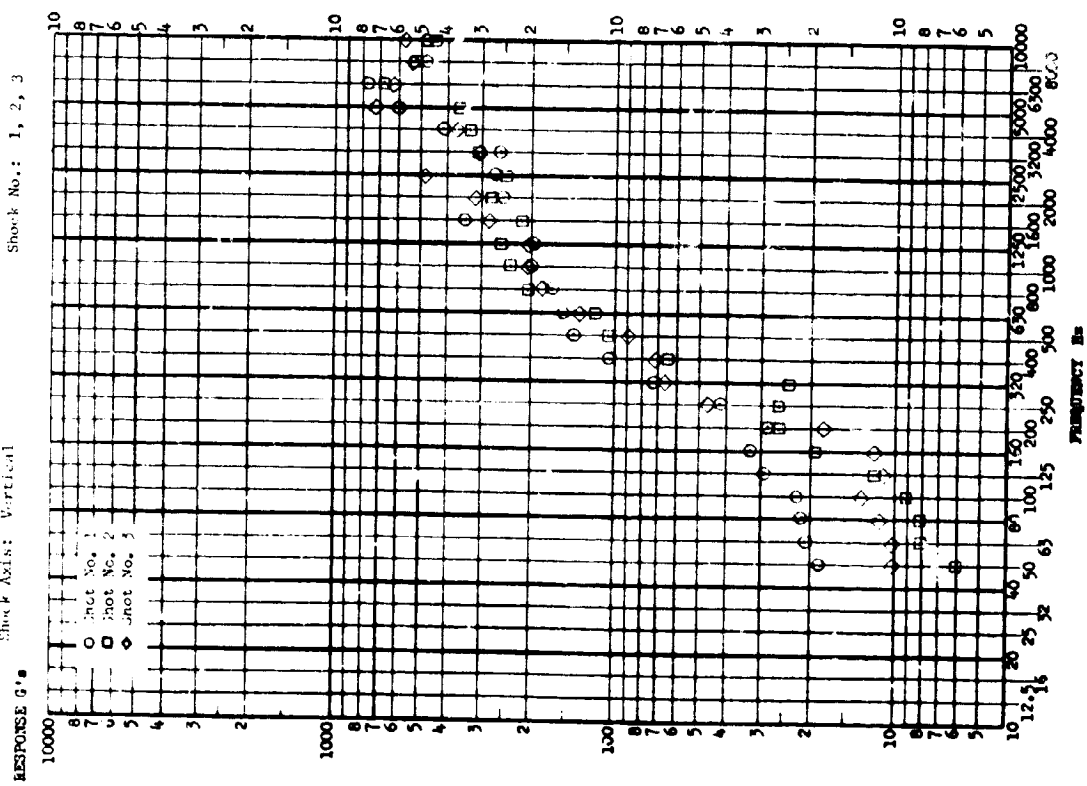


FIGURE 11.B.2-18

Test Item: Titan III-B Separation Nit Tests, 2/4 Inch Dual Nut
 A.C.T. No.: 9417
 Test Date: Aug. 1968
 Shock Axis: Lateral
 Shock No.: 1, 2, 3

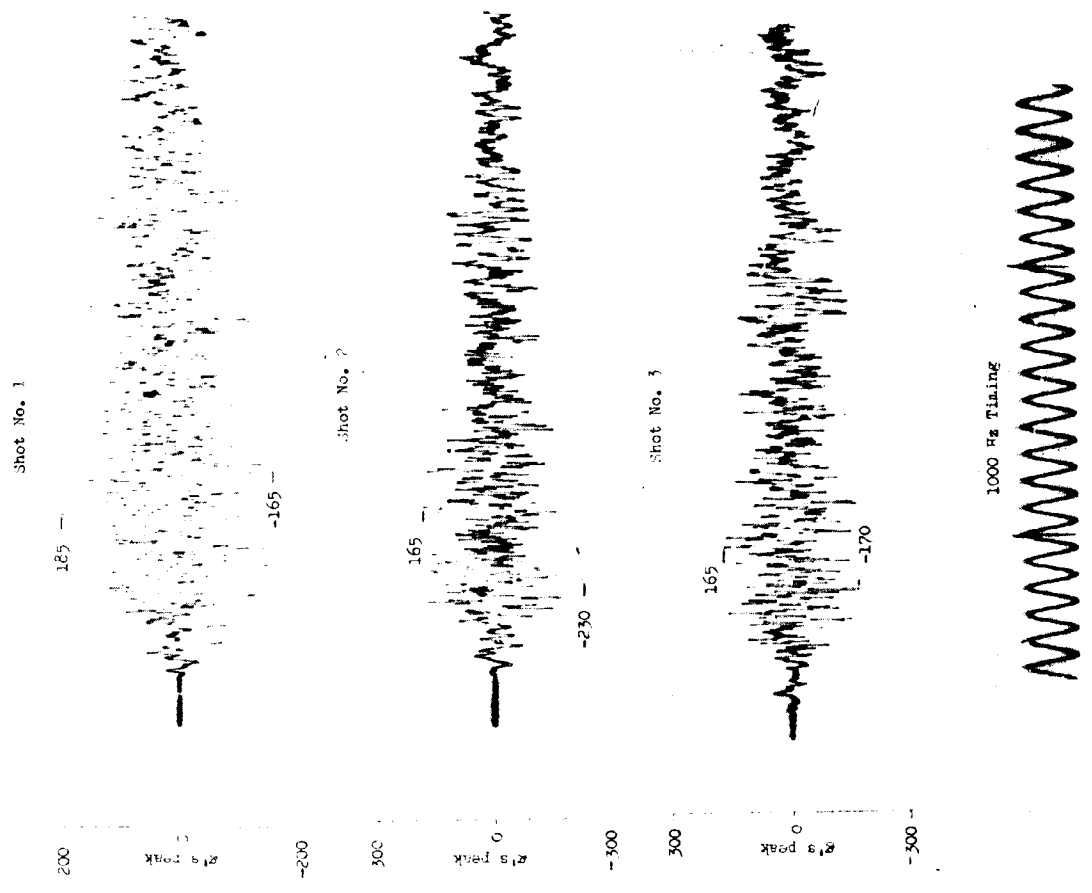
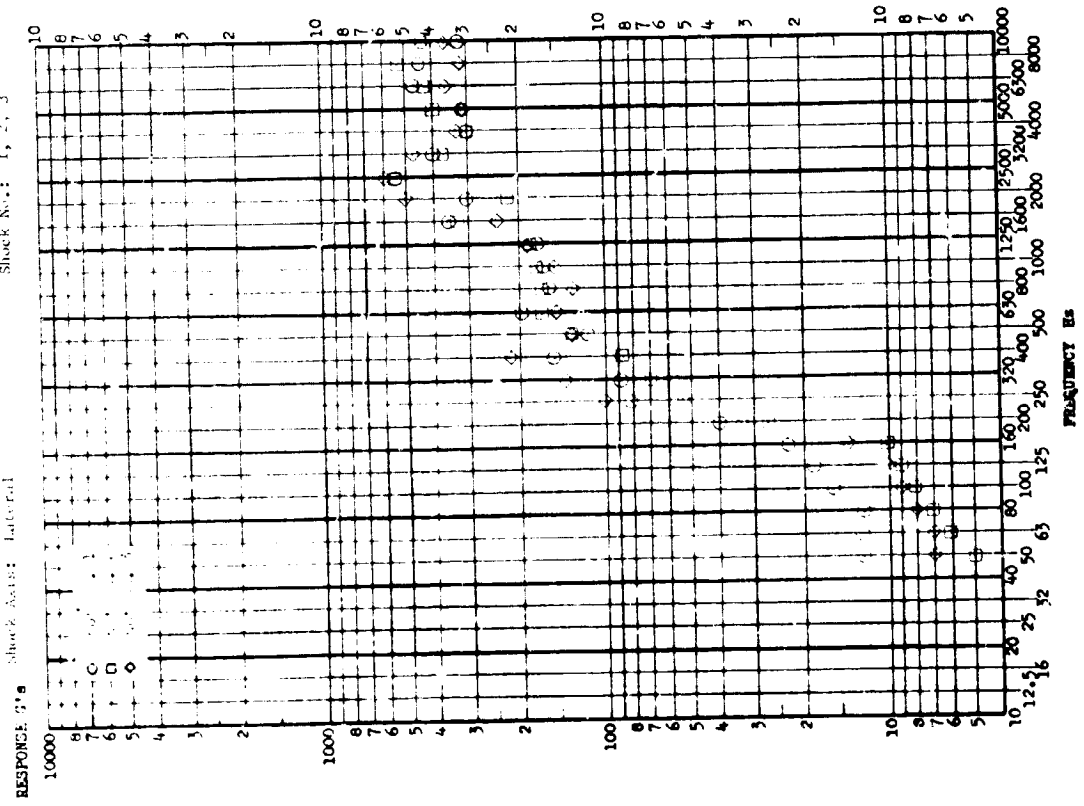


FIGURE 11.B.2-19

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Dual Nut

Accel. No.: 3A13

Test Date: Aug., 1968

Shock Axis: Longitudinal

Shock No.: 1, 2, 3

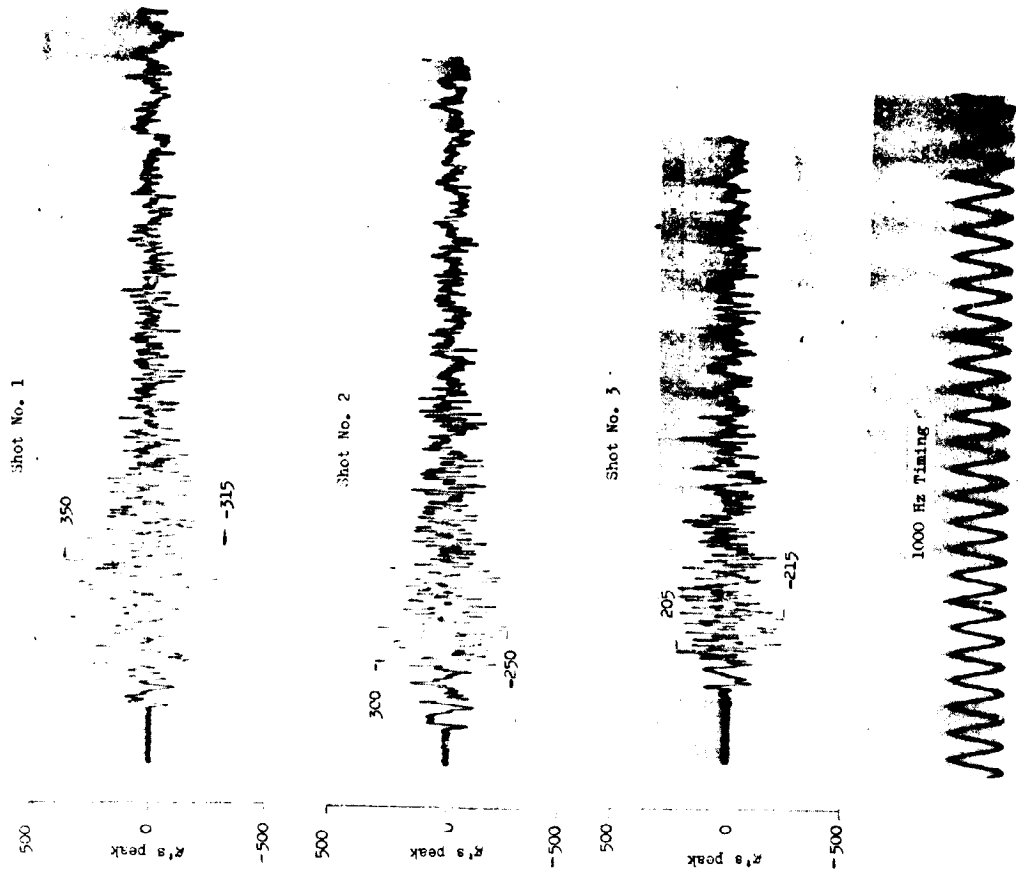
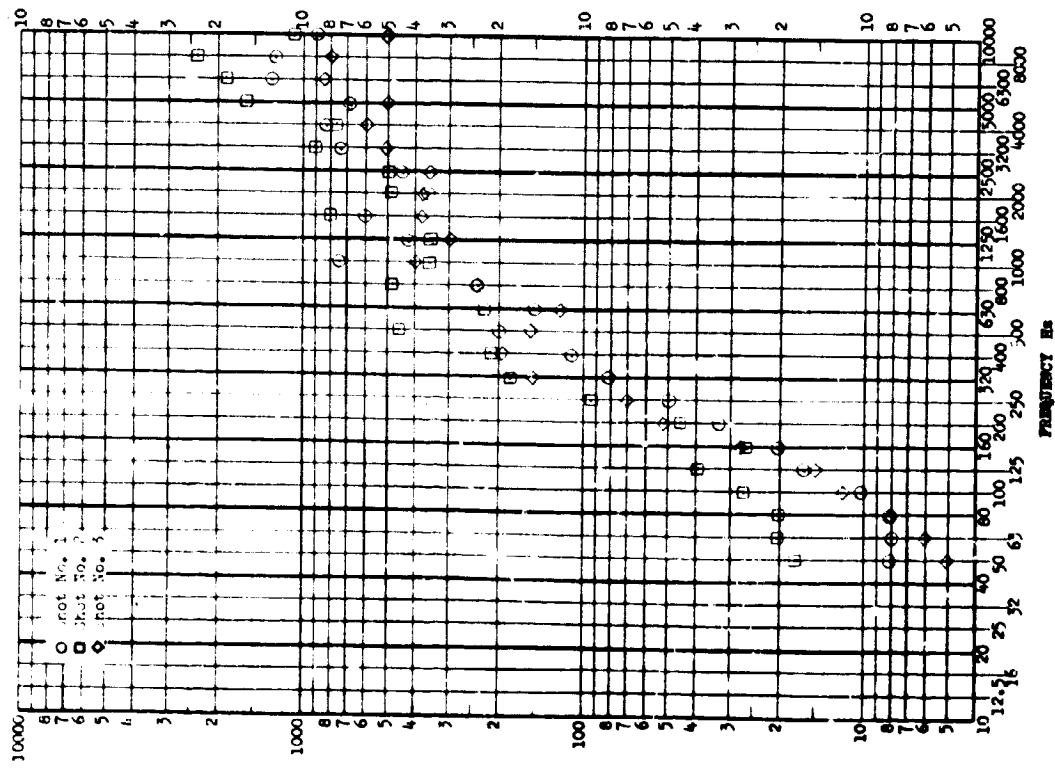


FIGURE 11.B.2-20

Test Item: Titan III-M Separation Nut Tests, 1/4 Inch Dual Nut

Accel. No.: 6A14

Test Date: Aug., 1968

Shock Axis: Vertical

Shock No.: 1, 2, 3

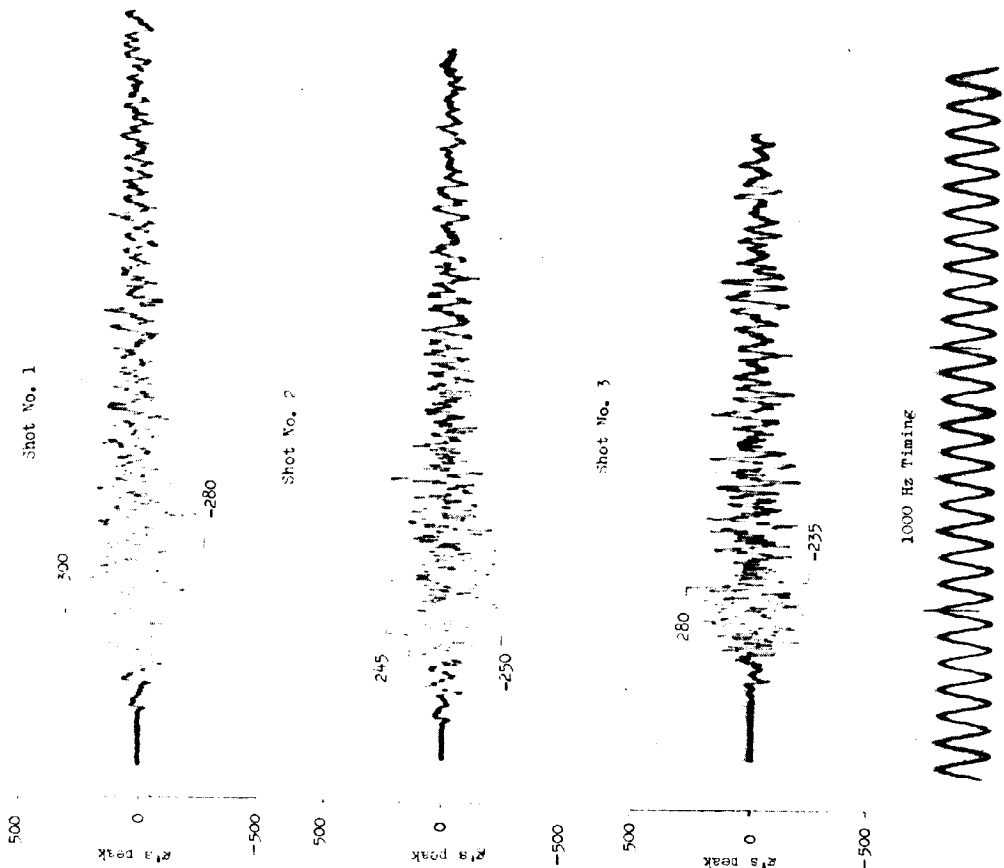
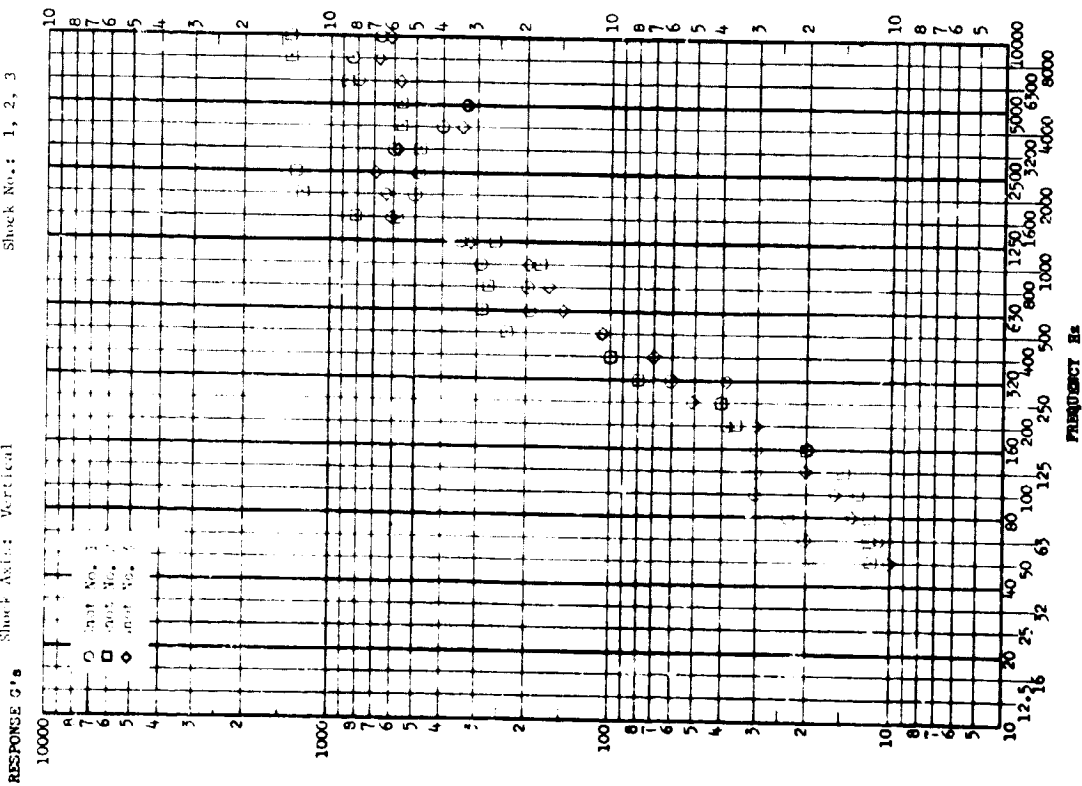


FIGURE 11.B.2-21

Test Item: Titan (I)M Separation Nut Tests, 3/4 Inch Dual Nut

Accel. No.: 3A15

Test Date: Aug., 1968

Shock No.: 1, 2, 3

Shock Axis: Lateral

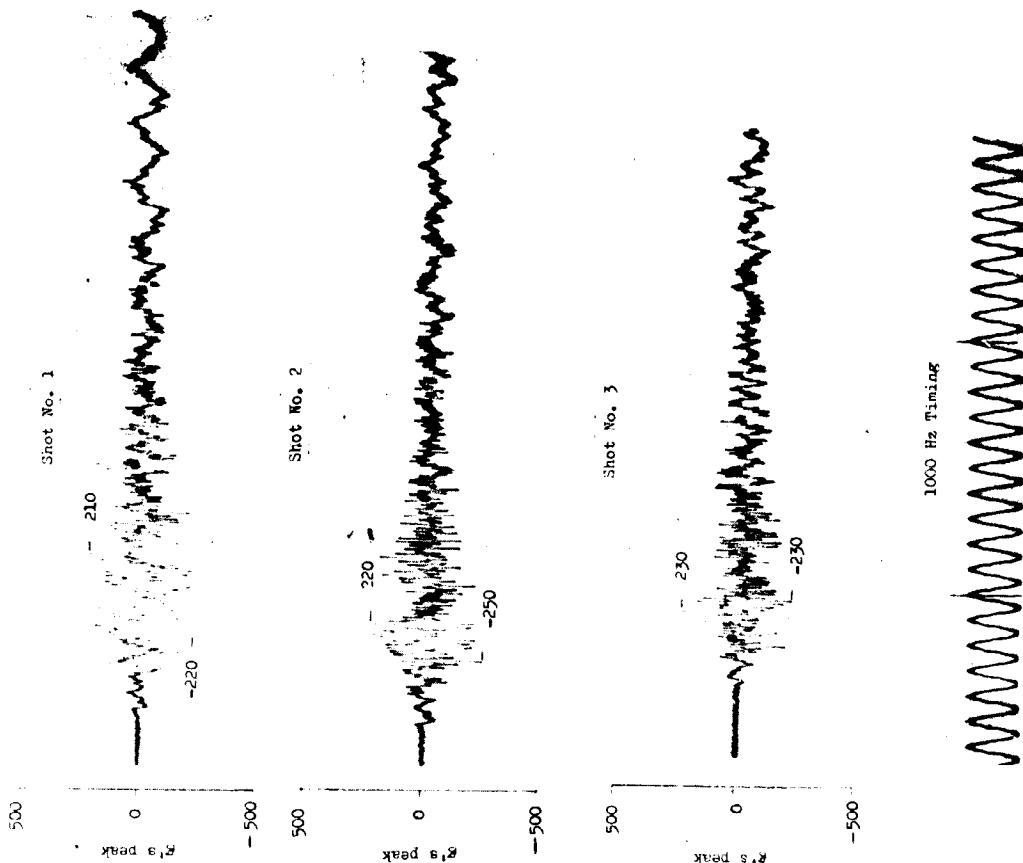
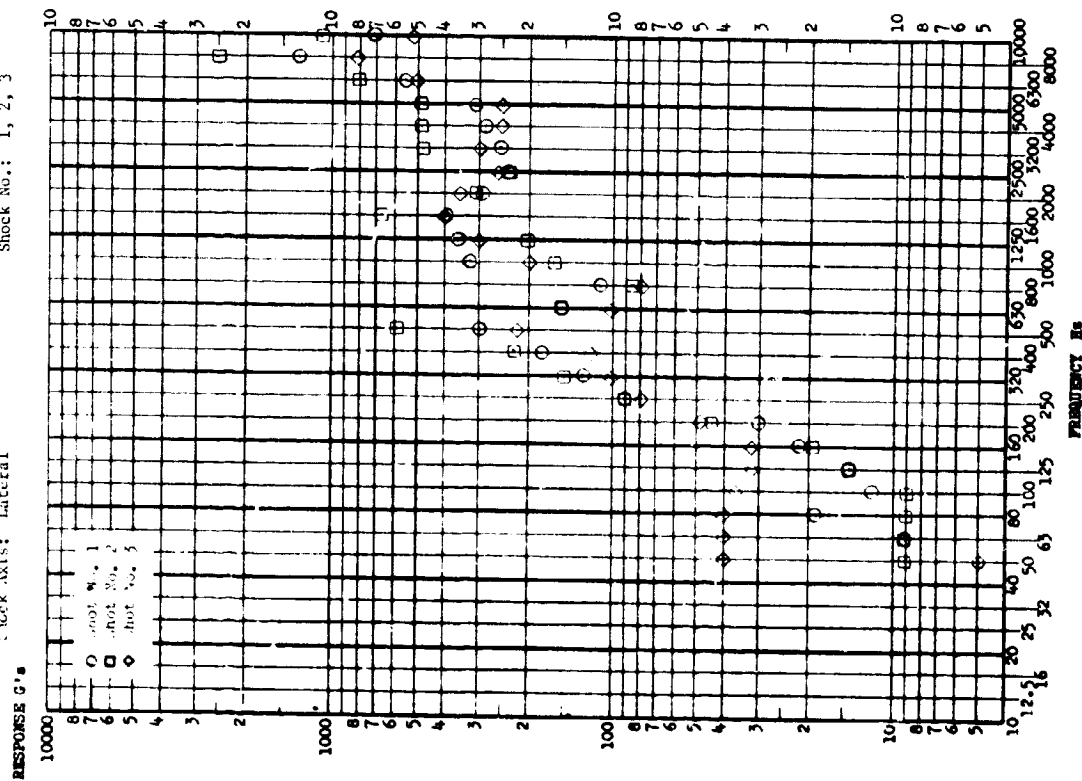


FIGURE 11.8.2-22

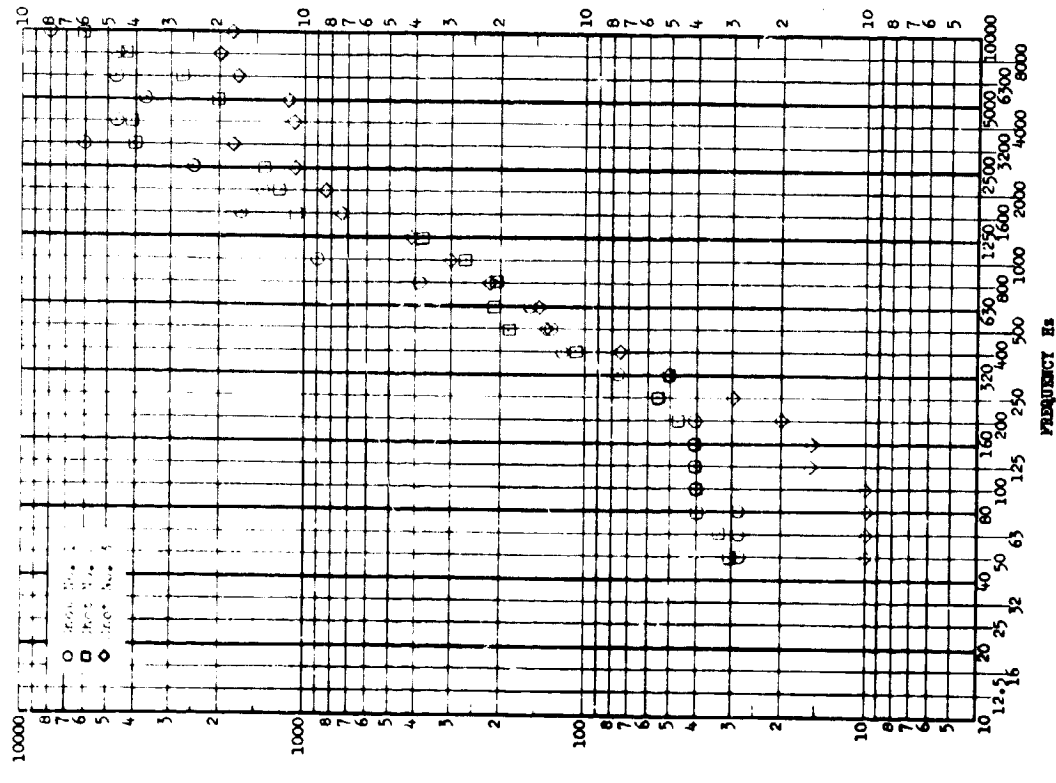
Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Dual Nut

Accel. No.: 5A16

Test Date: Aug., 1968

Shock Axis: Longitudinal

Shock No.: 1, 2, 3



Shot No. 1

-1500

1200

R's peak

-1200

Shot No. 2

-1370

1650

R's peak

-1150

2000

Shot No. 3

3000

R's peak

600

-850

-3000

1000 Hz Timing



FIGURE 11.B.2-23

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Dual Nut

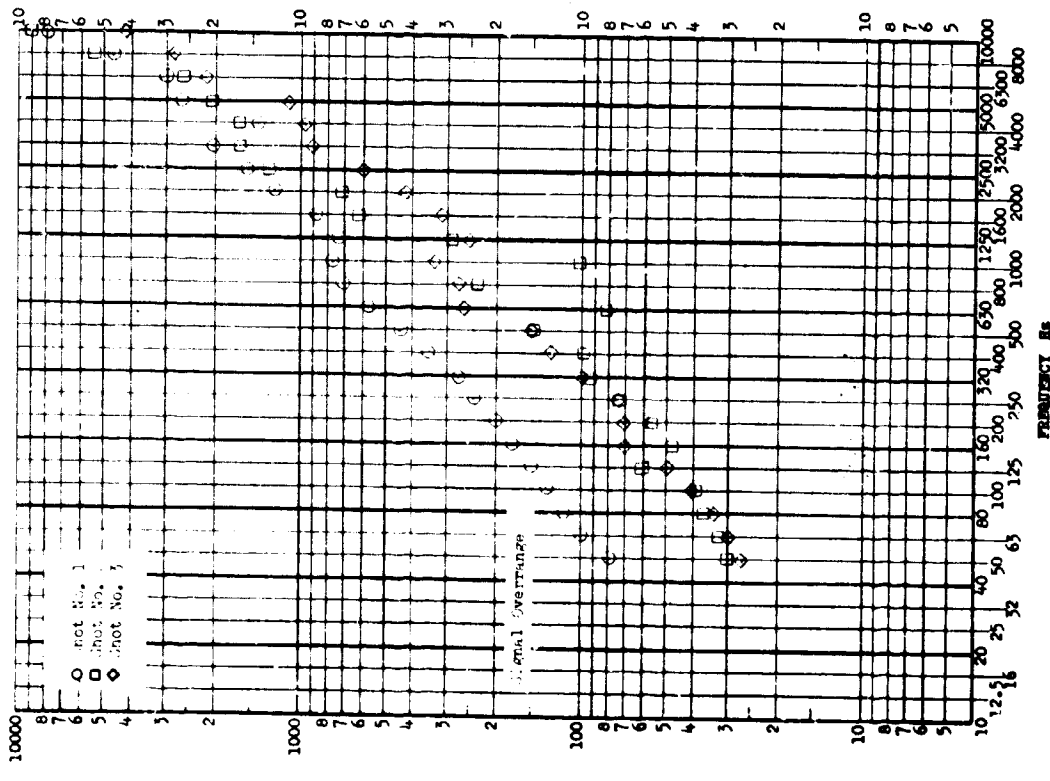
Accel. No.: 5A17

Test Date: Aug., 1968

Shock Axis: Radial

Shock No.: 1, 2, 3

RESPONSE G's



1200

1325

Shot No. 1

R's Peak

Signal Overrange

-1475

Shot No. 2

1050

R's Peak

-1500

Shot No. 3

1400

-950

R's Peak

-3000

1000 Hz Timing



FIGURE II.B.2-24

FREQUENCY Hz

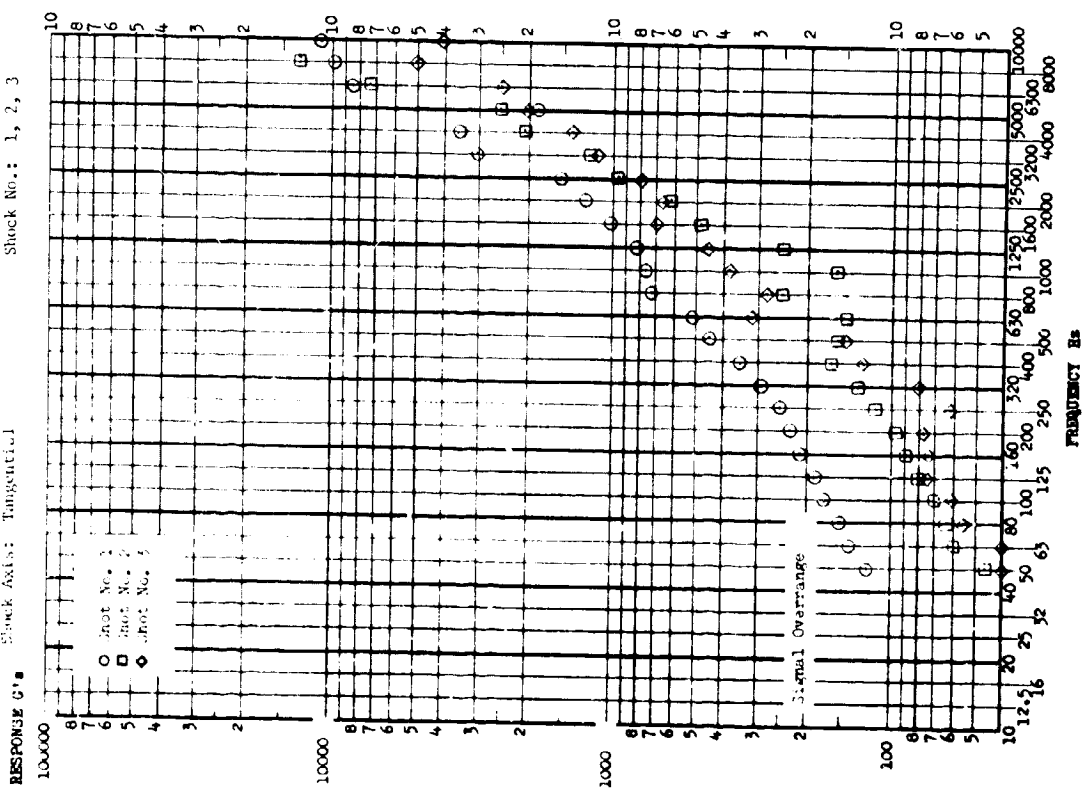
Test Item: Item III-M Separation Nut Tests, 3/4 Inch Dual Nut

Accel. No.: 3A18

Test Date: Aug., 1968

Shock Axis: Tangential

Shock No.: 1, 2, 3



1670

Shot No. 1

1200

R's Peak

Signal Overrange

-1200

-1850

Shot No. 2

1700

R's Peak

-1750

3000

Shot No. 3

1200

R's Peak

-1700

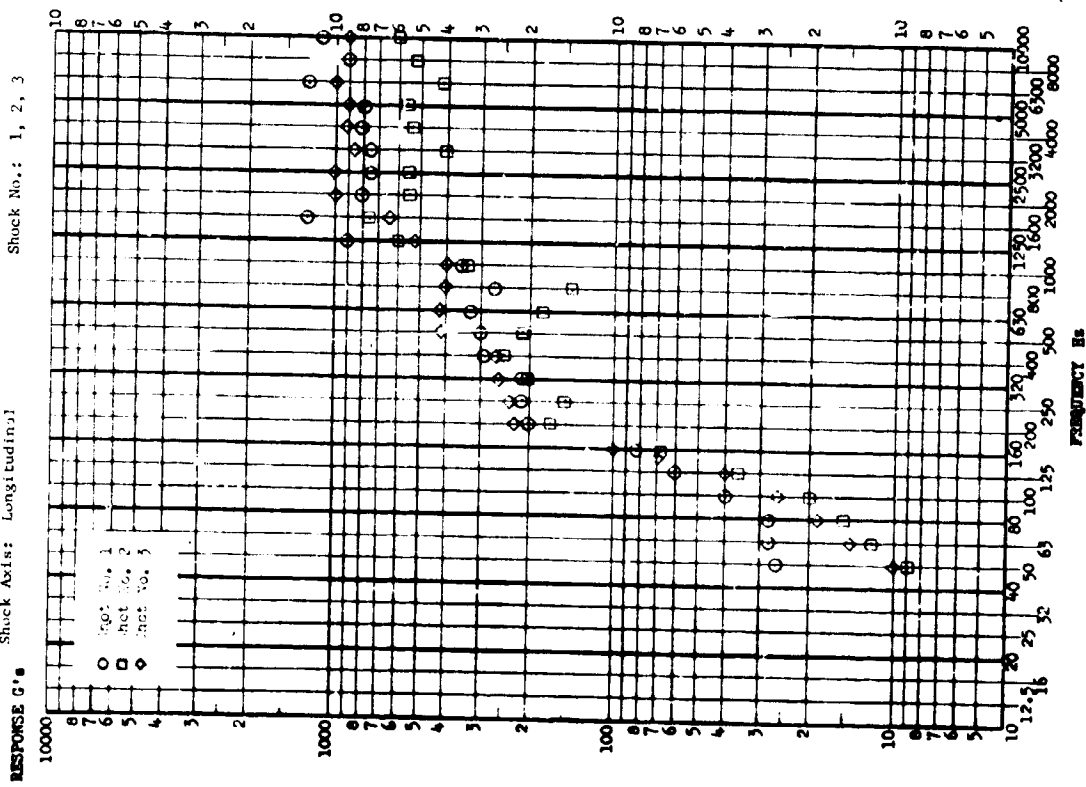
-3000

1000 Hz Timing



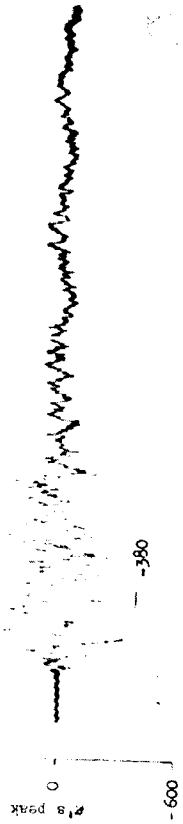
FIGURE II. B.2-25

Test Item: Titan III-M Separation Mt Tests, 3/4 Inch Dwal Nut
 Accel. No.: 2A19
 Test Date: Aug., 1968
 Shock Axis: Longitudinal
 Shock No.: 1, 2, 3



Shot No. 1

500
0
-600



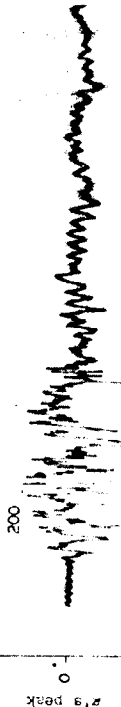
Shot No. 2

600
0
-600



Shot No. 3

500
0
-500



1000 Hz Timing



FIGURE 11.8.2-26

Test Item: 1100 III-3 Separation Nut Tests, 3/4 Inch Dual Nut
 Accel. No.: 5A70
 Test Date: Aug., 1968
 Shock No.: 1, 2, 3

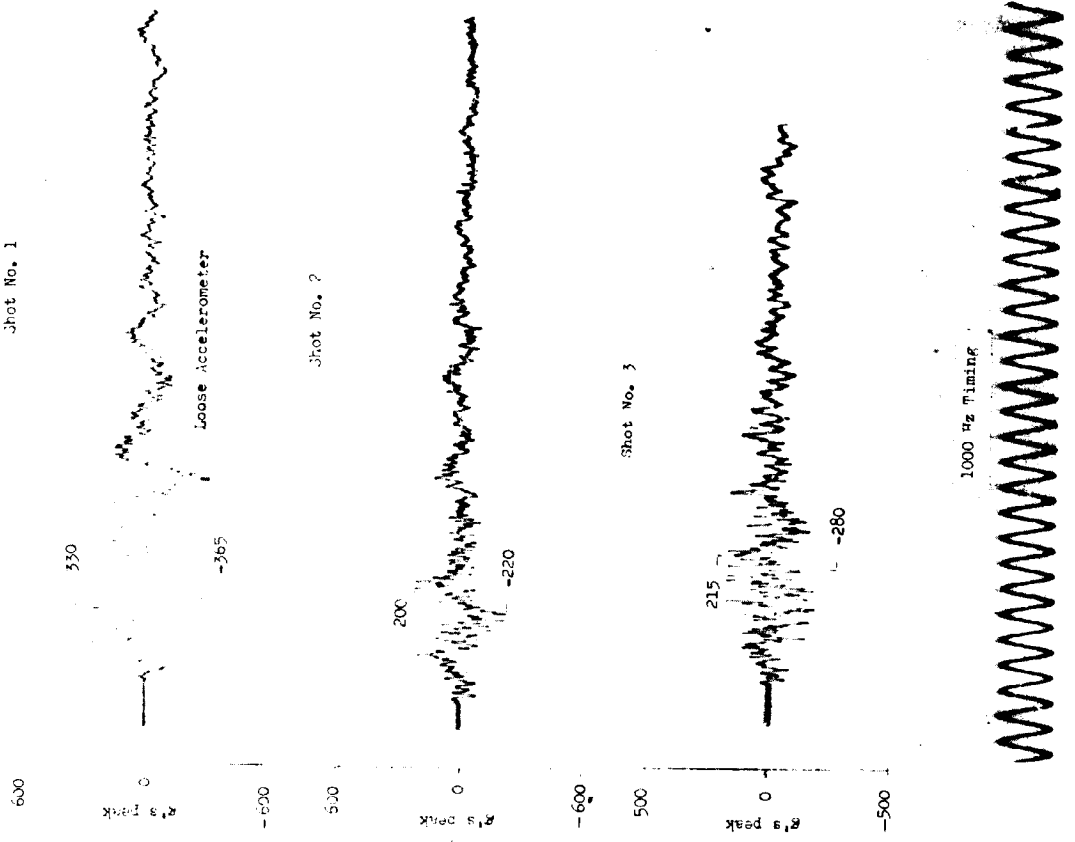
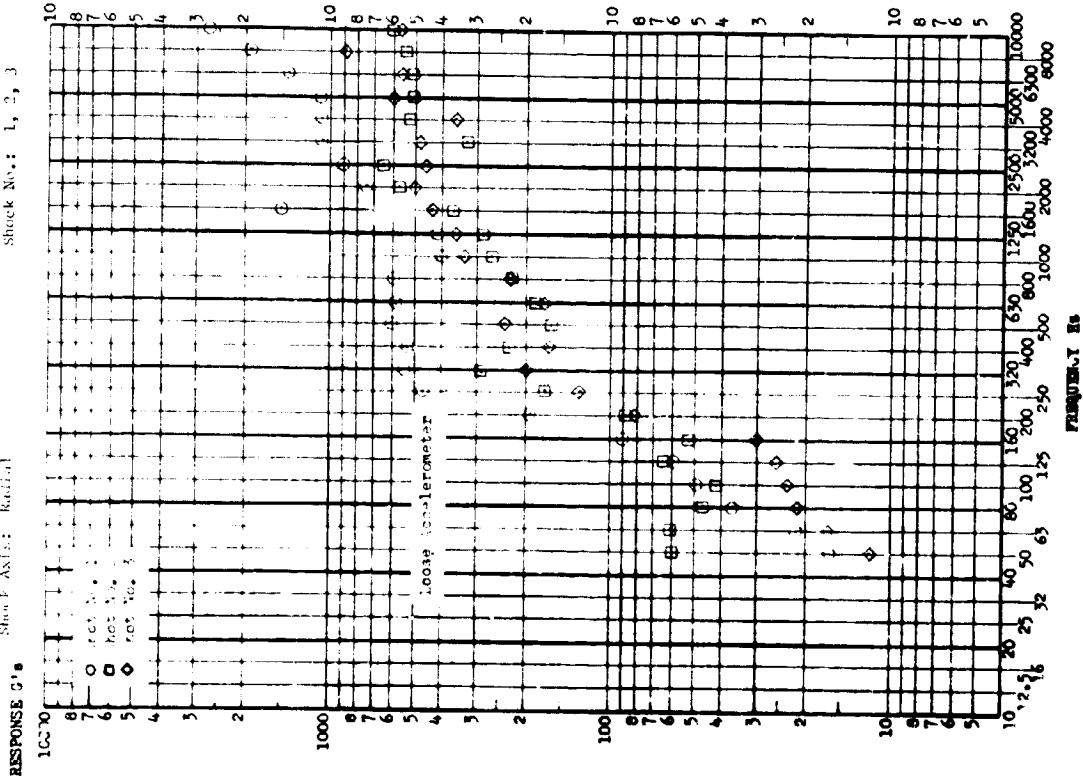


FIGURE II.8.2-27

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Dual Nut
 Accel. No.: 3A.1
 Test Date: Aug., 1968
 Shock Axis: Tangential
 Shock No.: 1, 2, 3

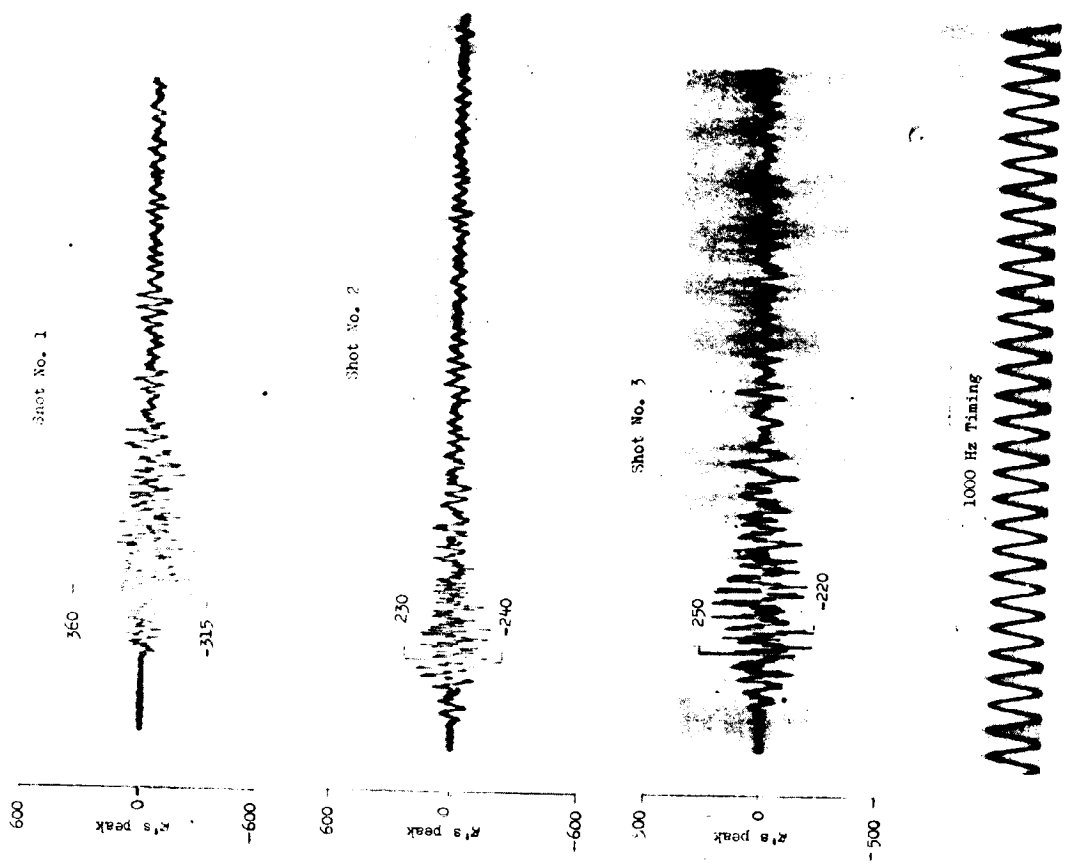
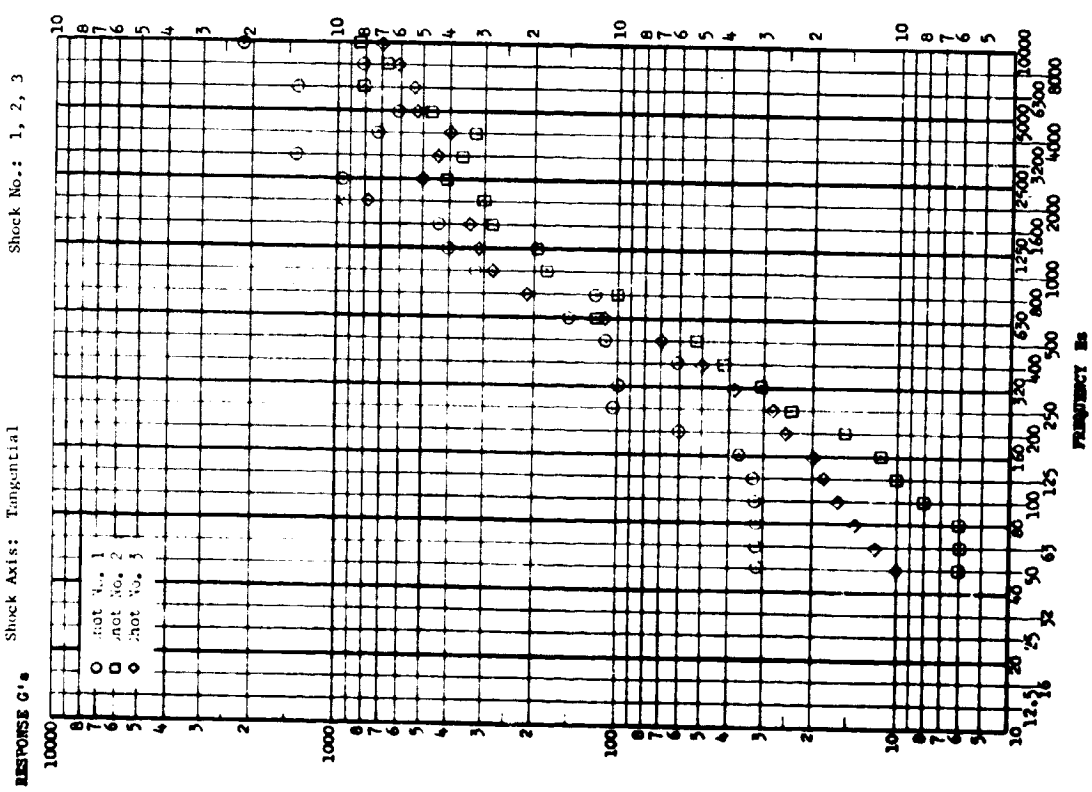


FIGURE II.B.2-28

Test Item: Titan III-S Separation Nut Tests, 3/4 inch Dual Nut
 Accel. No.: 9A22 Test Date: Aug., 1968
 Shock Axis: Longitudinal Shock No.: 1, 2, 3

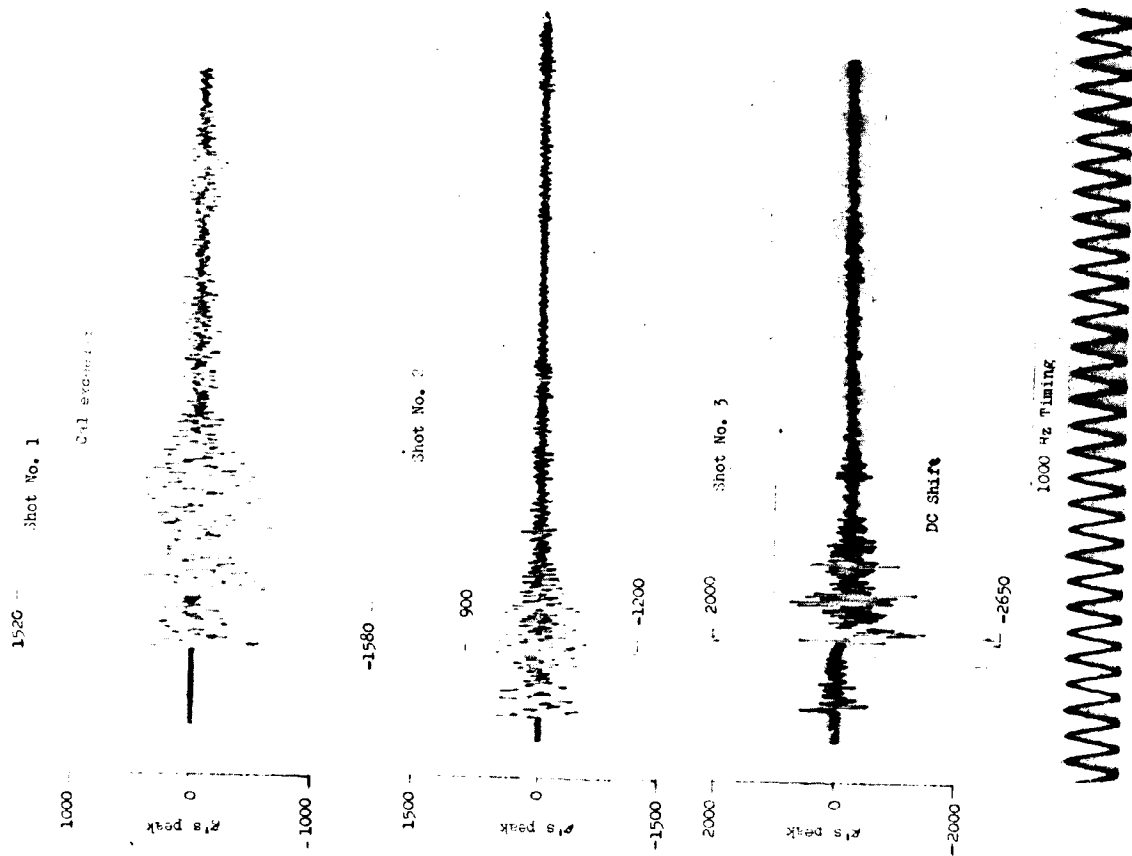
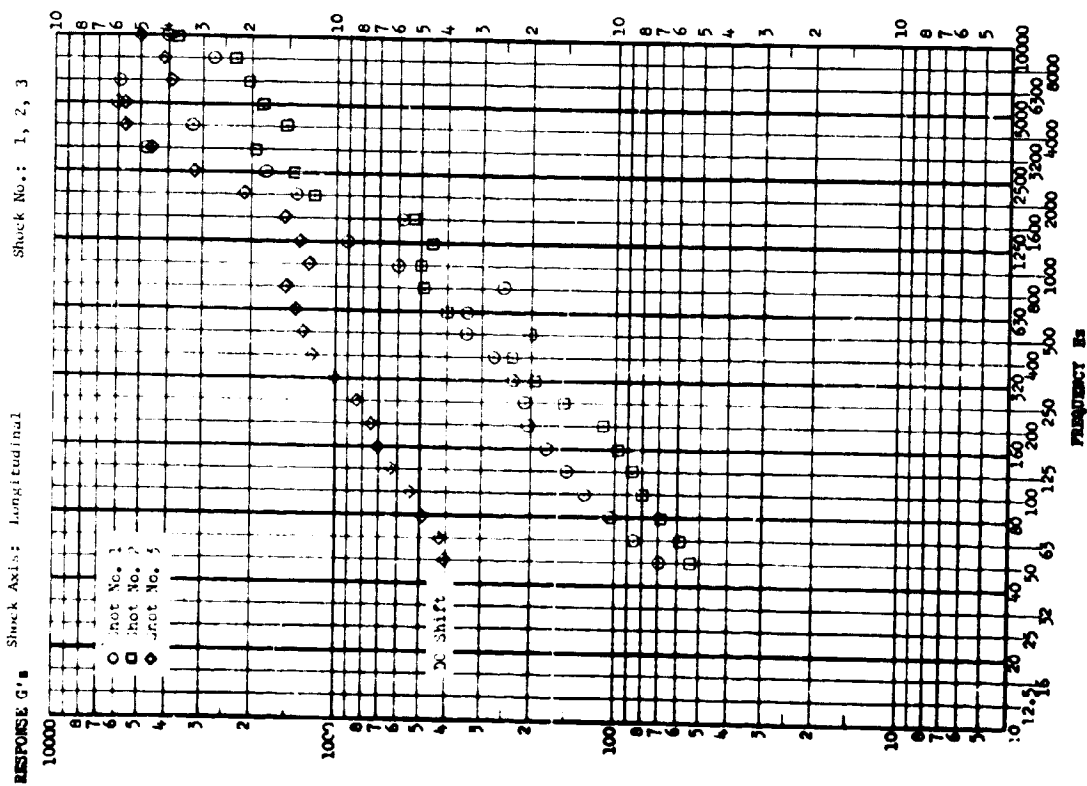


FIGURE 11.B.2-29

Test Item: Titan III-N Separation Wet Tests, 3/4 Inch Dual Nut
 Accel. No.: M21 Test Date: Aug., 1968
 Shock Axis: Radial Shock No.: 1, 2, 3

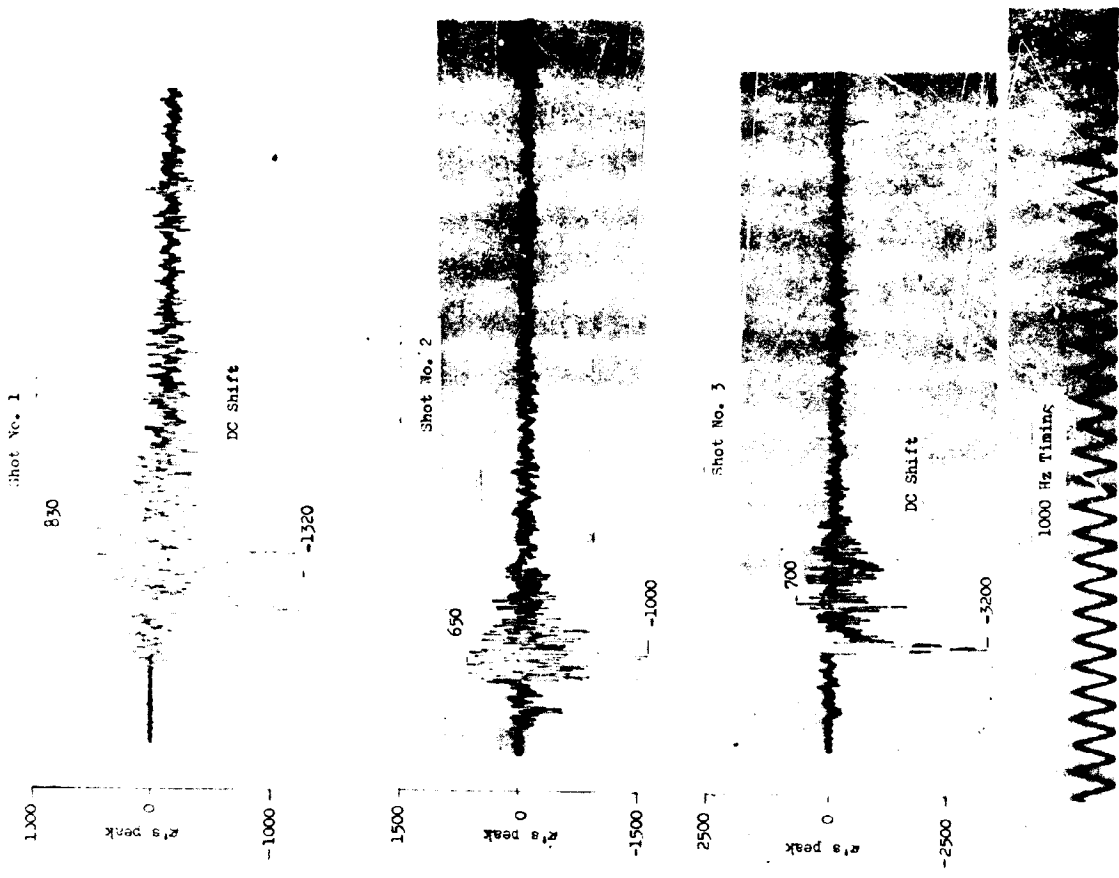
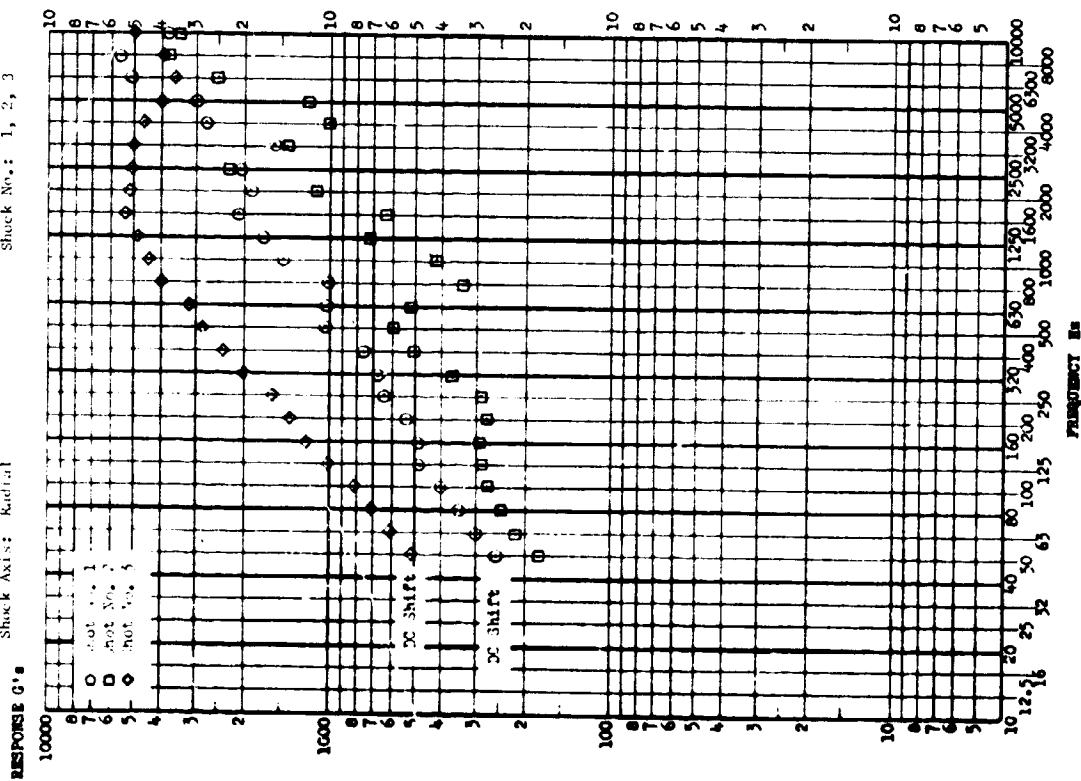
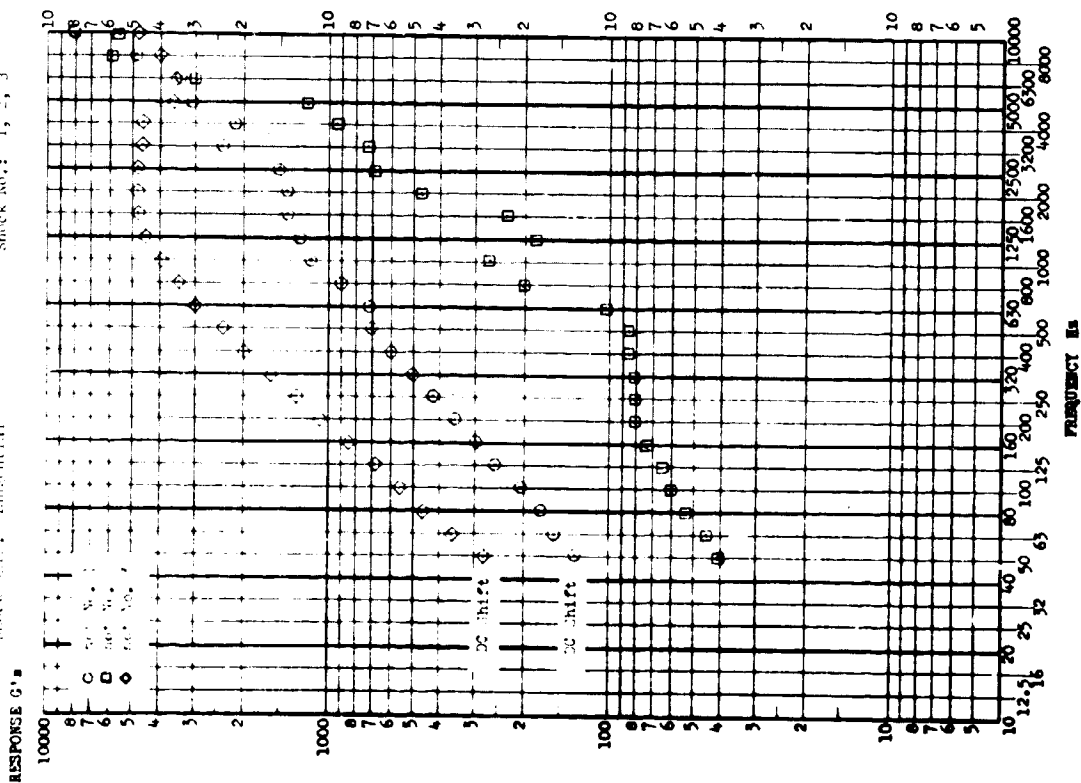


FIGURE 11.B.2-30

Test Item: Blank H-1 Separation Nit Tests, 3/4 Inch Dial Nit
 Acc. I. No.: 147
 Test Date: Aug., 1968

Shock Axis: Transmittal
 Shock No.: 1, 2, 3



1280 Shot No. 1

1000



-1200

1900

Shot No. 2



-2100

Shot No. 3

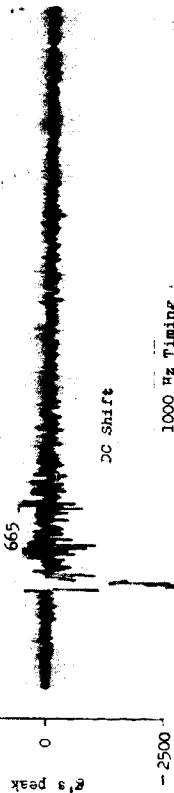


FIGURE II.B.2-31

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Single Nut
 Accel. No.: JAL Test Date: Aug., 1968
 Shock Axis: Longitudinal Shock No.: 4, 5, 6

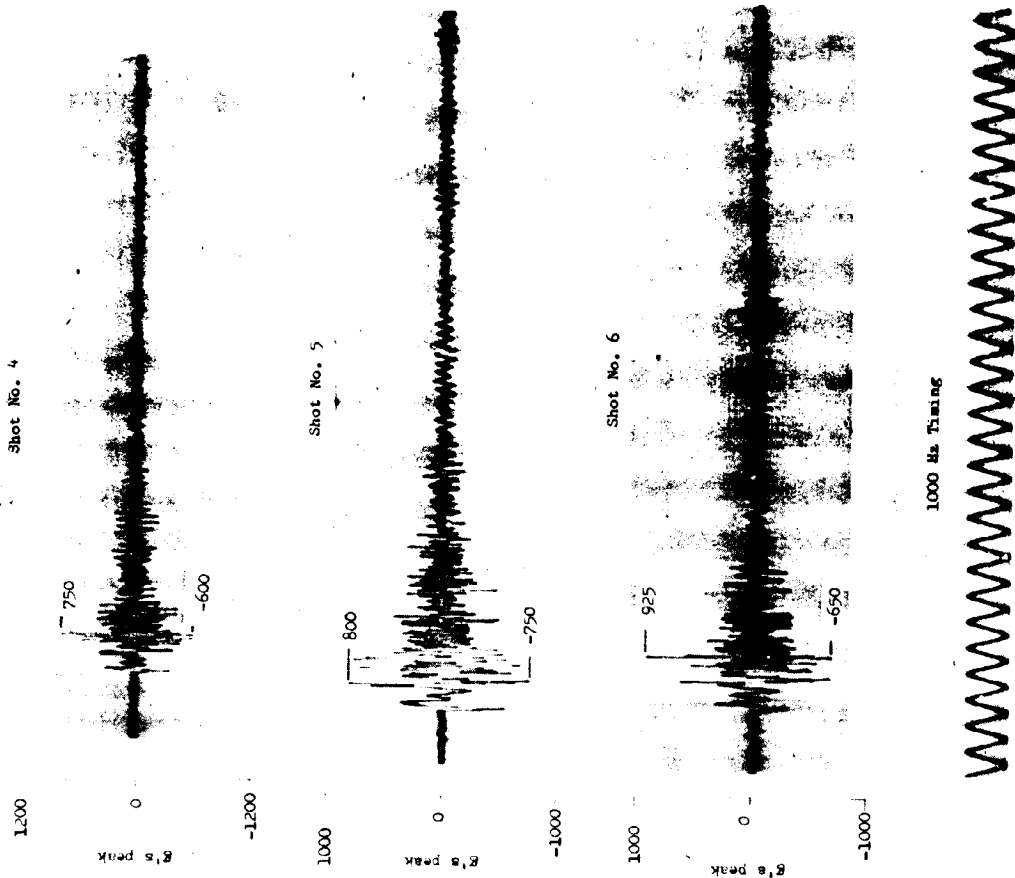
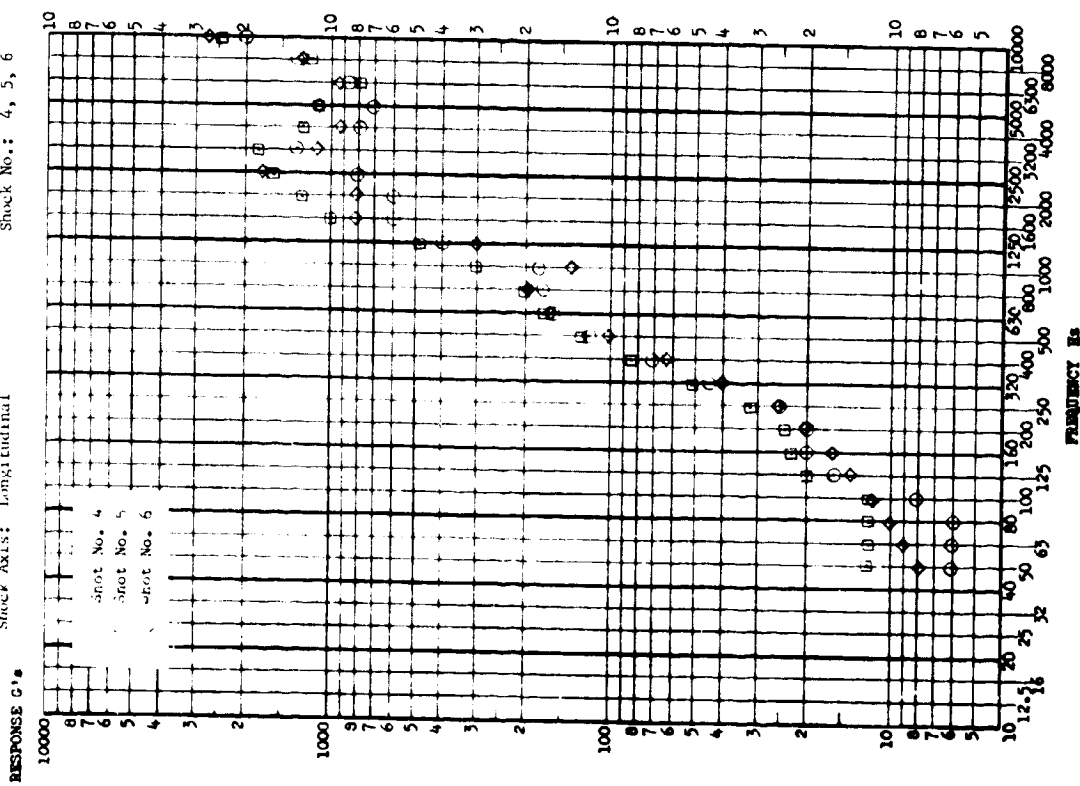


FIGURE II.B.2-32

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Single Nut
 Accel. No.: 9A2 Test Date: Aug., 1968
 Shuck Axis: Radial Shuck No.: 4, 5, 6

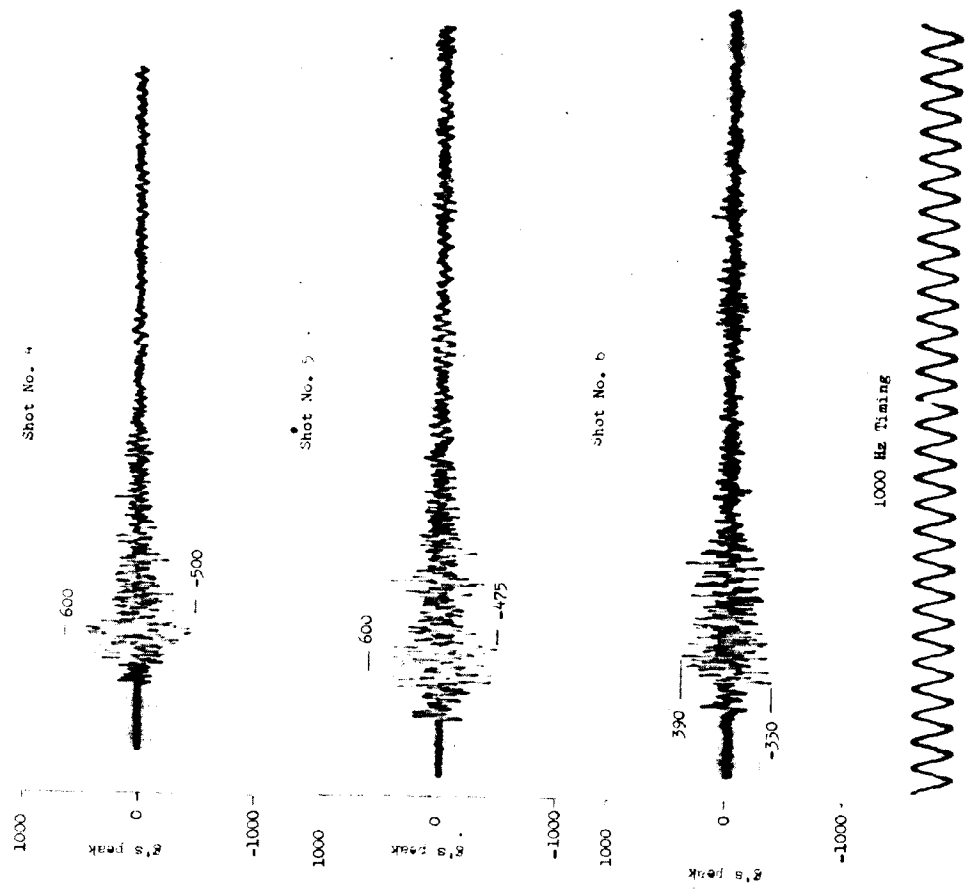
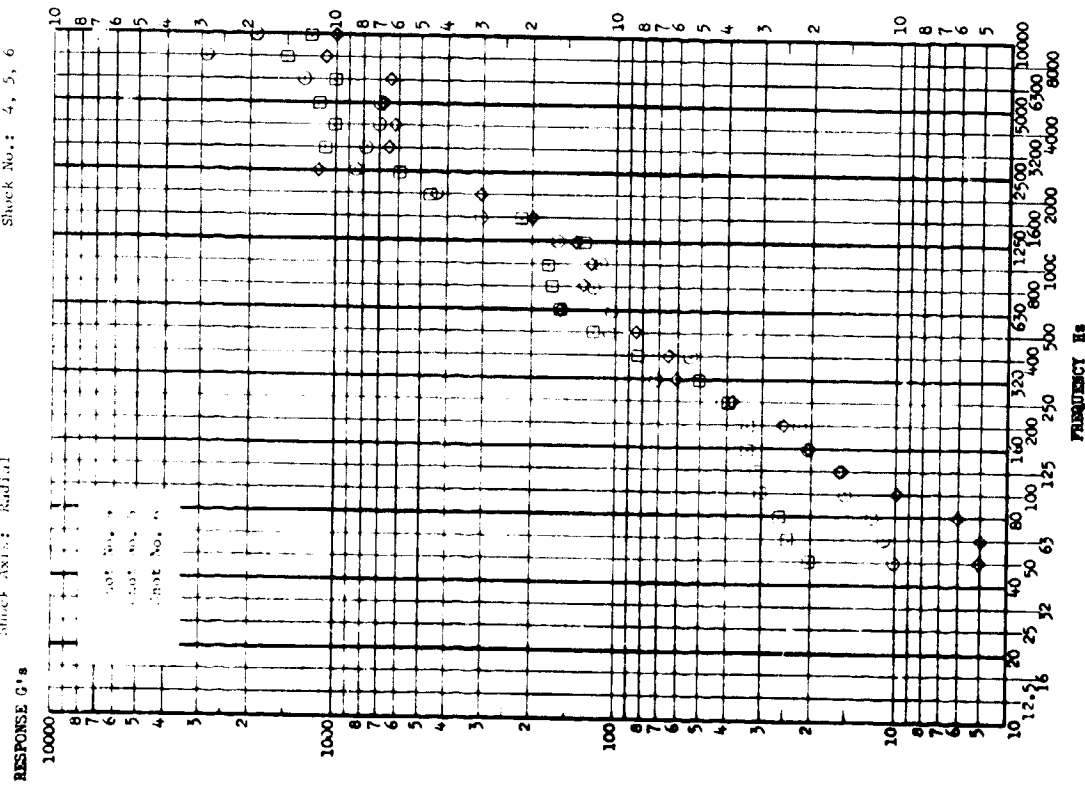


FIGURE II.B.2-33

Test Item: Titan III-M Separation Nut Tests, 3/4 inch Single Nut
 Accel. No.: 3A3 Test Date: Aug., 1968
 Shock Axis: Tangential Shock No.: 4, 5, 6

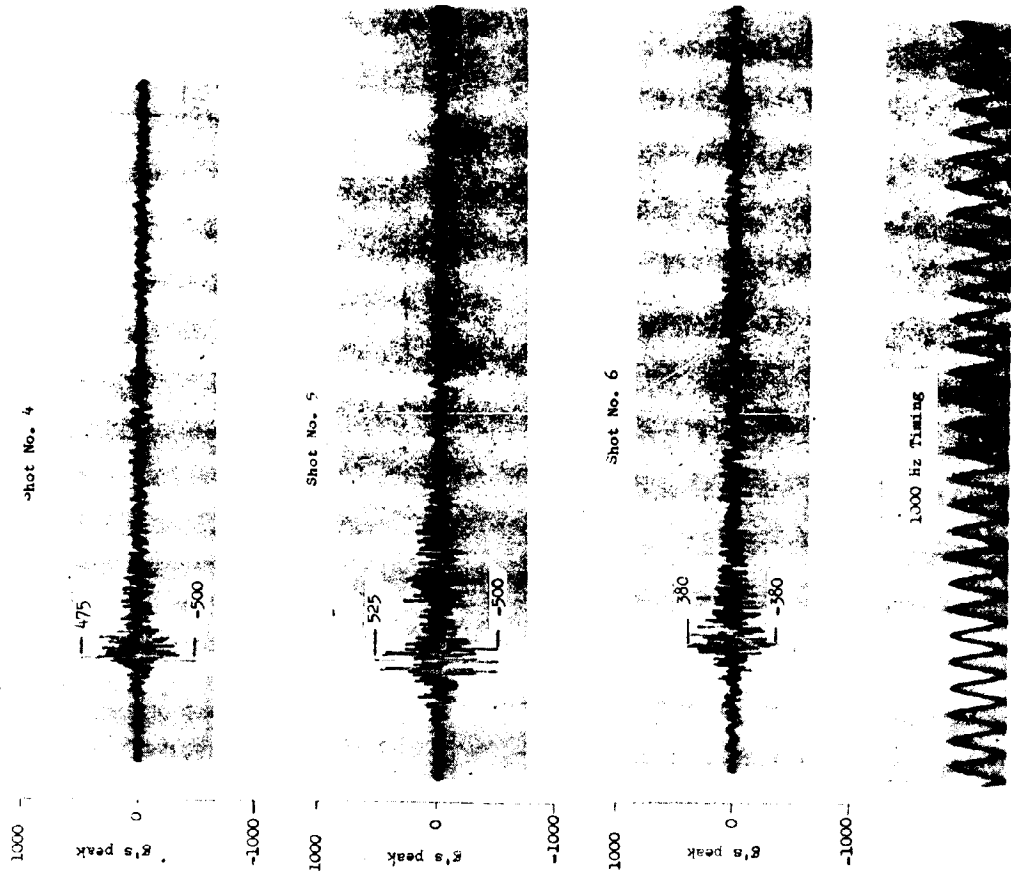
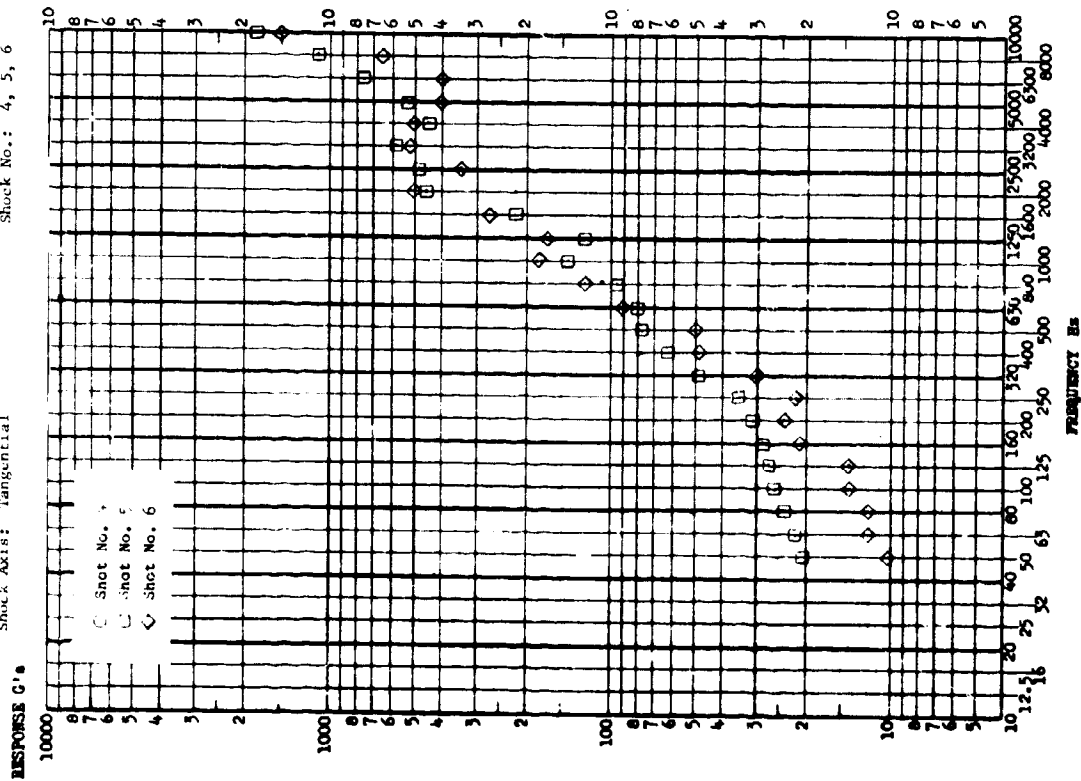


FIGURE 11.B.2-34

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Single Nut
 Accel. No.: 1A5
 Test Date: Aug., 1968
 Shock Axis: Longitudinal
 Shock No.: 4, 5, 6

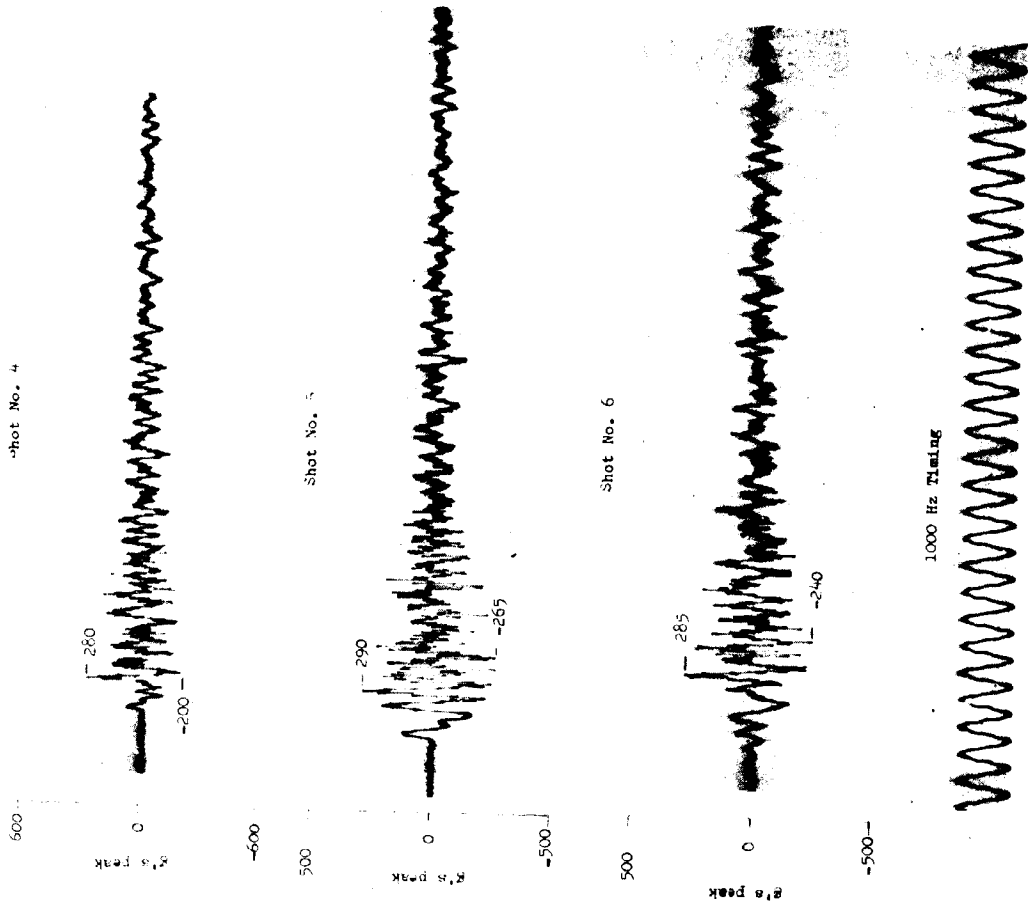
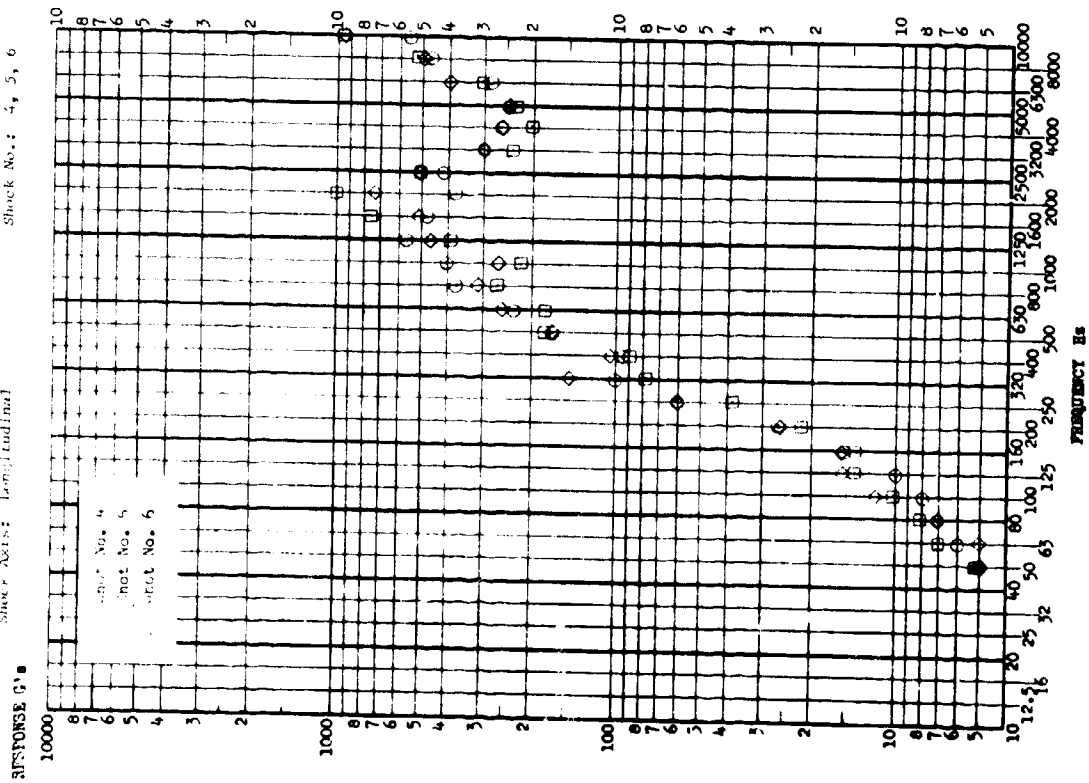


FIGURE 11.B.2-35

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Single Nut

Accel. No.: JAB

Test Date: Aug., 1968

Shock Axis: Vertical

Shock No.: 4, 5, 6

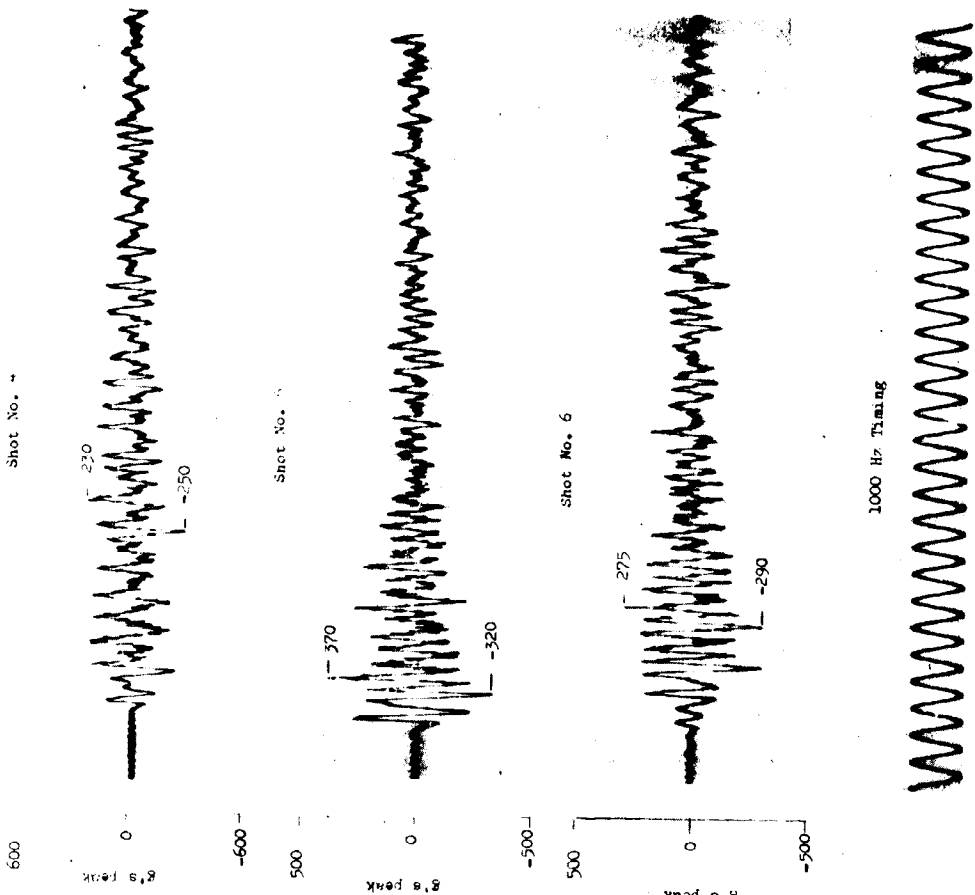
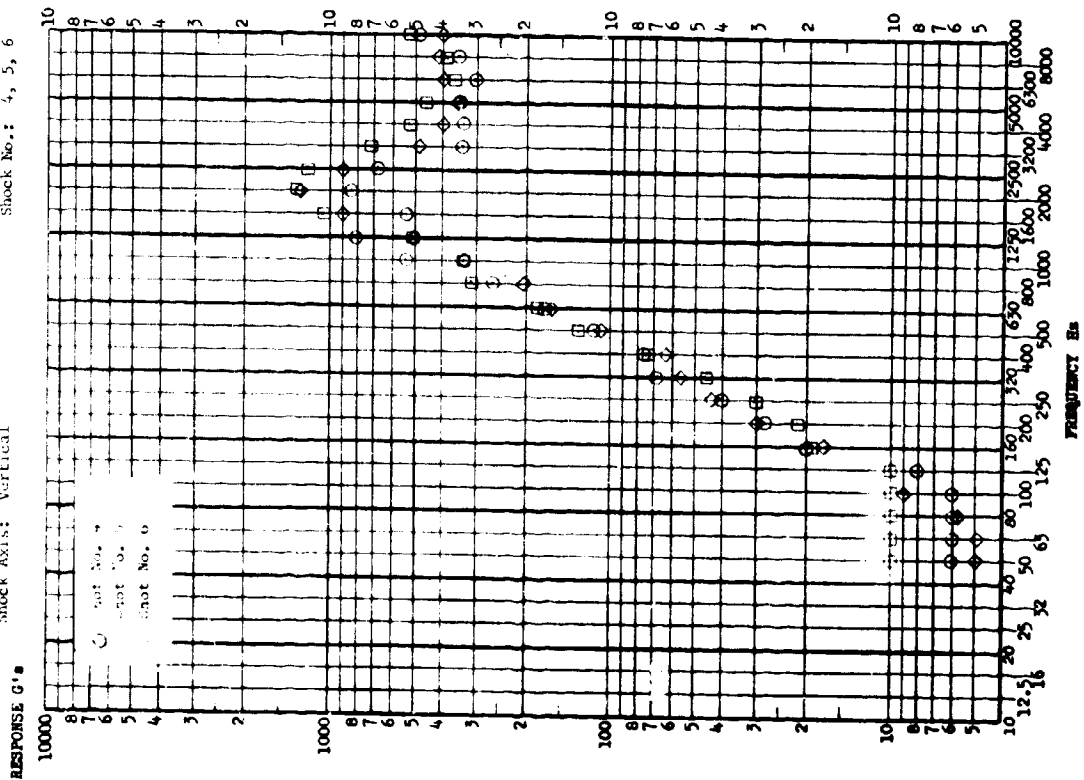
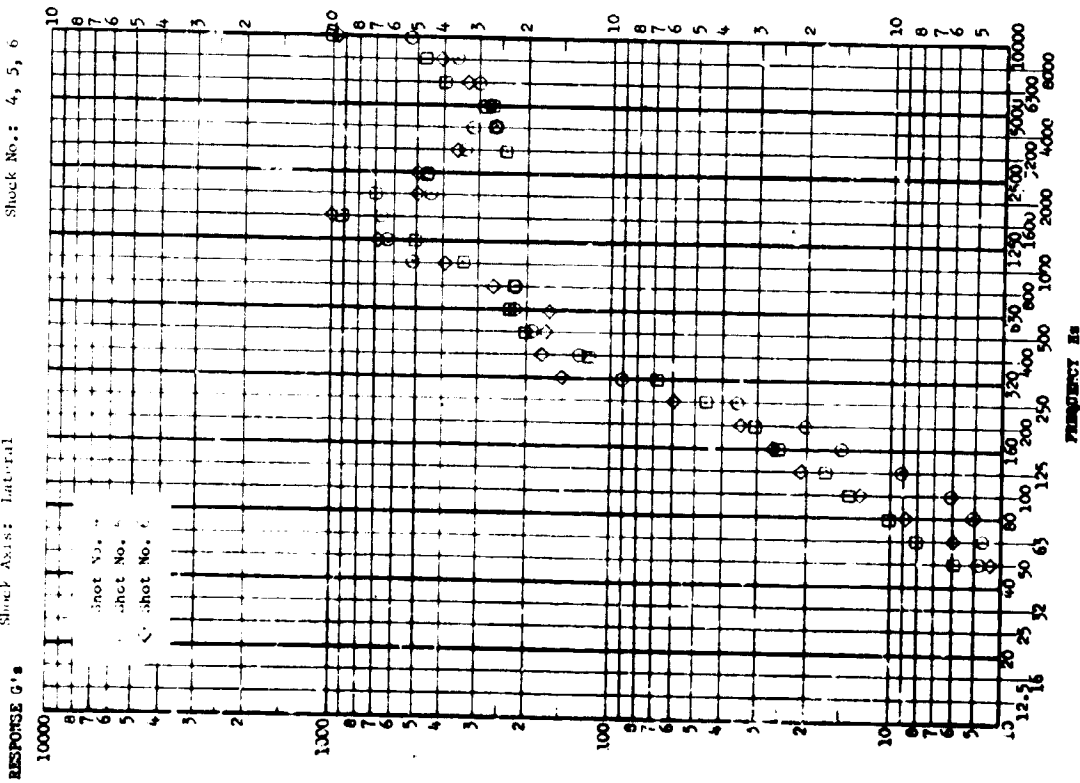


FIGURE 11.B.2-36

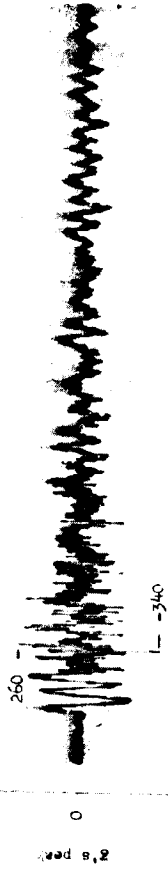
Test Item: TITAN III-M Separation Nut Tests, 3/4 Inch Single Nut
 Test Date: Aug., 1968
 Shock Axis: Lateral
 Shock No.: 4, 5, 6



Shot No. 4



Shot No. 5



Shot No. 6

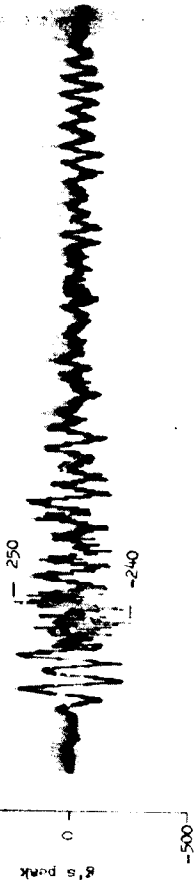


FIGURE 11.B.2-37

Test Item: Titan III-X Separation Nut Tests, 3/4 Inch Single Nut
 Acc'l. No.: 3A7 Test Date: Aug., 1968
 Shock Axis: Longitudinal Shock No.: 4, 5, 6

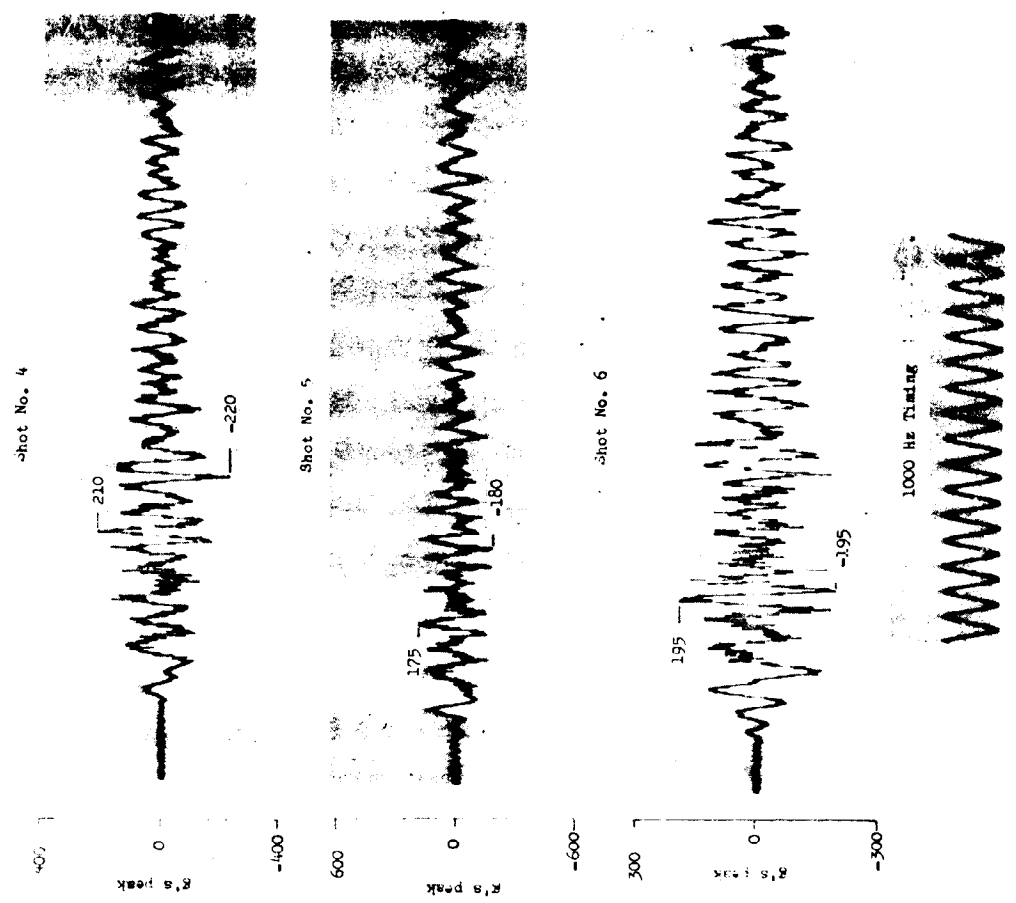
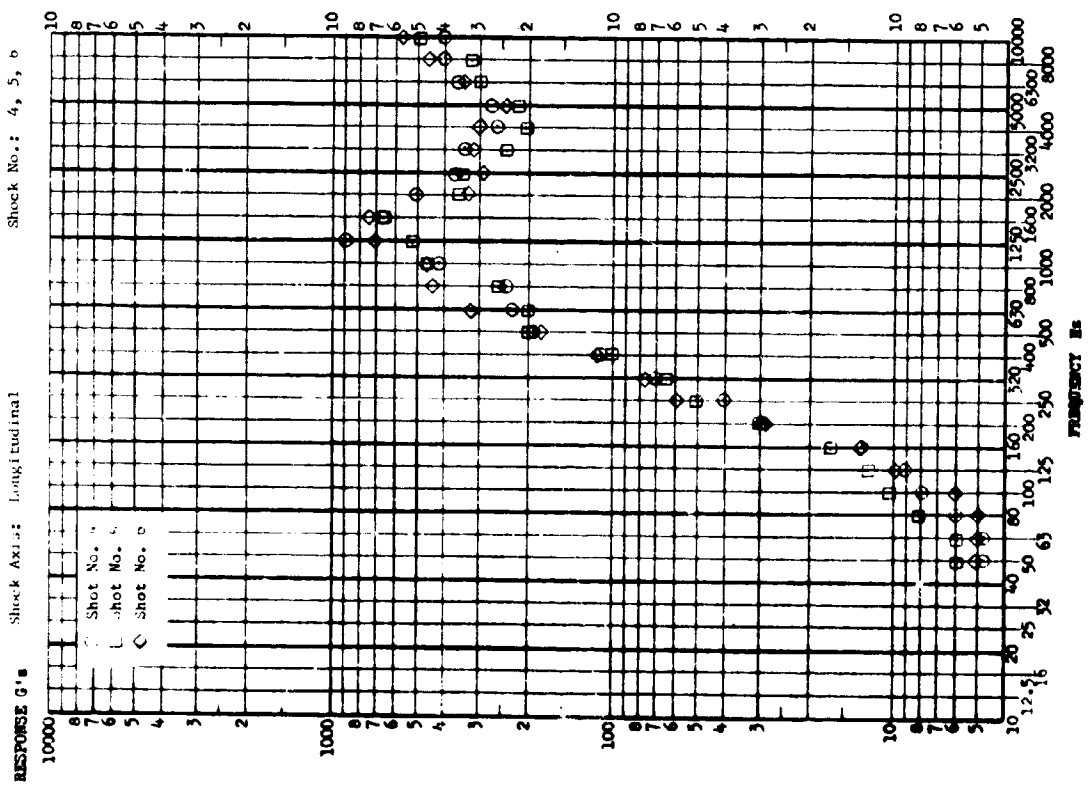


FIGURE 11.B.2-38

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Single Nut
 Accel. No.: 58B
 Test Date: Aug., 1968
 Shock Axis: Vertical
 Shock No.: 4, 5, 6

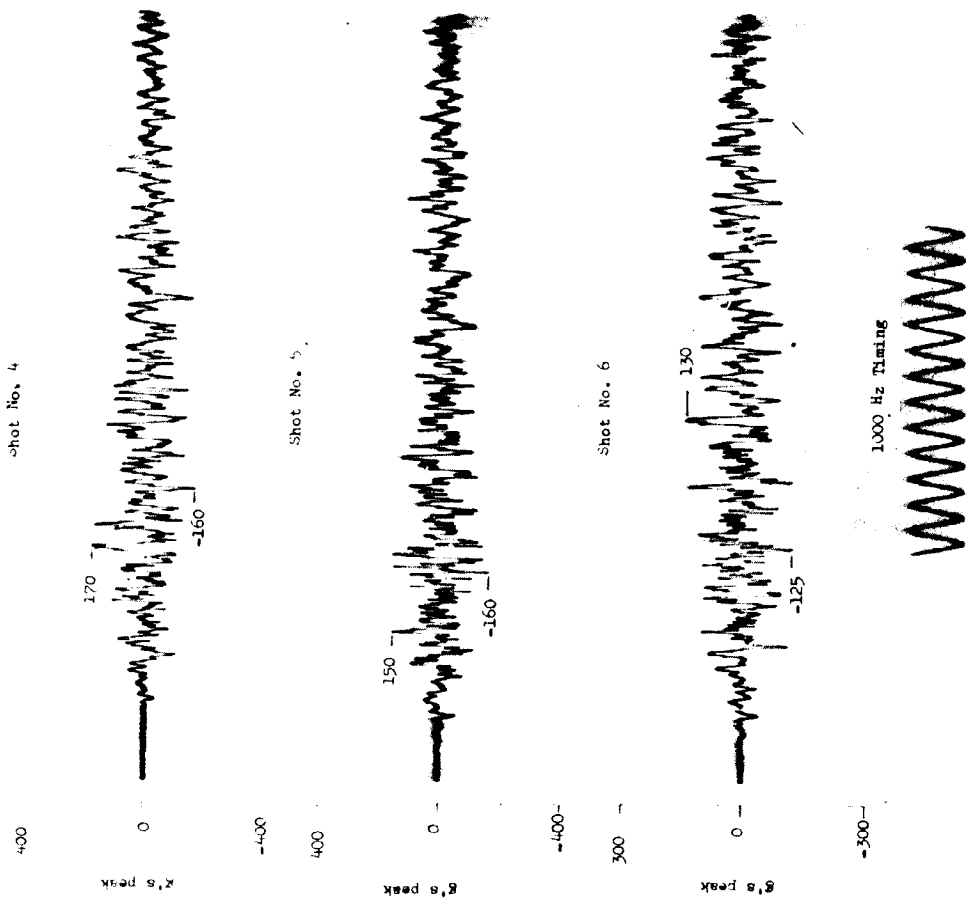
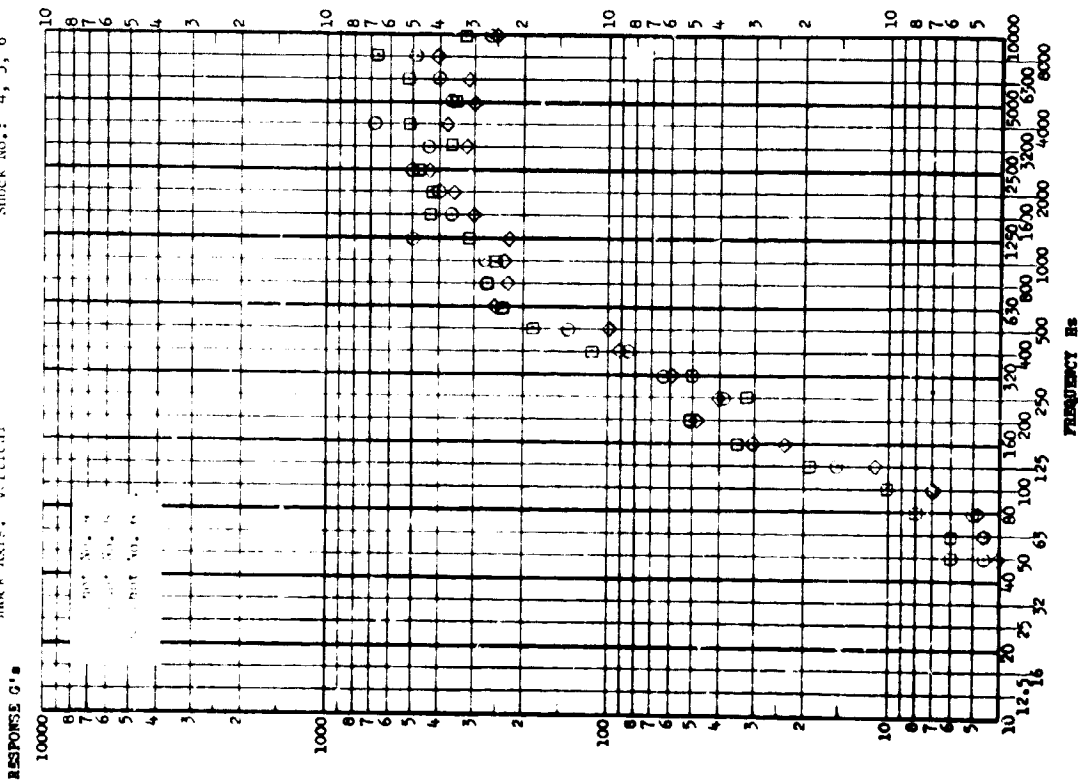


FIGURE 11.B.2-39

Test Item: Titan III-M Separation Nut Tests, 3/4 Incl. Single Nut
 Acc-I. No.: 3A9 Test Date: Aug., 1968
 Shock Axis: Lateral Shock No.: 4, 5, 6

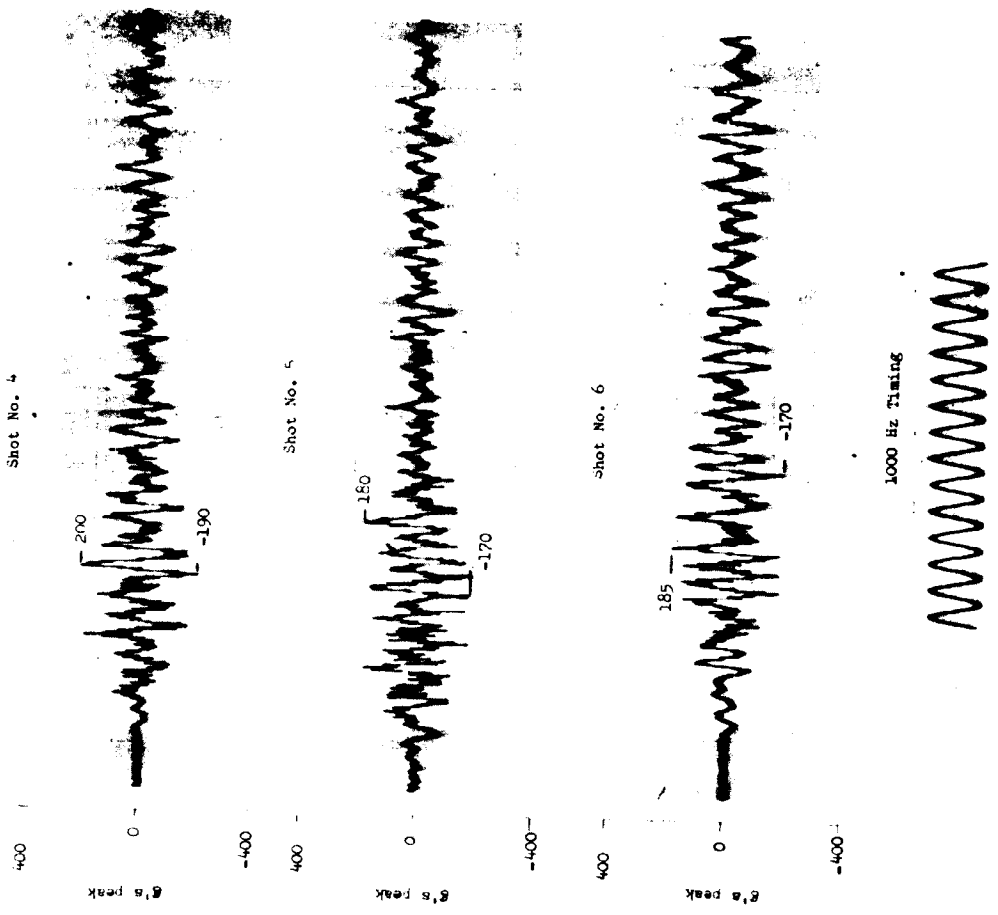
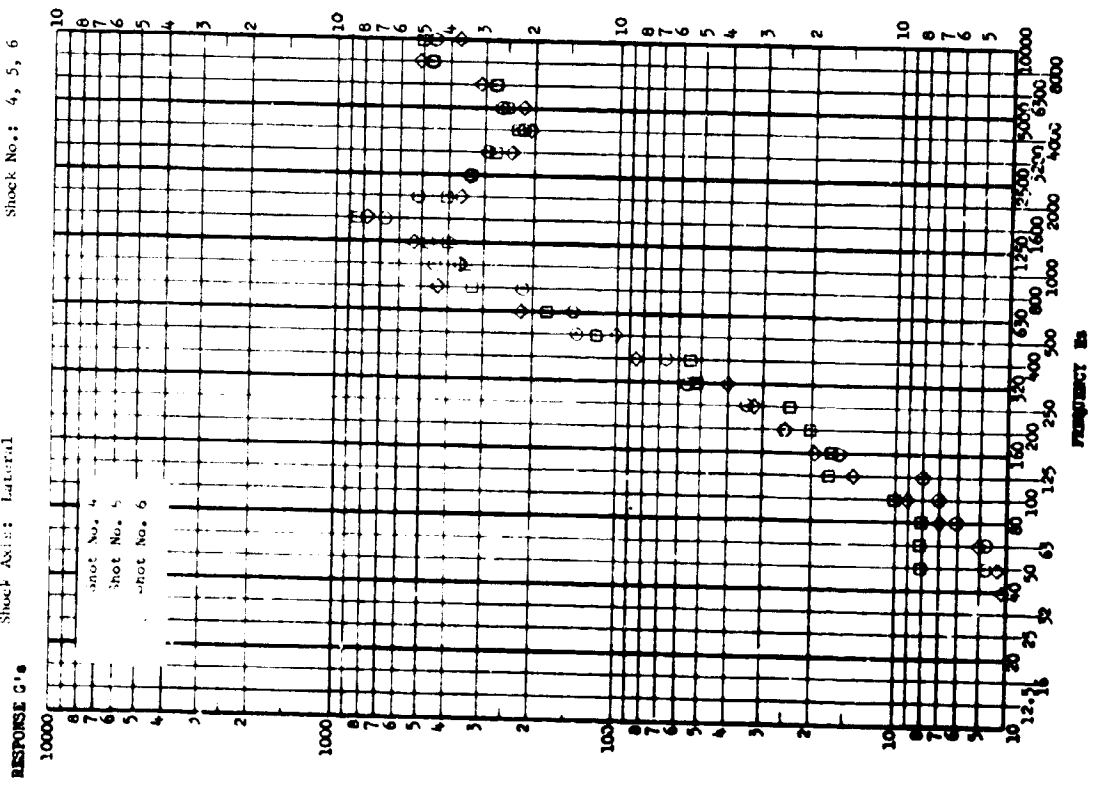


FIGURE 1. B.2-40

Test Item: Titan III-S Separation Nut Tests, 1/4 Inch Single Nut
 Accel. No.: 5A10 Test Date: Aug., 1968
 Shock Axis: Longitudinal Shot No.: 4, 5, 6

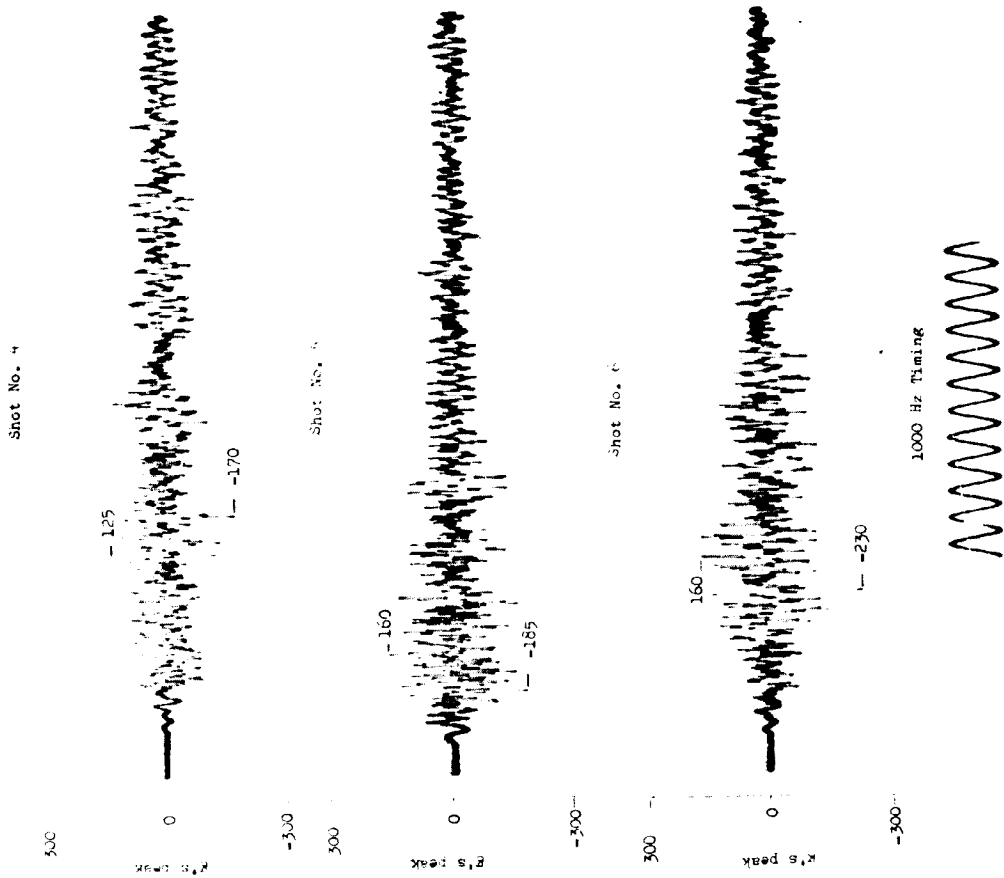
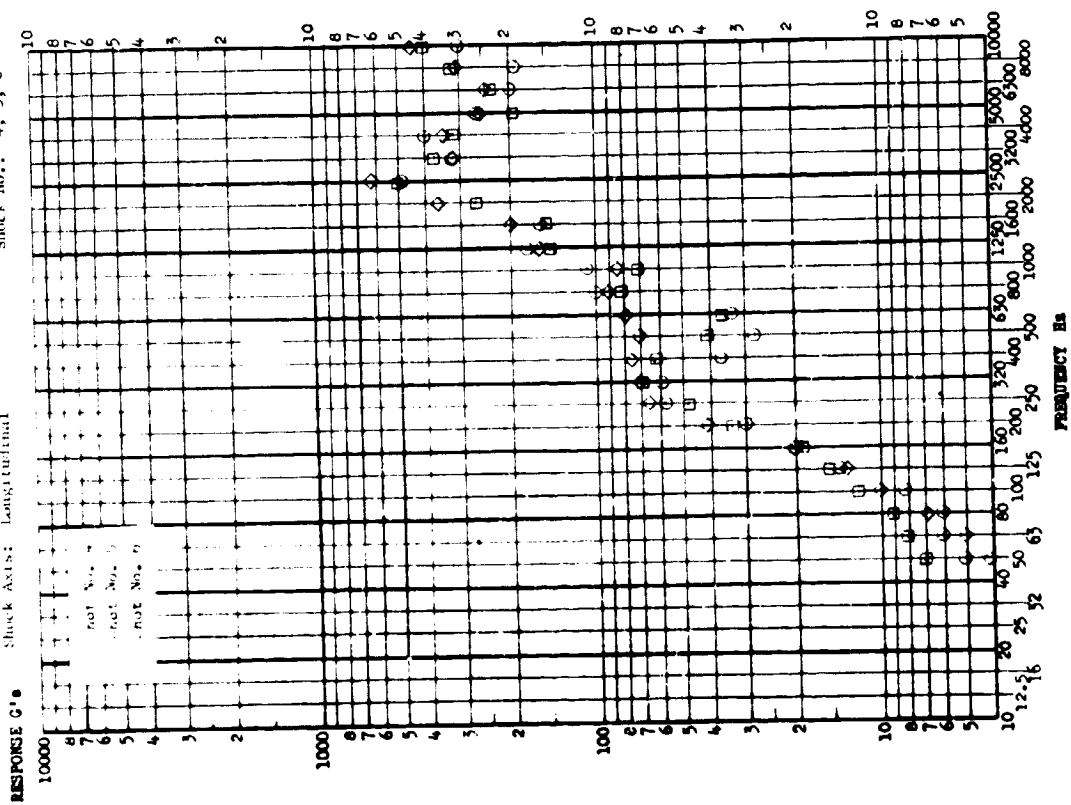


FIGURE II.B.2-41

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Single Nut
 Accel. No.: 841
 Shock Axis: Vertical
 Shock No.: 4, 5, 6
 Test Date: Aug., 1968

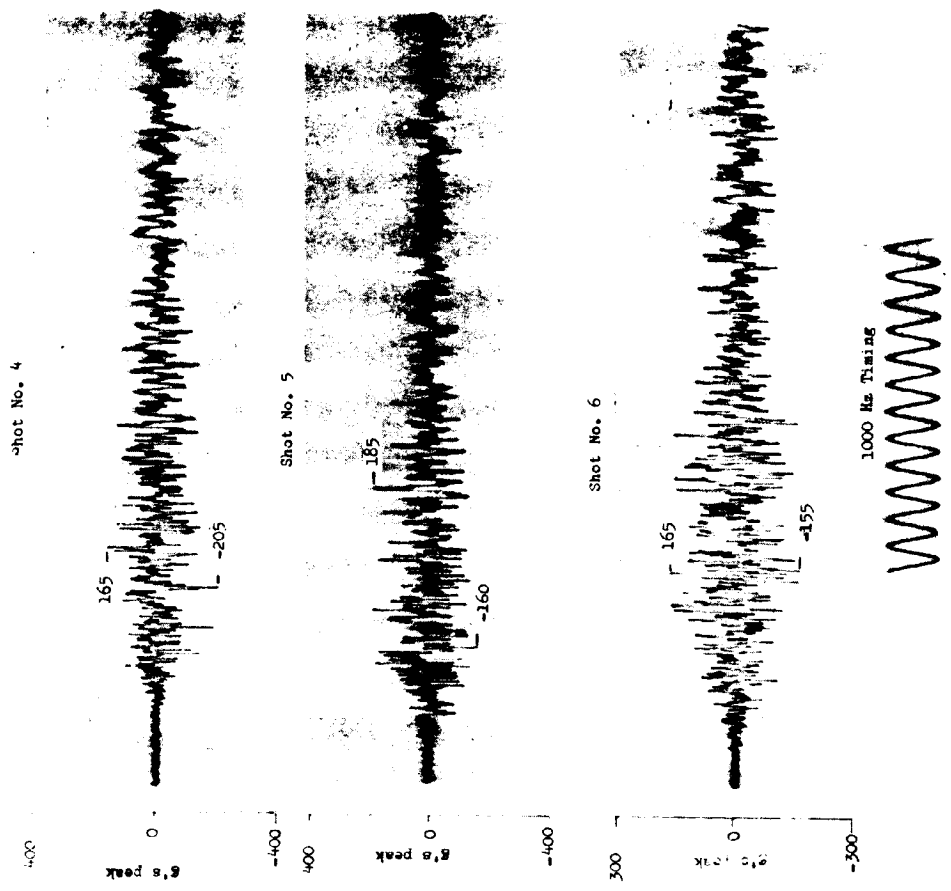
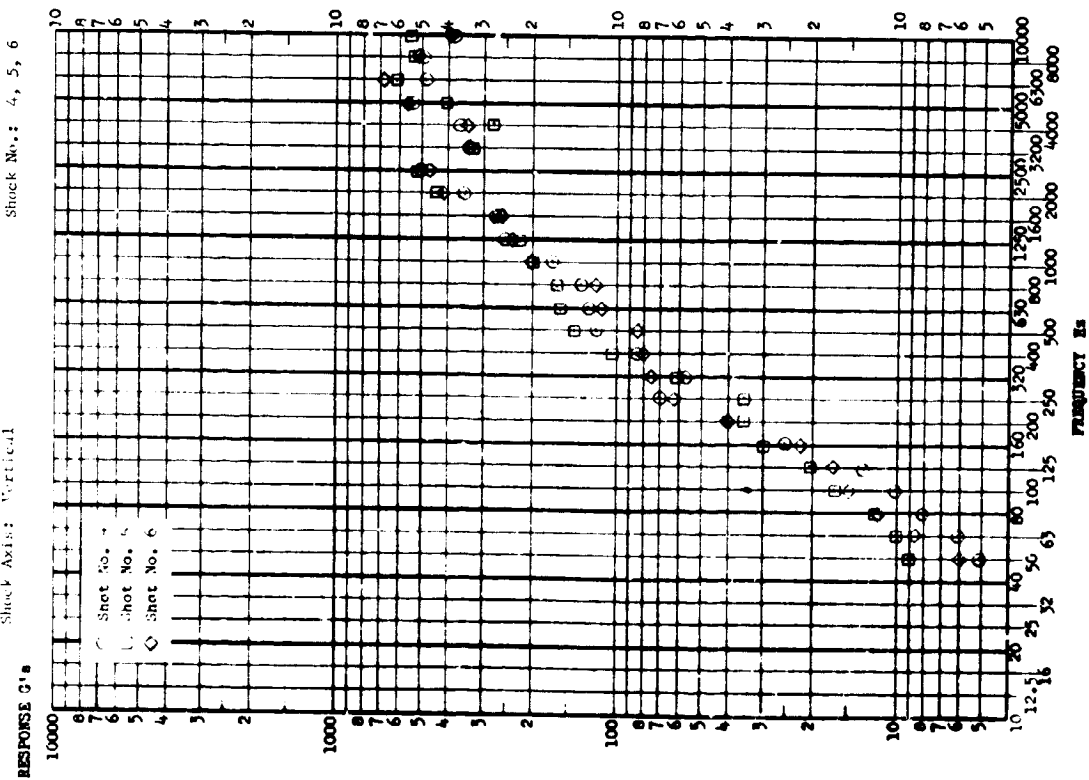


FIGURE 11.B.2-42

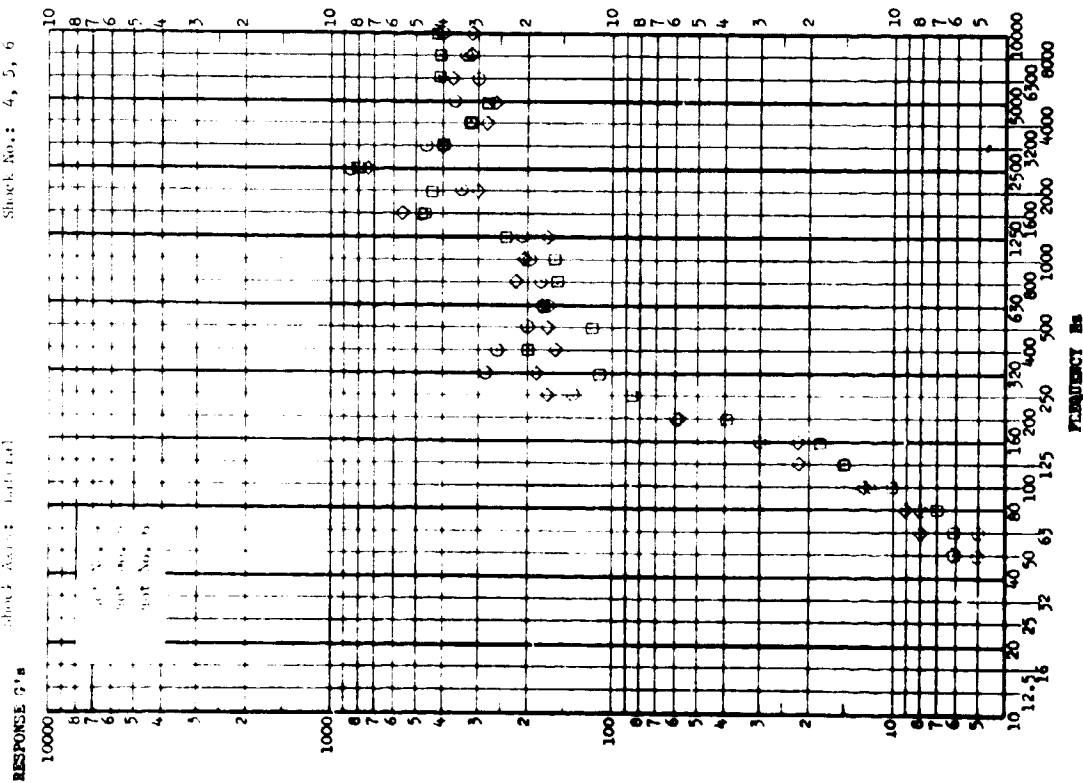
Test Item: Frim III-M Separation Nut Tests, 3/4 Inch Single Nut

Accel. No.: 641

Test Date: Aug., 1968

Shot No.: 4, 5, 6

Shot No.: 4, 5, 6



Shot No. 4

500

220



-500

Shot No. 5

500

170



-220

Shot No. 6

500

200



-180

1000 Hz Timing



FIGURE 11.8.2-43

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Single Nut

Accel. No.: 6A13

Test Date: Aug., 1968

Shock Axis: Longitudinal

Shock No.: 4, 5, 6

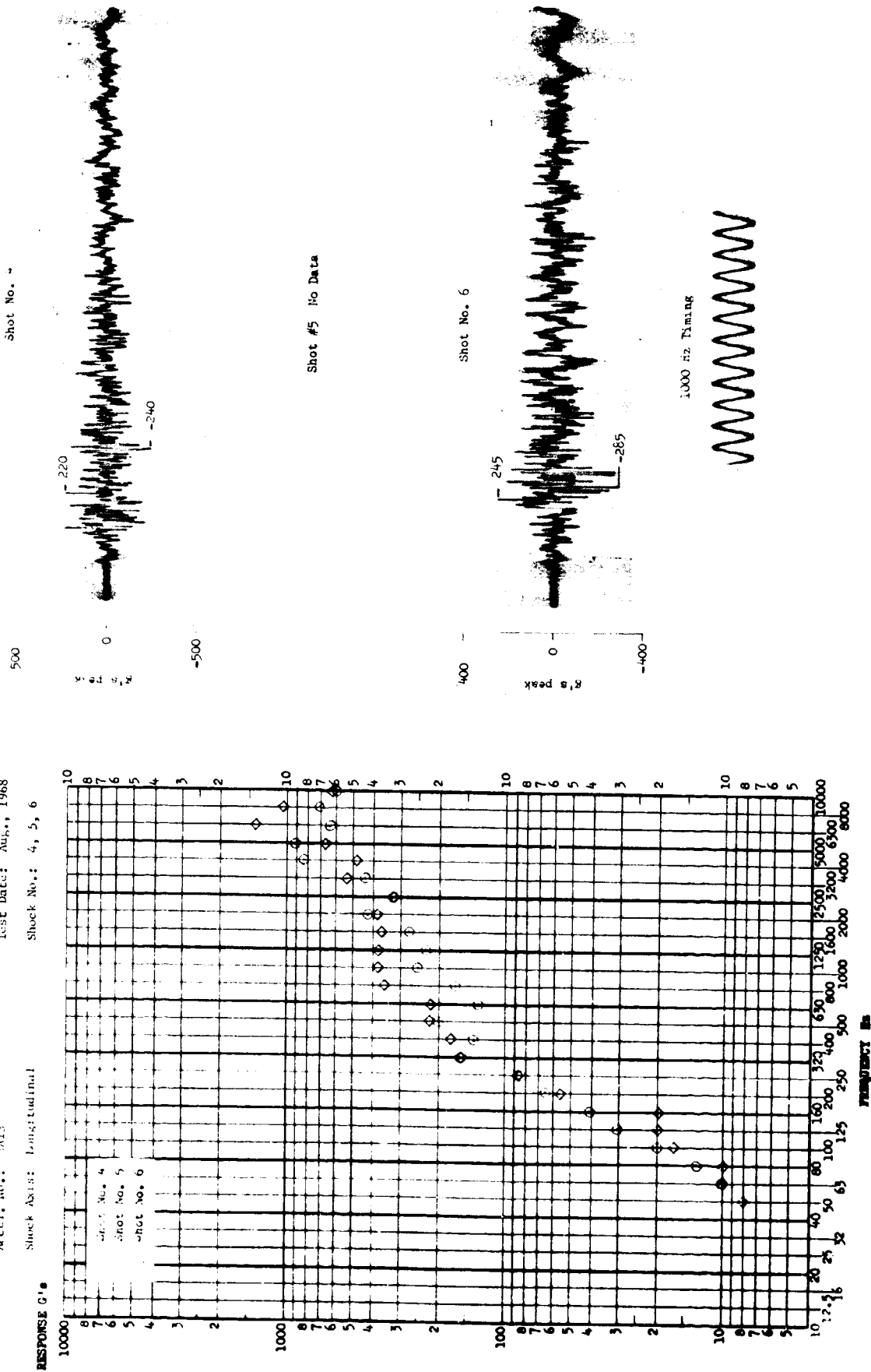
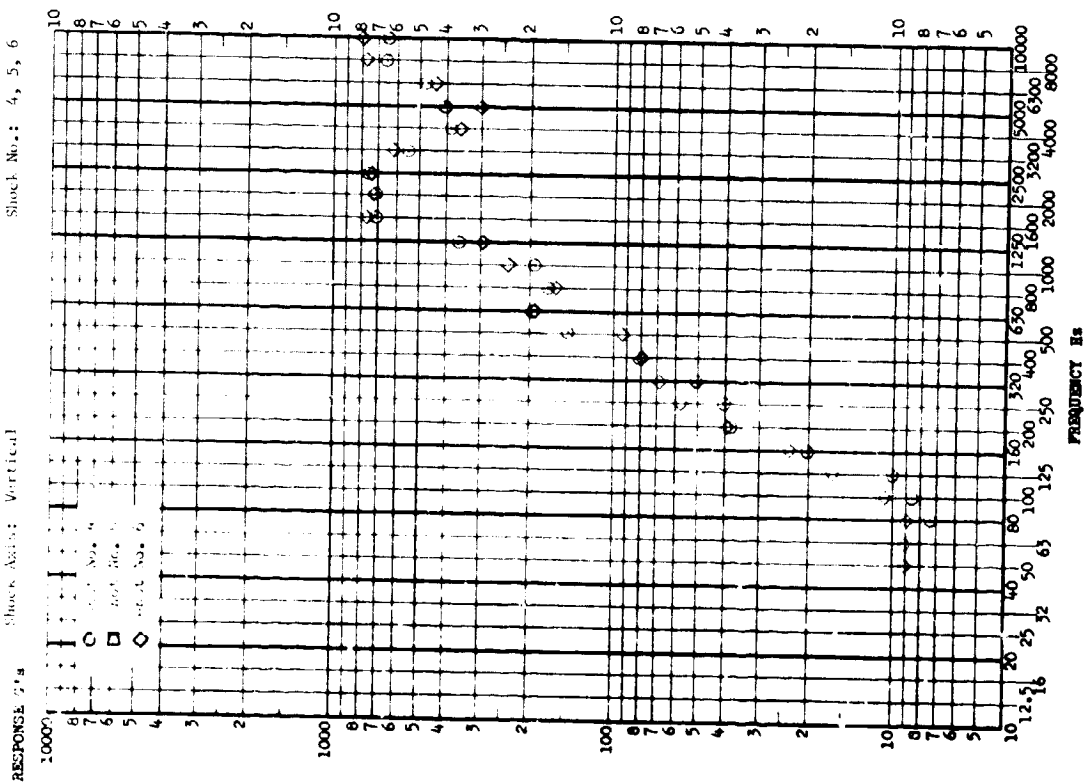


FIGURE 11.B.2-44

Test Item: Titan III-B Separation Nut Tests, 3/4 Inch Single Nut
 Accel. Axis: 3315
 Test Date: Aug., 1968
 Shock Axis: Vertical
 Shock No.: 4, 5, 6



Shot No. 4

500



Shot #5 No Data

Shot No. 6

500



1000 Hz Timing



FIGURE 11.B.2-45

Test Item: Titan III-M Separation Rut Tests, 3/4 Inch Single Rut

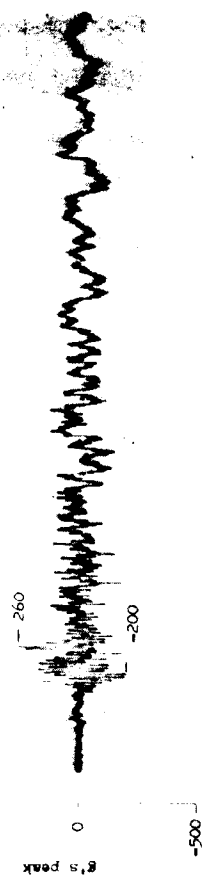
Accel. No.: 3A15

Shock Axis: Lateral

Shock No.: 4, 5, 6

Shot No. 4

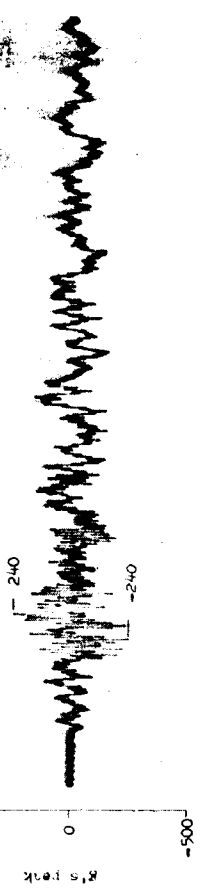
500



Shot #5 No Data

Shot No. 6

500



1000 Hz Timing

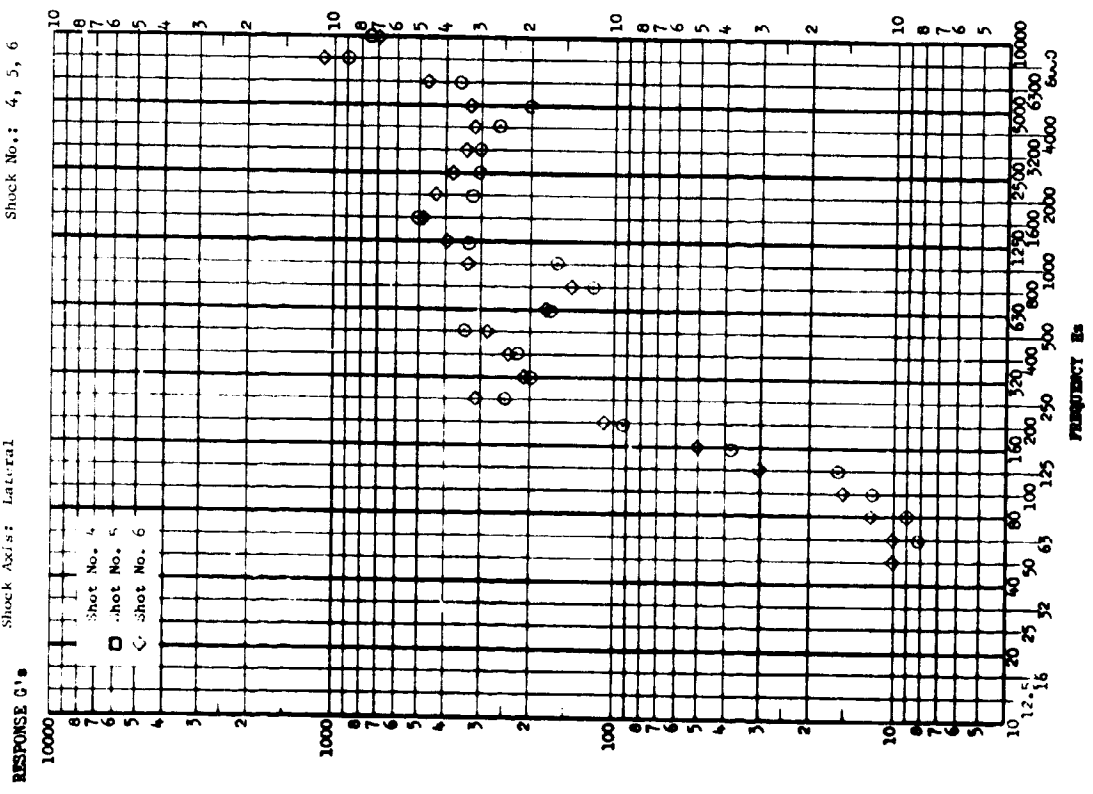
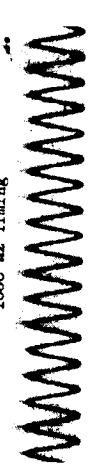
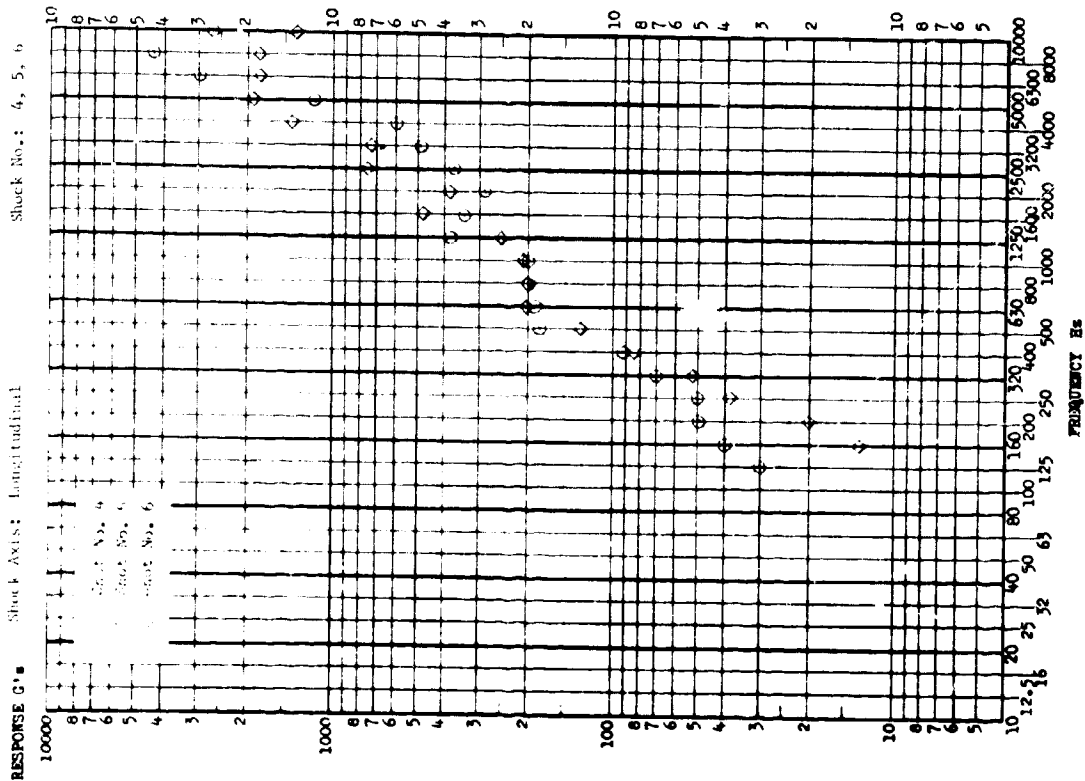


FIGURE 11.B.2-46

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Single Nut
 Accel. No.: 3A16
 Test Date: Aug., 1968
 Shock Axis: Longitudinal
 Shock No.: 4, 5, 6



Shot No. 4



Shot #5 No Data

Shot No. 6

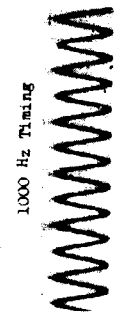
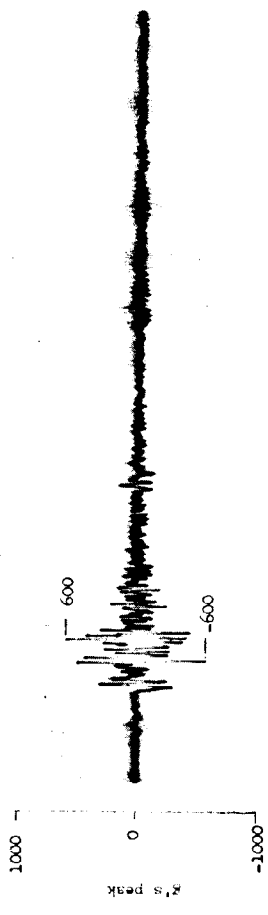


FIGURE 11.B.2-47

Test Item: Titan III-M Separation Nut Tests, 3/4 inch Single Nut

Accel. No.: 3A17

Test Date: Aug., 1968

Shock Axis: Radial

Shock No.: 4, 5, 6

3000

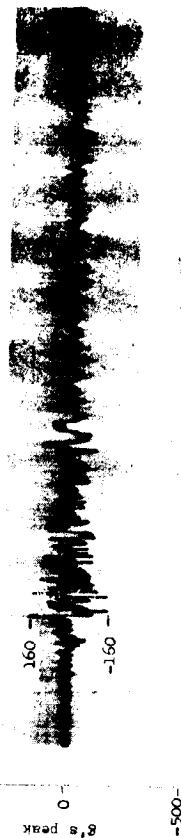
Shot No. 4



Shot #5 No Data

500

Shot No. 6



1000 Hz Thining

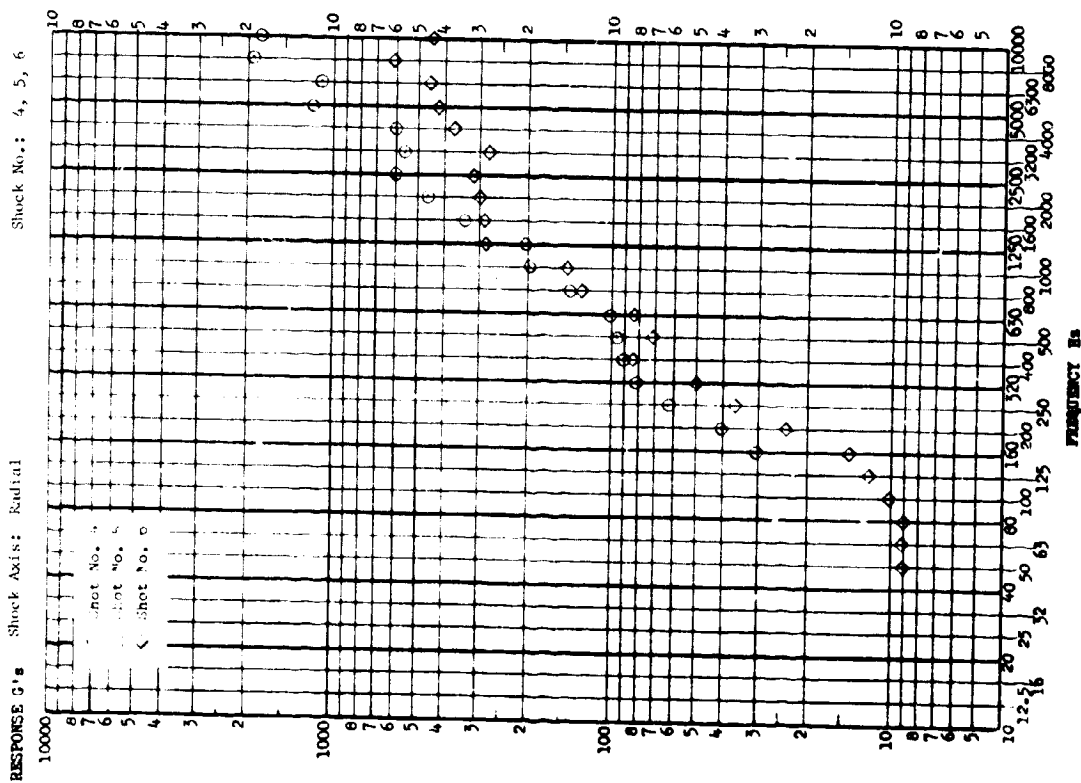


FIGURE 11.B.2-48

Test Item: F14M H1-M Separation Nut Tests, 3/4 Inch Single Nut
 Accel. No.: 3A18 Test Date: Aug., 1968
 Shock Axis: Tangential Shock No.: 4, 5, 6

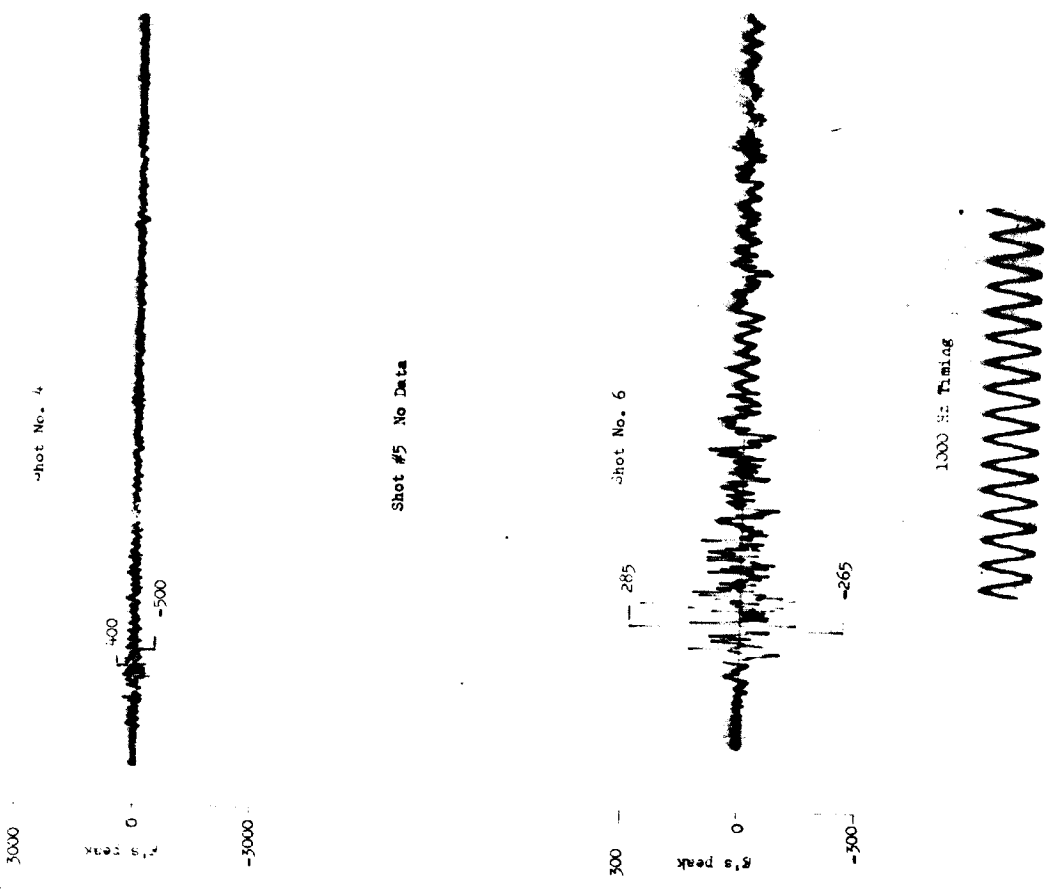
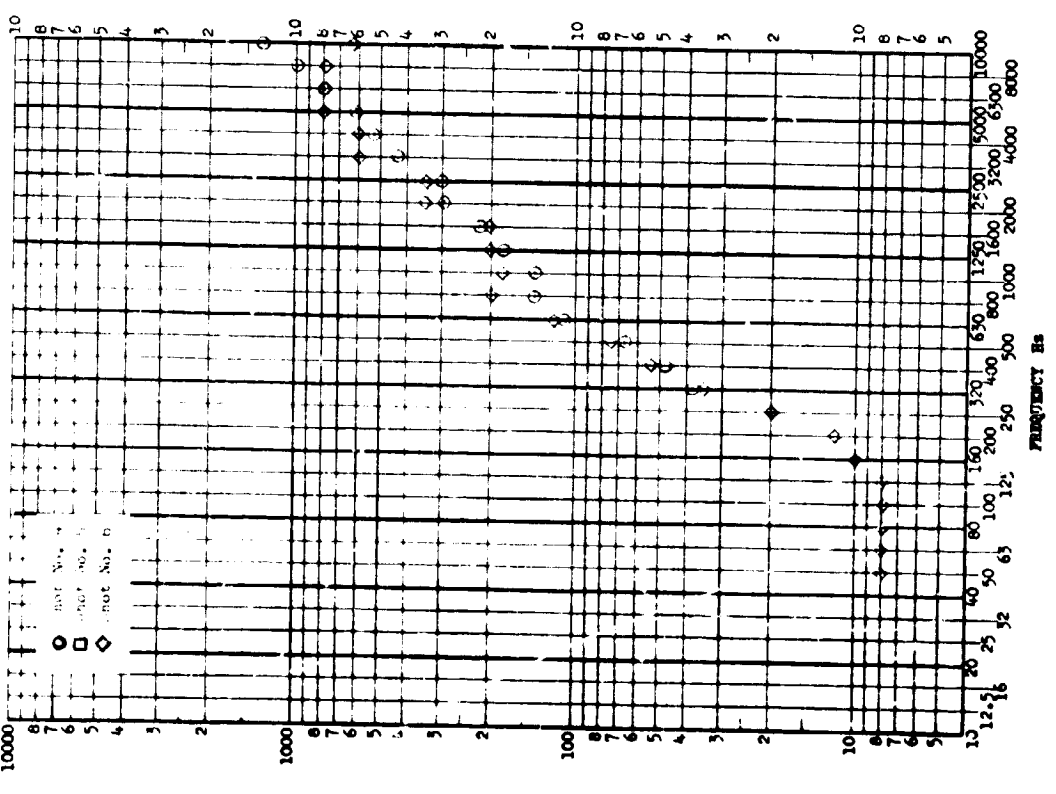


FIGURE 11.B.2-49

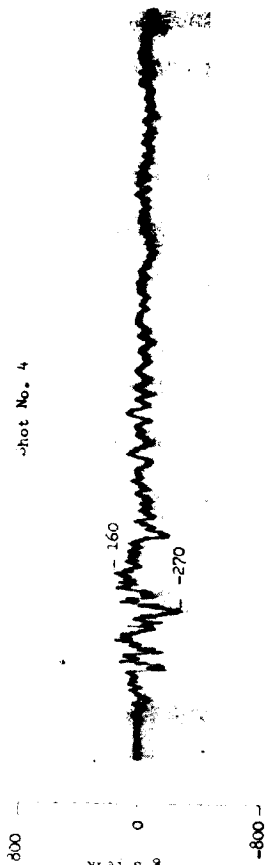
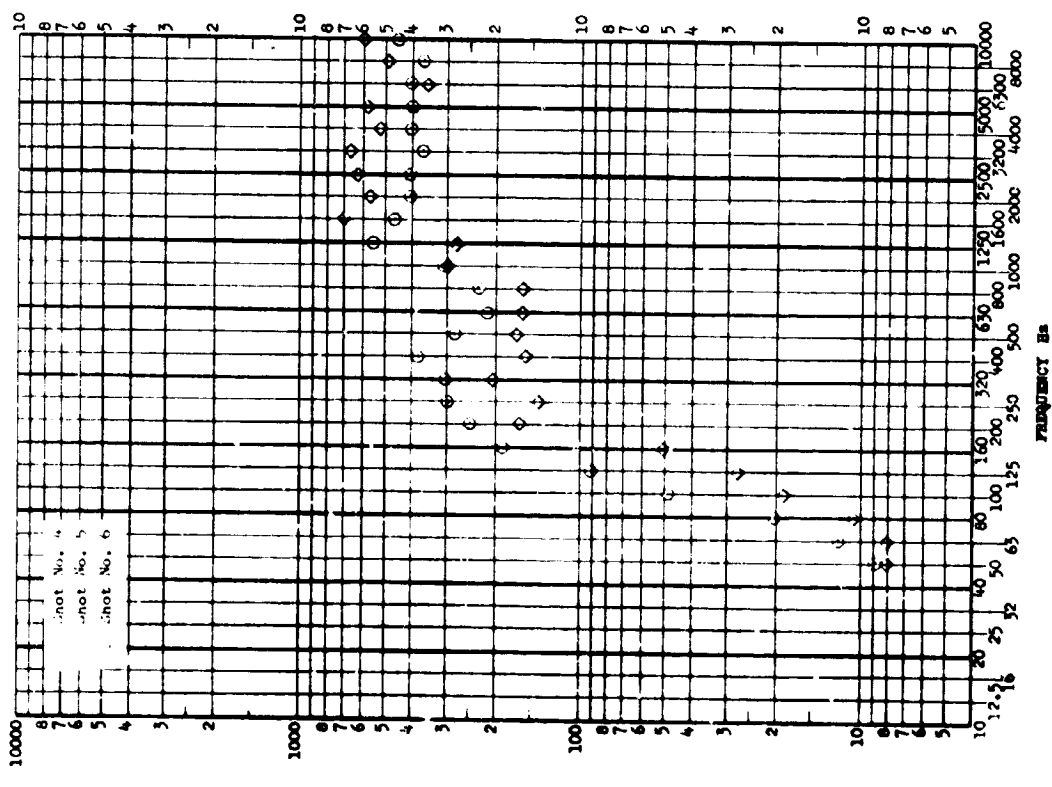
Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Single Nut

Accel. No.: 0M19

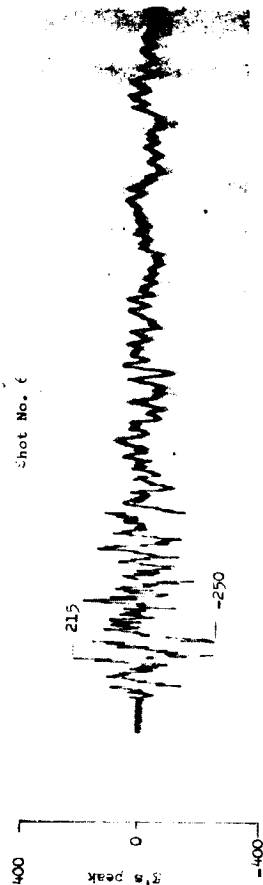
Test Date: Aug., 1968

Shock No.: 4, 5, 6

Shock Axis: Longitudinal



Shot #5 No Data



1000 Hz Timing



FIGURE 11.B.2-50

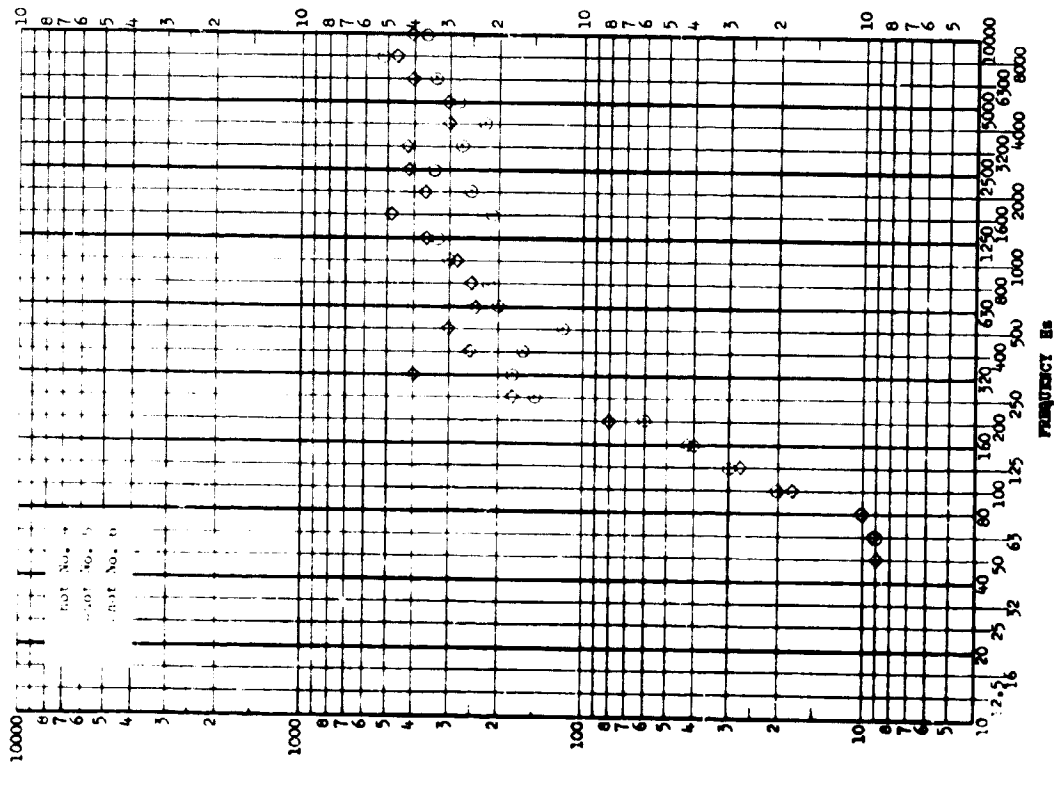
Test Item: Titan III-M Separation Mat Test, 3/4 Inch Single Mat

Mat. No.: 576

Test Date: Aug., 1968

Shock Axis: Radial

Shock No.: 4, 5, 6



Shot No. 4



Shot #5 No Data

Shot No. 6

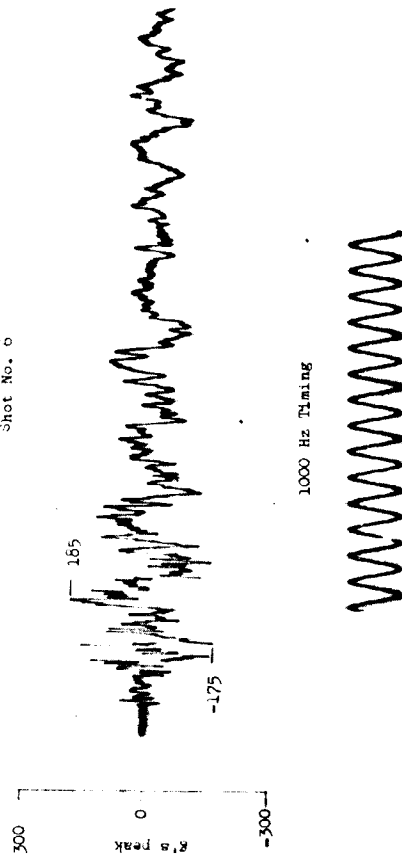
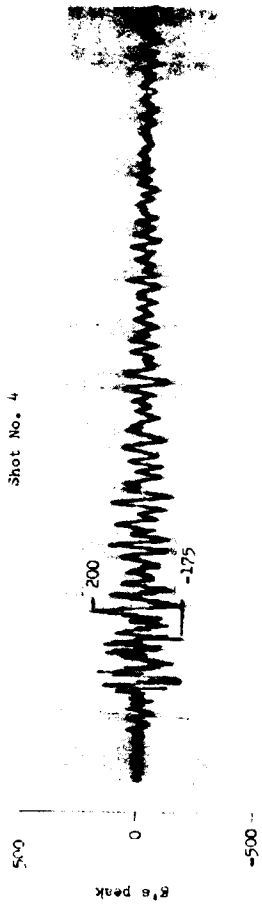
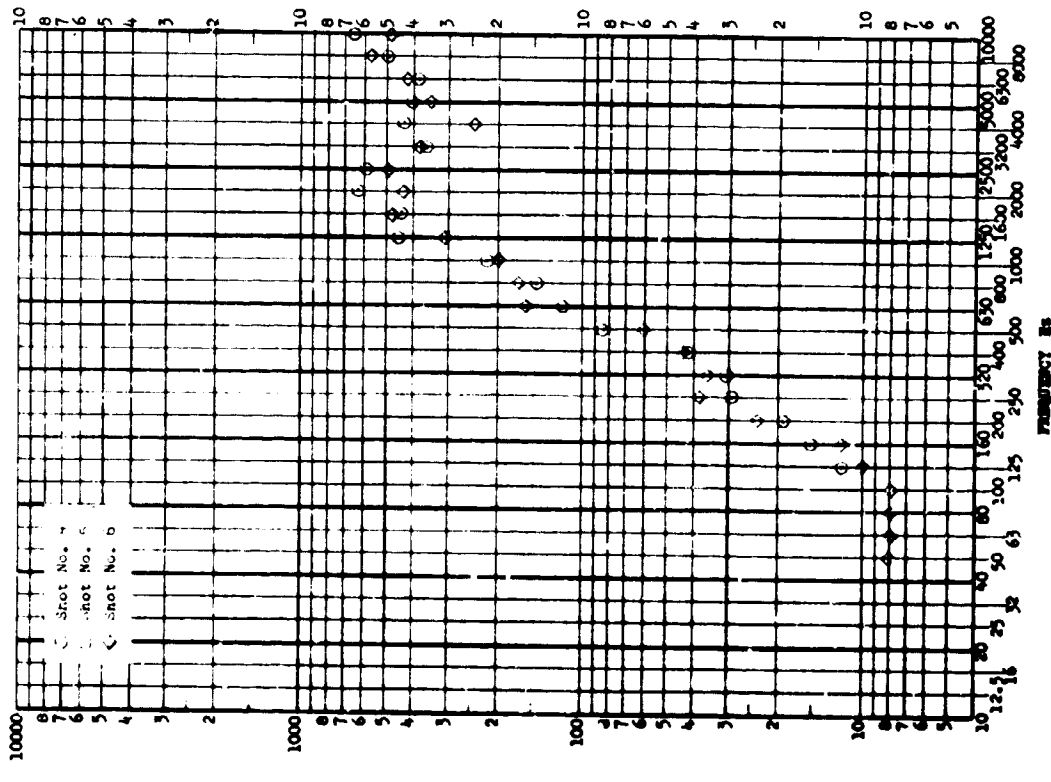


FIGURE II.B.2-51

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Single Nut
 Accel. No.: JA21
 Test Date: Aug., 1968

Shock Axis: Tangential Shock No.: 4, 5, 6



Shot #5 No Data

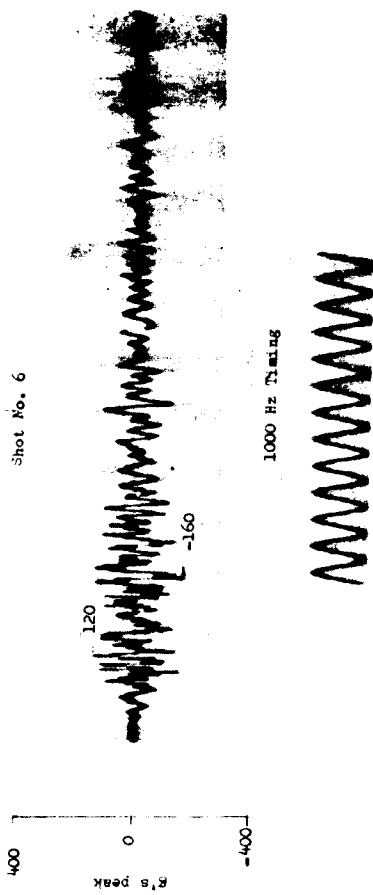
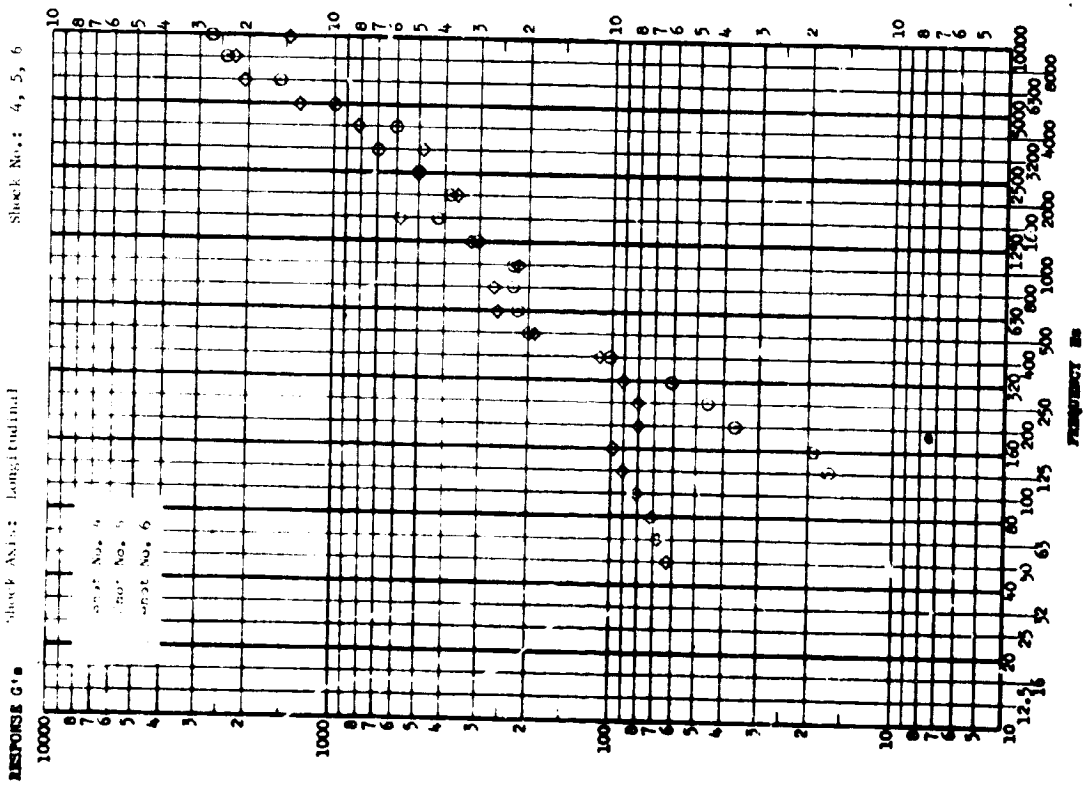


FIGURE 11.B.2-52

Test Item: Titan III-M Separation Nut Tests, 3/4 Inch Single Nut
 Test Date: Aug., 1968
 Shock Axis: Longitudinal
 Shock No.: 4, 5, 6



Shot No. 4

2500



Shot #5 No Data

Shot No. 6

800

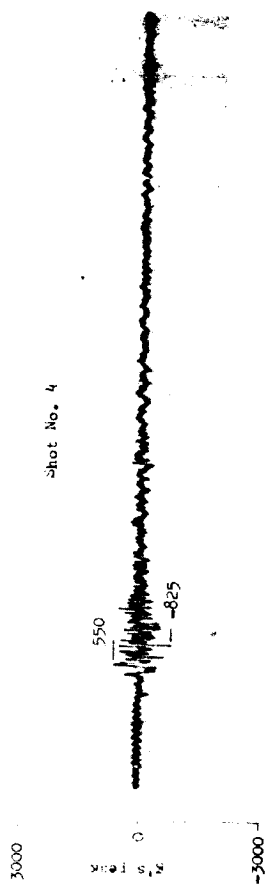
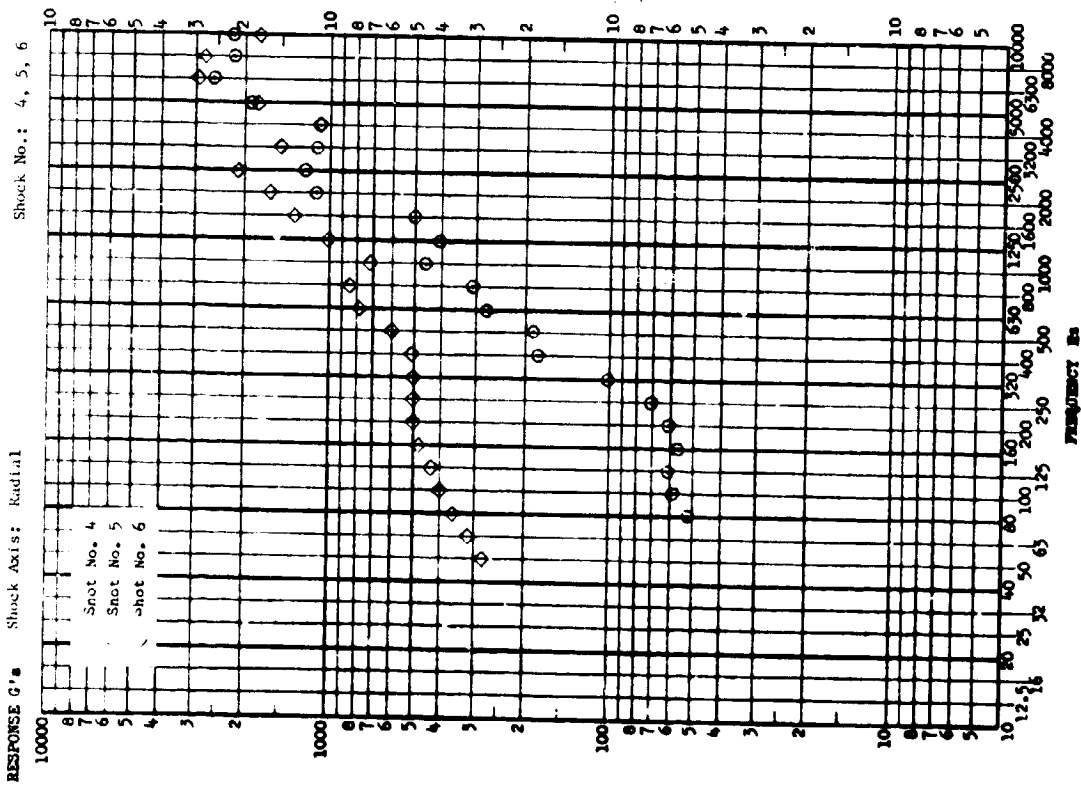


1000 Hz Timing

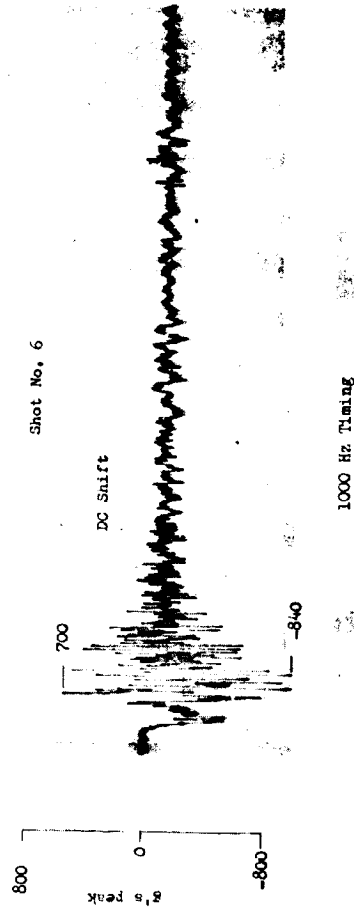


FIGURE II.B.2-53

Test Item: Titan II-M Separation Nut Test, 3/4 Inch Single Nut
 Accel. No.: 3A23
 Test Date: Aug., 1968



Shot #5 No Data



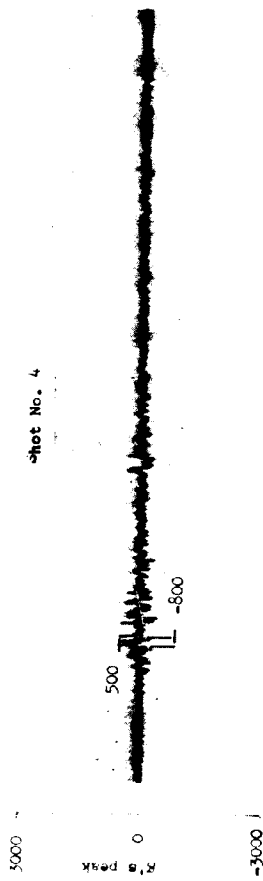
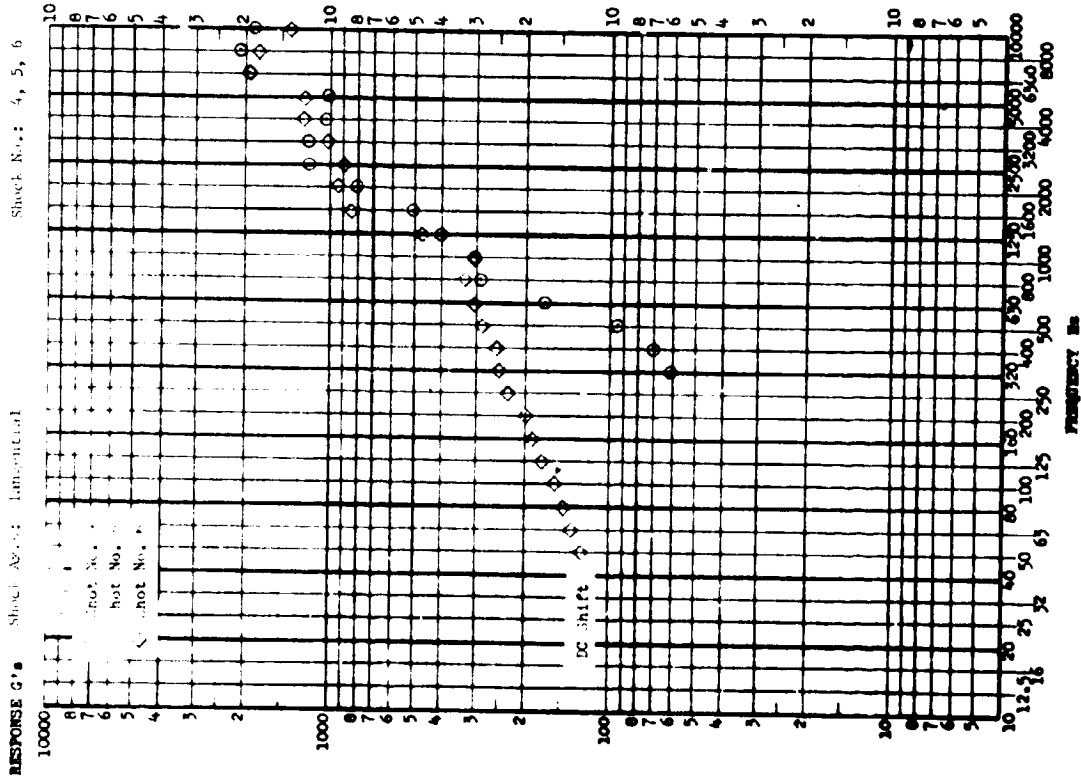
1000 Hz Timing



FIGURE 11.B.2-54

Test Item: Titan III-M Separation Rst Tests, 3/4 Inch Single Rst
 Accl. No.: 3A25
 Test Date: Aug., 1968

Shock Axis: Longitudinal
 Shock No.: 4, 5, 6



Shot #5 No Data

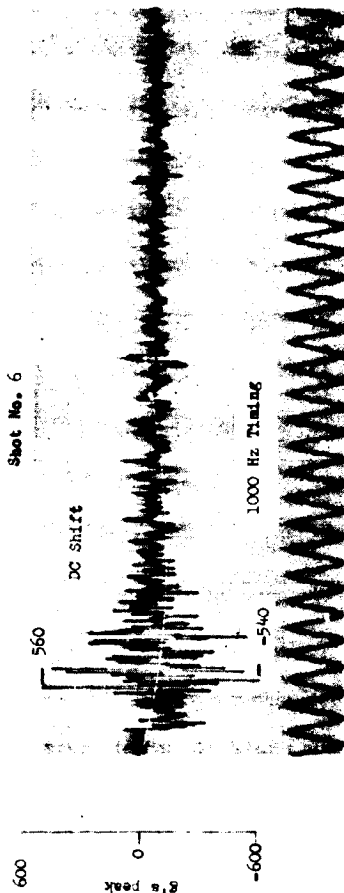


FIGURE 11.8.2-55

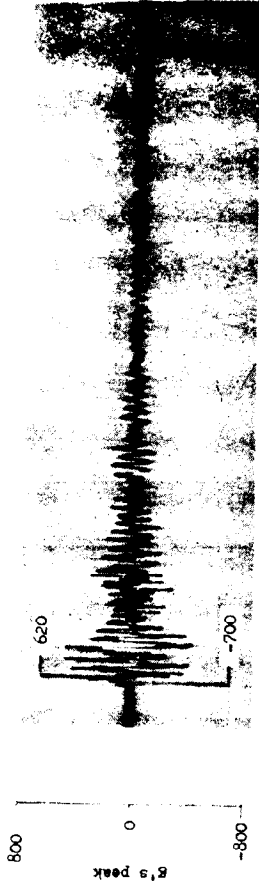
Test Item: Titan III-M Separation Nut Tests, 1 Inch Single
 Accel. No.: JAI
 Test Date: Aug., 1968
 Shock Axis: Longitudinal
 Shock No.: 7, 8, 9

1400

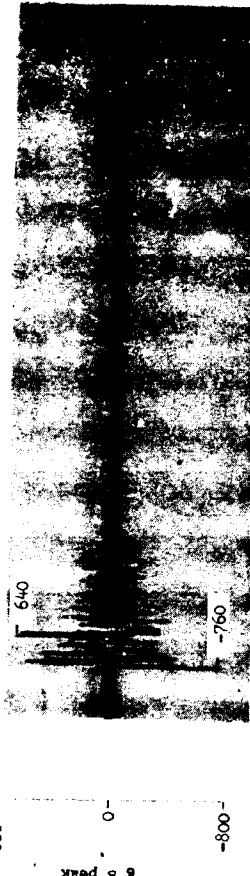
Shot No. 7



Shot No. 8



Shot No. 9



1000 Hz Timing

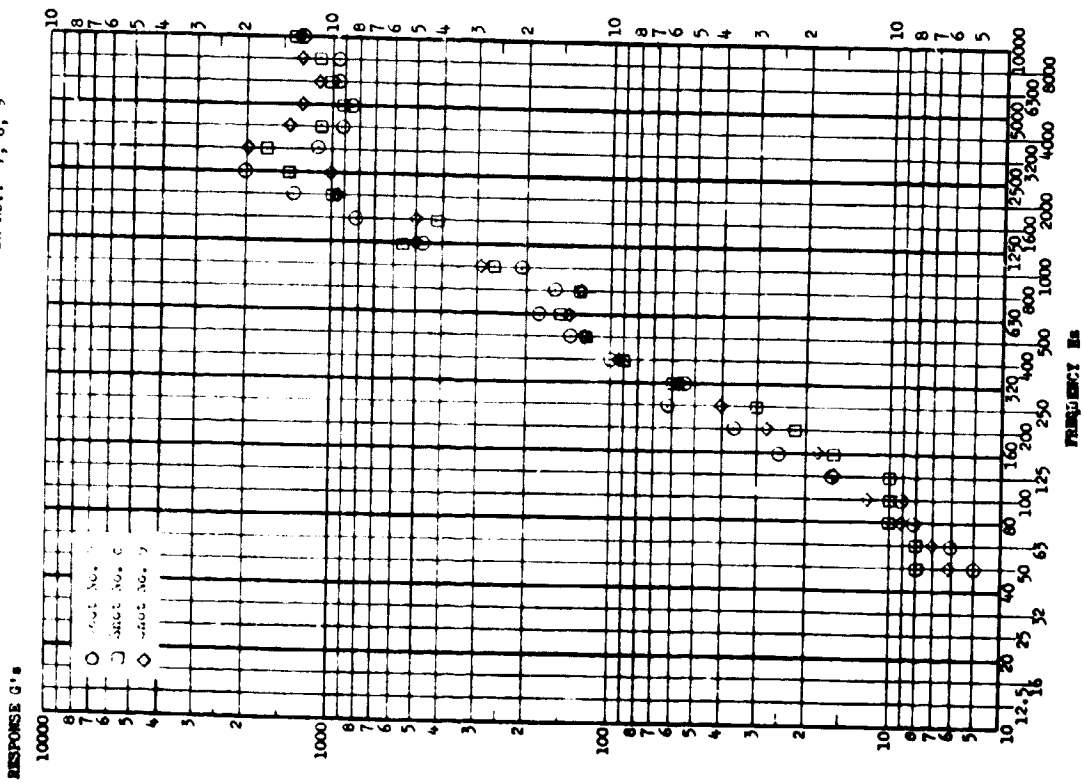


FIGURE 11.B.2-56

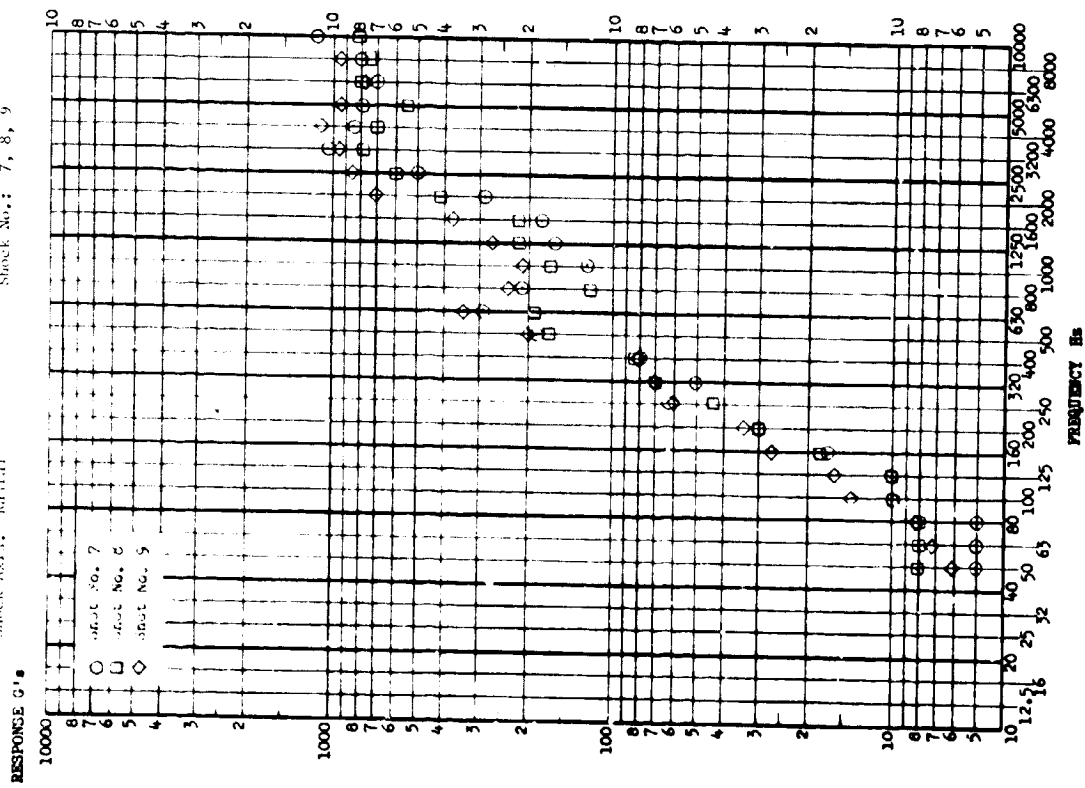
TEST ITEM: Titan I-L-N Separation Nut Tests, 1 Inch Single

ACCEL. No.: 342

TEST DATE: Aug., 1968

SHOCK AXES: Radial

SHOT No.: 7, 8, 9



1000

G's peak

-1000

600

G's peak

-600

600

G's peak

-600

Shot No. 7

300

-350

Shot No. 8

340

-350

Shot No. 9

360

-400

1000 Hz Timing



FIGURE 11.B.2-57

Test Item: Titan III-M Separation Nut Tests, 1 Inch Single

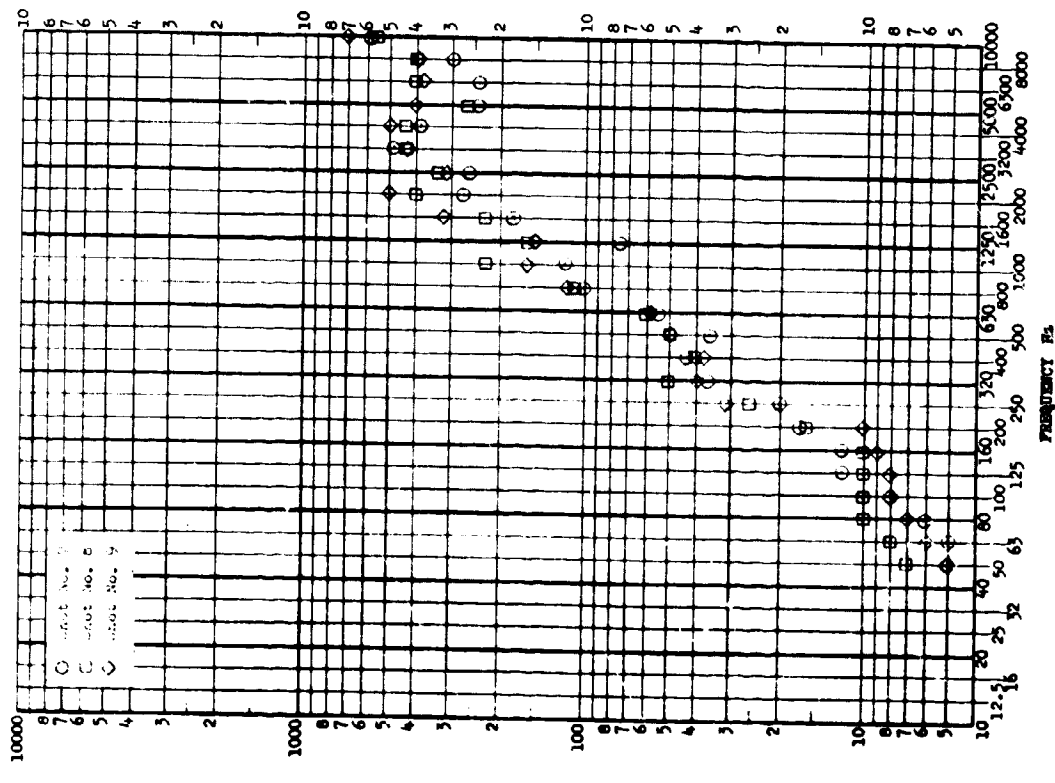
Accel. No.: 3A3

Test Date: Aug., 1968

RESPONSE G's

Shock Axis: Tangential

Shock No.: 7, 8, 9



1200

0
-1200

Shot No. 7

250

-200

600

0
-600

Shot No. 8

210

-200

600

0
-600

Shot No. 9

170

-200

1000 Hz Timing

FIGURE 11.B.2-58

U. I. 11-04: Titan III-M Separation Sol. Tests, 1 Inch Single-
 Wave, 500 g's Test Date: Aug., 1968
 Shock Axis: Longitudinal Shock No.: 7, 8, 9

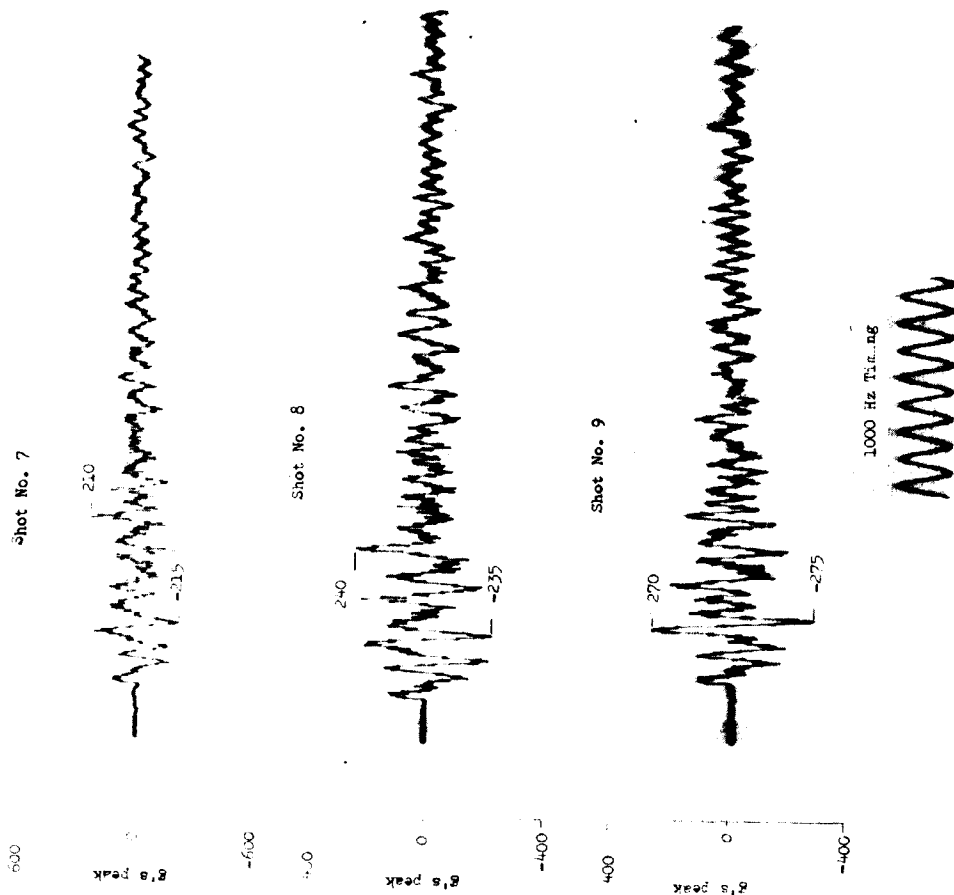
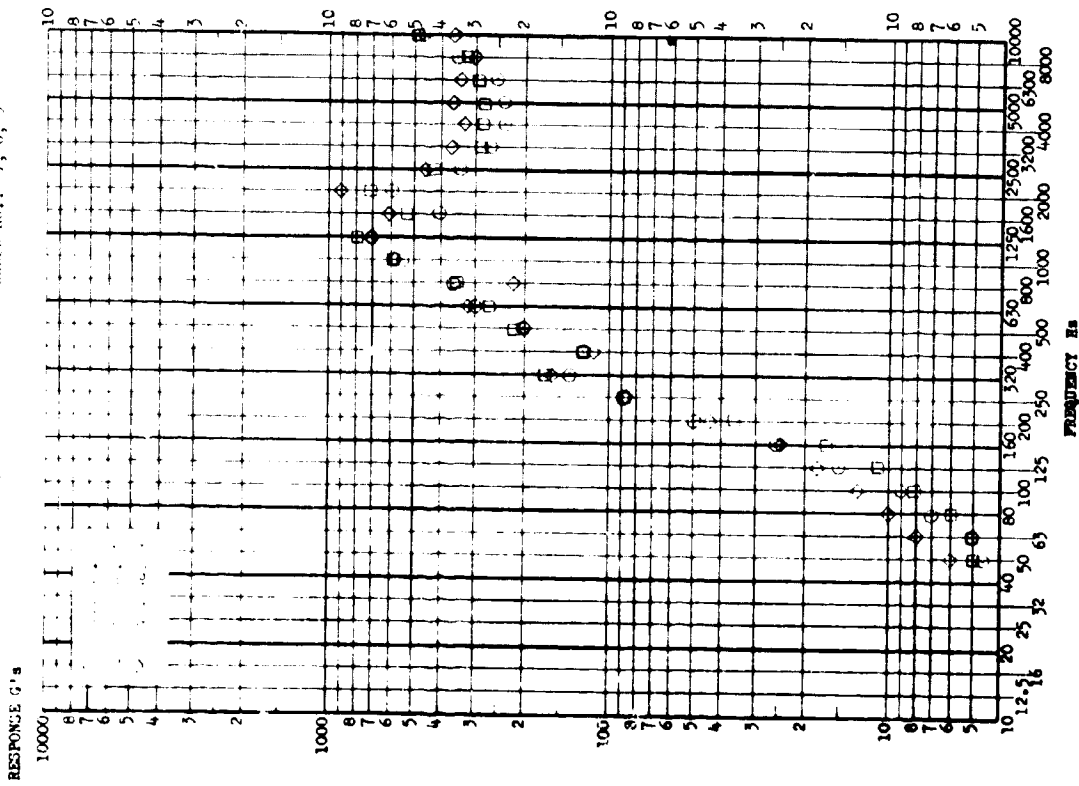


FIGURE 11.8.2-59

Test Item: Titan III-M Separation Nut Tests, 1 Inch Single
 Accel. No.: 3A5
 Test Date: Aug., 1968
 Shock Axis: Vertical
 Shock No.: 7, 8, 9

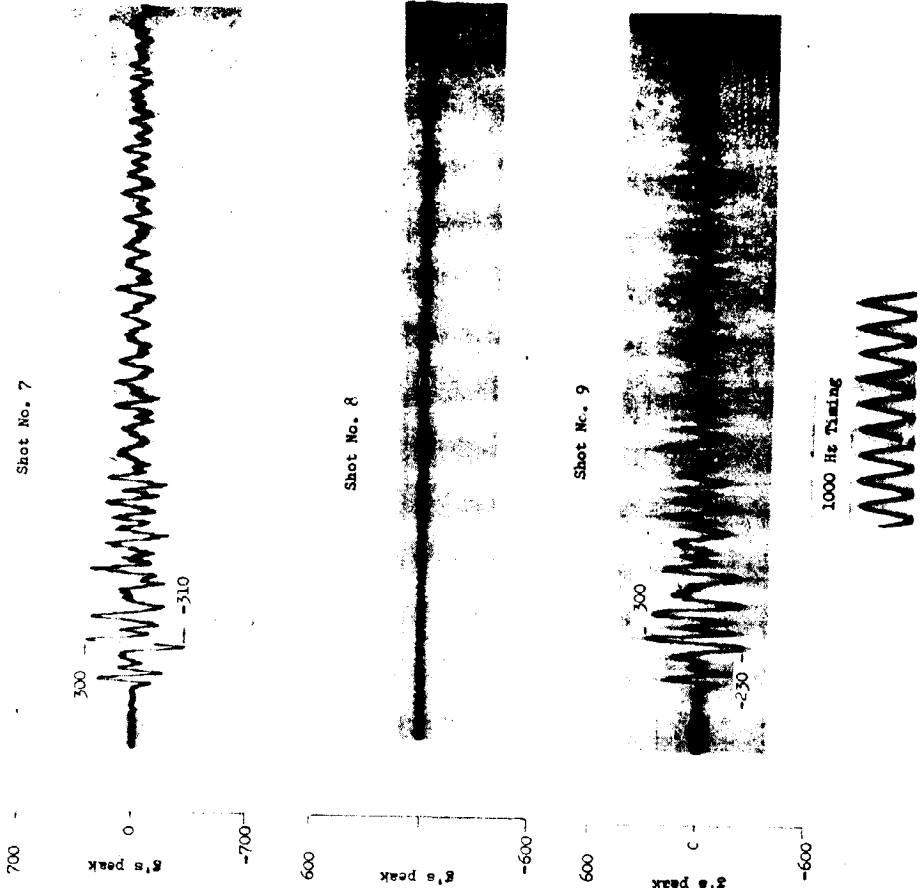
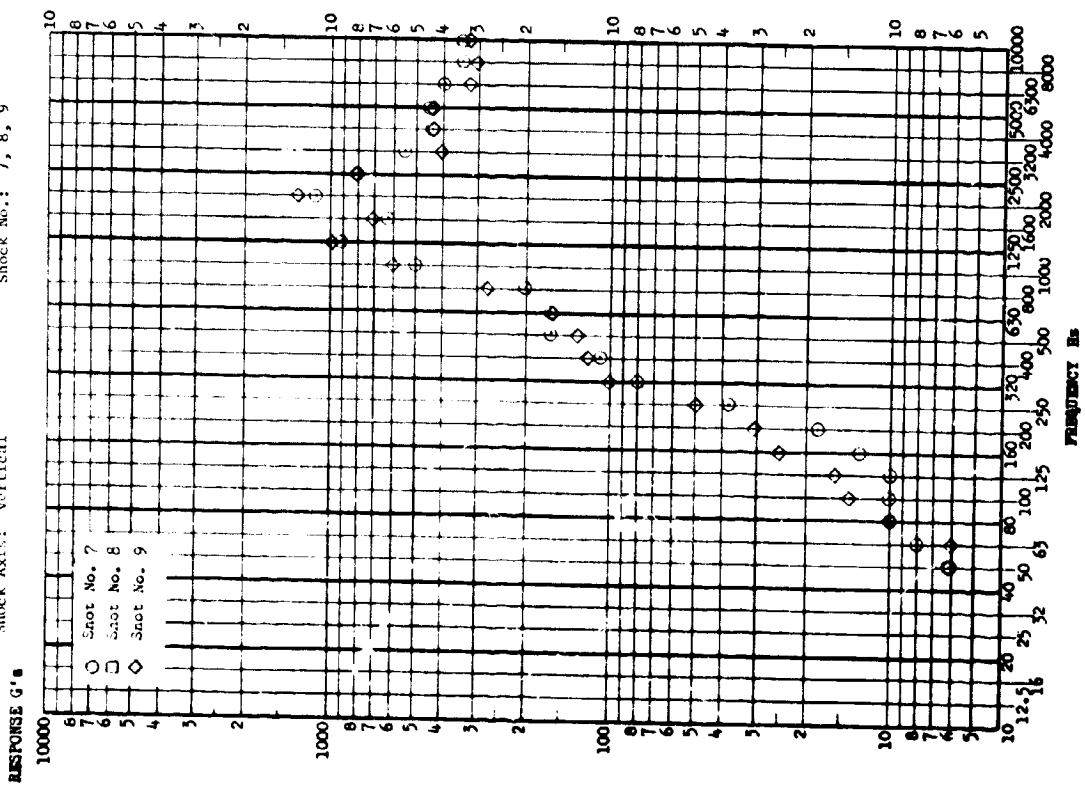


FIGURE 11.B.2-60

Test Item: Titan III-S Separation Rot Tester, 1 Inch Single

Acc'l. No.: 136

Test Date: Aug., 1968

Shock Axis: Horizontal

Shock No.: 7, 8, 9

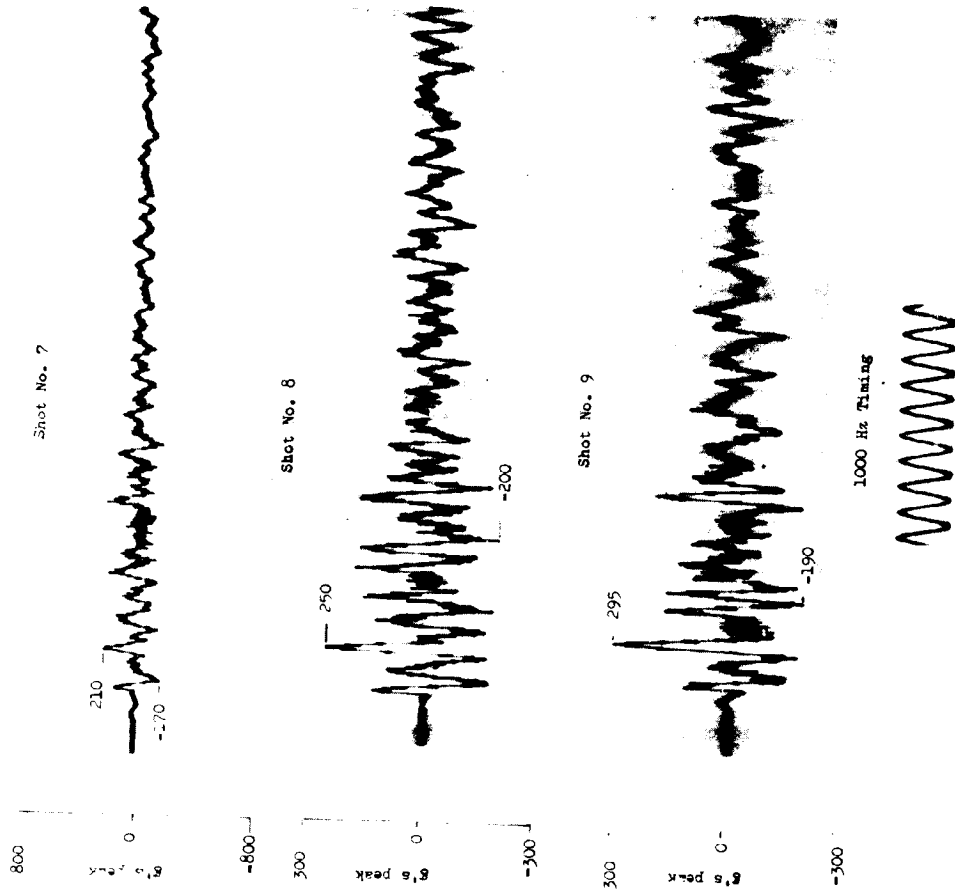
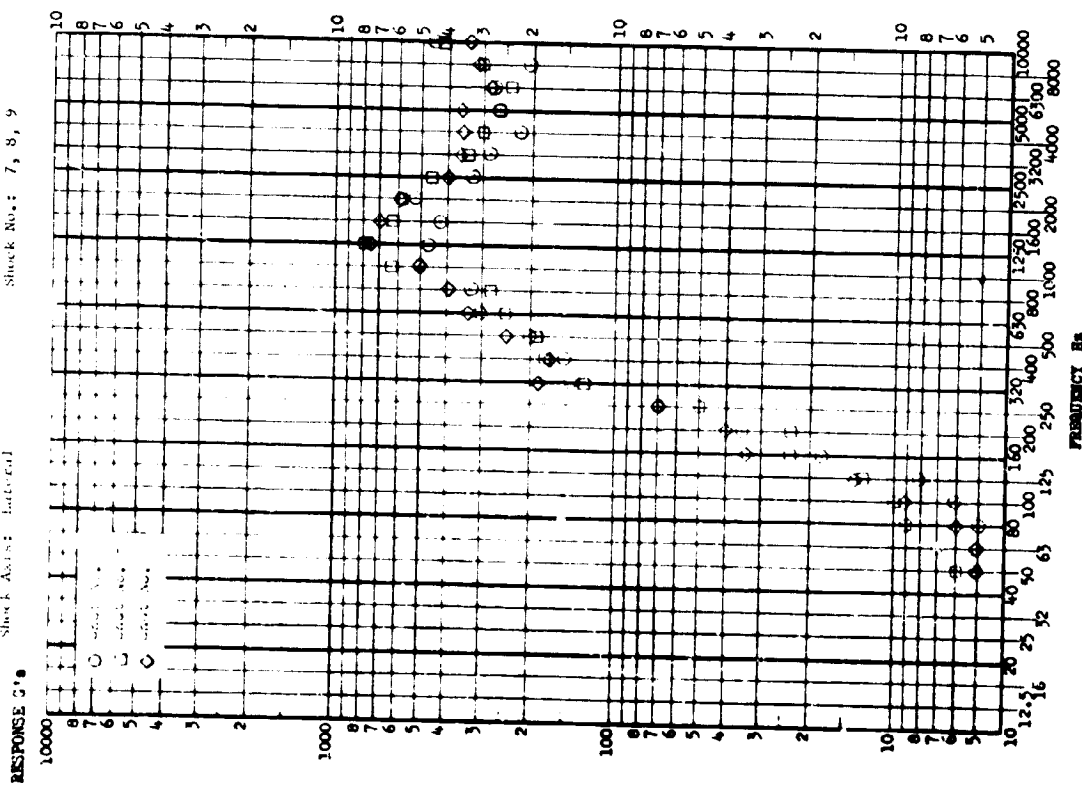


FIGURE II.B.2-61

Test Item: Titan III-M Separation Nut Tests, 1 Inch Single
 Accel. No.: J47 Test Date: Aug., 1968
 Shock Axis: Longitudinal Shock No.: 7, 8, 9

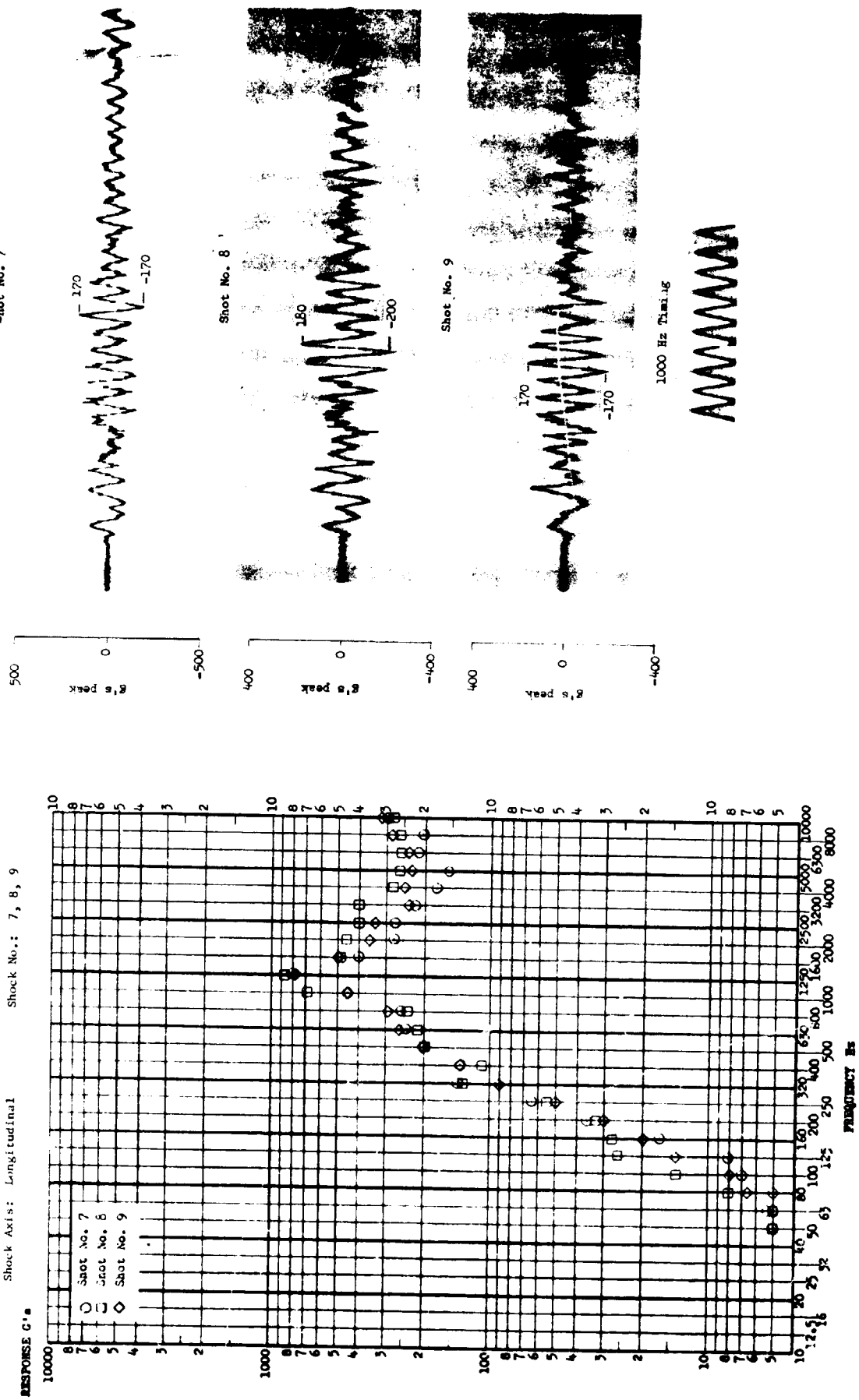
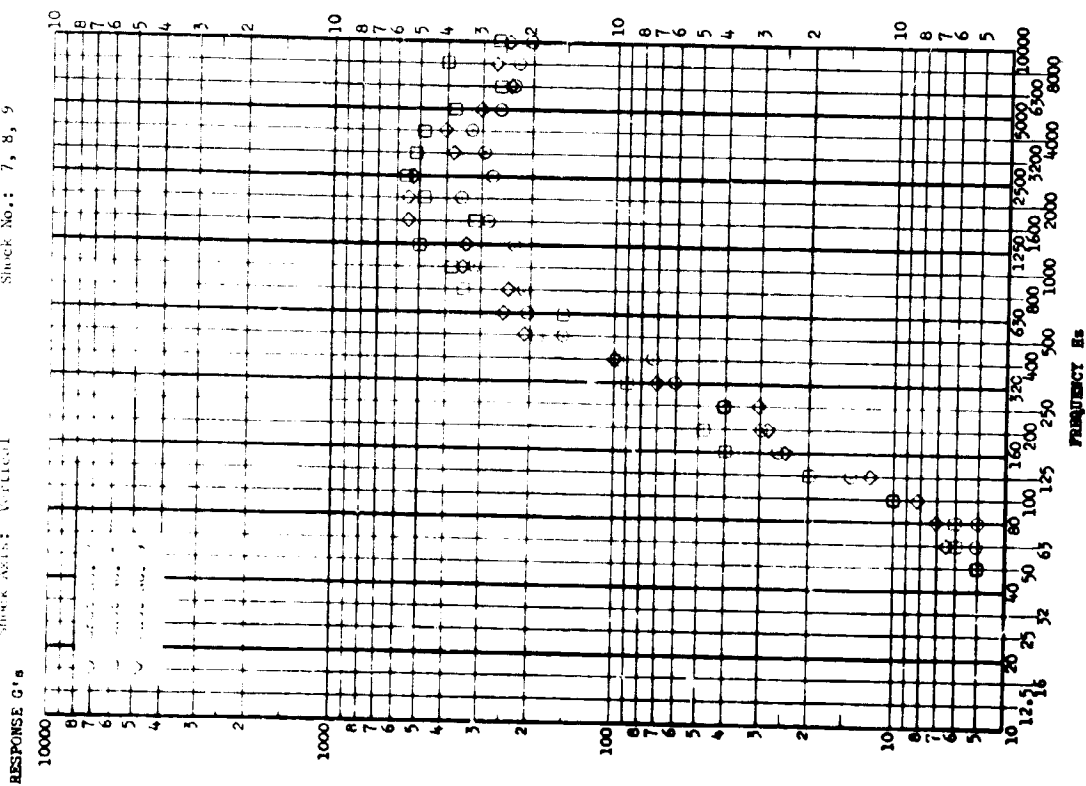
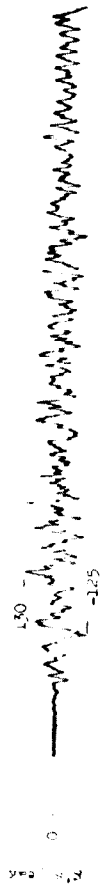


FIGURE 11.B.2-62

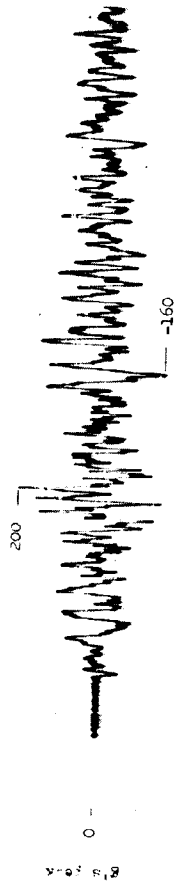
Test Item: Titan III-9 Separation Ret Tests, 1 Inch Single
 Accel. No.: 458
 Shock Axis: Vertical
 Test Date: Aug., 1968
 Shock No.: 7, 8, 9



Shot No. 7



Shot No. 8



Shot No. 9

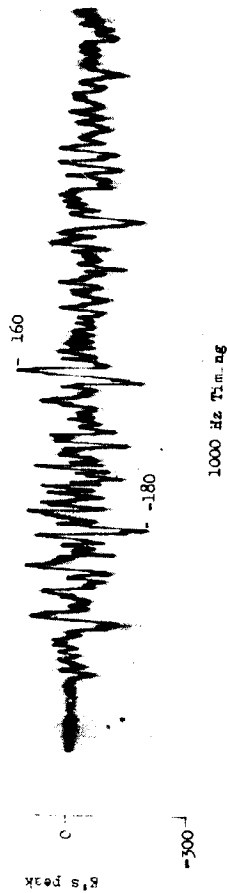


FIGURE 11.B.2-63

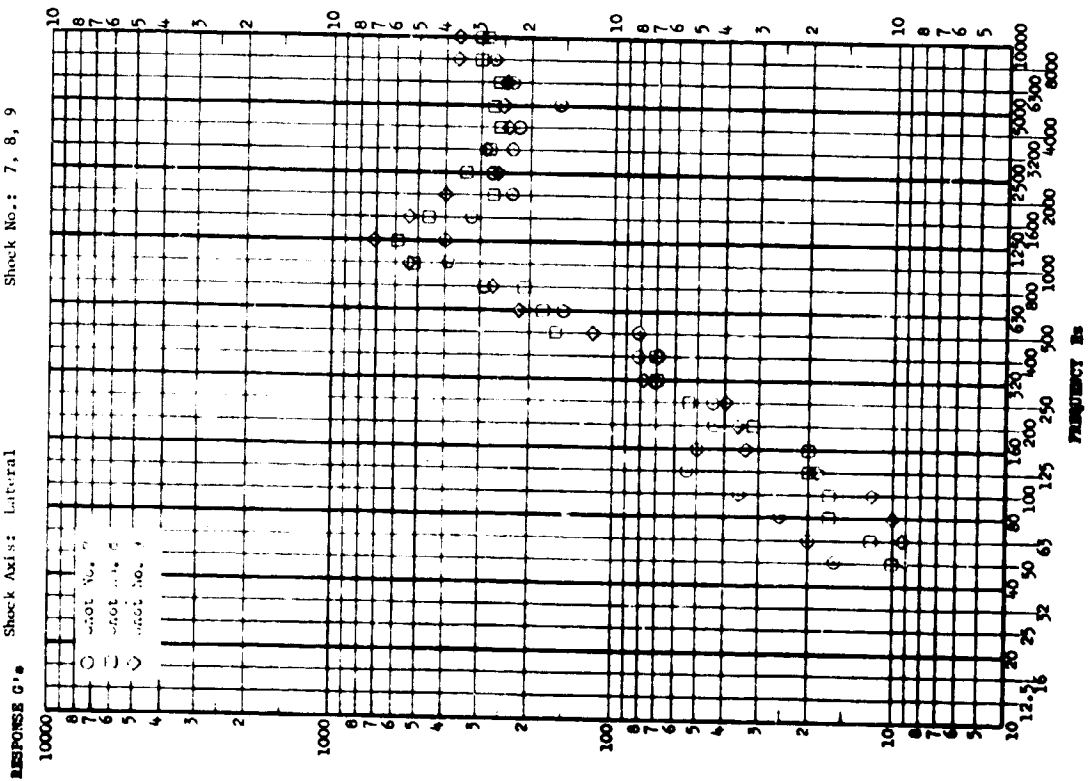
Test Item: Titan III-M Separation Nut Tests, 1 Inch Single

Accel. No.: 3A9

Test Date: Aug., 1968

Shock No.: 7, 8, 9

Shock Axis: Lateral



Shot No. 7

500



Shot No. 8

300



Shot No. 9

300



1,000 Hz Timing



FIGURE 11.B.2-64

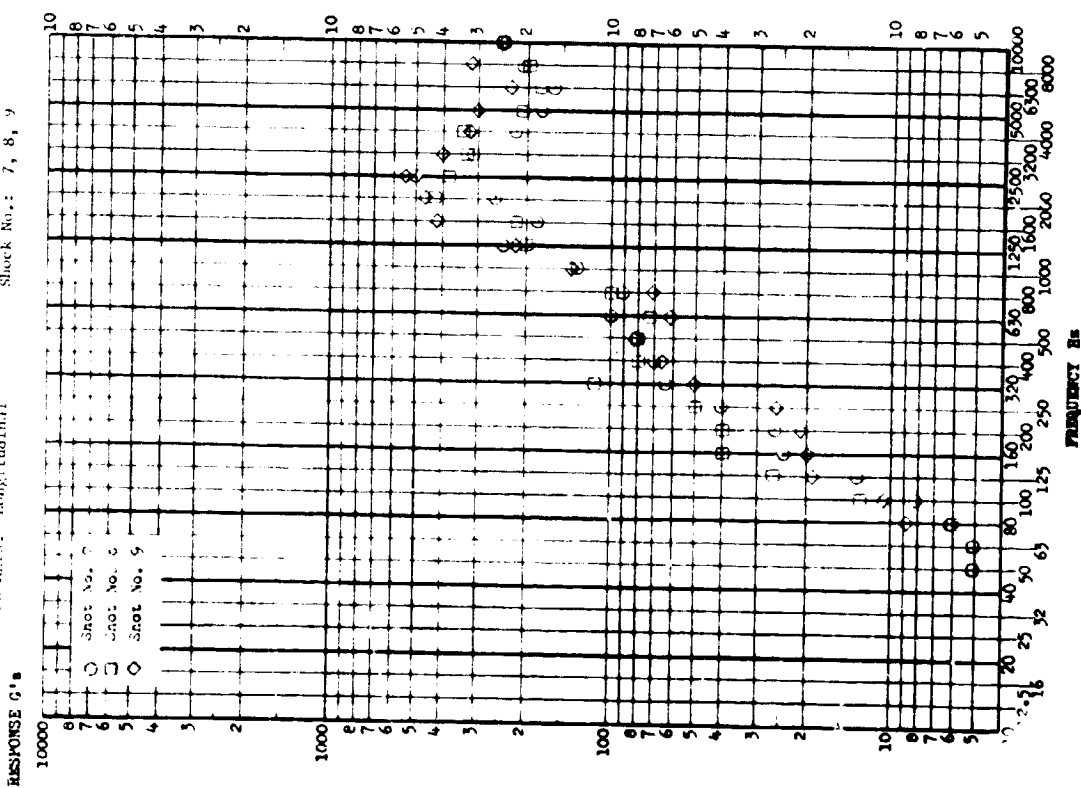
Test Item: Titan III-S Separation Ref Tests, 1 Inch Single

Acc. I. No.: 1510

Test Date: Aug., 1968

Shock Axis: Longitudinal

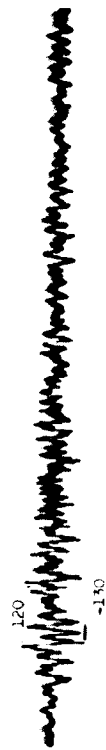
Shock No.: 7, 8, 9



500

Shot No. 7

R's Peak



-500

Shot No. 8

R's Peak



-500

Shot No. 9

R's Peak



-500

1000 Hz Timing



FIGURE 11.B.2-65

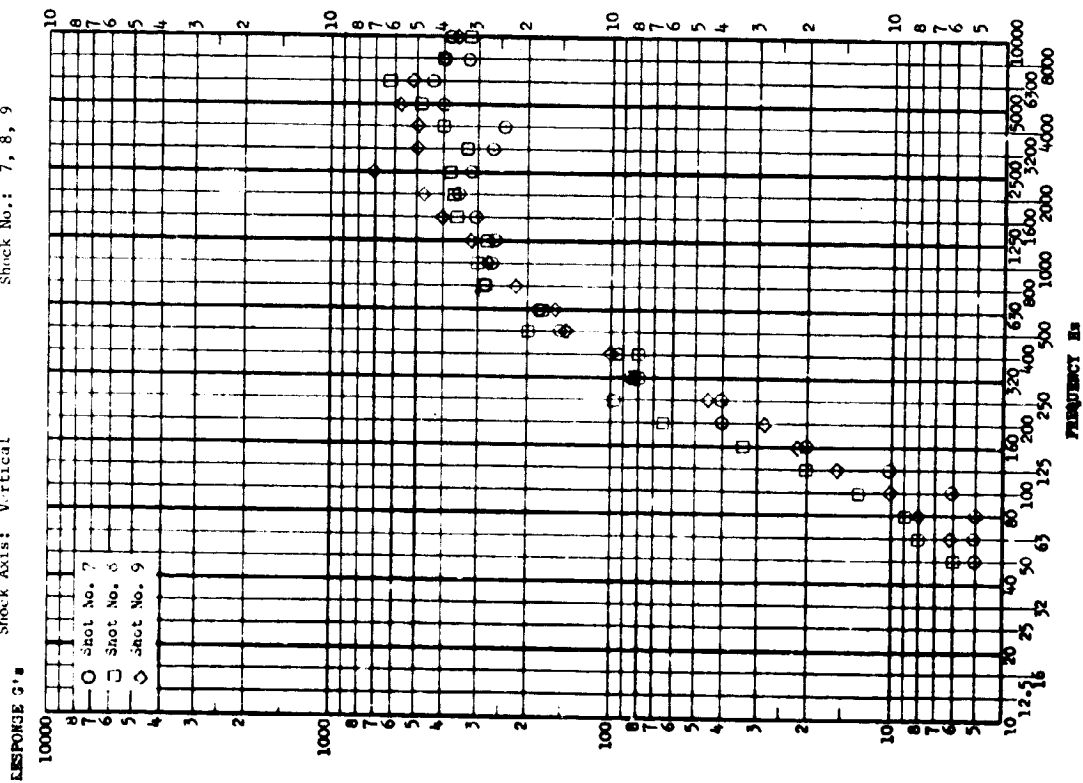
Test Item: Titan III-M Separation Nut Tests, 1 Inch Single

Acc'l. No.: J411

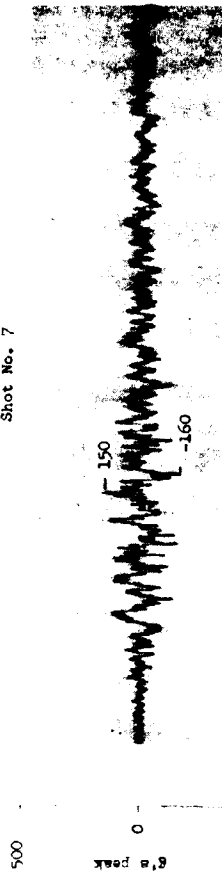
Test Date: Aug., 1968

Shock Axis: Vertical

Shock No.: 7, 8, 9



Shot No. 7



Shot No. 8



Shot No. 9

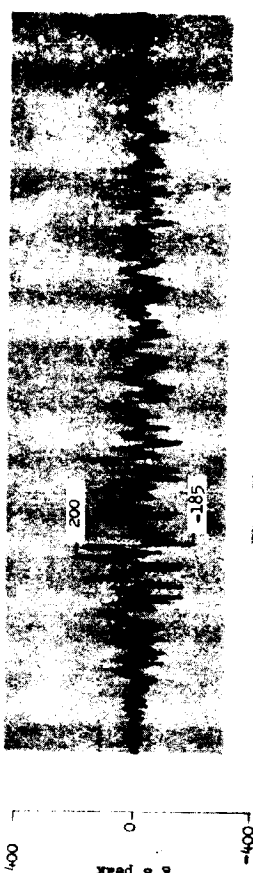


FIGURE 11.B.2-66

Test Item: Titan III-M Separation Nut Tests, 1 Inch Single

Accel. No.: JAL2

Test Date: Aug., 1968

Shock Axis: Lateral

Shock No.: 7, 8, 9

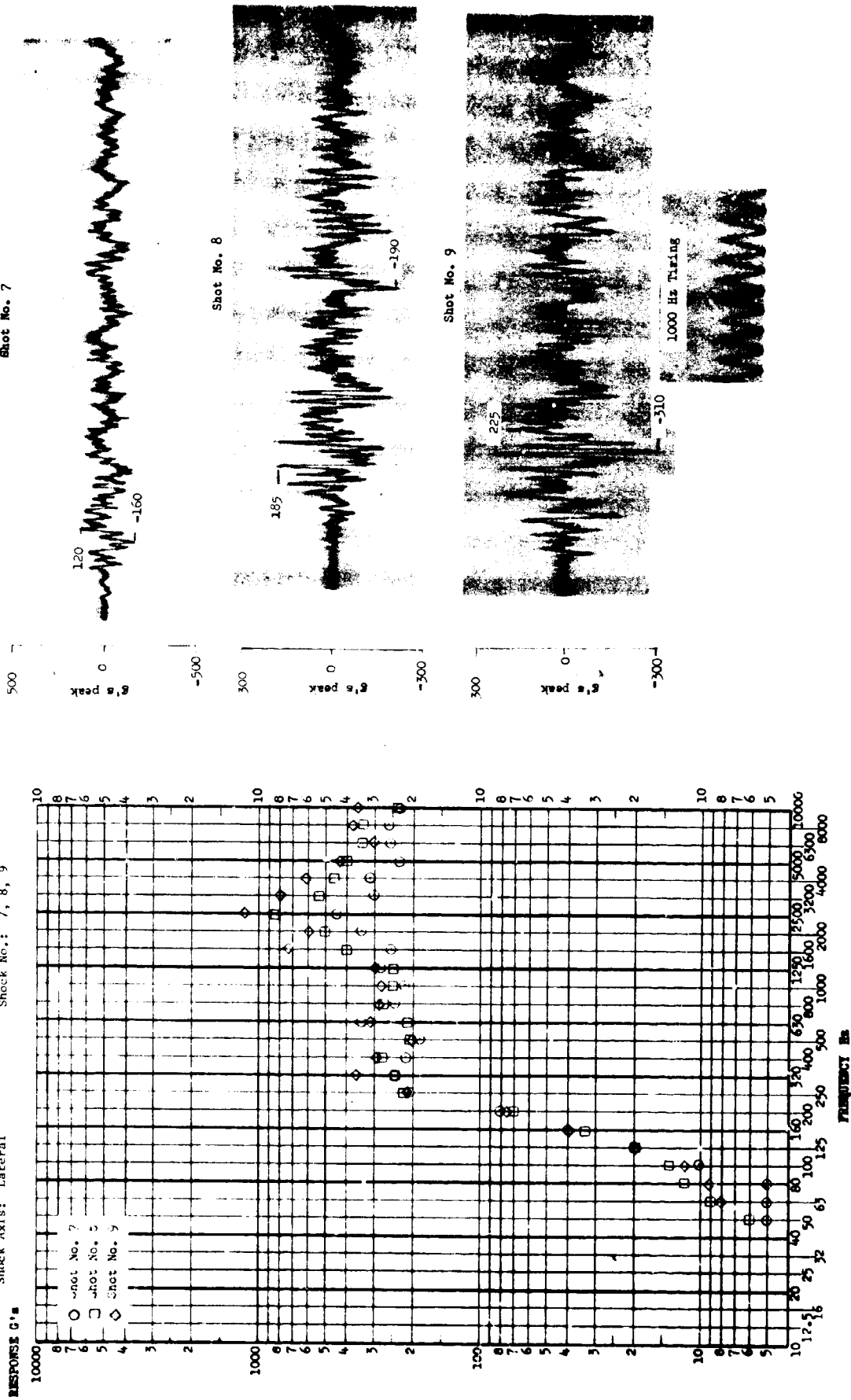


FIGURE 11.B.2-67

Test Item: Titan III-M Separation Nut Tests, 1 Inch Single
 Accel. No.: 3A13 Test Date: Aug., 1968
 Shock Axis: Longitudinal Shock No.: 7, 8, 9

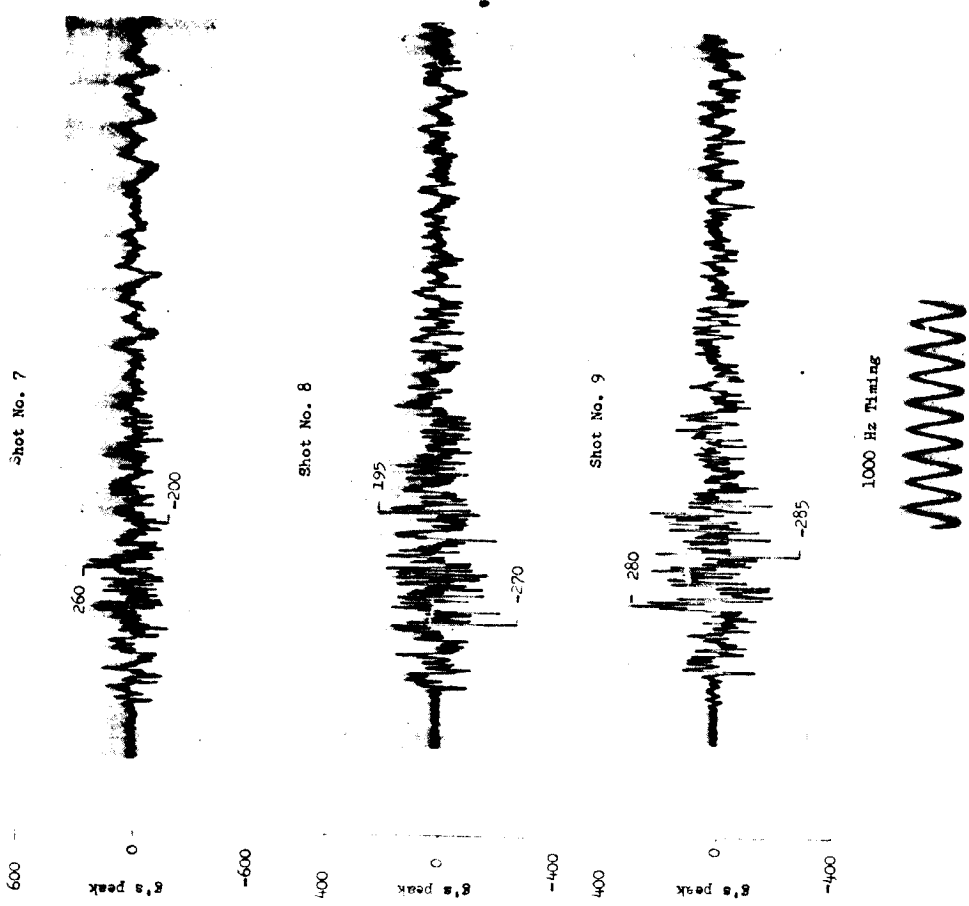
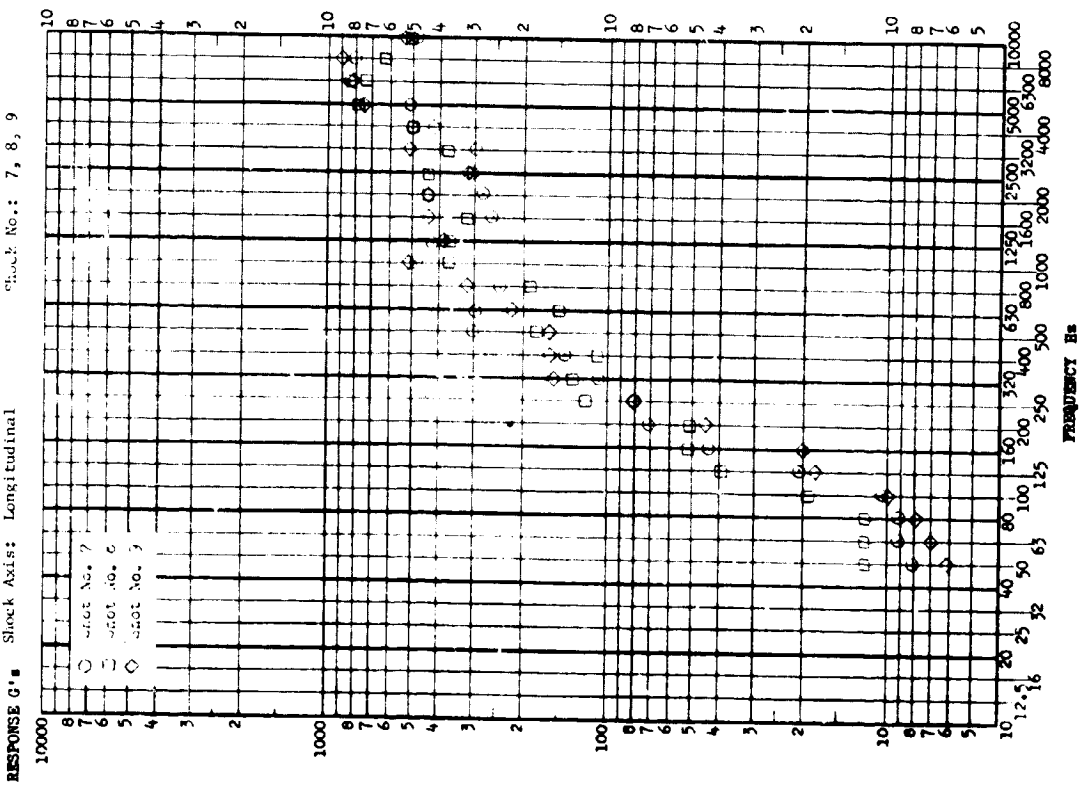


FIGURE 11.B.2-68

Test Item: Clean III-M Separation Nut Tests, 1 Inch Single
 Accel. No.: 3A14 Test Date: Aug., 1968
 Shock Axis: Vertical Shock No.: 7, 8, 9

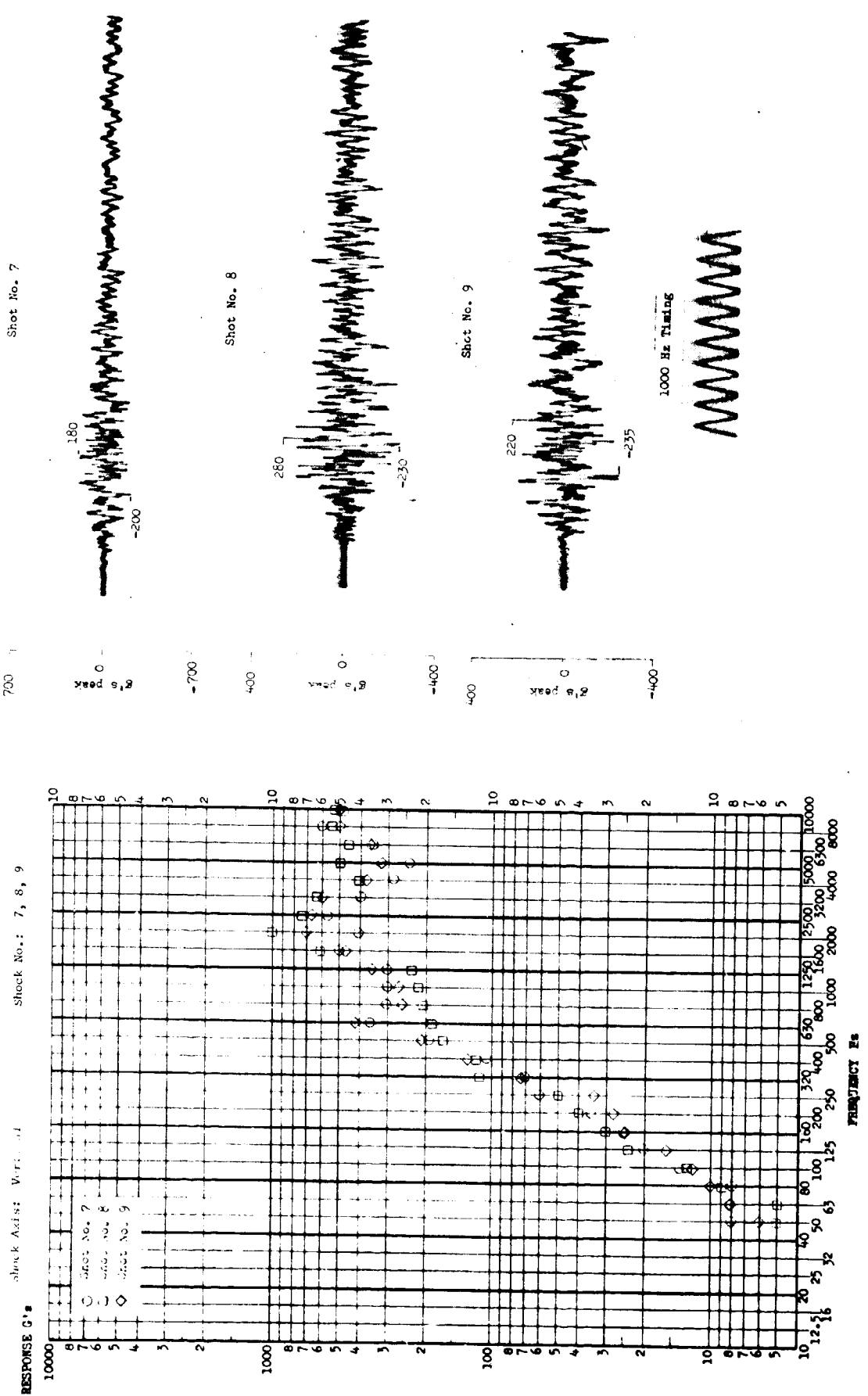
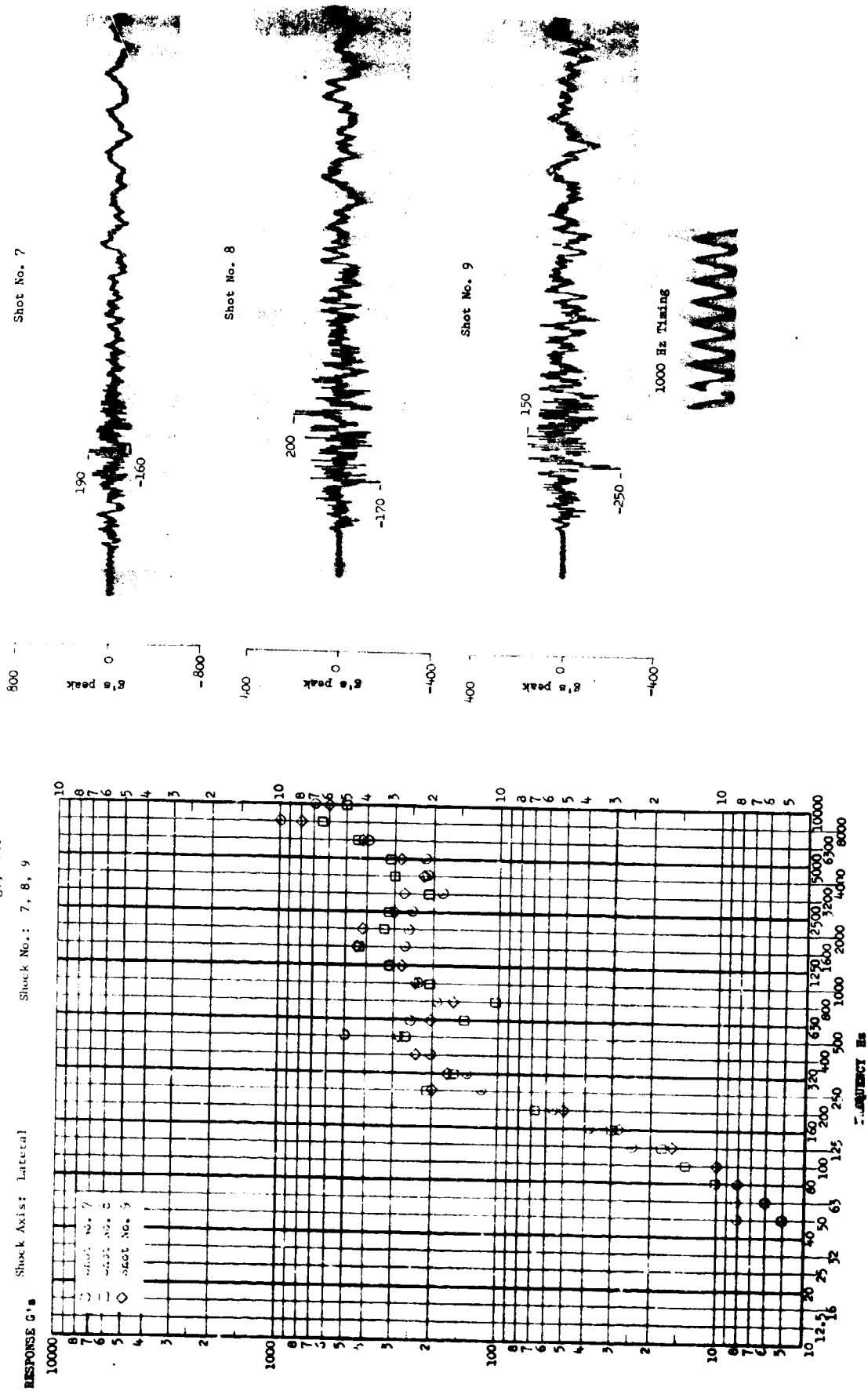


FIGURE II.B.2-69

Test Item: Titan III-M Separation Nut Tests, 1 Inch Single
 Accel. No.: 3A15 Test Date: Aug., 1968
 Shock Axis: Lateral Shock No.: 7, 8, 9



1000 Hz Timing
 WAAAAA

FIGURE 11.8.2-70

E. O. Lutz: Titan III-3 Separation Nut Tests, 1 Inch Single
 Accel. Dir.: 44In. Test Date: Aug., 1968
 Shock Axis: Longitudinal Shock Nos.: 7, 8, 9

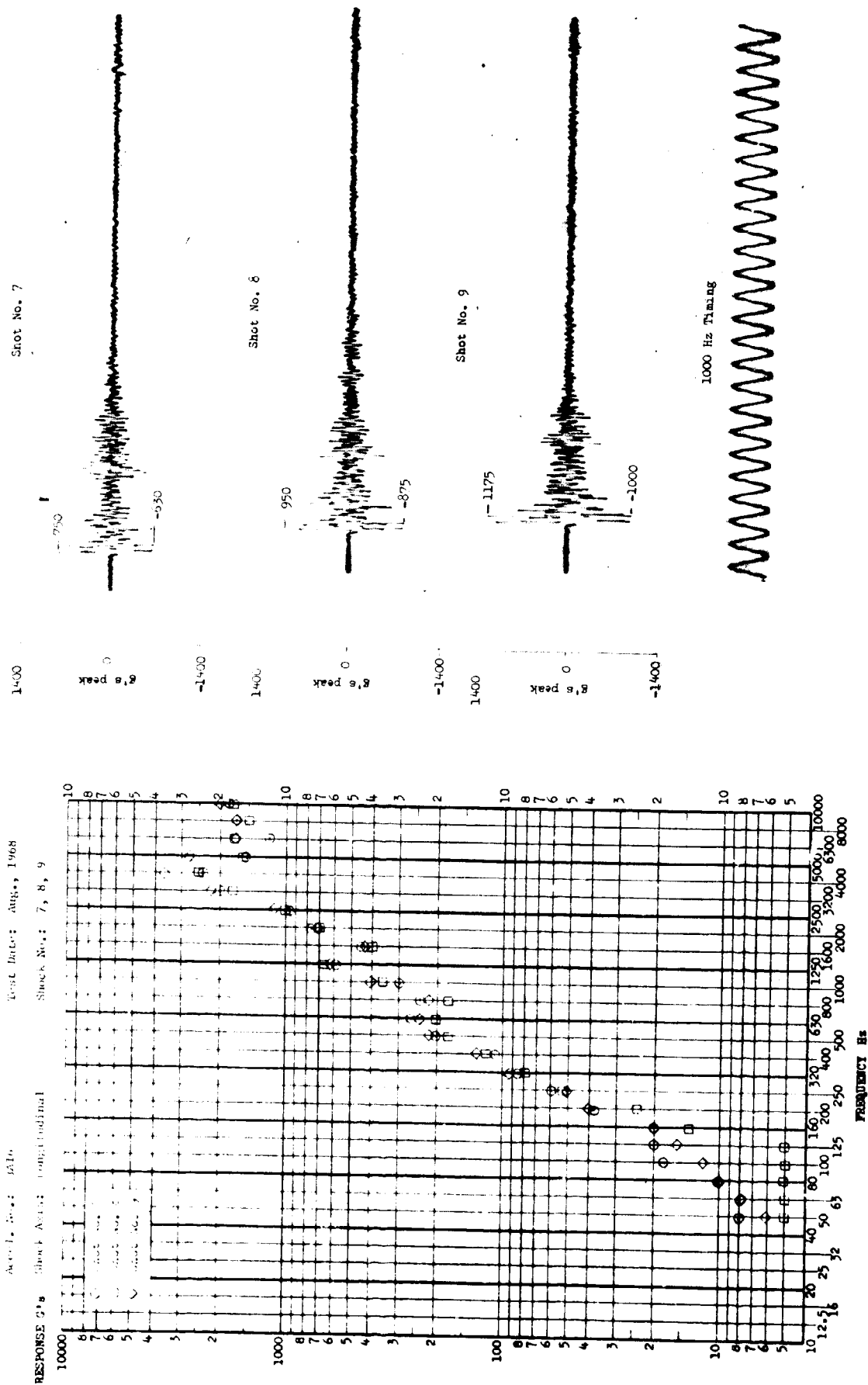


FIGURE 11.B.2-71

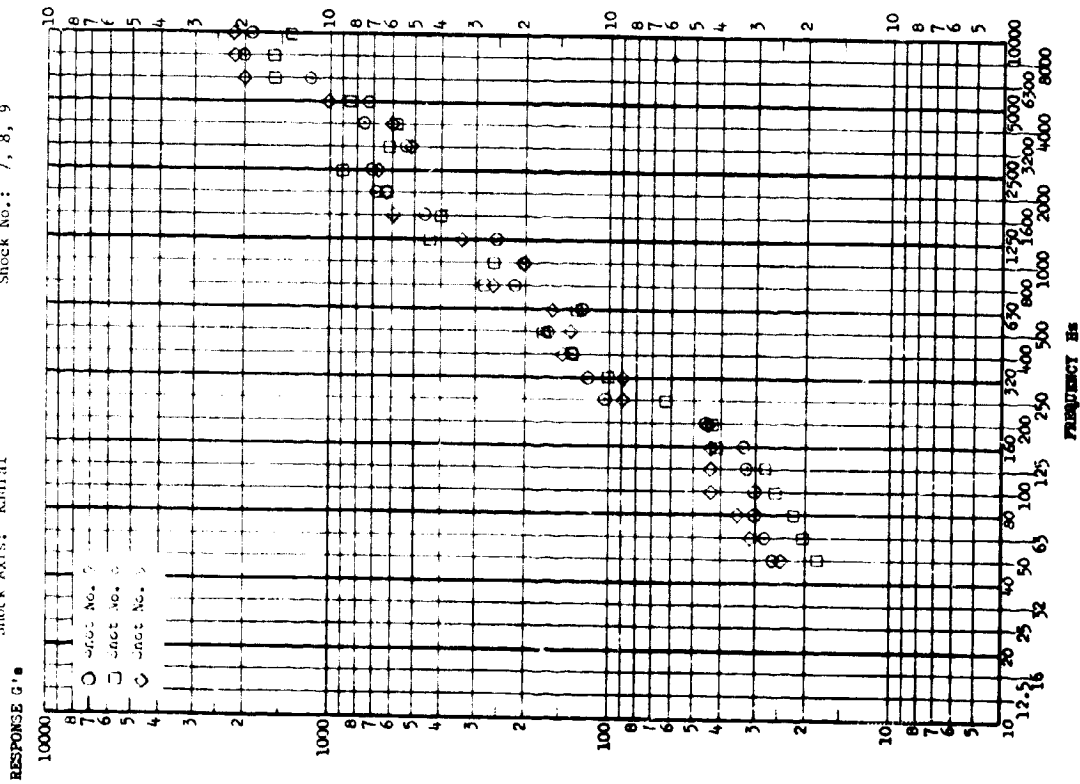
Test Item: Titan III-M Separation Nut Tests, 1 Inch Single

Accel. No.: 3A17

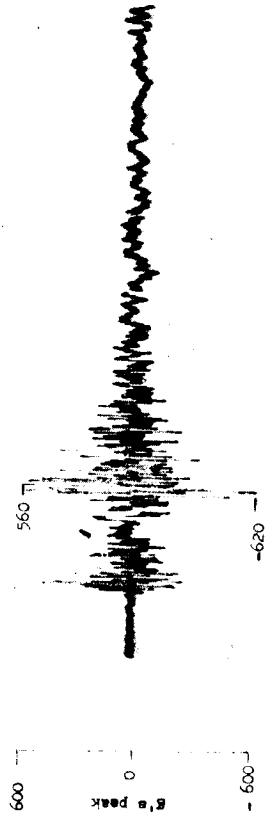
Test Date: Aug., 1968

Shock Axis: Radial

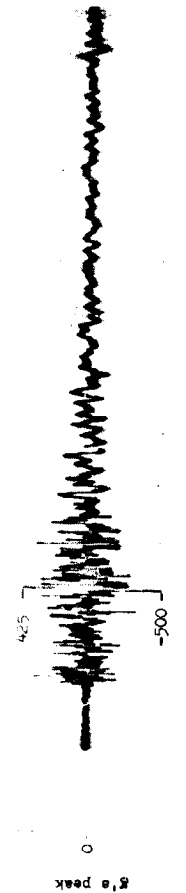
Shock No.: 7, 8, 9



Shot No. 7



Shot No. 8



Shot No. 9



1000 Hz Timing



FIGURE 11.B.2-72

Test Item: Eaton H1-M Suspension Mat Tests, 1 Inch Single

Accel. No.: 3414 Test Date: Aug., 1968

Shock Axis: Longitudinal Shock No.: 7, 8, 9

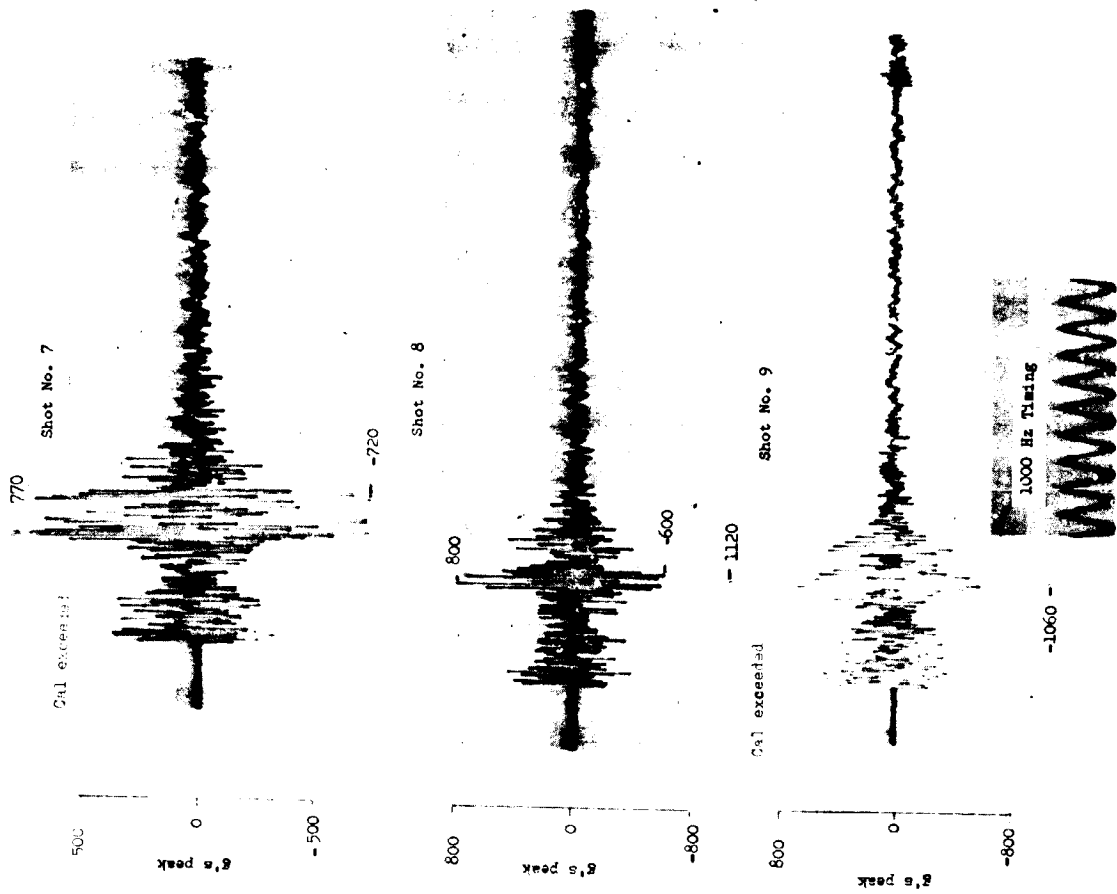
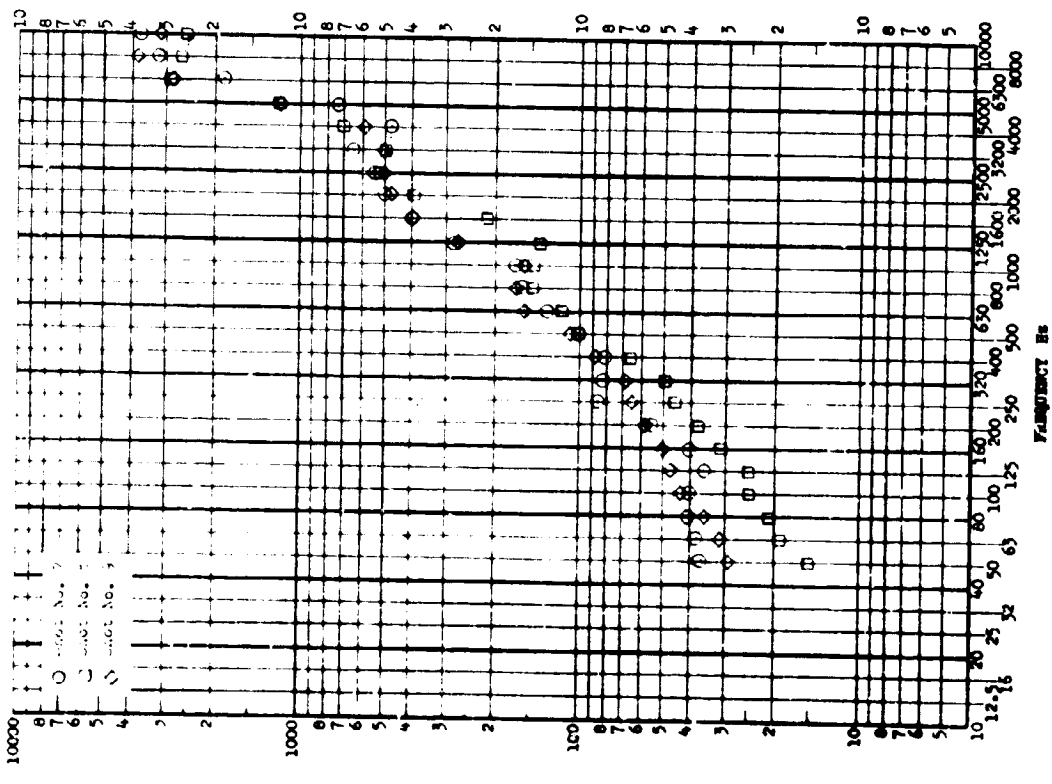


FIGURE 11.B.2-73

Test Item: Titan III-M Separation Nut Tests, 1 Inch Single
 Accel. No.: 5A19 Test Date: Aug., 1968
 Shock Axis: Longitudinal Shock No.: 7, 8, 9

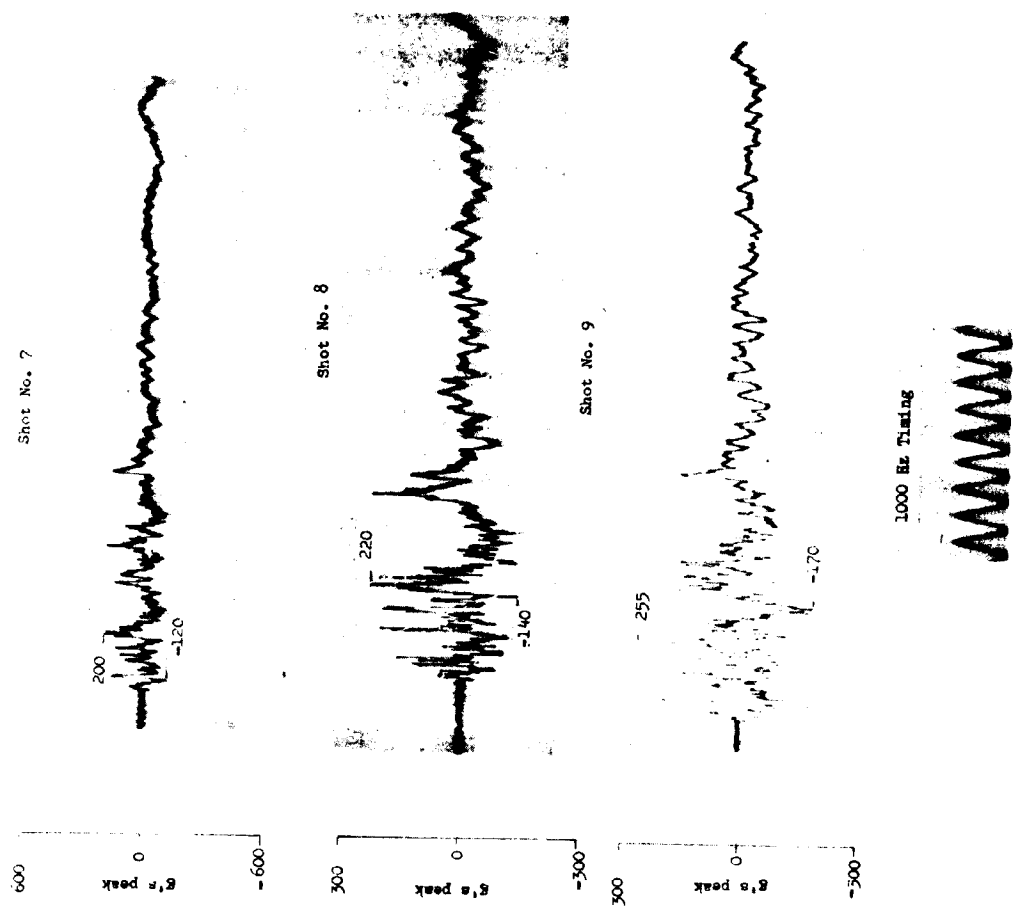
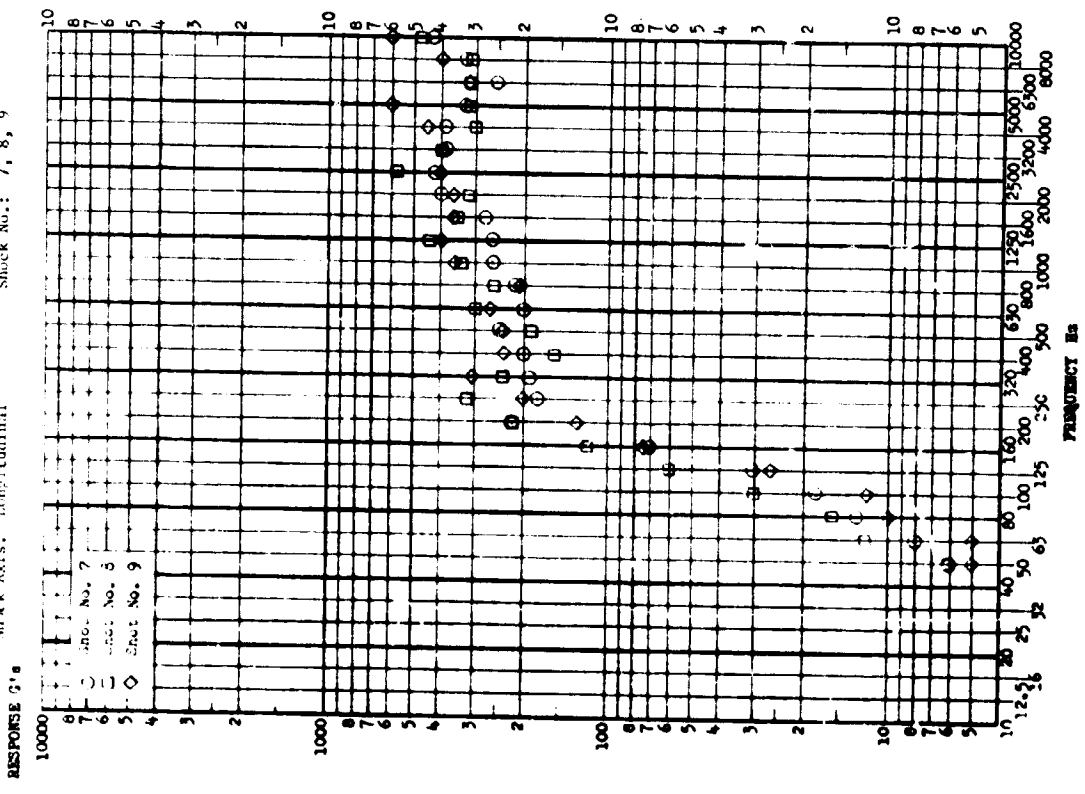


FIGURE 11.B.2-74

Test Item: Titan III-M Separation Nut Tests, 1 Inch Singl.

Acc'l. No.: 3A20

Test Date: Aug., 1968

Shock Axis: Radial

Shock No.: 7, 8, 9

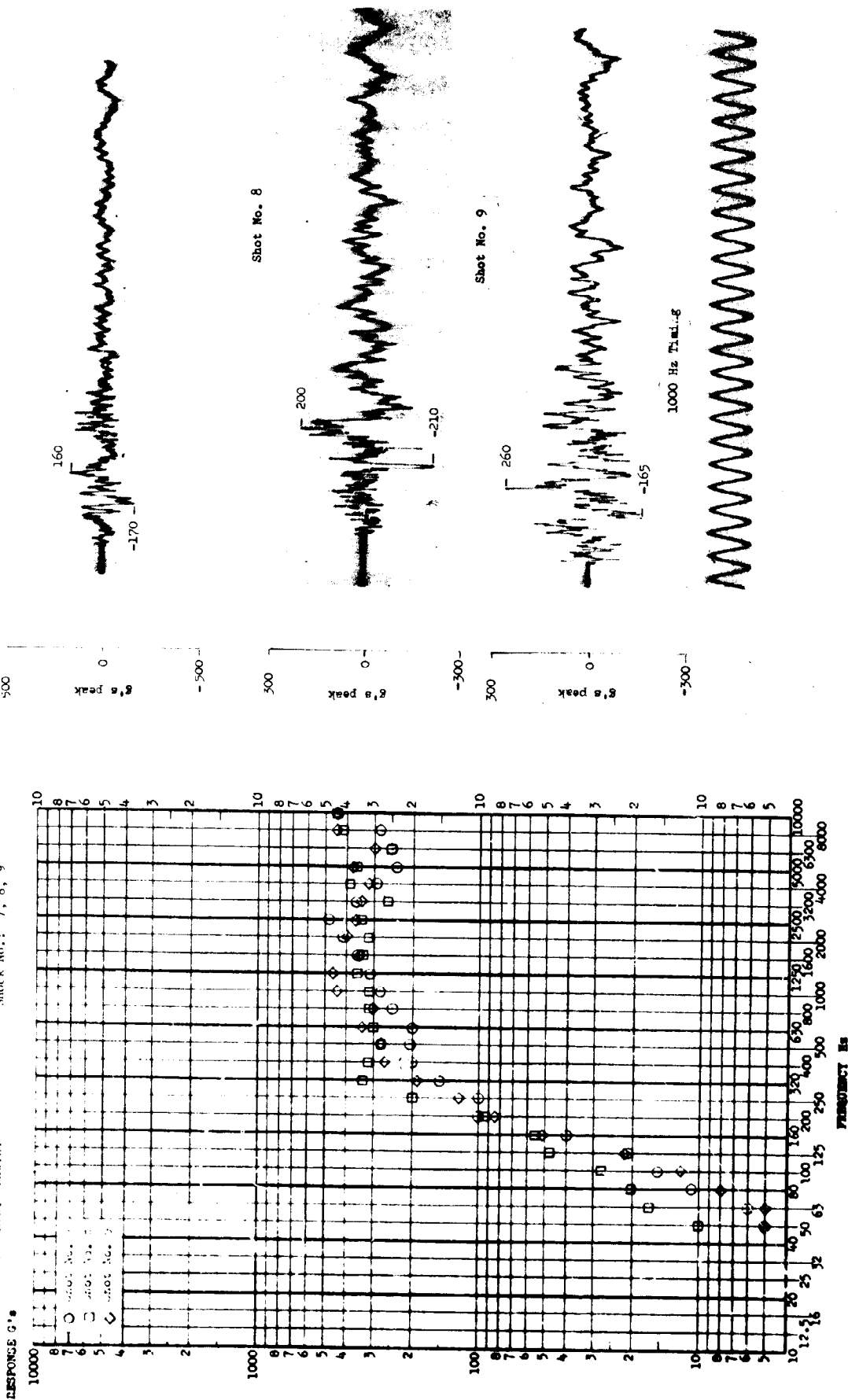


FIGURE 11.B.2-75

Test Item: Titan III-M Separation Nut Tests, 1 Inch Single
 Accel. No.: 3A21 Test Date: Aug., 1968
 Shock Axis: Longitudinal Shock No.: 7, 8, 9

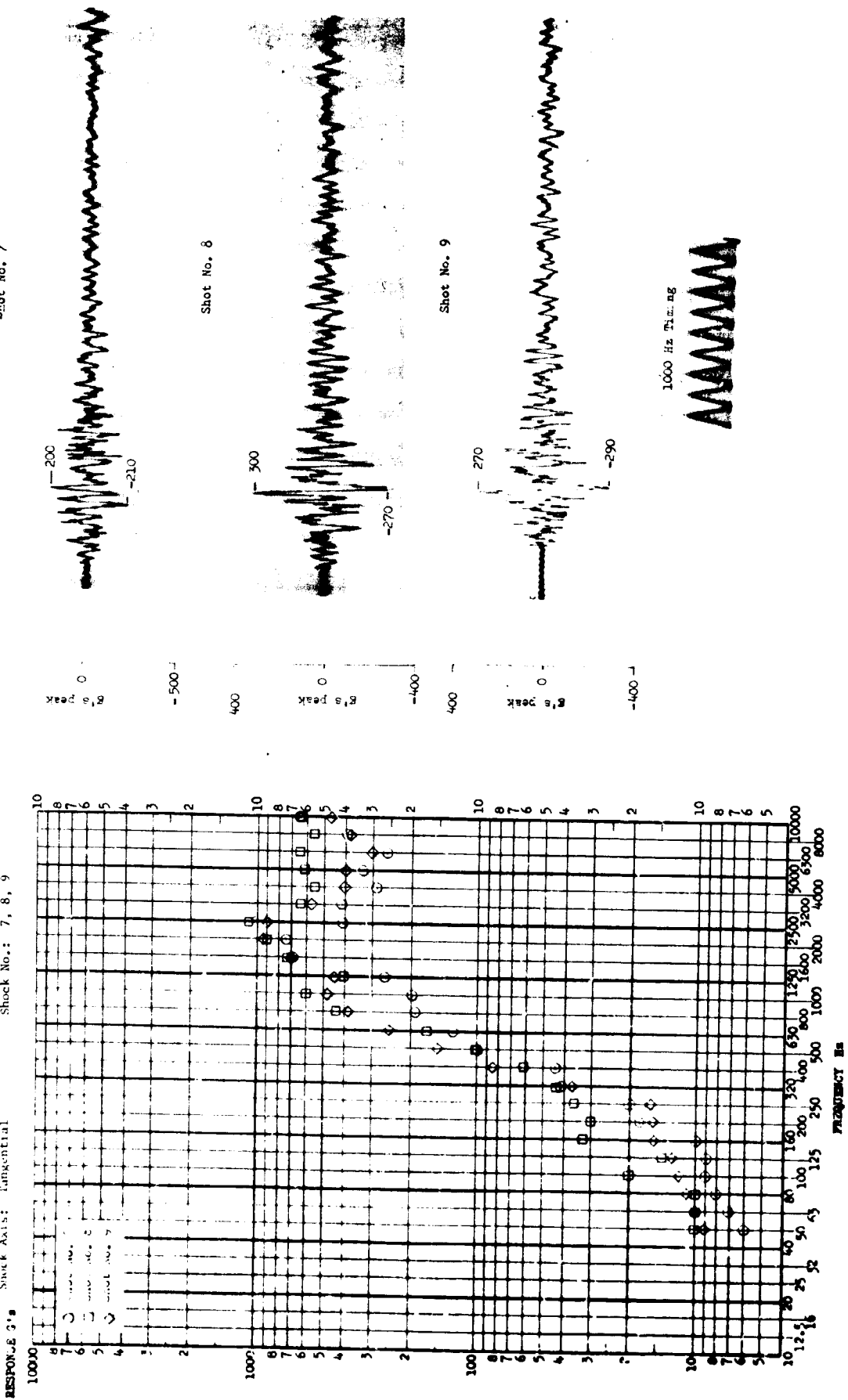


FIGURE 11.B.2-76

Test Item: Titan III-N Separation Nut Tests, 1 Inch Single

Accl. No.: 0427 Test Date: 7/5, 1968

Shock Axis: Longitudinal Shock Job: 7, 8, 9

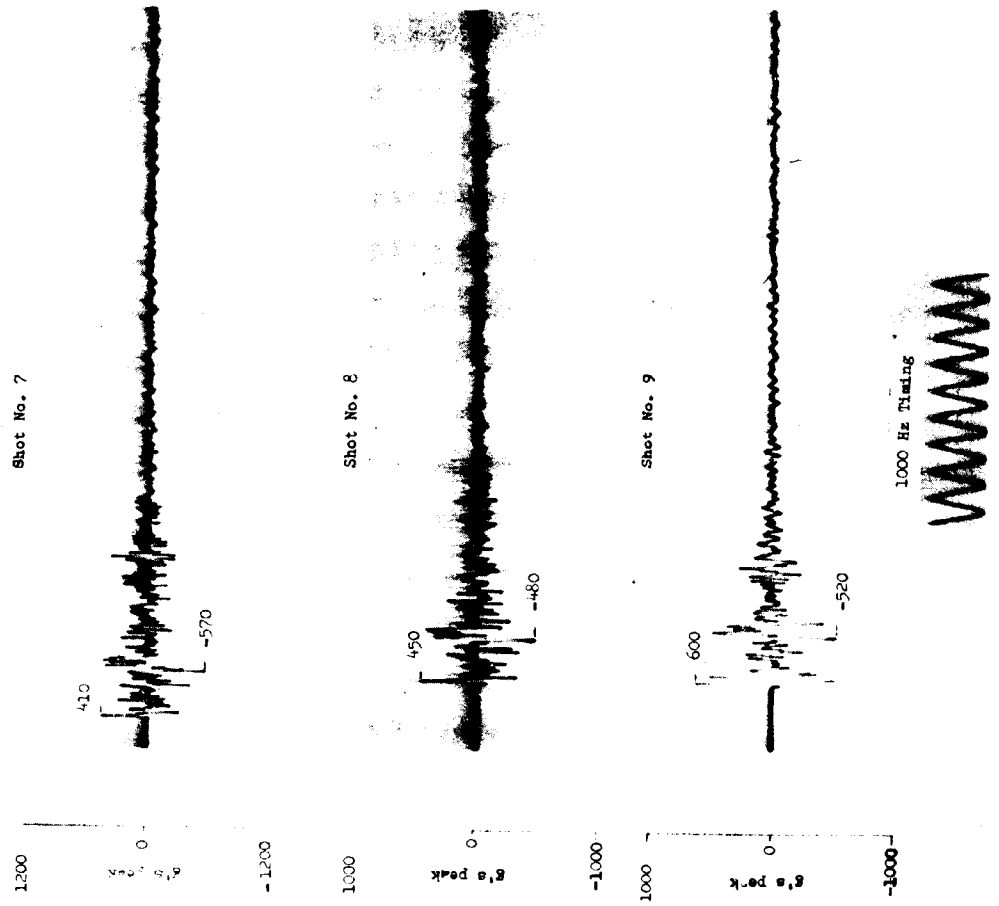
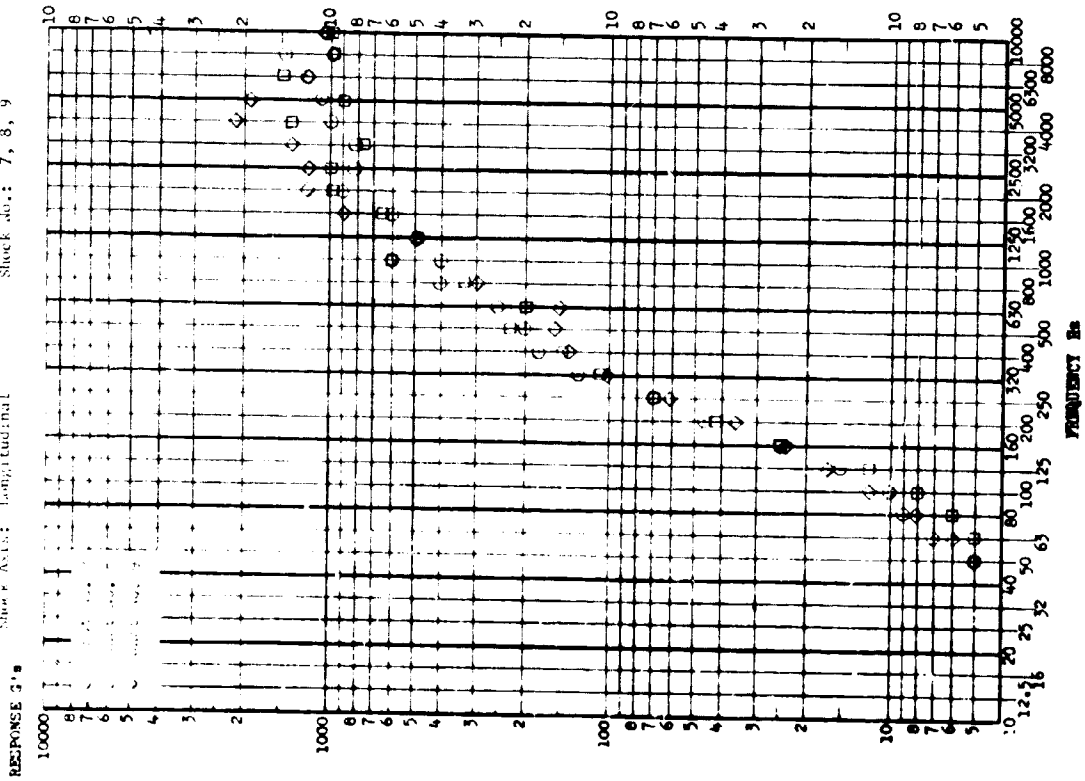


FIGURE 11.B.2-77

Test Item: Titan III-M Separation Nut Tests, 1 Inch Single

Accel. No.: 3A23

Test Date: Aug., 1968

Shock Axis: Radial

Shock No.: 7, 8, 9

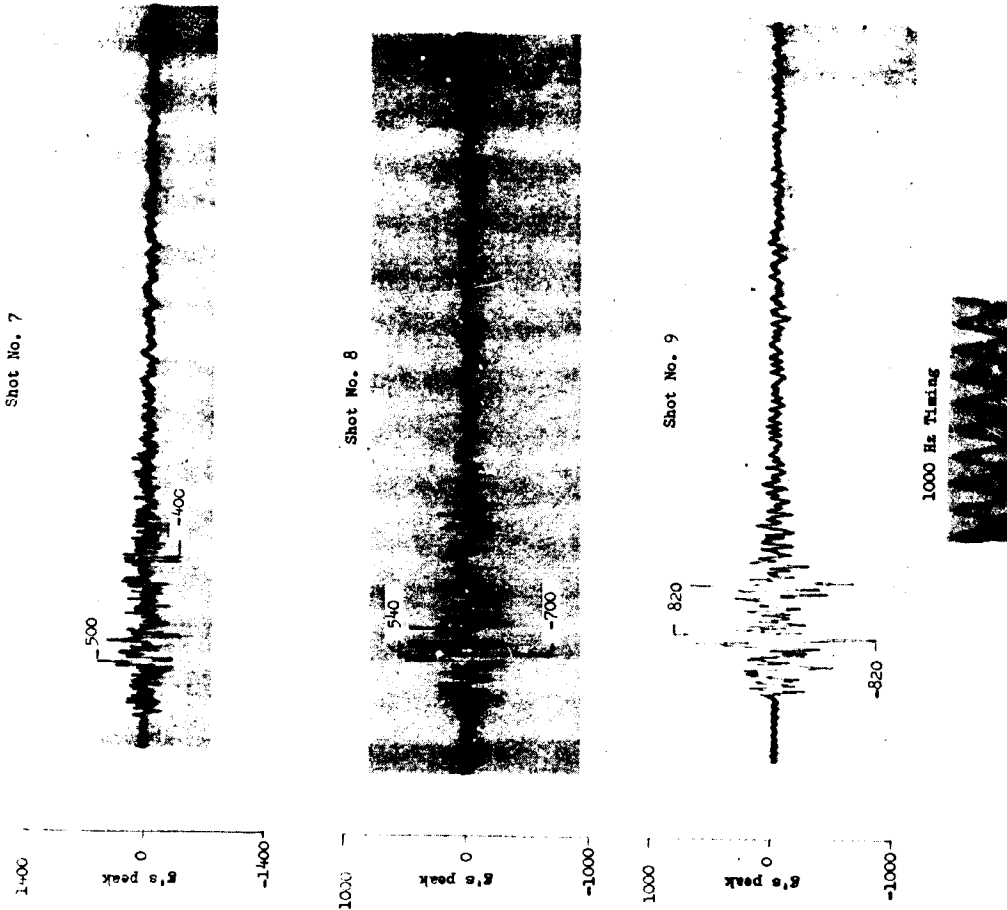
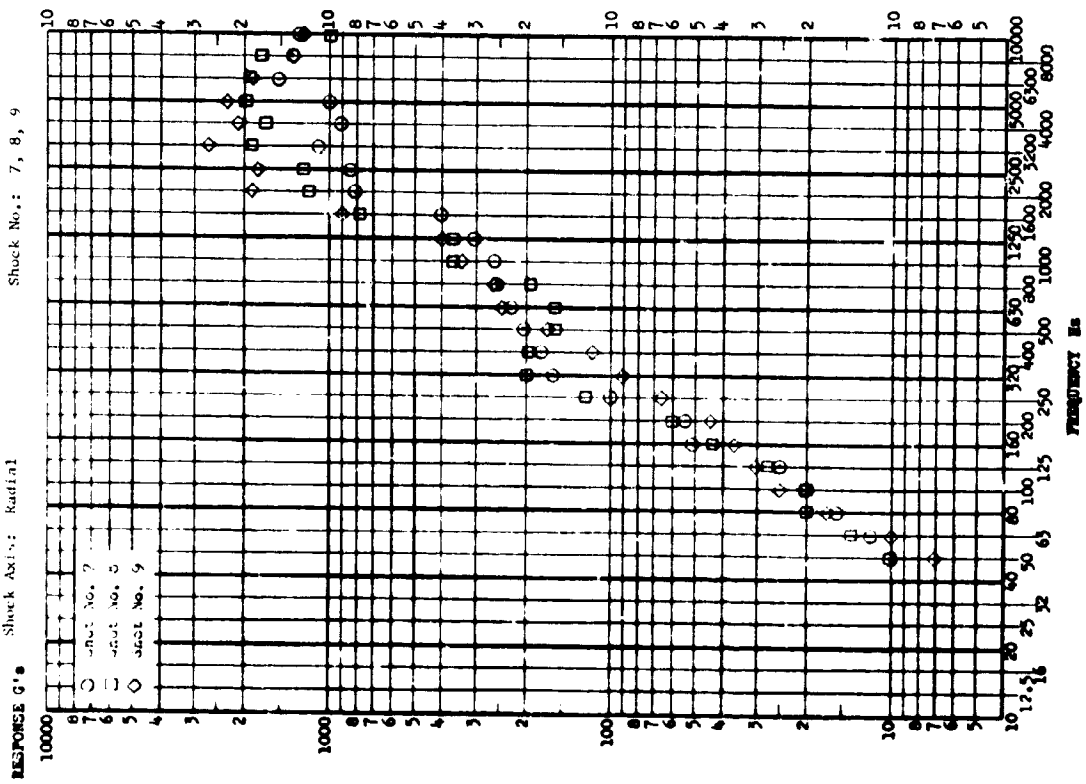


FIGURE 11.8.2-78

Test Item: Titan III-M Separation Nut Tests, 1 Inch Single
 Accel. No.: 3A25 Test Date: Aug., 1968
 Chuck Axis: Tangential Shock No.: 7, 8, 9

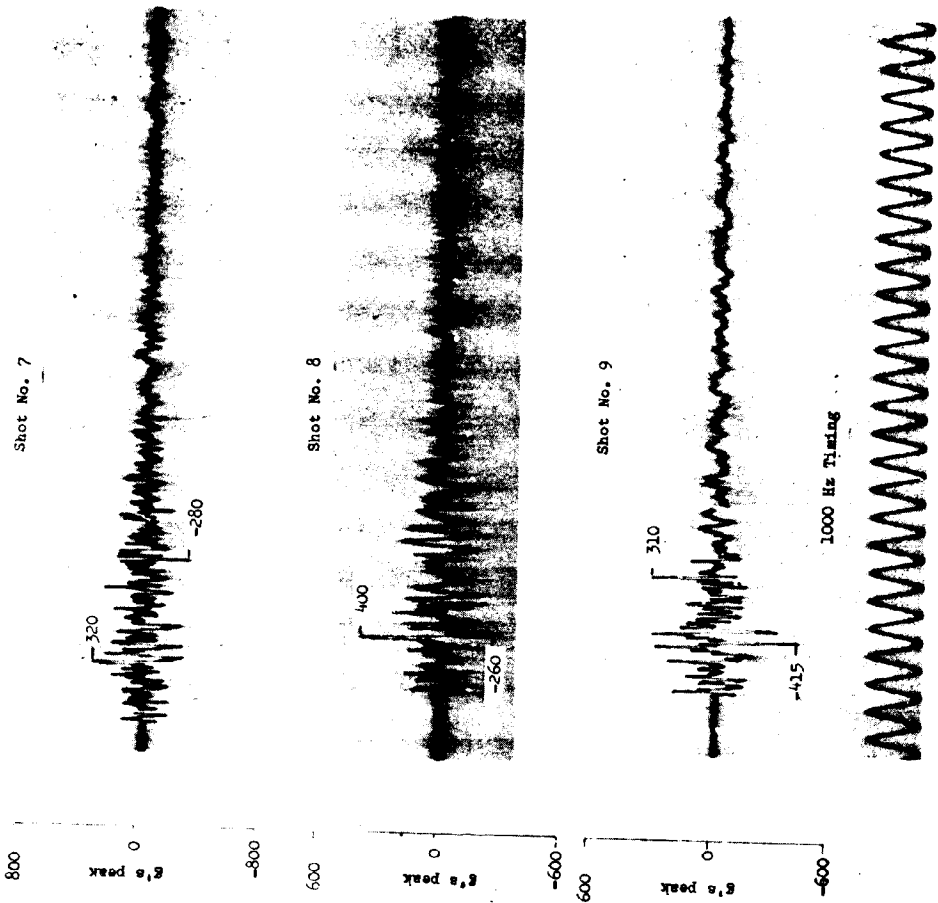
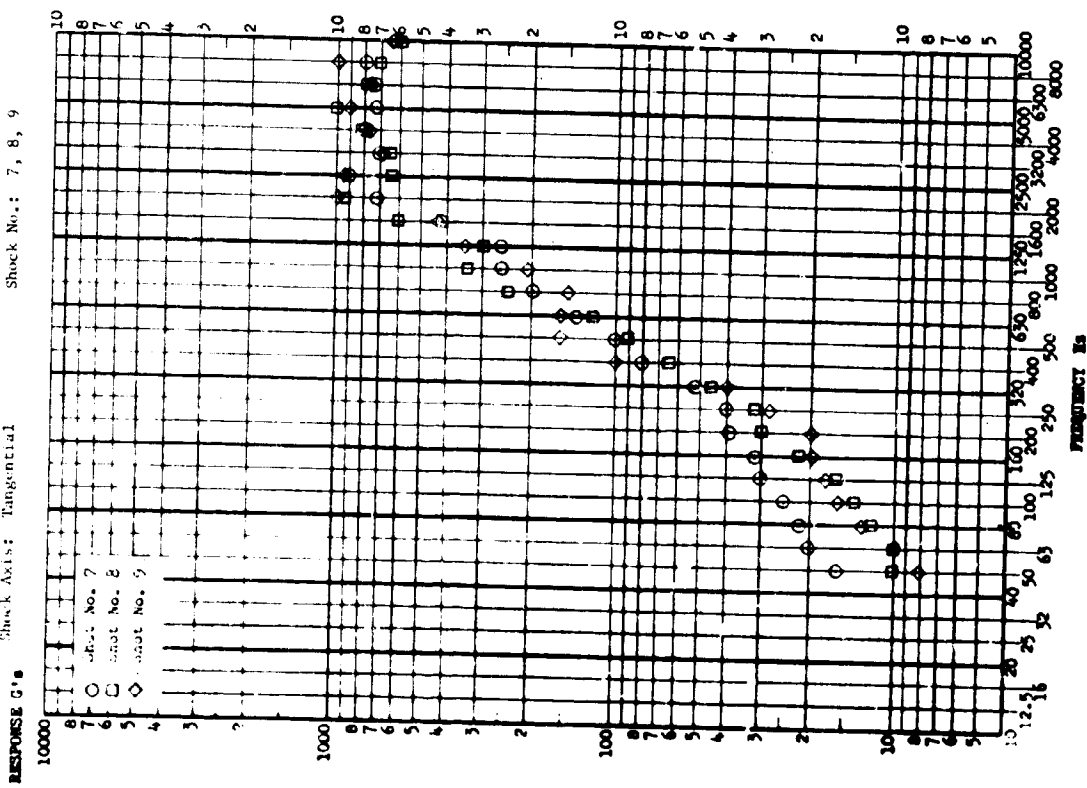


FIGURE 11.B.2-79

SECTION II.B.3

PAYLOAD TRUSS SHOCK PROPAGATION TESTS

PURPOSE OF TESTS

These tests were conducted to obtain shock propagation and attenuation data for light-weight truss structures. A second major objective was to compare the result of using multiple charges with the effect of using a single charge.

DESCRIPTION OF EVENTS

The Article 5 Payload Truss (SESP) was attached to the Titan IIIC transtage with separation nuts and bolts at each longeron as shown in Figure II.B.3-1. Dummy satellites were installed in the truss, and safety cables were attached to the truss to prevent excessive movement of the truss during the test.

Testing consisted of seven shots detonating either one or all four of the separation nuts. Each nut was caused to separate into four segments by the detonation and pressure build up produced by the attached pressure cartridge. The nut/pressure cartridge configuration is depicted in Figure II.B.3-2. Table II.B.3-1 indicates the quadrant(s) in which the explosive nut(s) were actuated for each test. The locations of the quadrants

are called out in Figure II.B.3-3.

DESCRIPTION OF DATA

No. of time histories	83
No. of shock spectra	83
Type of analysis	analog
Analog machine	Ling SSA-100
Frequency Range	50-10,000 Hz
Frequency Increments	3 points per octave
Damping	Q=10

These shock spectra are presented along with their corresponding time histories as Figures II.B.3-4 through II.B.3-43. Due to the various combinations of pyrotechnic configurations and measurement locations, Table II.B.3-2 has been prepared to facilitate convenience in locating particular measurements.

DESCRIPTION OF PYROTECHNIC

Single cartridge 3/4 inch separation nuts were used with one nut at each location.

Nuts: PD3350007-005 (mfg.: Hi Shear Corp.)

Nut and cartridge configuration: Figure II.B.3-2

Pyrotechnic locations: Table II.B.3-1 and Figures
II.B.3-1 and II.B.3-3

Pressure cartridge: PD60S0129-505 (mfg.: McCormick-Selph Associates)

The charges contained in the pressure cartridges are as follows:

Prime charge: 90 mg pressed zirconium

Base charge: 346 mg boron and potassium nitrate

Booster charge: 86 mg boron and potassium nitrate

Sustainer charge: 193 mg ammonium nitrate and rubber

DESCRIPTION OF STRUCTURE

Figure II.B.3-1

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225

Locations: Table II.B.3-3 and Figure II.B.3-3

Axis of Sensitivity: Figure II.B.3-3

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorder: Ampex ES-100 (0-20,000 Hz frequency response)

Amplifiers: Kistler 504A (0-100,000 Hz frequency response)

COMMENTS

A number of time histories appear to be beyond the noted calibration level. However, the instrumentation equated volts RMS to g's peak. Thus, the acceleration data is valid to a level of 1.414 greater than the noted calibration level. Those cases where the acceleration level is beyond the range of the instrumentation are noted on the time histories.

TABLE II.B.3-1

DIFFERENCES AMONG TEST RUNS

<u>Shot Number</u>	<u>Number of Nuts Fired</u>	<u>Location of Nut(s) Fired</u>	<u>Accelerometer Locations Monitored</u>
1	1	Quadrant I	1,2,5,6
2	1	Quadrant II	1,2,5,6
3	4	Quadrants I,II,III,IV	1,4,5,10
4	4	Quadrants I,II,III,IV	1,4,7,8
5	1	Quadrant I	1,3,4,6
6	1	Quadrant II	2,6,12,13
7	1	Quadrant II	2,6,9,11

TABLE II.B.3-2

INDEX OF DATA CONTAINED IN FIGURES

<u>Figure Number</u>	<u>Test Number(s)</u>	<u>Accelerometer Location(s) Monitored</u>
II.B.3-4	1,2,5	1 BL
-5	3,4	1 BL
-6	1,2,5	1 WL
-7	3,4	1 WL
-8	1,2,5	1 Vert.
-9	3,4	1 Vert.
-10	1,2	2 BL
-11	6	2 BL
-12	1,2	2 WL
-13	6,7	2 WL
-14	1,2	2 Vert.
-15	6,7	2 Vert.
-16	5	3 BL, 3 WL
-17	5	3 Vert., 4 BL
-18	3,4	4 BL
-19	3,4	4 WL
-20	5	4 WL, 4 Vert.
-21	3,4	4 Vert.
-22	1,2	5 BL
-23	3	5 BL, 5 WL

TABLE II.B.3-2

INDEX OF DATA CONTAINED IN FIGURES

<u>Figure Number</u>	<u>Test Number(s)</u>	<u>Accelerometer Location(s) Monitored</u>
II.B.3-24	1,2	5 WL
-25	1,2	5 Vert.
-26	3	5 Vert.
-27	1,2	6 BL
-28	5,6,7	6 BL
-29	1,2	6 WL
-30	5,6,7	6 WL
-31	1,2	6 Vert.
-32	5,6,7	6 Vert.
-33	4	7 BL, 7 WL
-34	4	7 Vert., 8 BL
-35	4	8 WL, 8 Vert.
-36	7	9 BL, 9 WL
-37	7/3	9 Vert/10 BL
-38	3	10 WL, 10 Vert
-39	7	11 BL, 11 WL
-40	7/6	11 Vert., 12 BL'
-41	6	12 WL, 12 Vert.
-42	6	13 BL, 13 WL
-43	6	13 Vert.

TABLE II.B.3-3

DISTANCE OF ACCELEROMETER LOCATIONS FROM SHOCK SOURCE

<u>Accelerometer Location No.</u>	<u>Distance in Inches</u>		
	<u>Shots 1 and 5</u>	<u>Shots 3 and 4</u>	<u>Shots 2, 6 and 7</u>
1	0	0	105
2	105	*	0
3	42	*	*
4	72	42	*
5	68	63	100
6	100	*	68
7	*	68	*
8	*	112	*
9	*	*	156
10	*	112	*
11	*	*	138
12	*	*	116
13	*	*	106

*Indicates that no measurement was taken.



FIGURE 11.B.3-1

TEST INSTALLATION - SESP PAYLOAD TRUSS SHOCK TEST

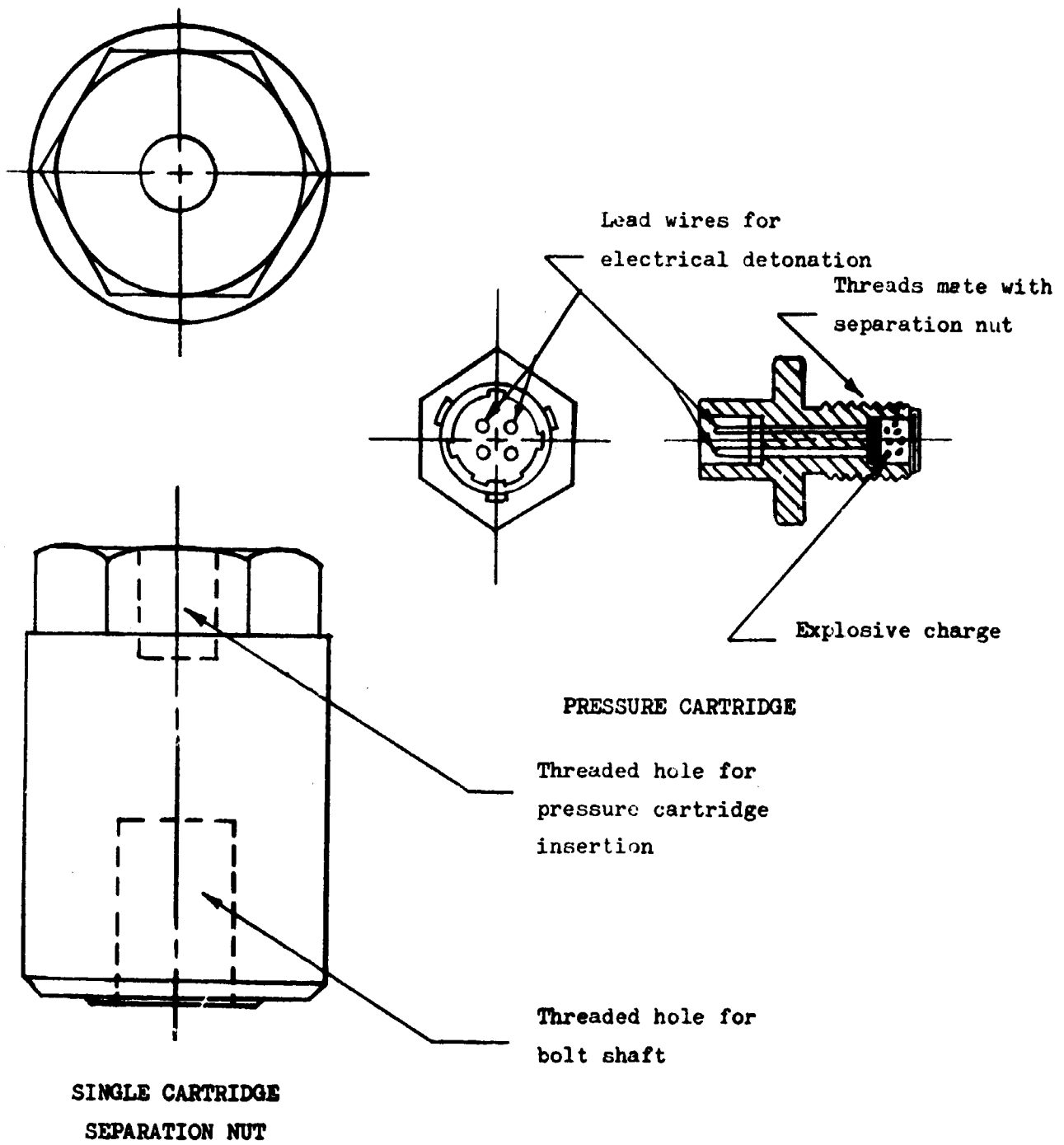


FIGURE II.B.3-2
SEPARATION NUT

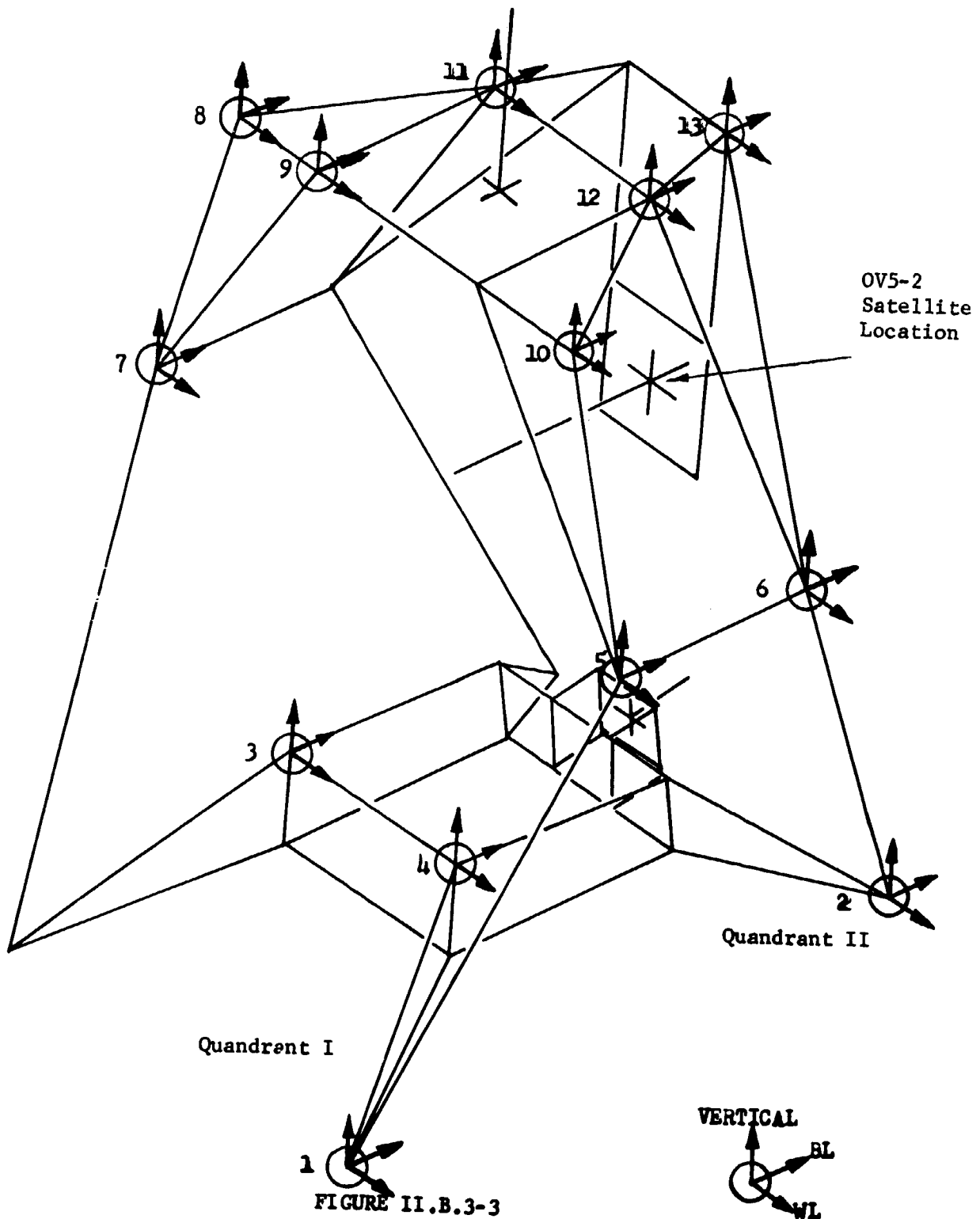


FIGURE II.B.3-3
 ACCELEROMETER LOCATIONS (THREE AXES) FOR SESP PAYLOAD TRUSS SHOCK TEST

TEST ITEM _____
 ACCEL. NO. _____ TEST DATE 3-14-66
 SHOCK AXIS _____ SHOCK NO. 1,2,3

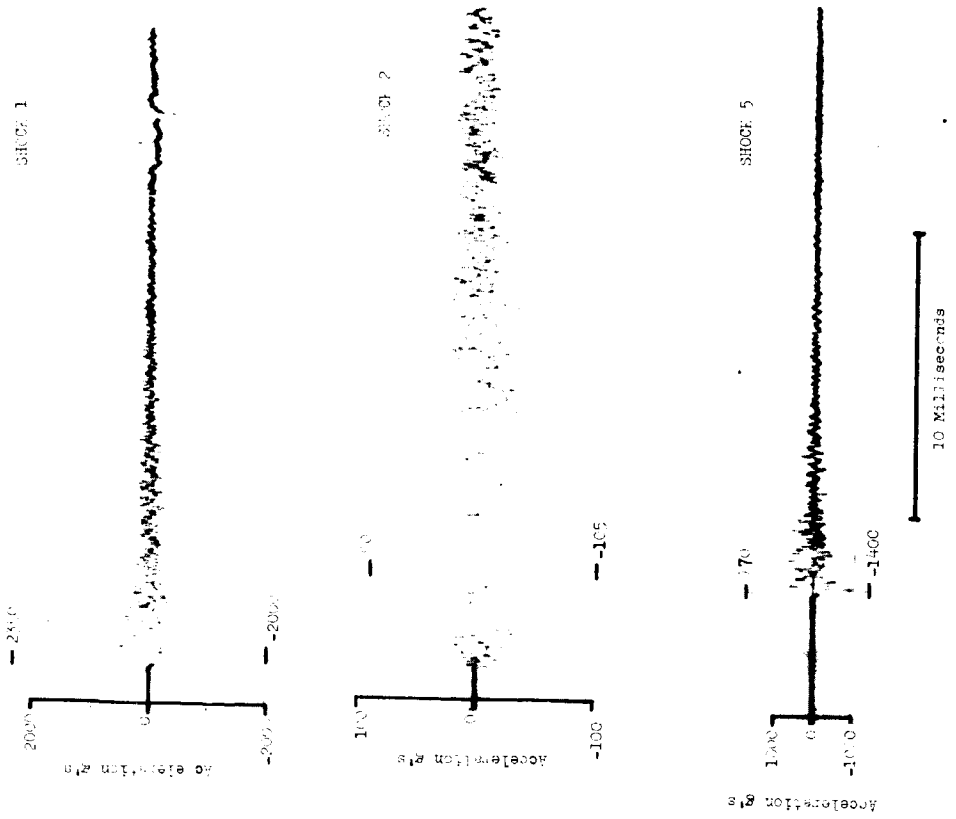
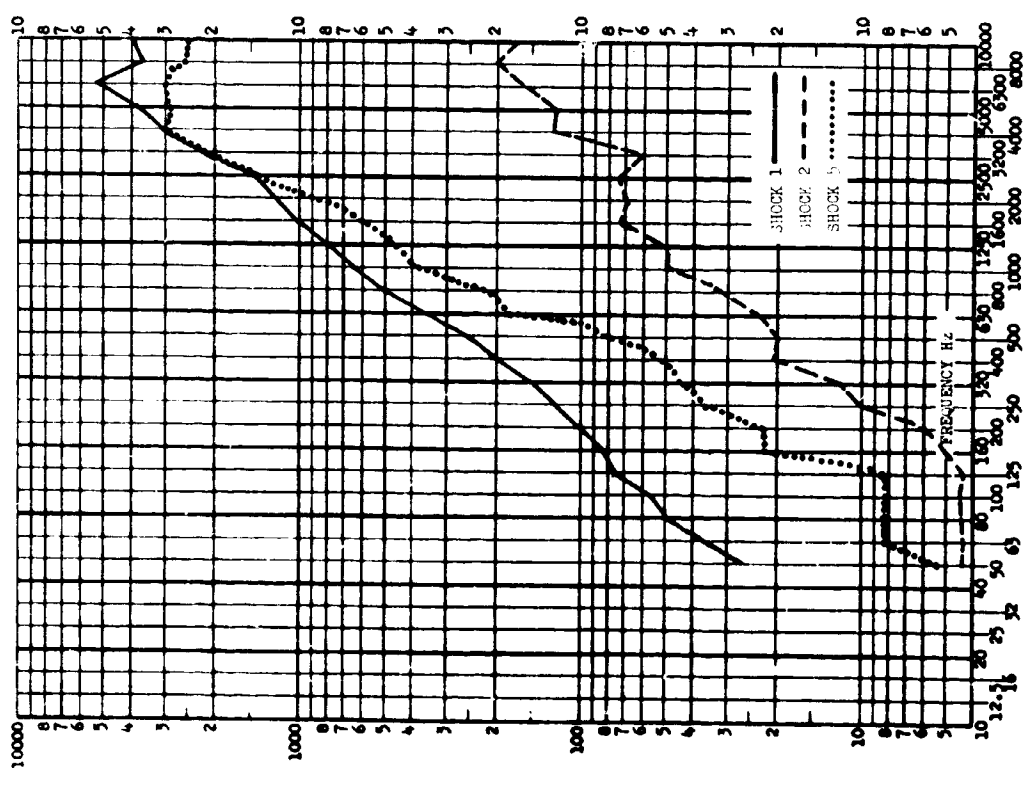


FIGURE 11.B.3-4

TEST ITEM _____
 TEST DATE _____
 CHECK MARKS _____
 SHOCK NO. _____

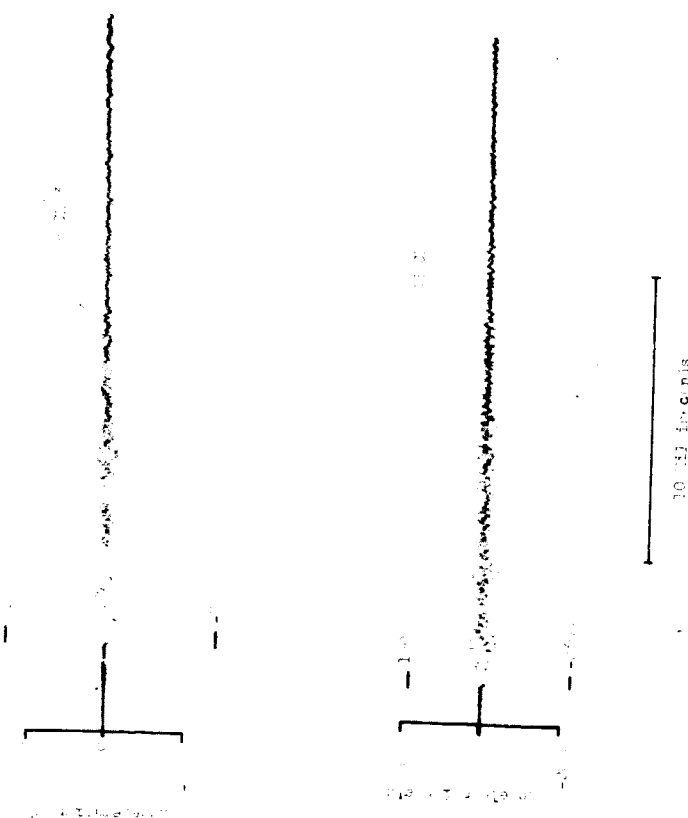
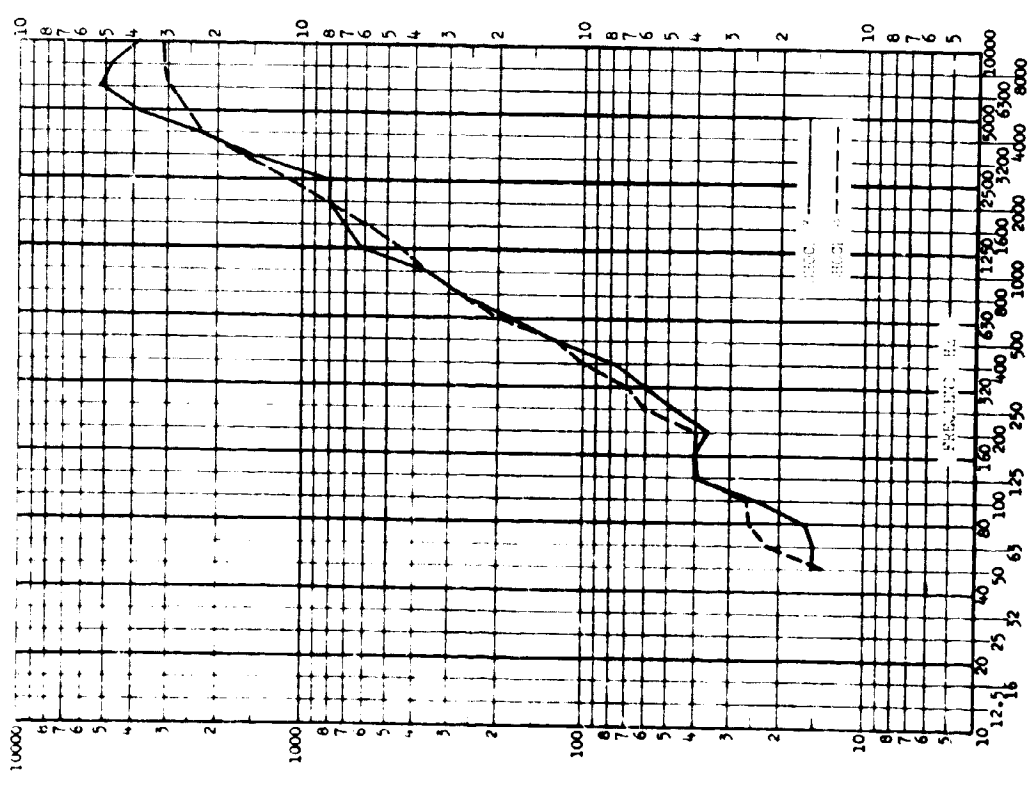


FIGURE 11.B.3-5

TEST ITEM _____
 ACCEL. NO. _____ TEST DATE 4-19-59
 SHOCK AXIS _____ SHOCK NO. 1, 2, 5

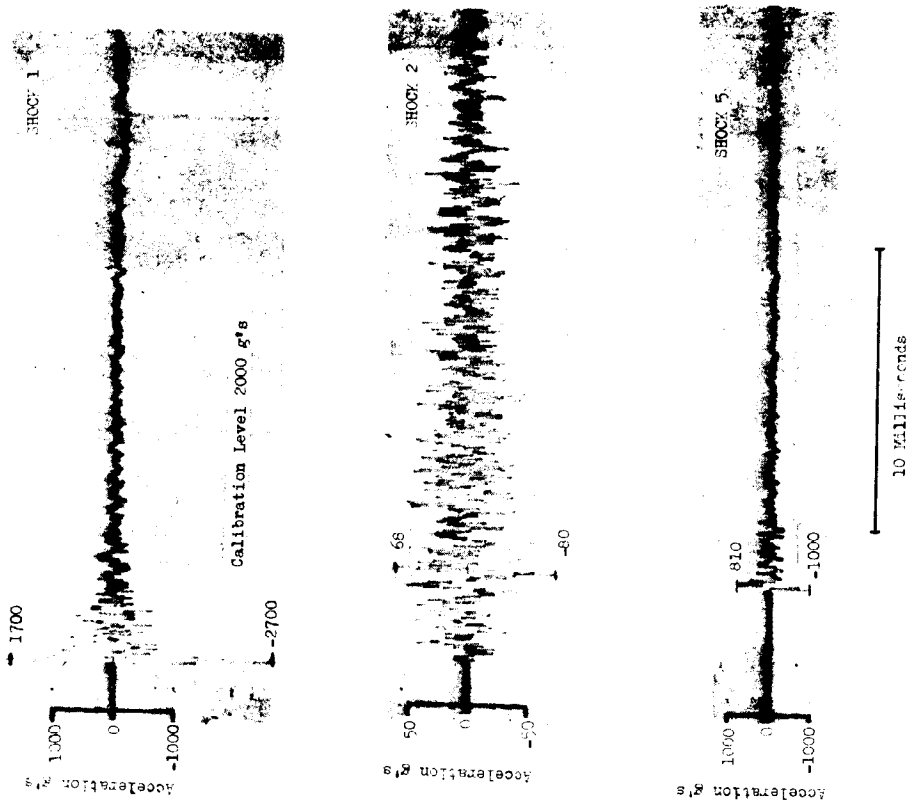
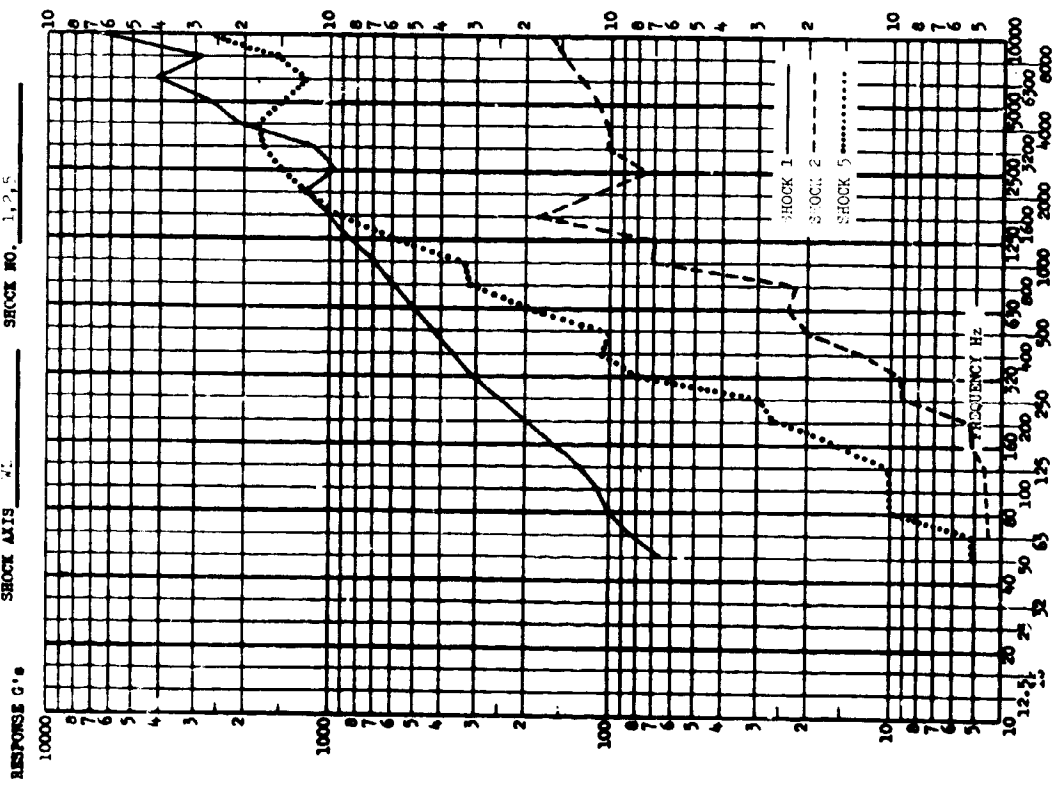


FIGURE 11.B.3-6

TEST ITEM _____
 TEST NO. _____ TEST DATE 7-2-50
 SHOCK AXIS _____ SHOCK NO. 3

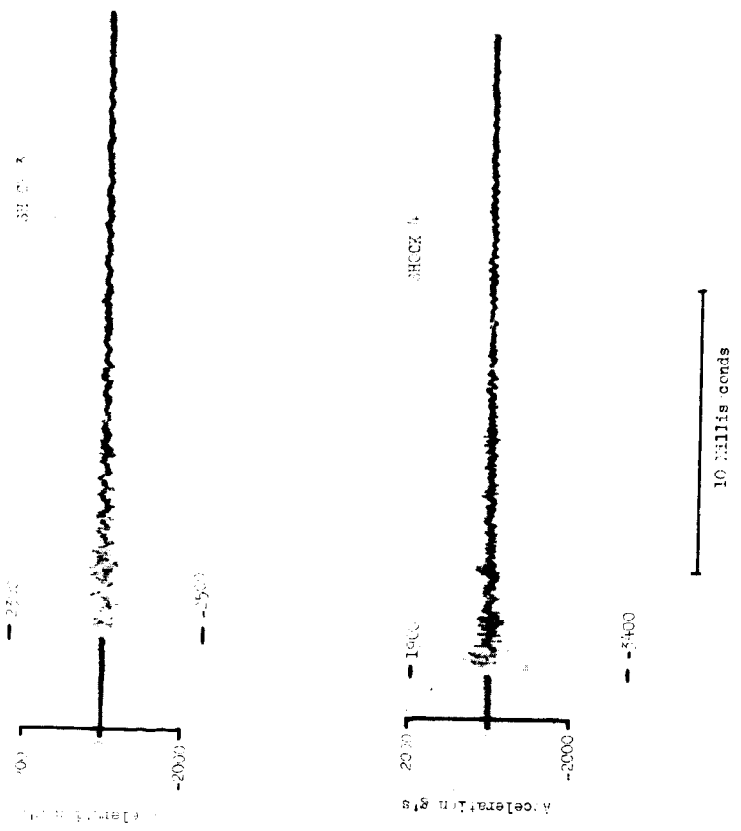
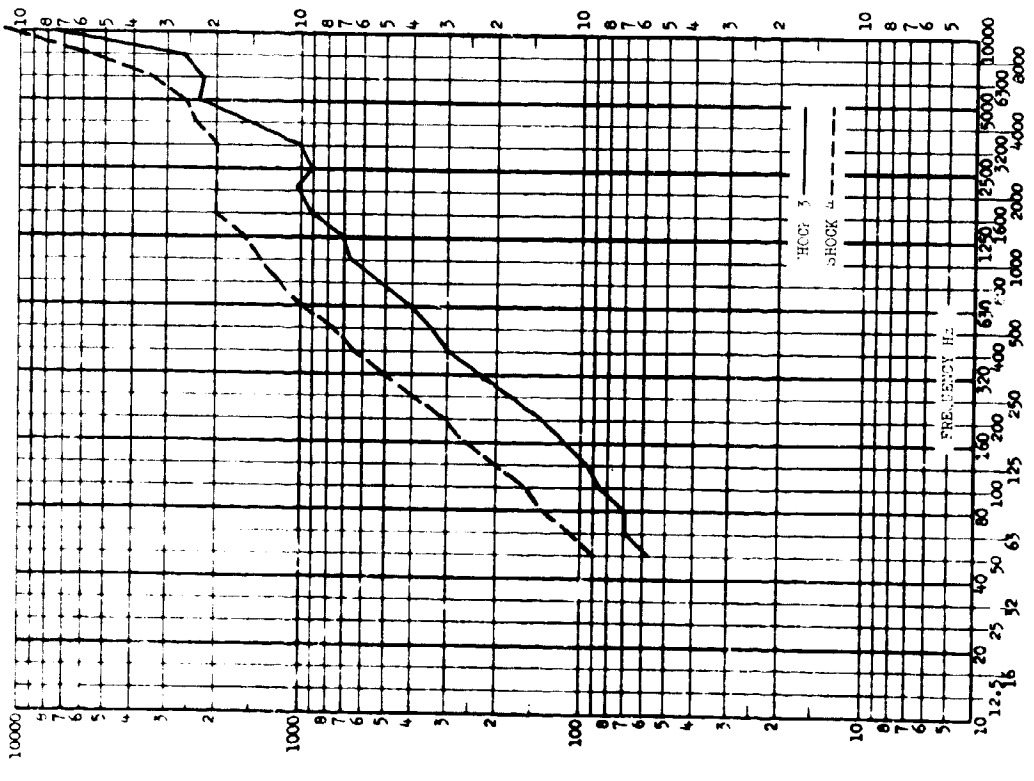


FIGURE 11.B.3-7

TEST ITEM _____
 ACCEL. NO. _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

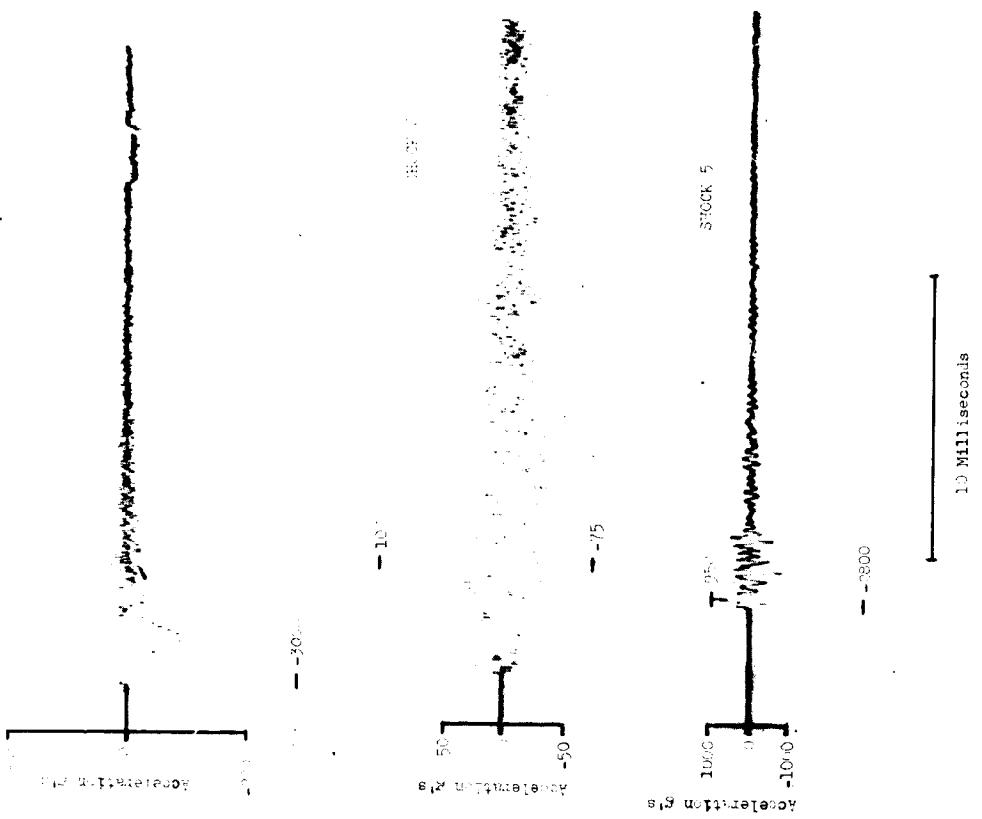
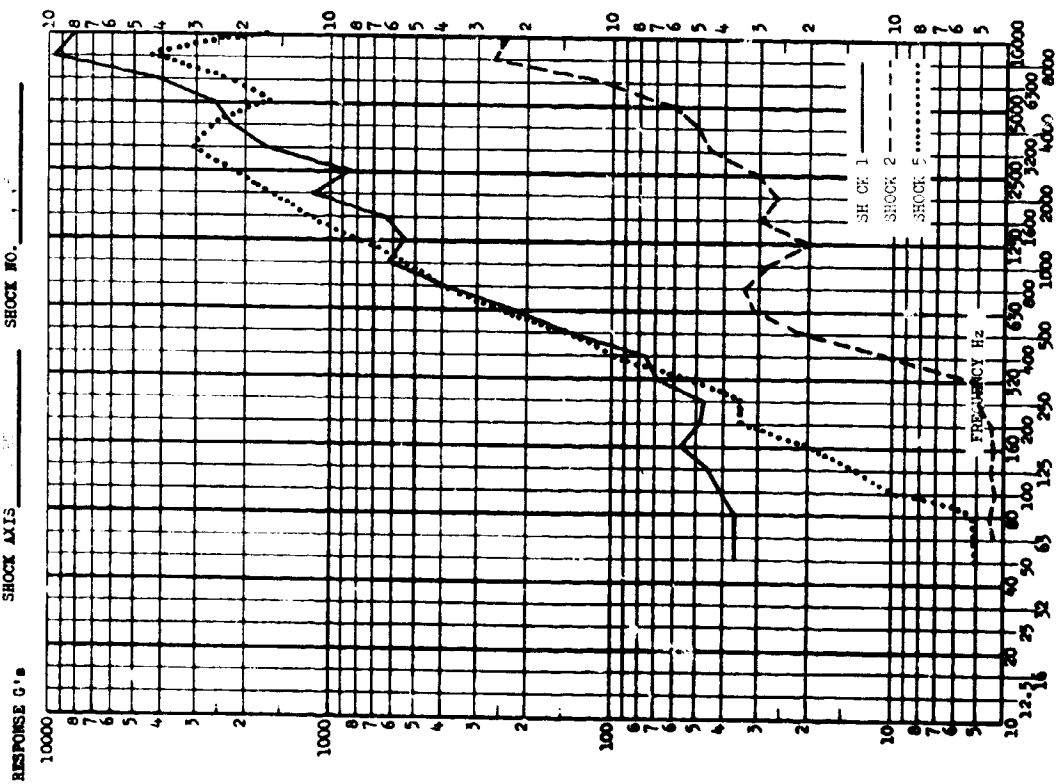


FIGURE 11.B.3-8

TEST ITEM _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

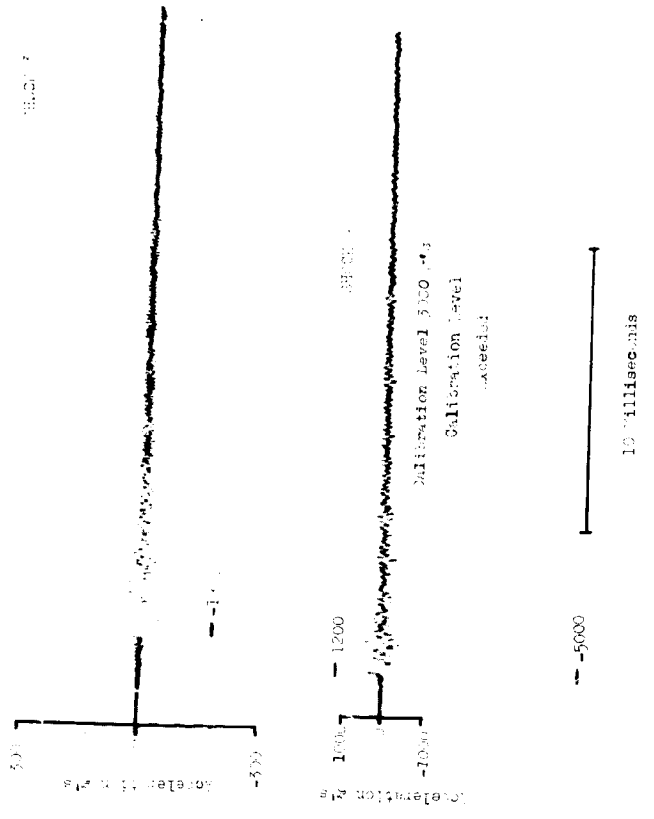
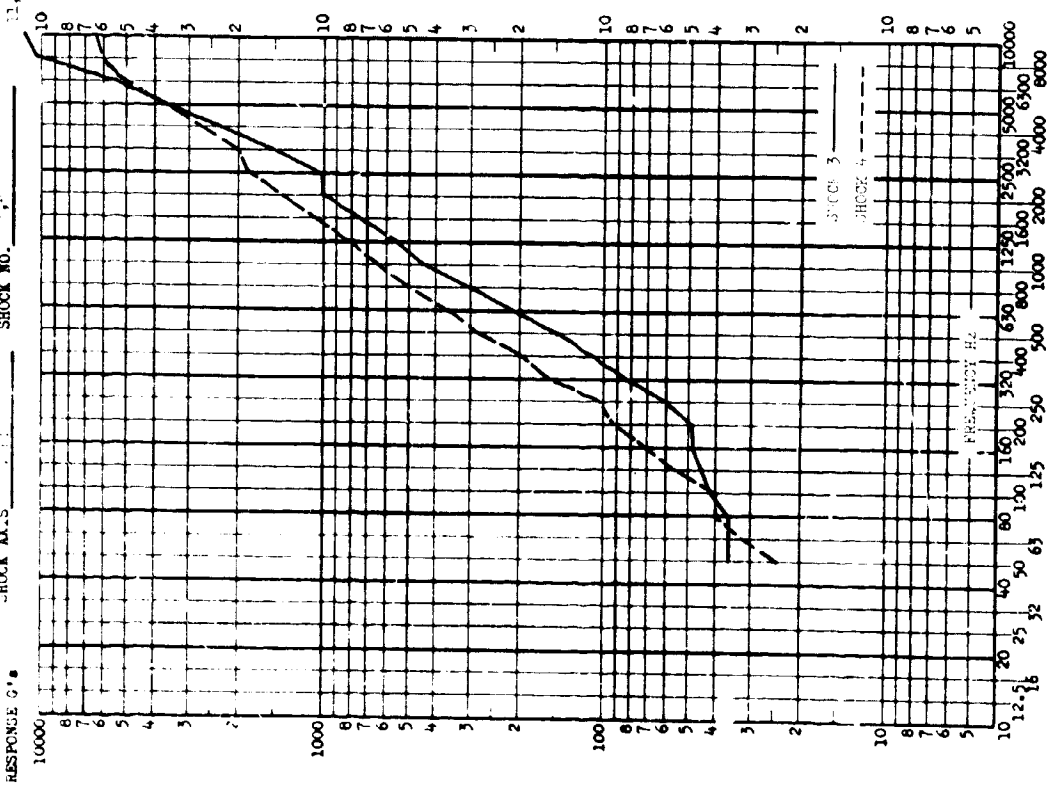


FIGURE 11.B.3-9

TEST ITEM: Transducer Calibration Shock Test
 MODEL NO.: 2 TEST DATE: 3-13-58
 SHOCK AXIS: BC SHOCK NO.: 1,2

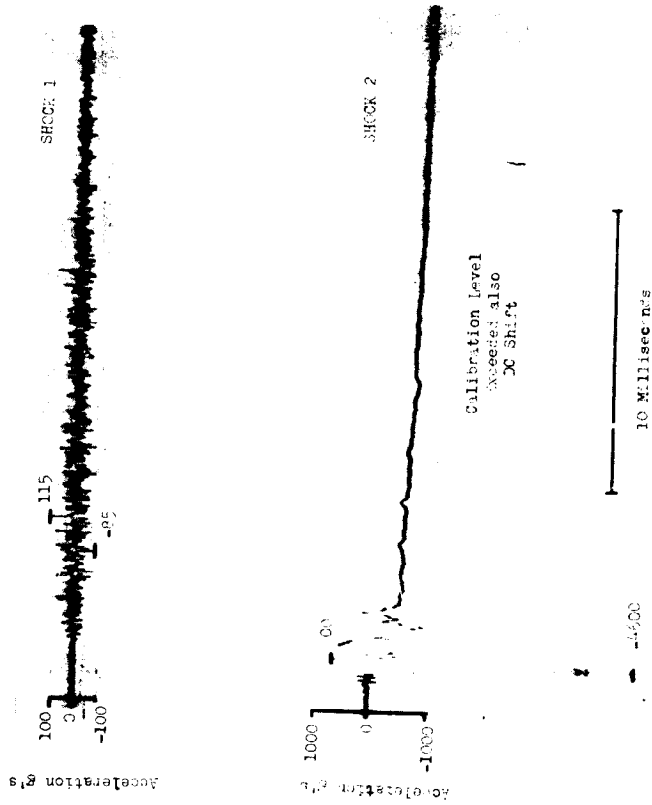
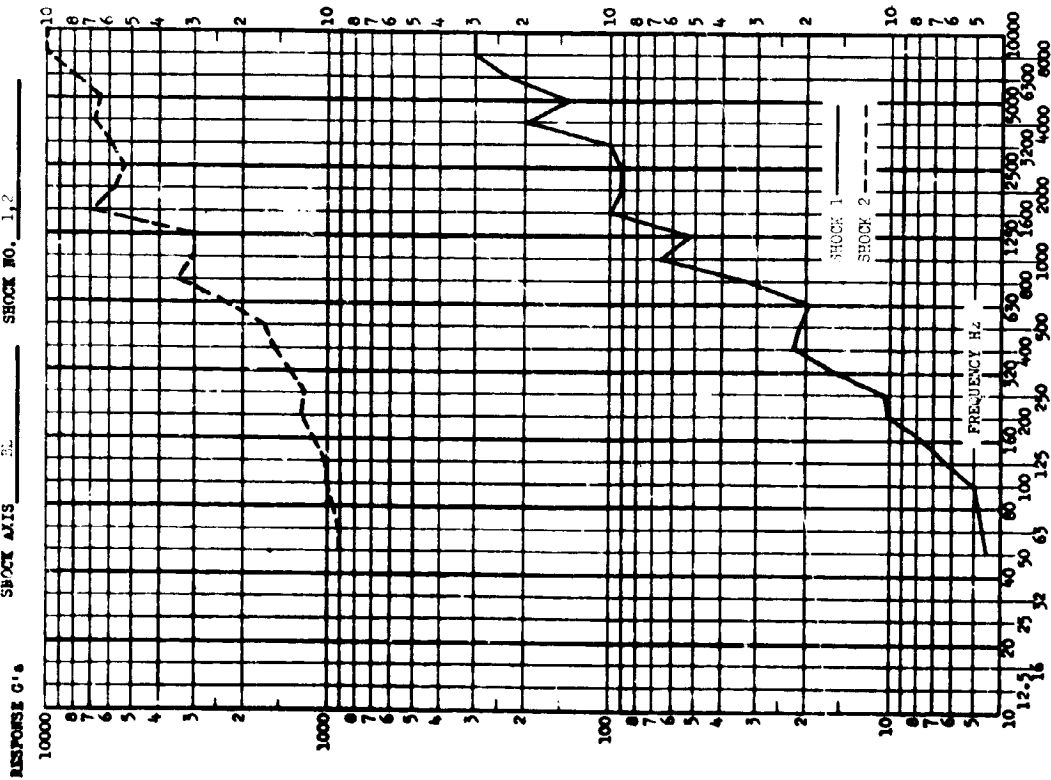


FIGURE 11.B.3-10

TEST ITEM _____
 TEST DATE _____
 SHOCK AXIS _____
 SHOCK NO. _____

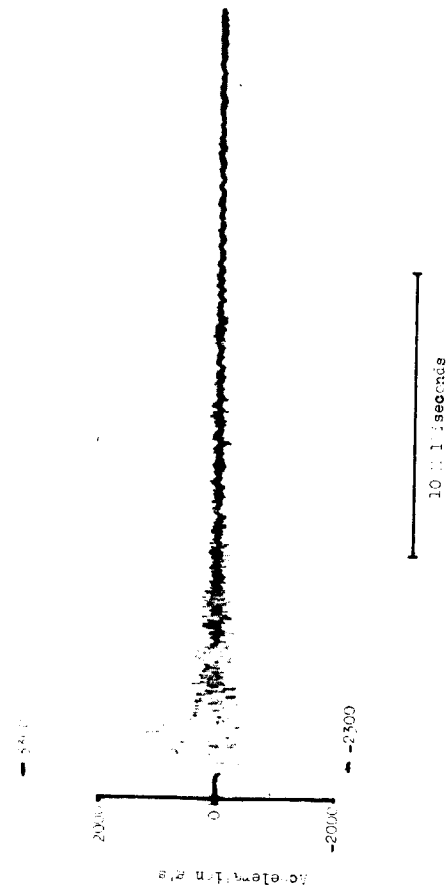
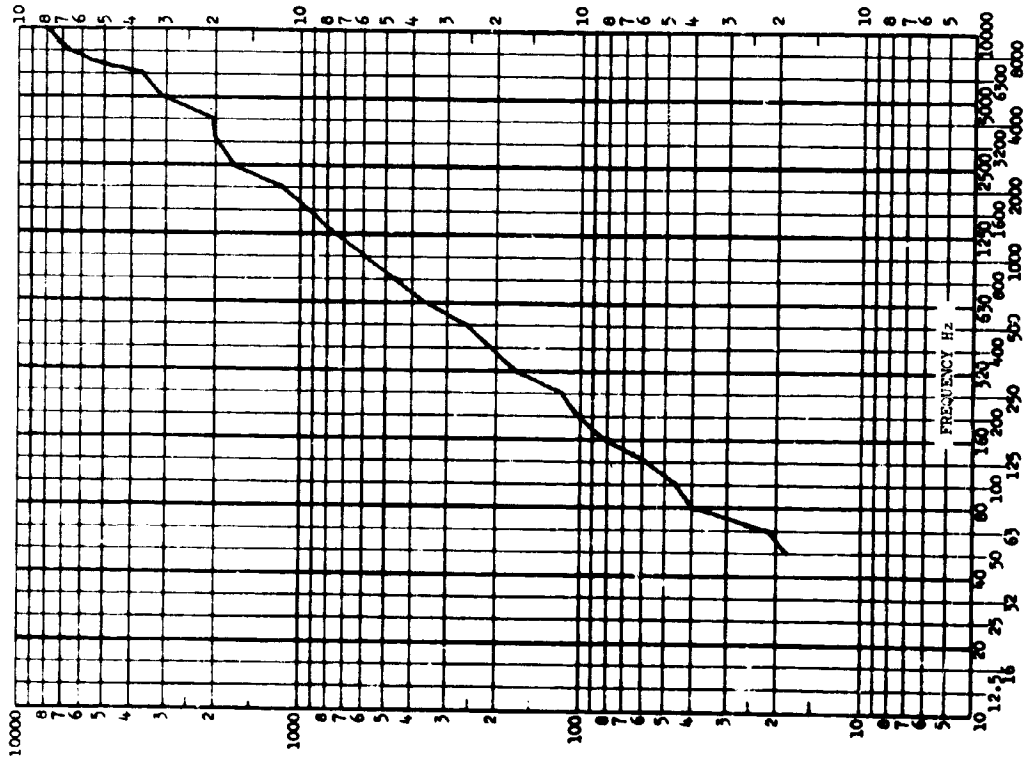


FIGURE II.B.3-11

TEST ITEM _____
 TEST NO. _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

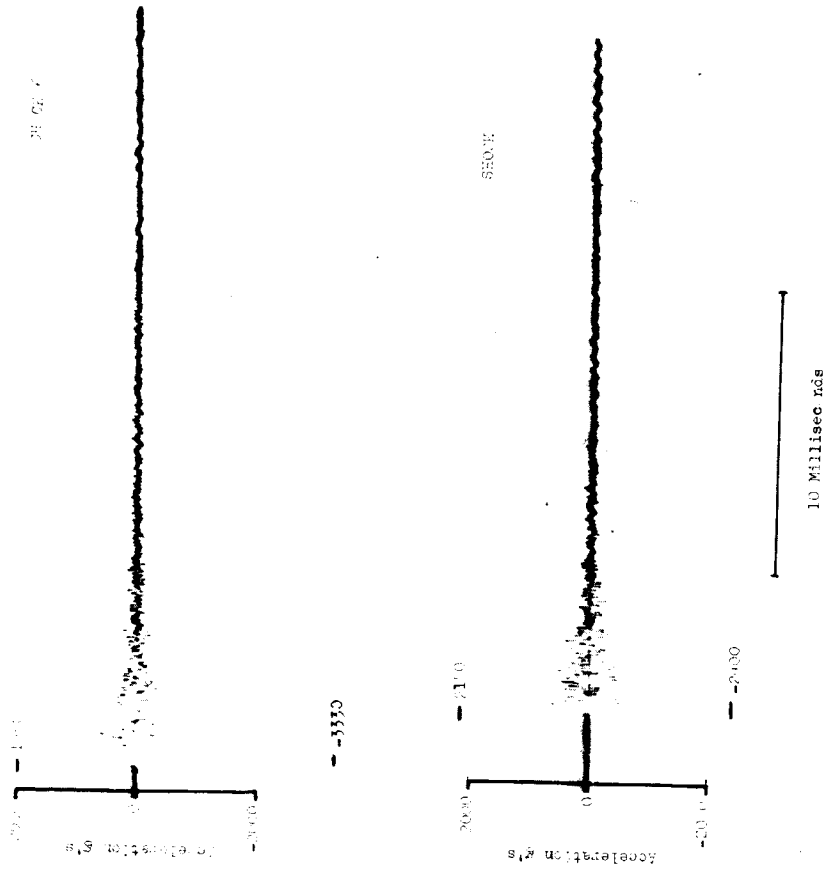
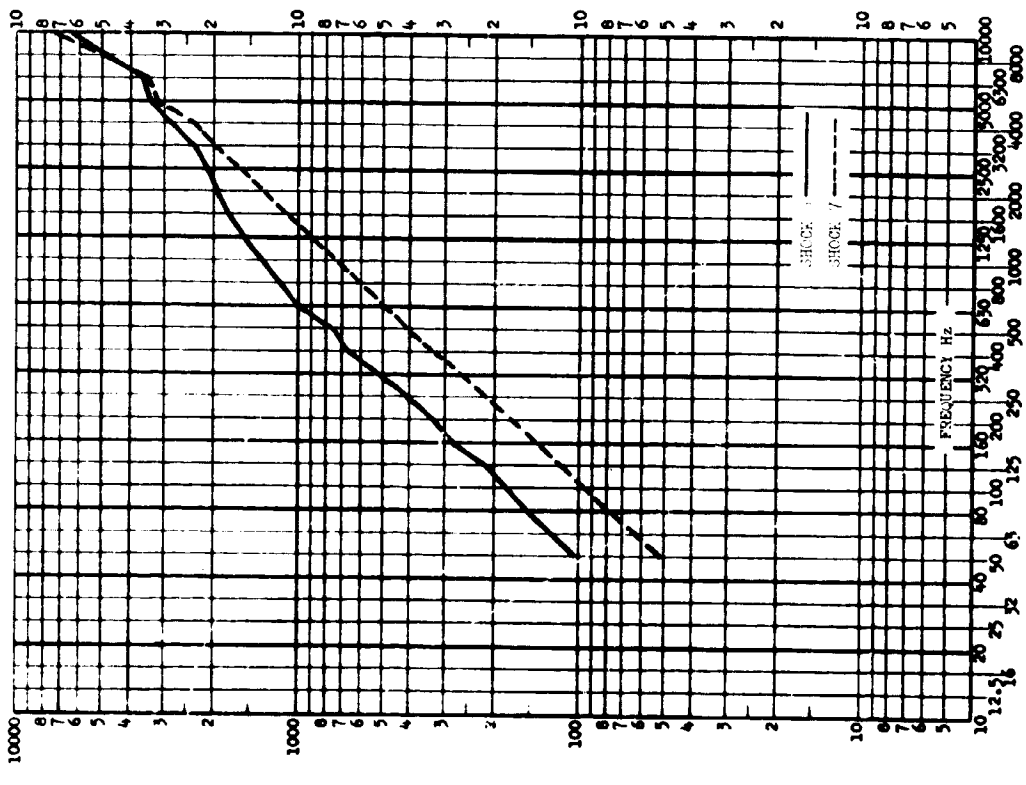


FIGURE 11.B.3-13

TEST ITEM _____
 A.I.D. NO. _____ TEST DATE 3-19-67
 SHOCK AXIS _____ TEST _____ SHOCK NO. 1,2

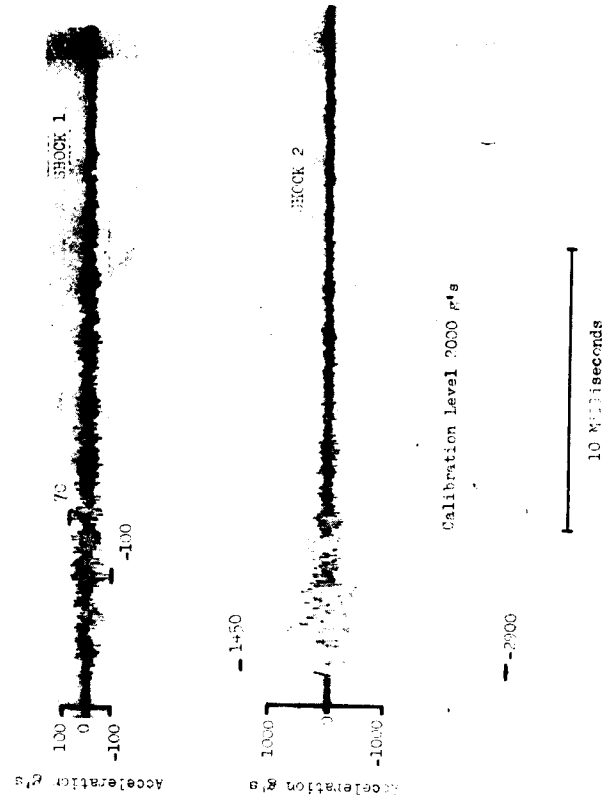
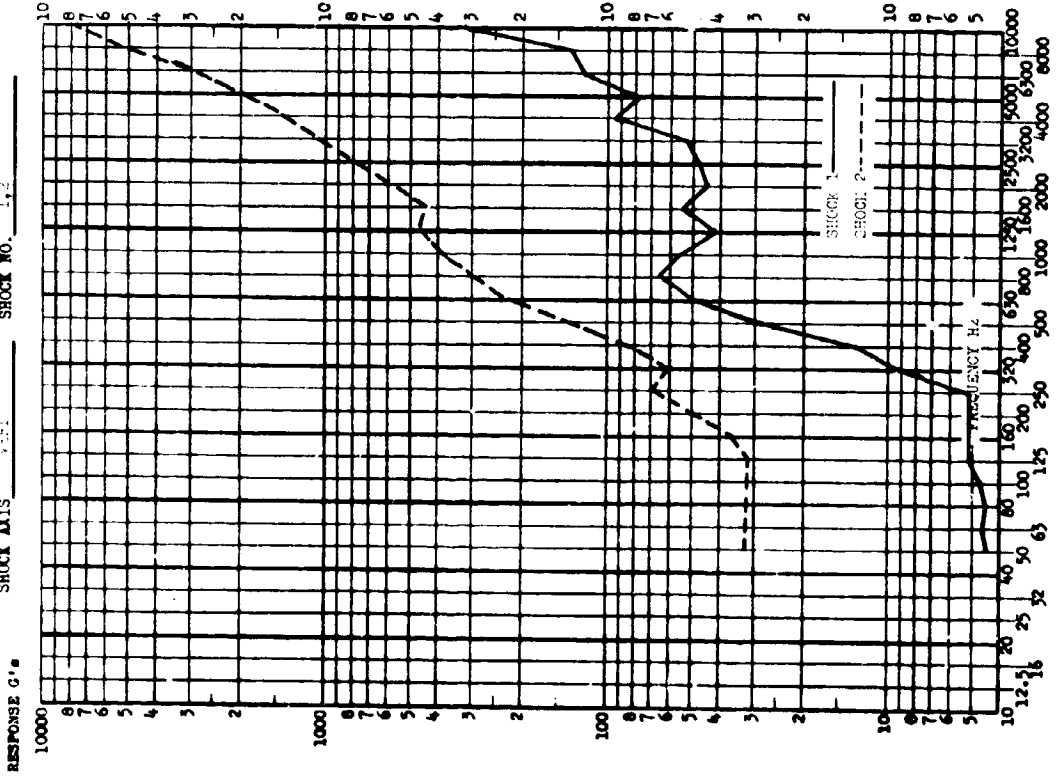


FIGURE 11.8.3-14

TEST ITEM _____
 CASE NO. _____ TEST DATE _____
 SHOCK AXIS _____ SEC'S NO. _____

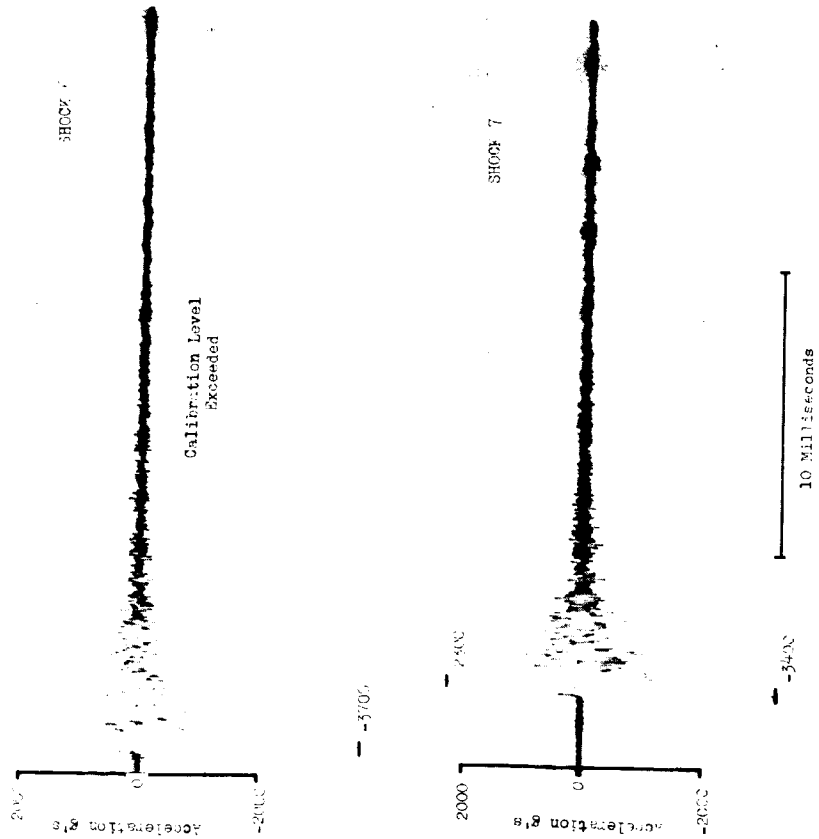
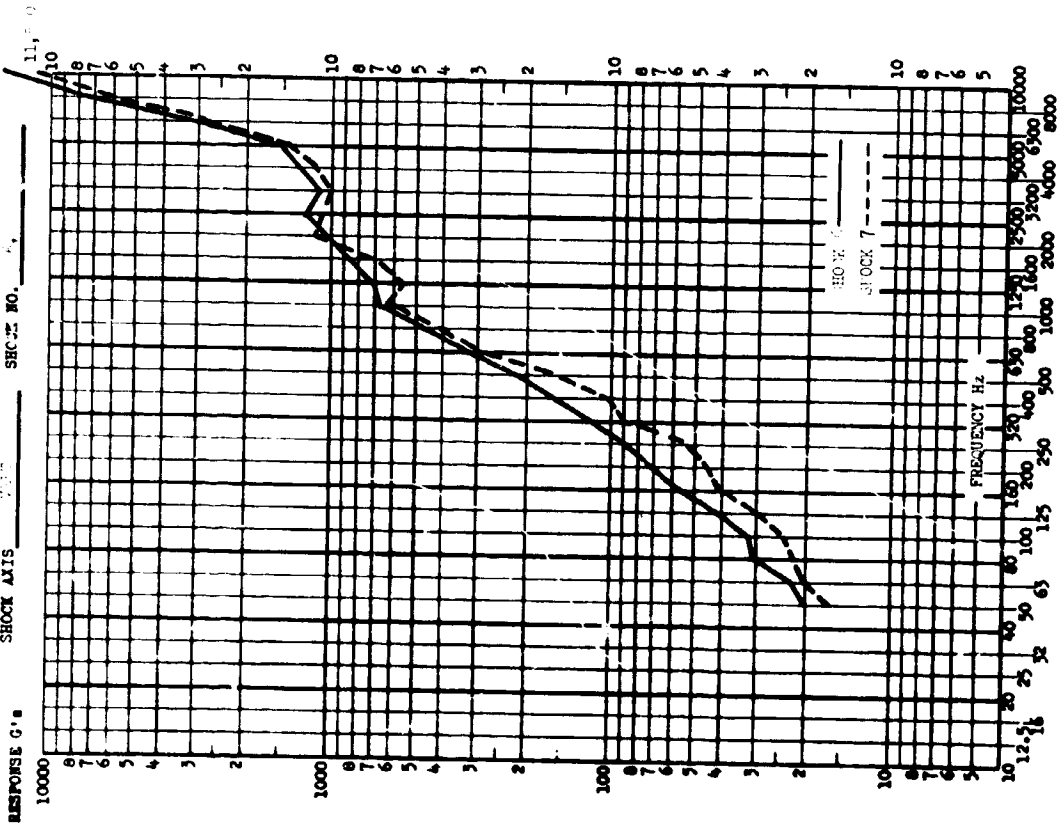
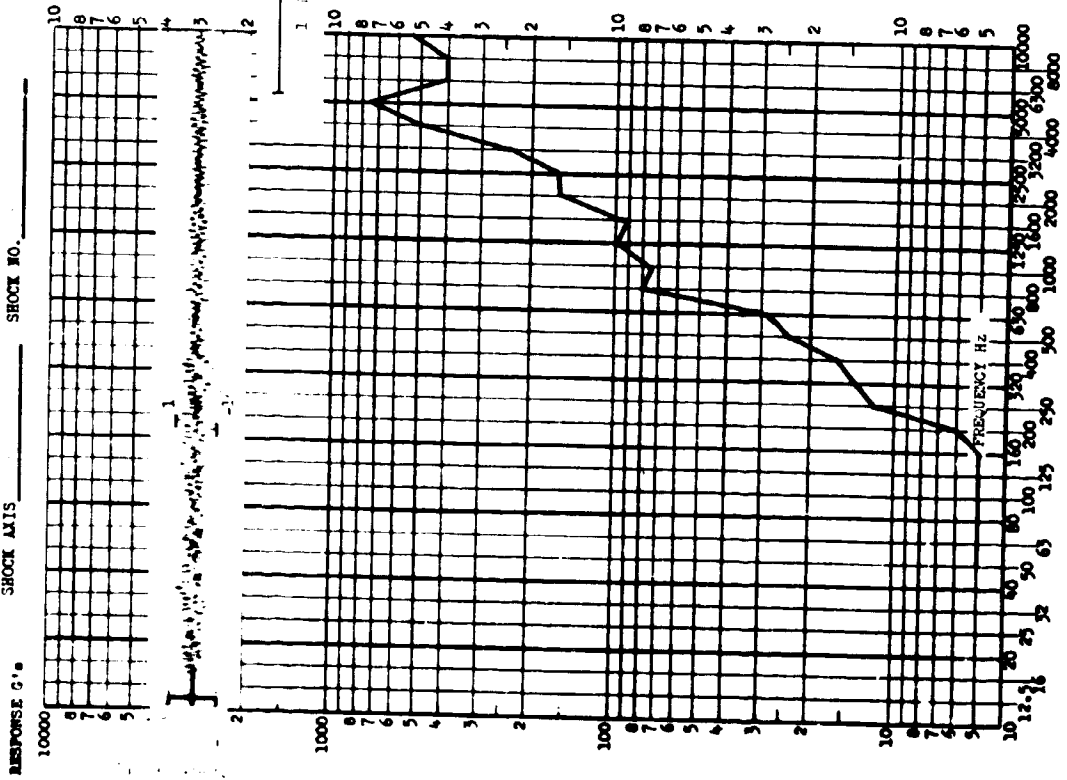


FIGURE 11.B.3-15

TEST ITEM _____
 ACCEL. NO. _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____



TEST ITEM Water Load Tray Shock Test
 ACCEL. NO. 7 TEST DATE 3-1-68
 SHOCK AXIS XL SHOCK NO. 5

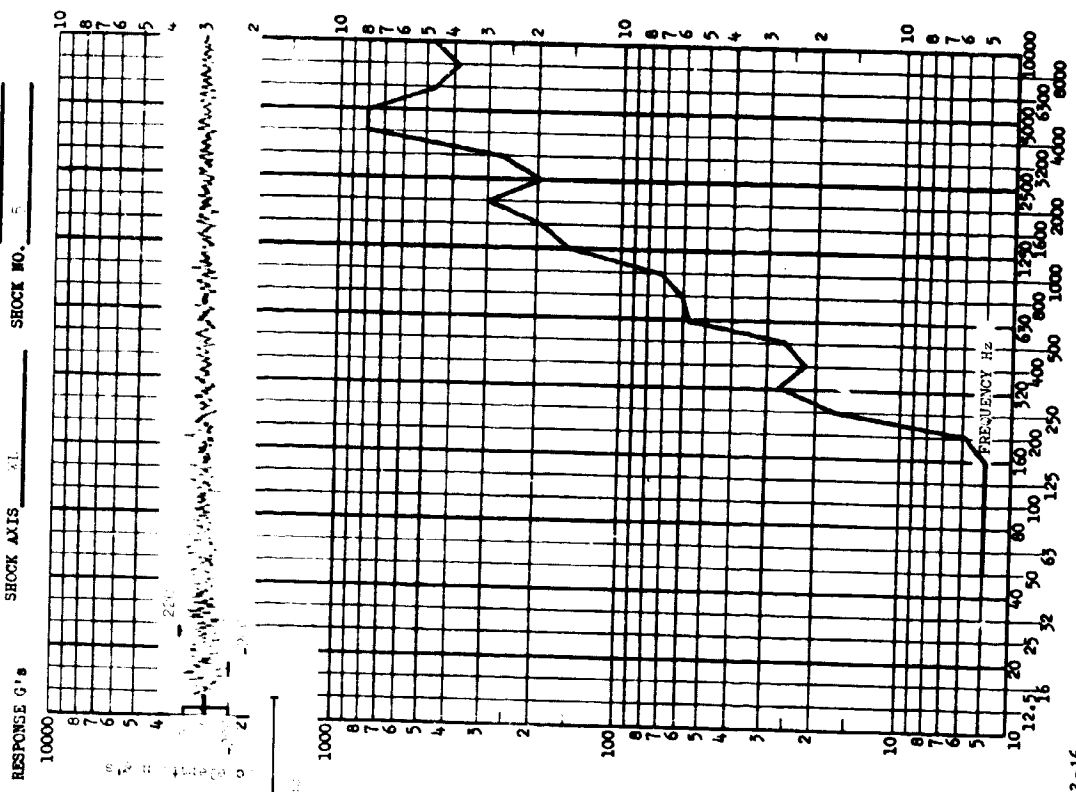
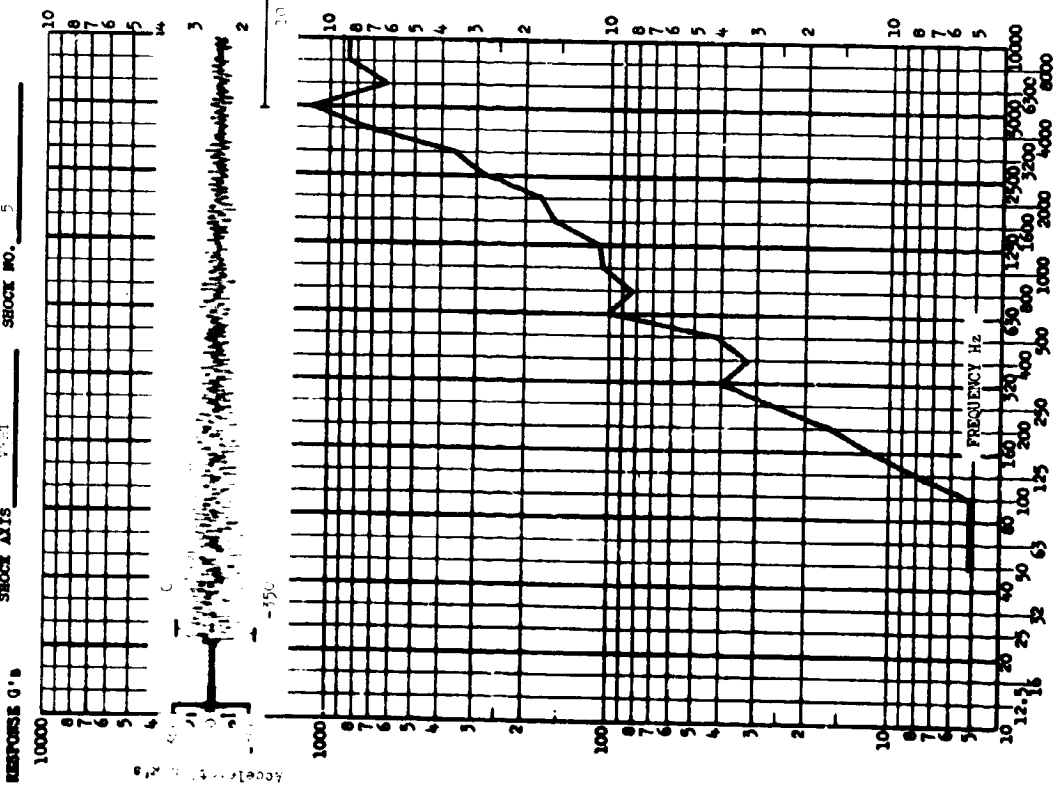


FIGURE II.B.3-16

TEST ITEM Titan IIC Payload Truss Shock Test
 ACCEL. NO. 7 TEST DATE 3-10-66
 SHOCK AXIS TEST SHOCK NO. 5



TEST ITEM Titan IIC Payload Truss Shock Test
 ACCEL. NO. 4 TEST DATE 7-19-66
 SHOCK AXIS BL SHOCK NO. 5

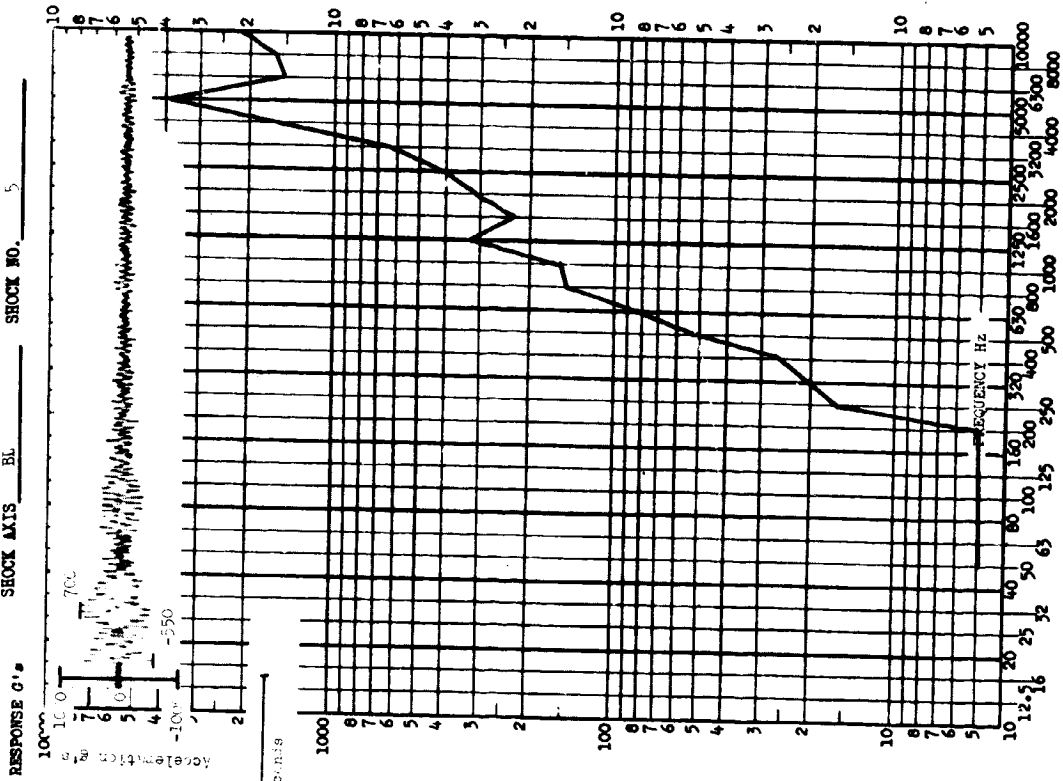


FIGURE 11.B.3-17

TEST ITEM Titan IIIC Payload Truss Shock Test

TEST DATE 3-19-68

SHOCK AXIS N SHOCK NO. 3¹⁴

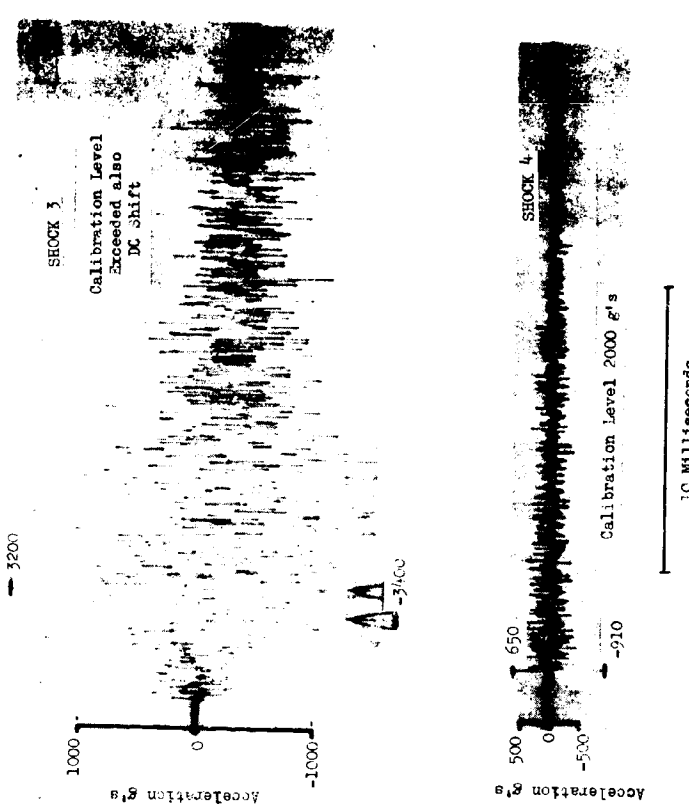
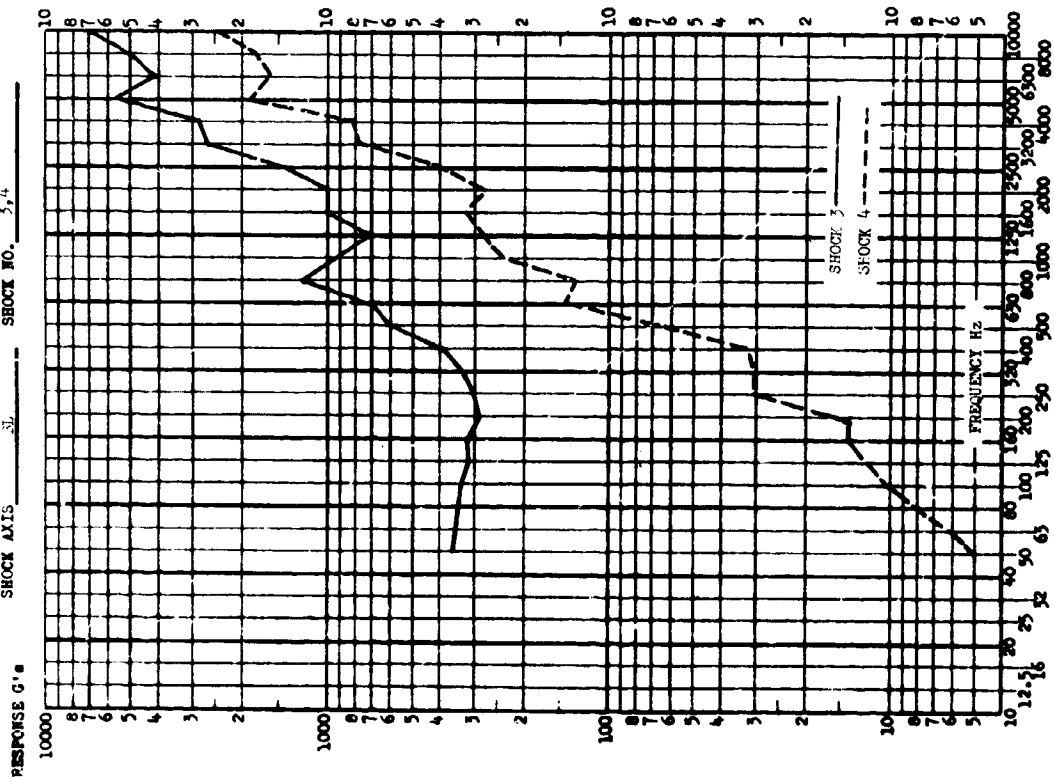


FIGURE II.B.3-18

TEST ITEM _____
 TEST DATE _____
 SHOCK AXIS _____
 SHOCK NO. _____

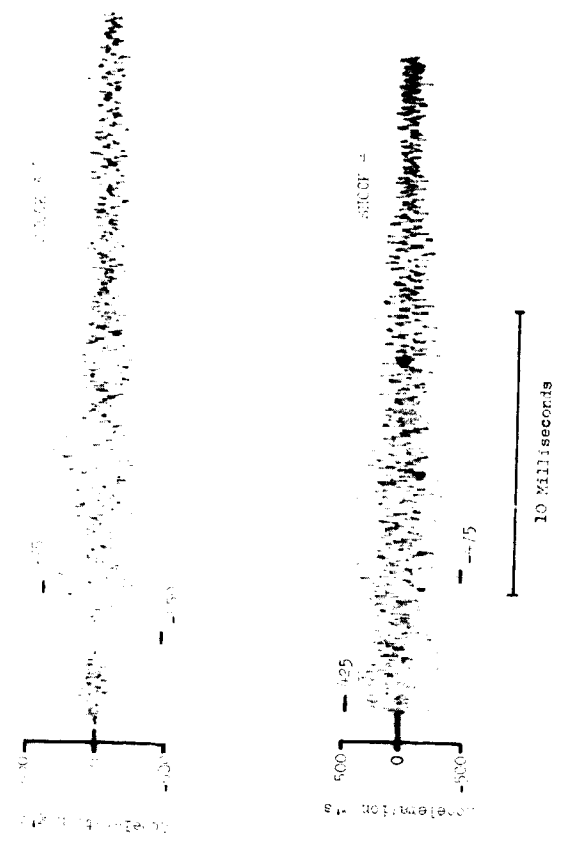
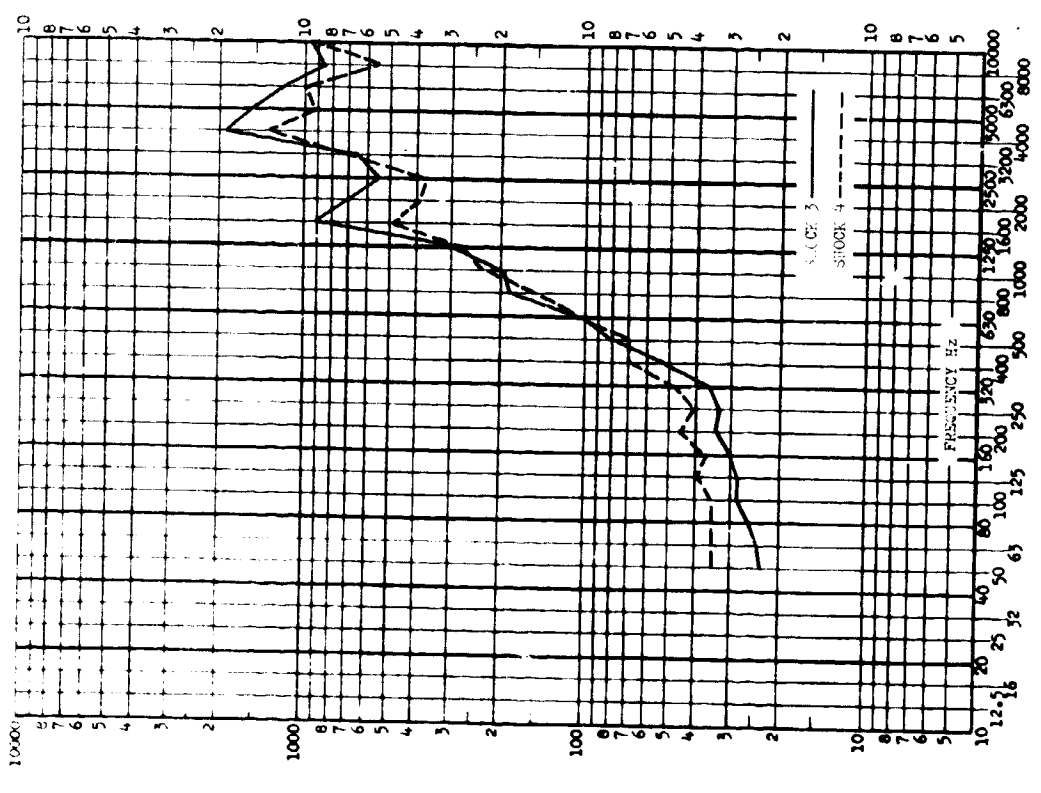
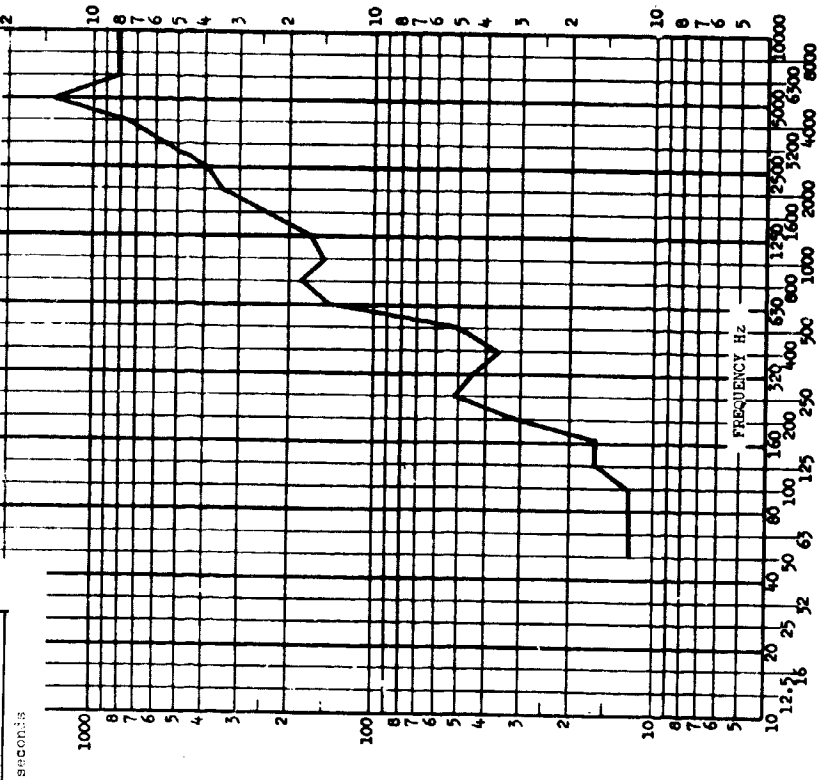
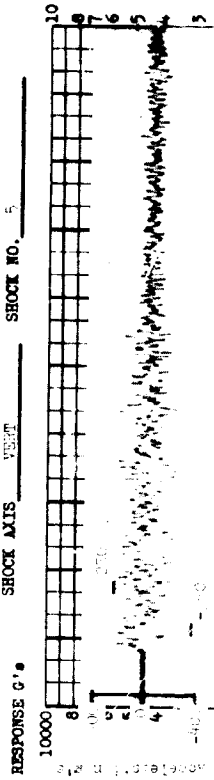


FIGURE 11.8.3-19

TEST ITEM Titan IIIC Payload Mass Shock Test
 ACCEL. NO. 4 TEST DATE 4-19-64
 SHOCK AXIS YEST SHOCK NO. 5



TEST ITEM Titan IIIC Payload Mass Shock Test
 ACCEL. NO. 4 TEST DATE 4-19-64
 SHOCK AXIS YEST SHOCK NO. 5

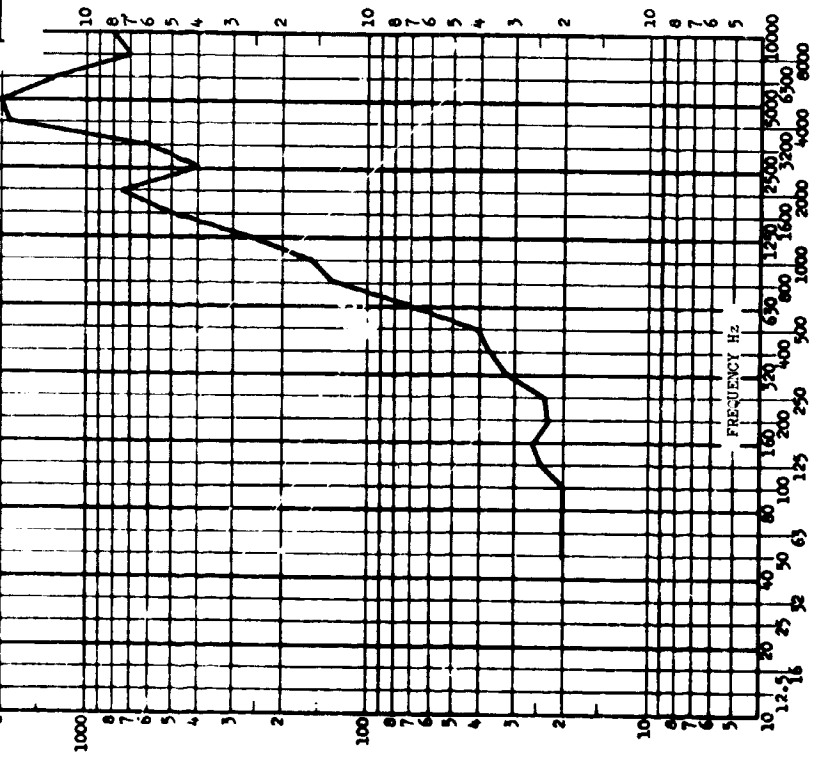
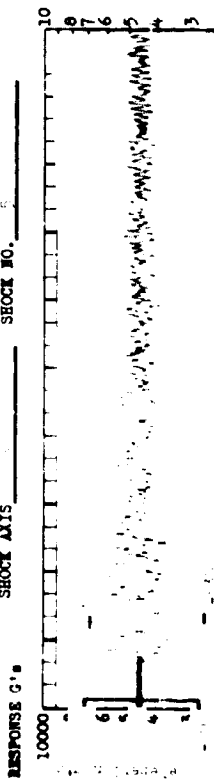


FIGURE 11.8.3-20

TEST ITEM: 1000 lb. Applied Trans Shock Test
 TEST DATE: 3-19-68
 SHOCK AXIS: Y SHOCK NO.: 3-1

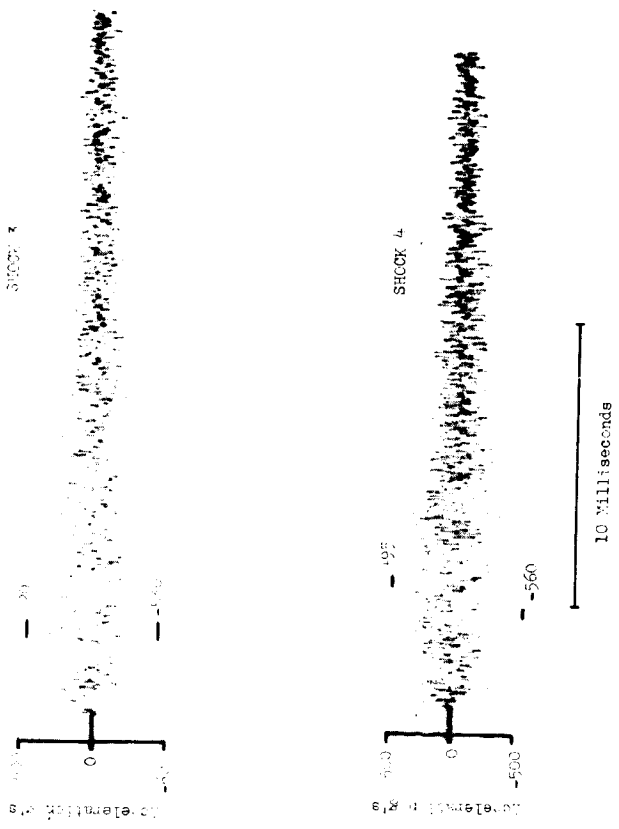
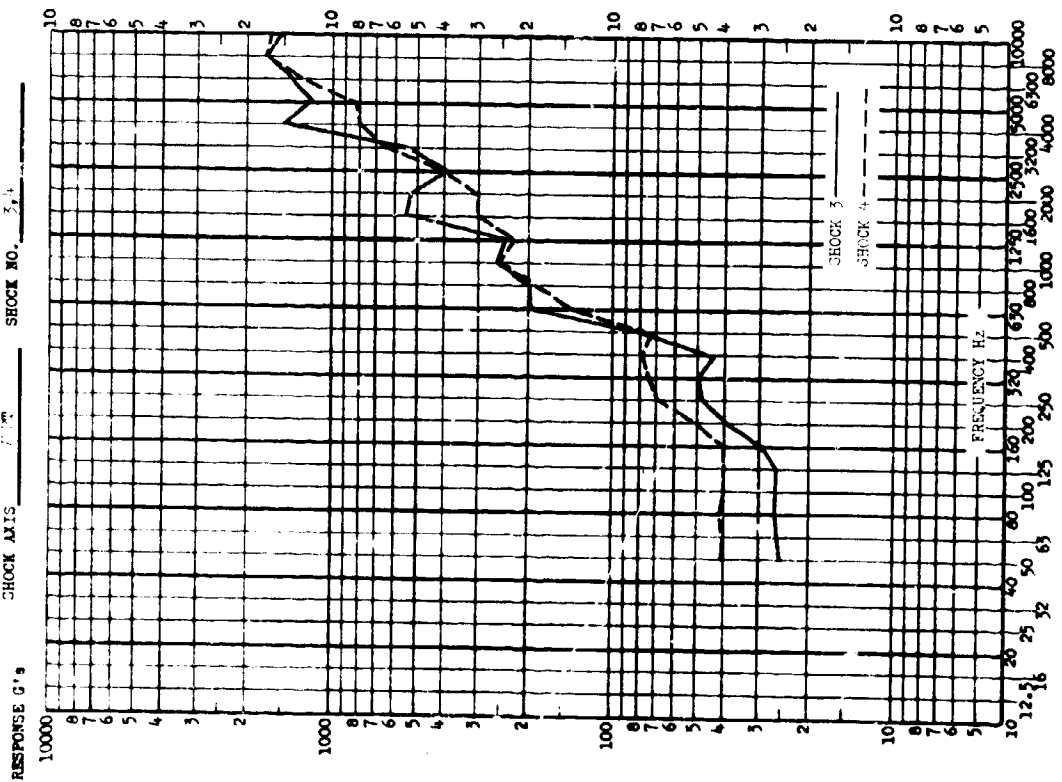


FIGURE 11.B.3-21

TEST ITEM: Titan II-2 Payload (77-88) Shock Test
 APP. NO.: 5 TEST DATE: 3-19-68
 SHOCK AXIS: XL SHOCK NO.: 172

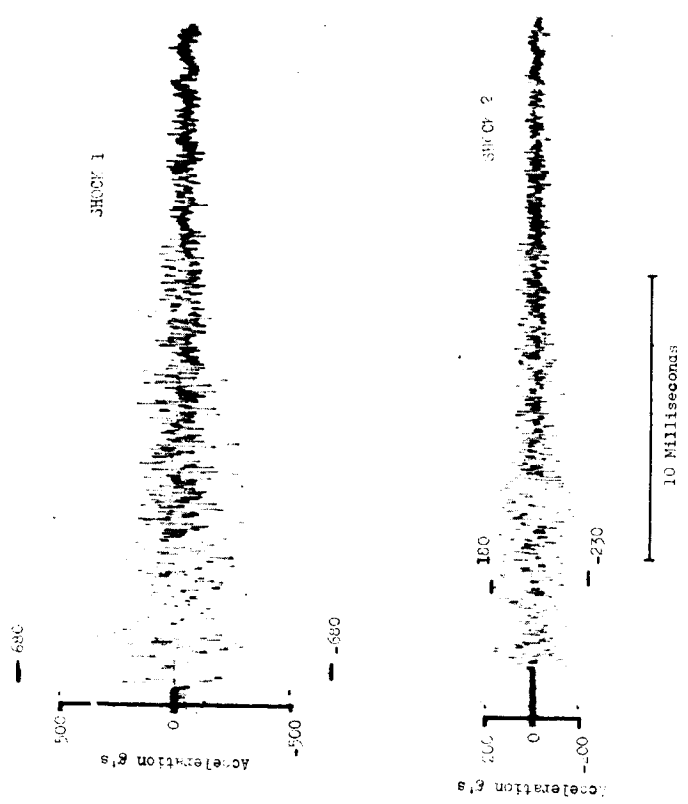
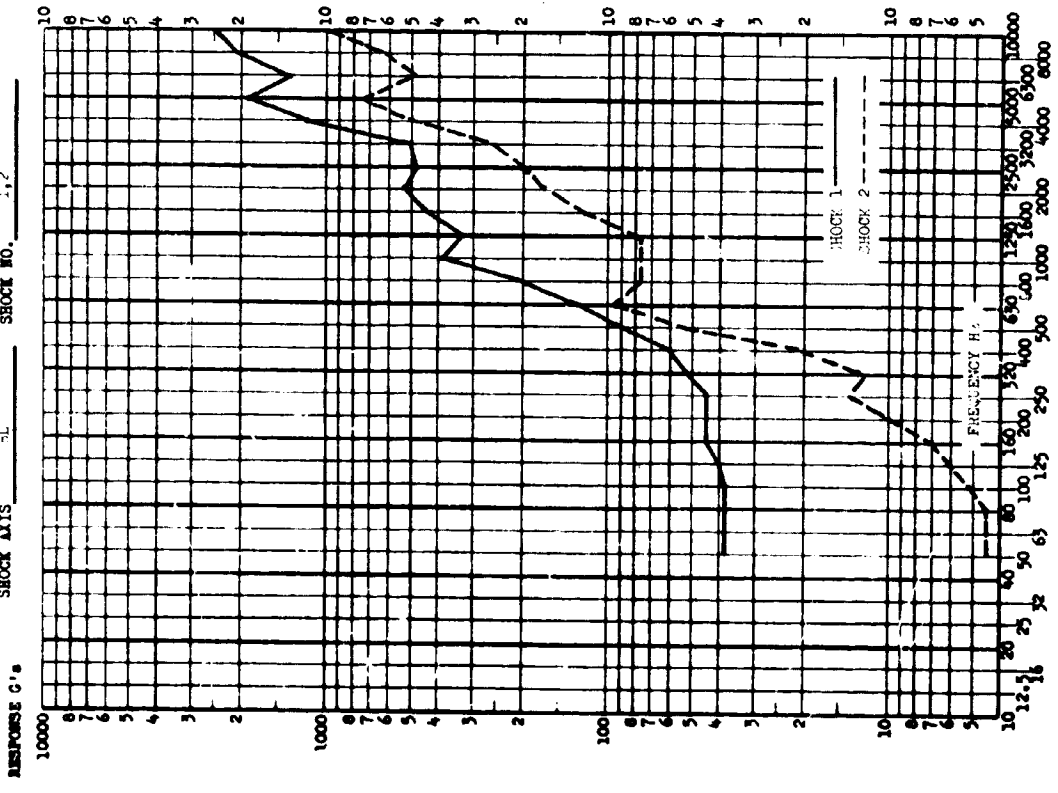
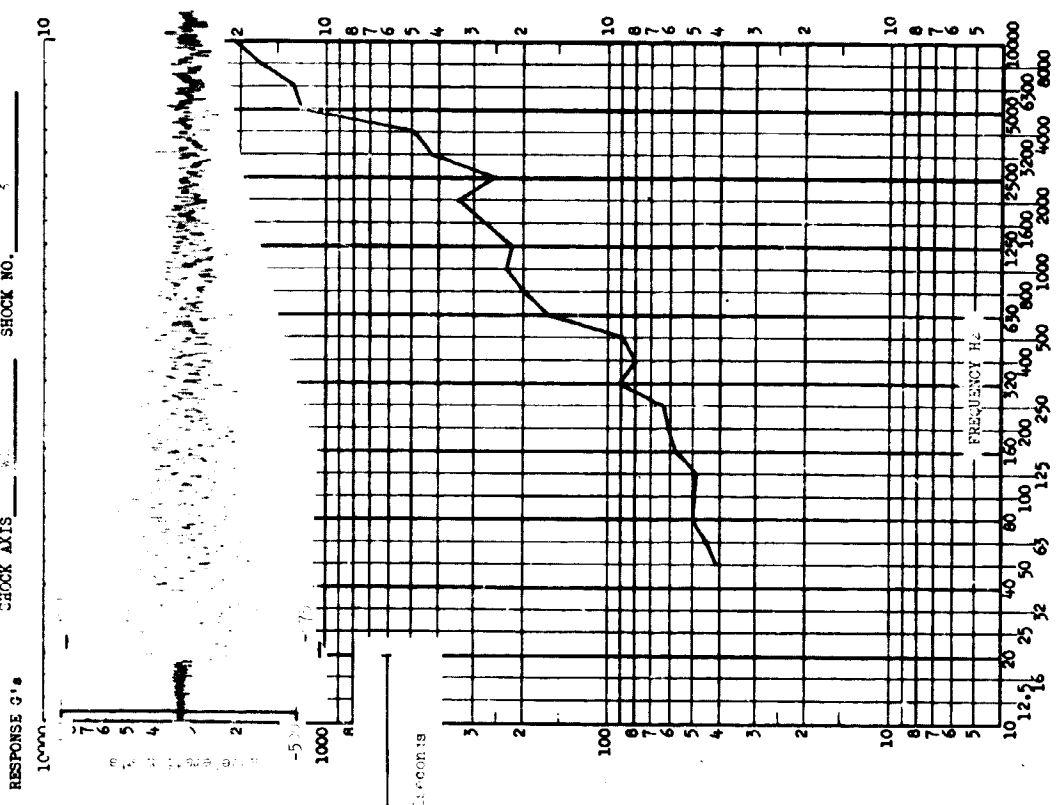


FIGURE 11.B.3-22

TEST ITEM: Carrier Payload Truss Shock Test
 ASSEM. NO.: TEST DATE: 4-19-66
 SHOCK AXIS: SHOCK NO.:



TEST ITEM:
 ASSEM. NO.: TEST DATE:
 SHOCK AXIS: SHOCK NO.:

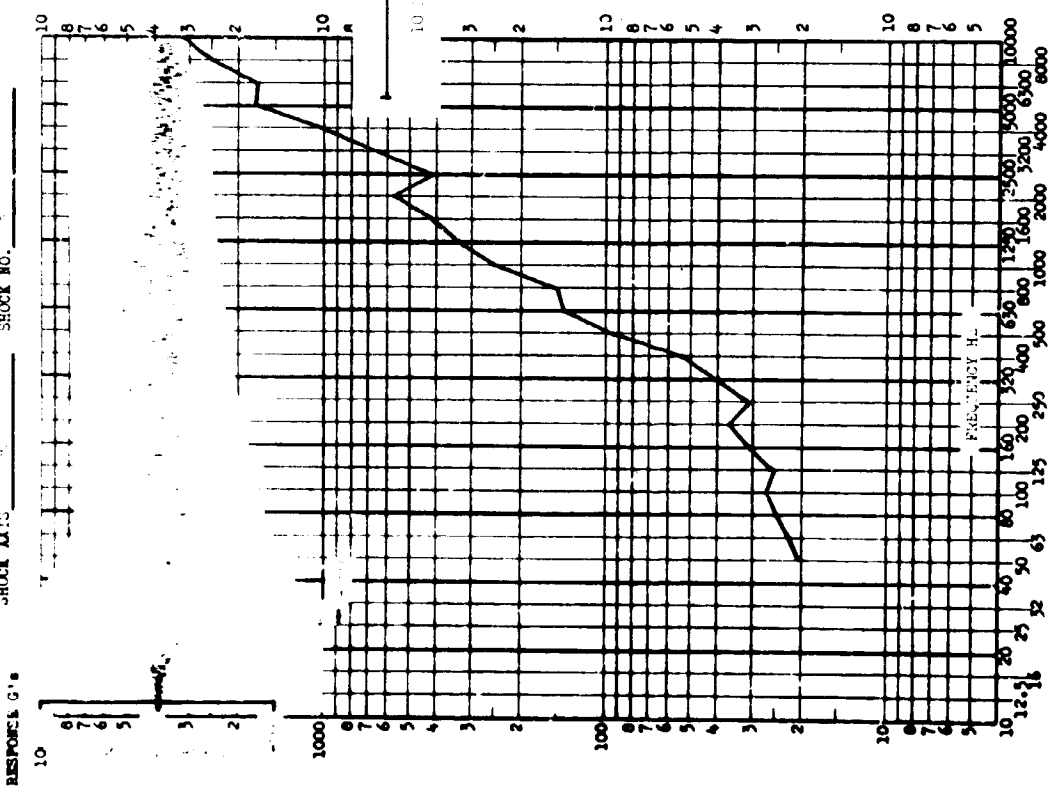


FIGURE 11.8.3-23

TEST ITEM _____
 TEST NO. _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

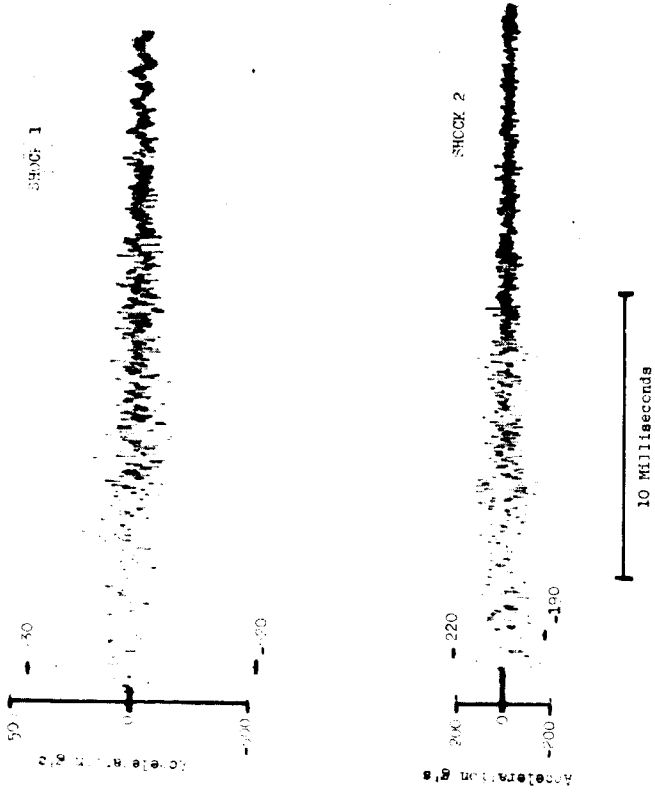
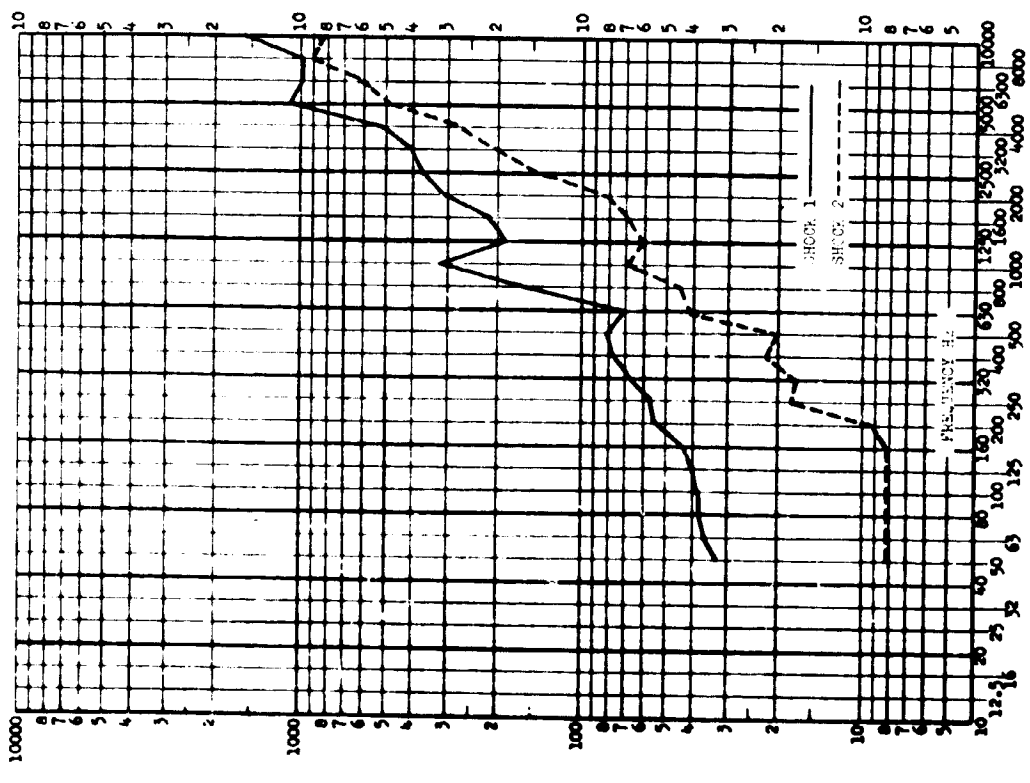


FIGURE 11.B.3-24

TEST ITEM _____
 TEST NO. _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

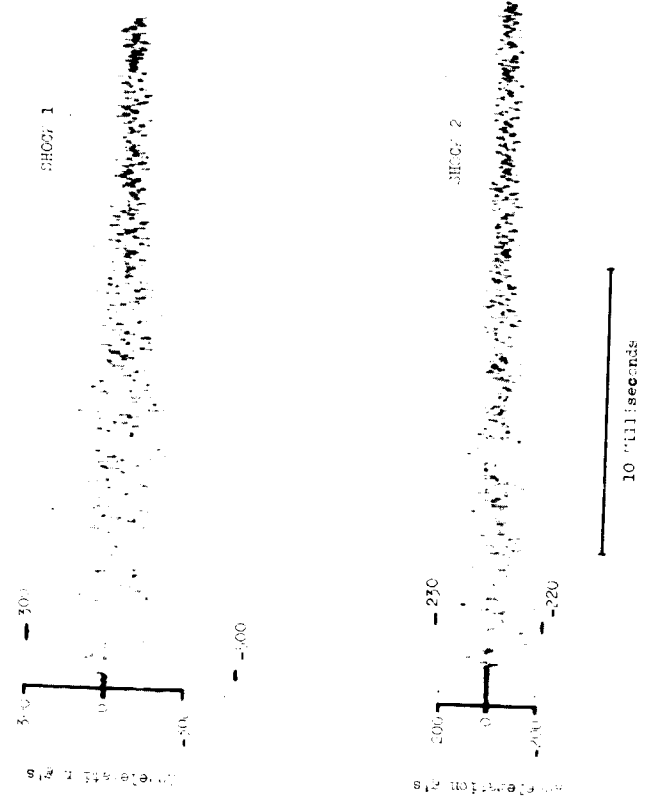
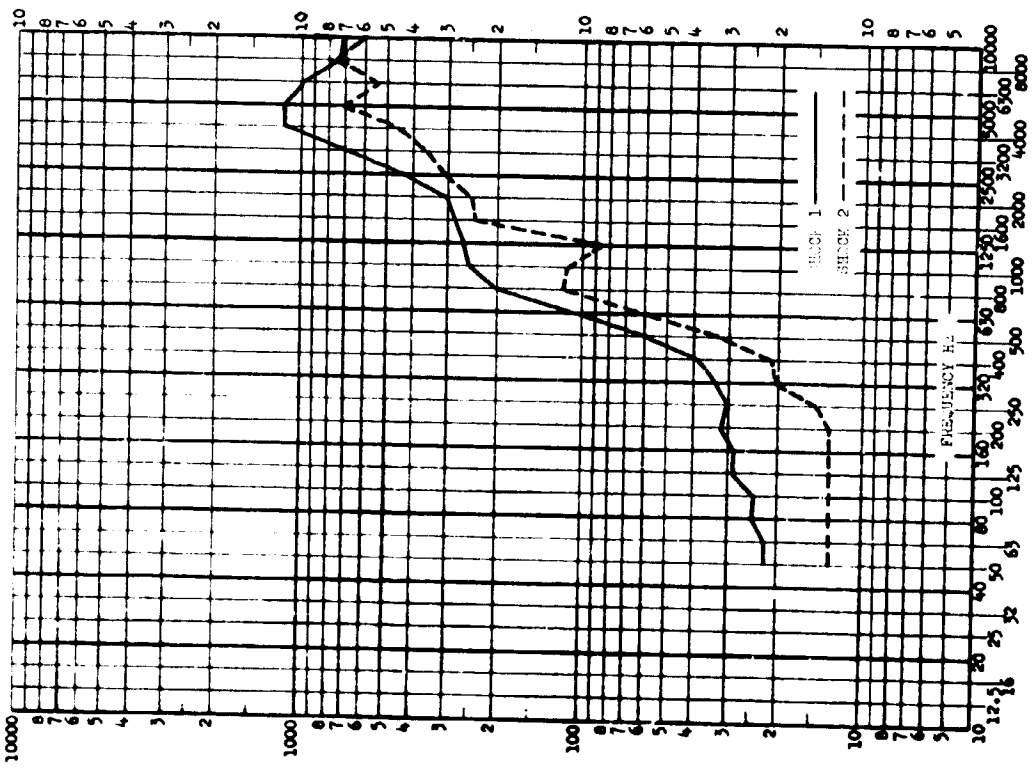


FIGURE 11.B.3-25

TEST ITEM: PAVLOV Truss Shock Test
 ACCEL. NO.: TEST DATE: 3-19-66
 SHOCK AXIS: SHOCK NO.: 3

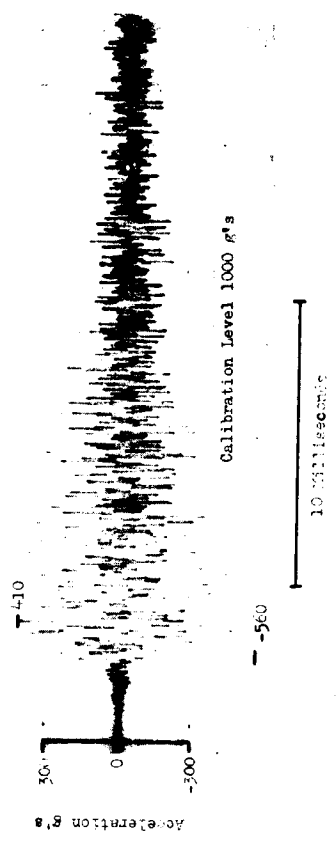
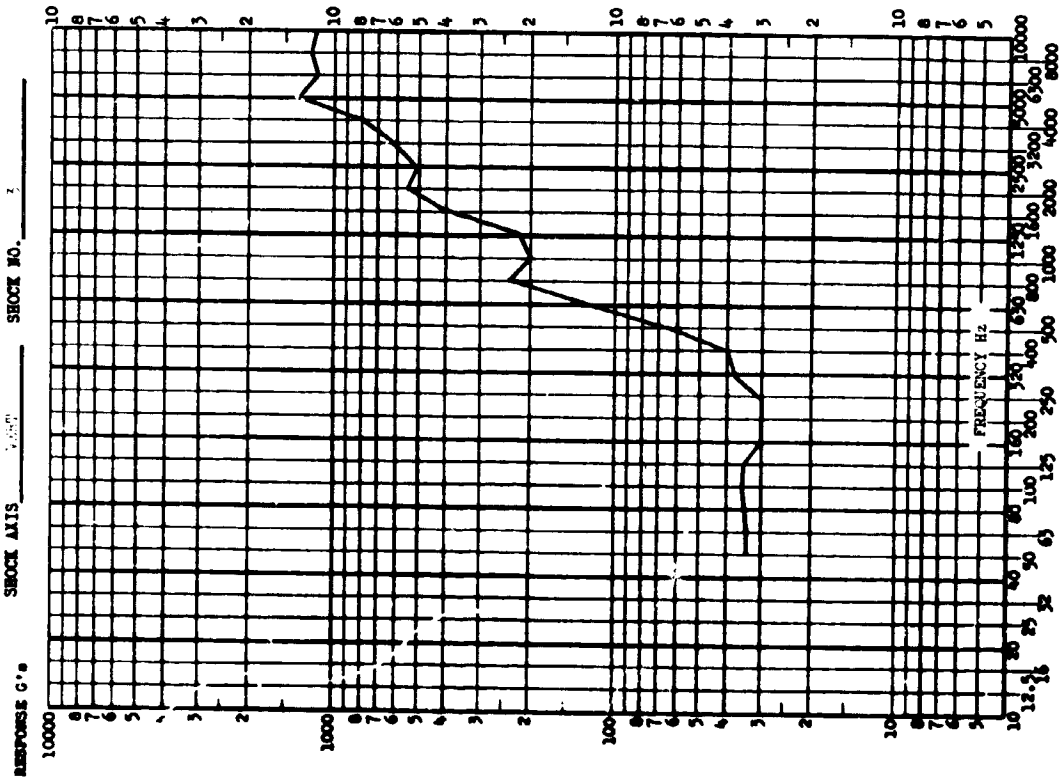


FIGURE 11.B.3-26

TEST ITEM: [Blank]
 TEST DATE: 1-19-68
 SHOCK AXIS: [Blank] SHOCK NO.: 3, 2

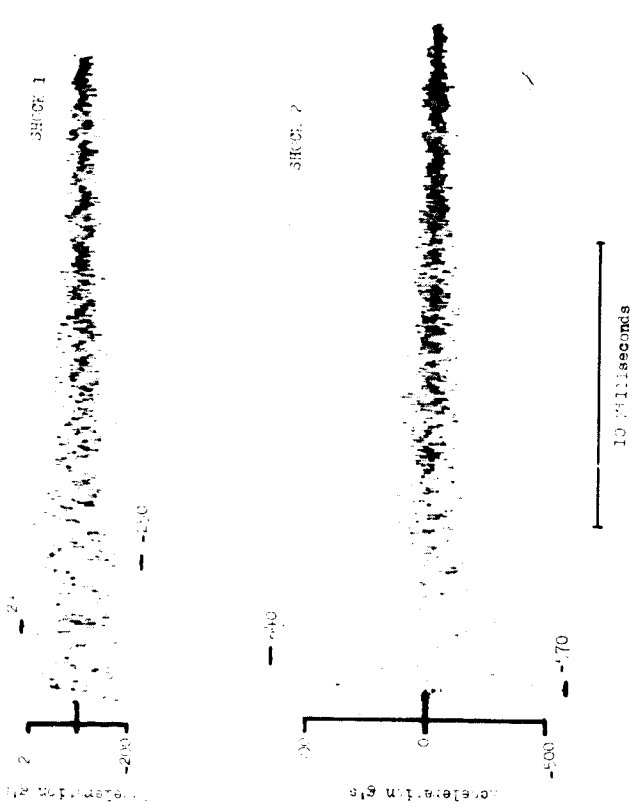
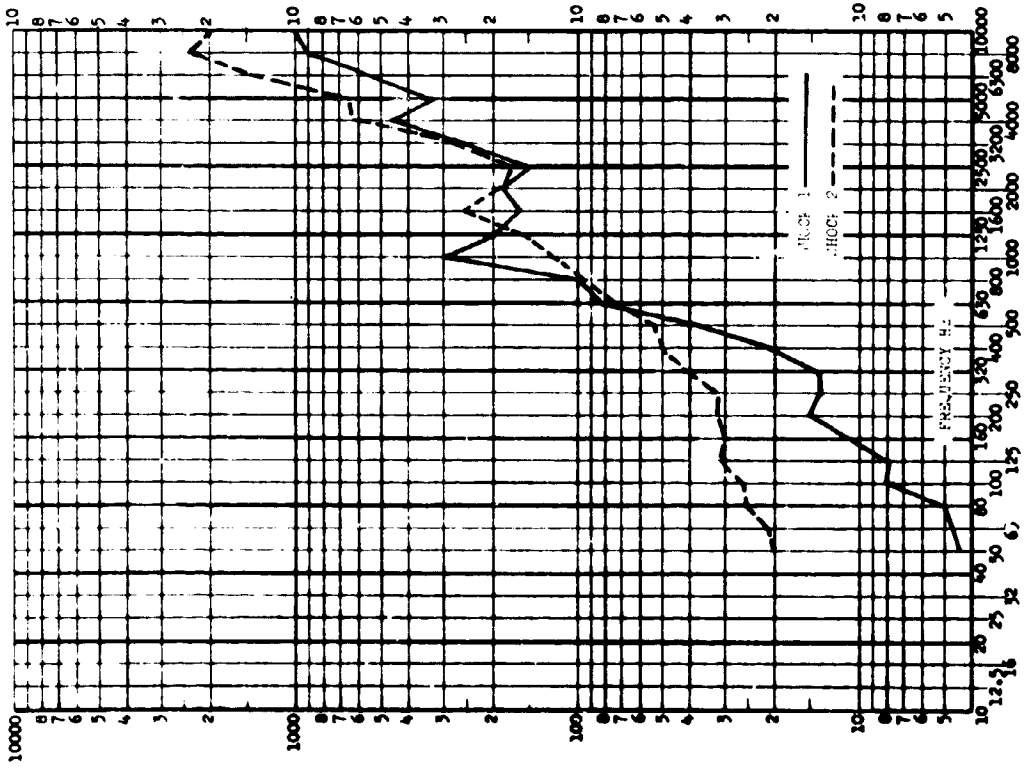


FIGURE II.B.3-27

TEST ITEM _____
 TEST DATE _____
 SHOCK AXIS _____
 SHOCK NO. _____

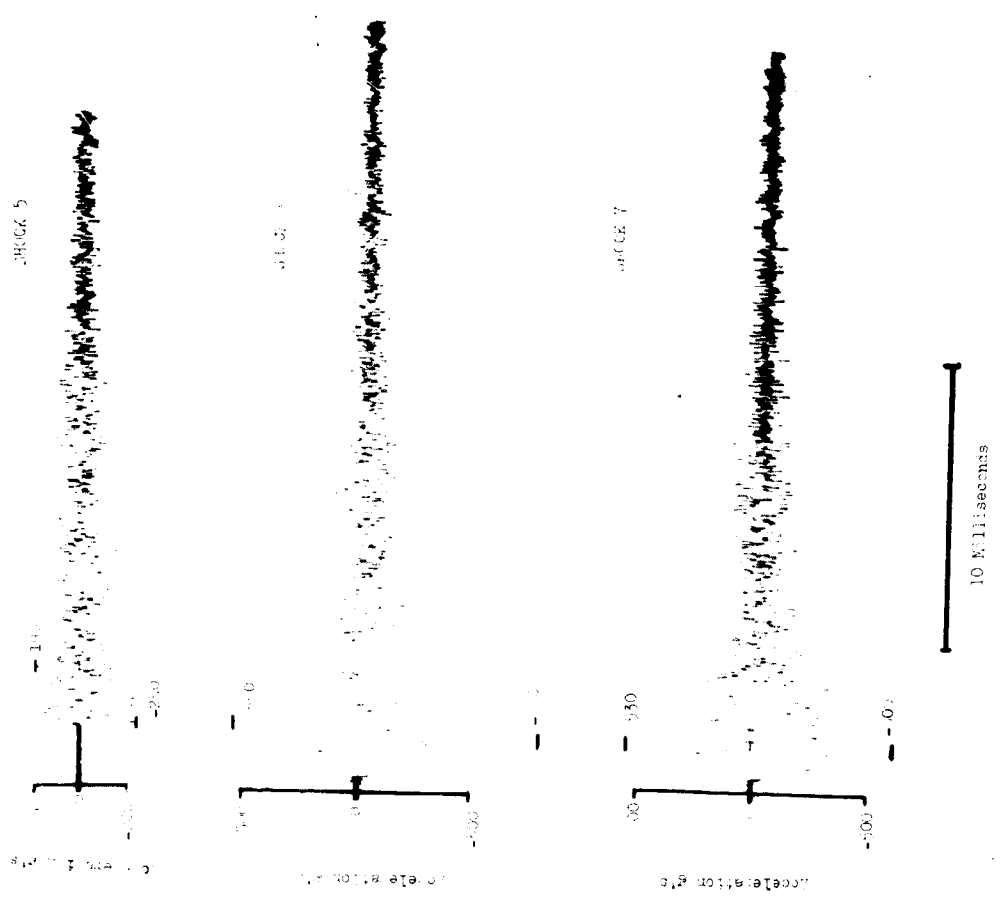
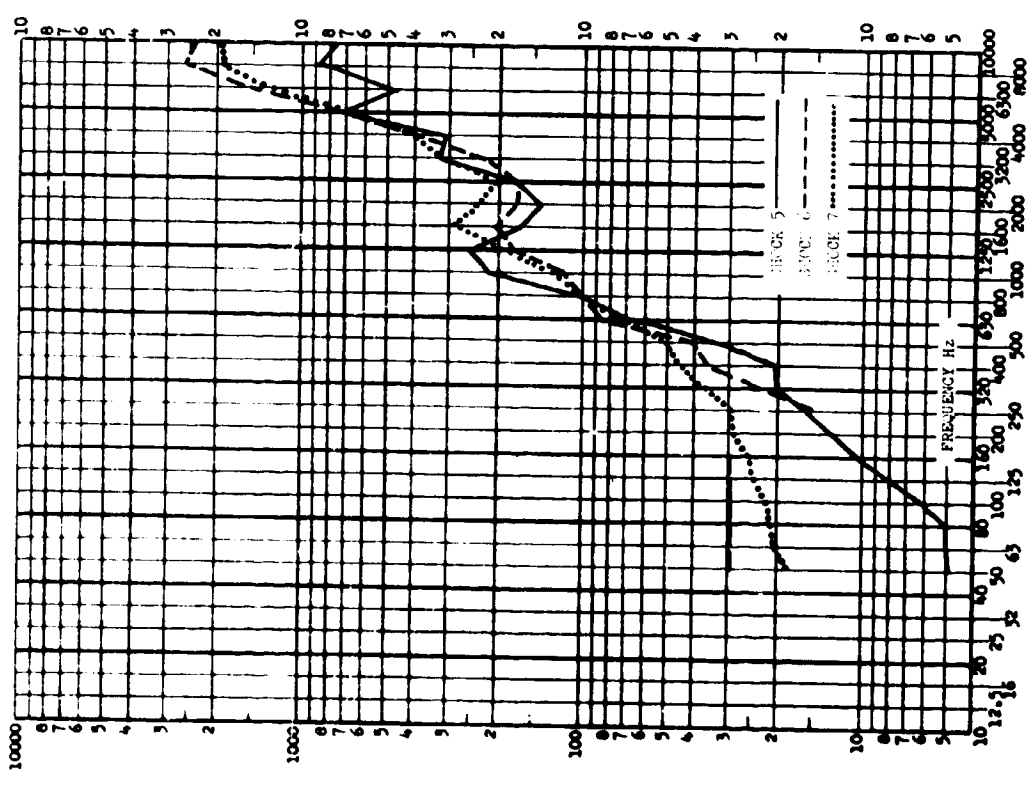


FIGURE II.B.3-28

TEST ITEM _____
 I. I. NO. _____ TEST DATE 3-2-58
 SHOCK AXIS _____ SHOCK NO. 1

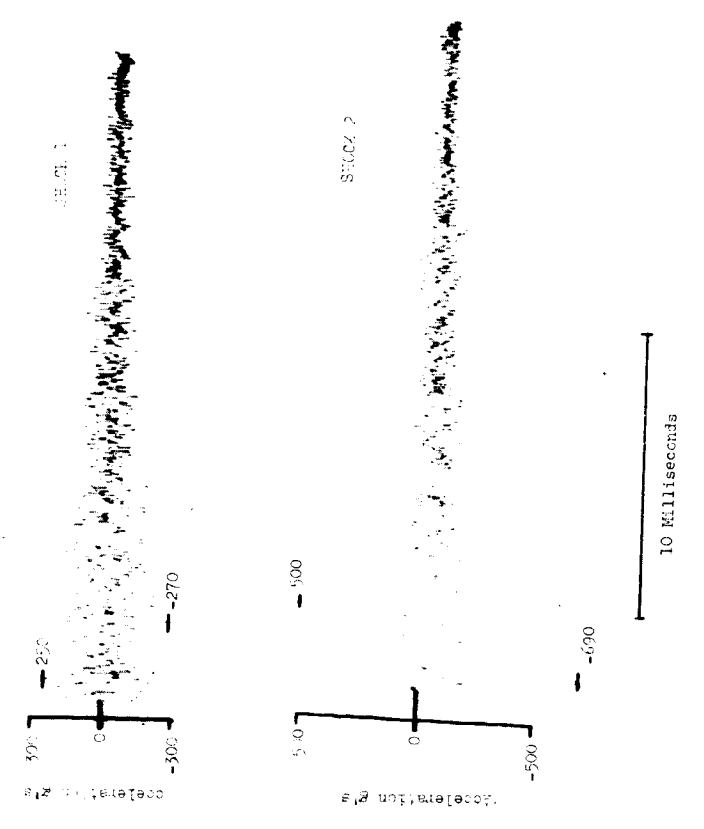
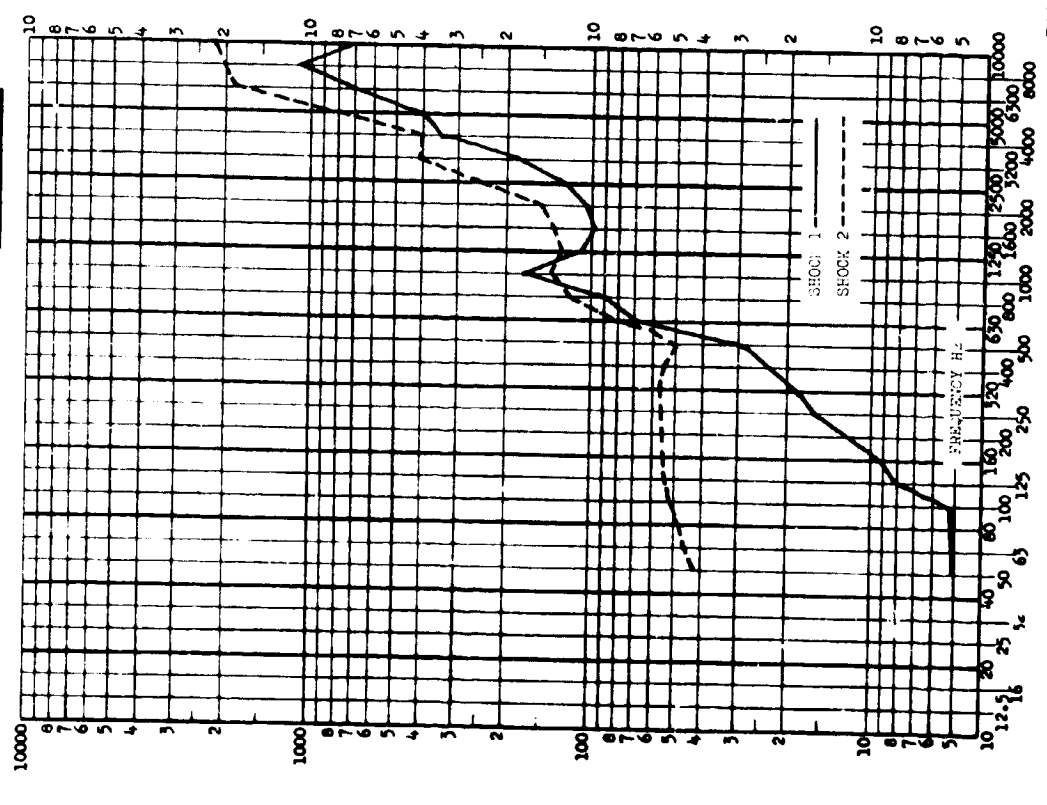


FIGURE 11.8.3-29

TEST ITEM _____
 APPL. NO. _____ TEST DATE 3-19-68
 SHOCK AXIS AL SHOCK NO. 5,6,7

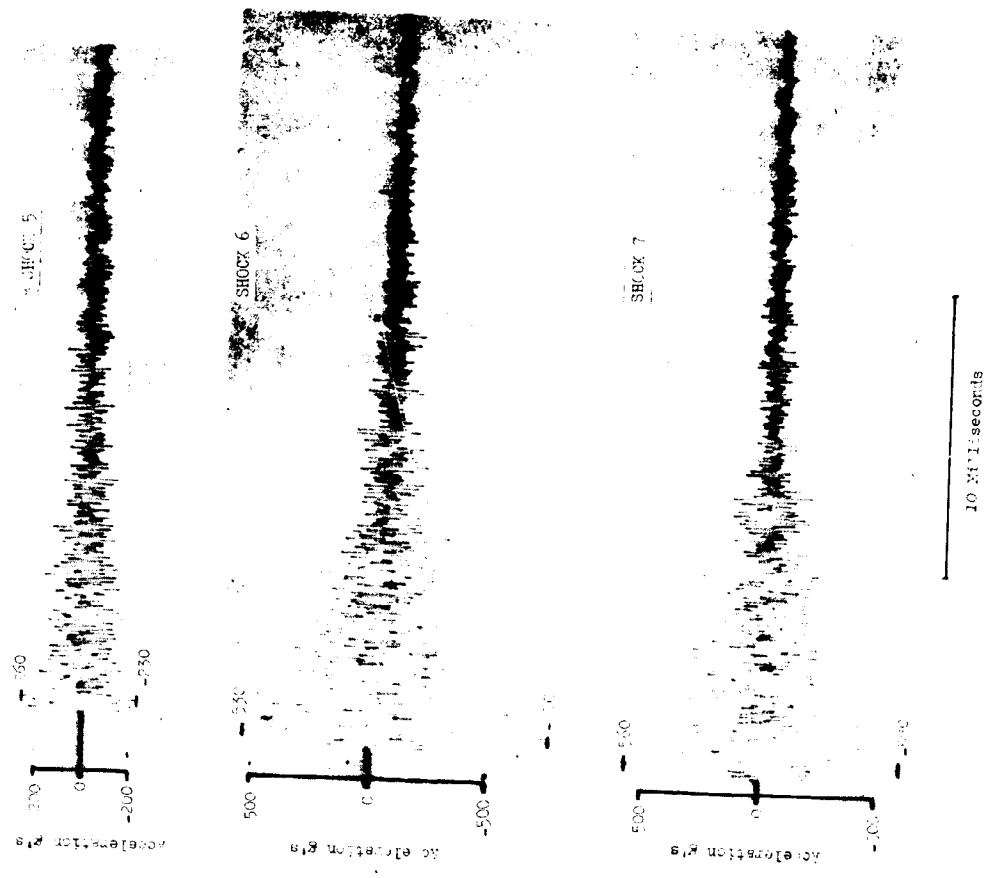
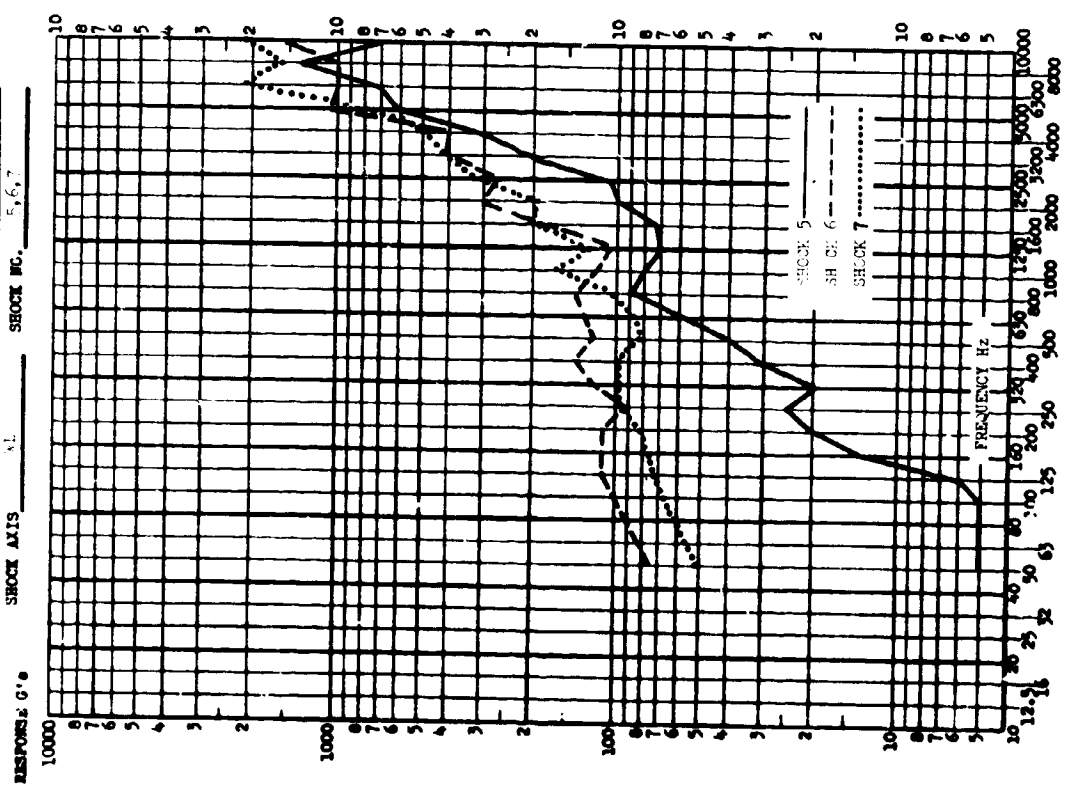


FIGURE II.B.3-30

TEST ITEM _____
 ACCEL. NO. _____
 SHOCK AXIS _____

TEST DATE 7-19-67
 SHOCK NO. 5, 6, 7

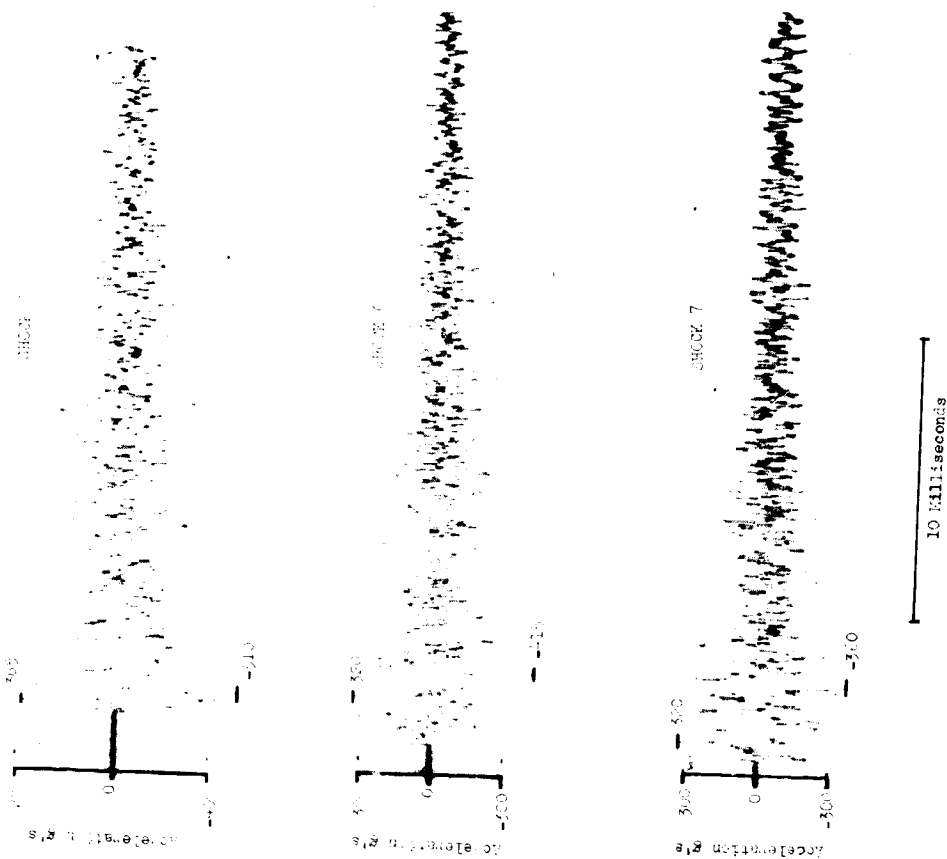
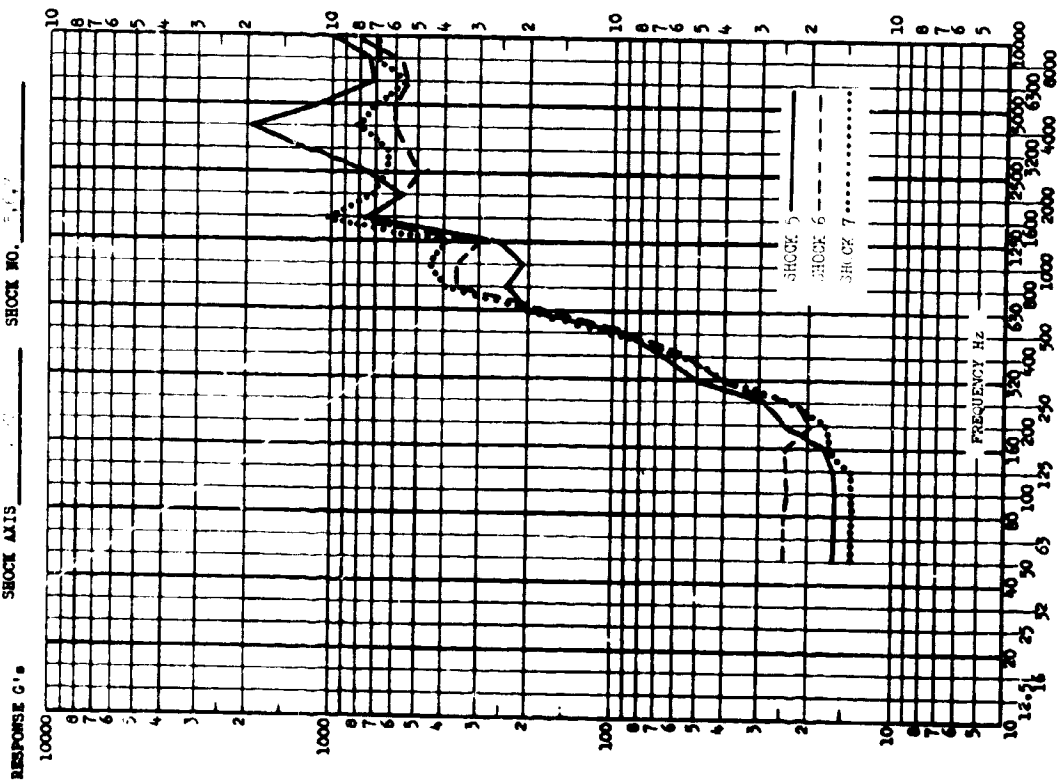
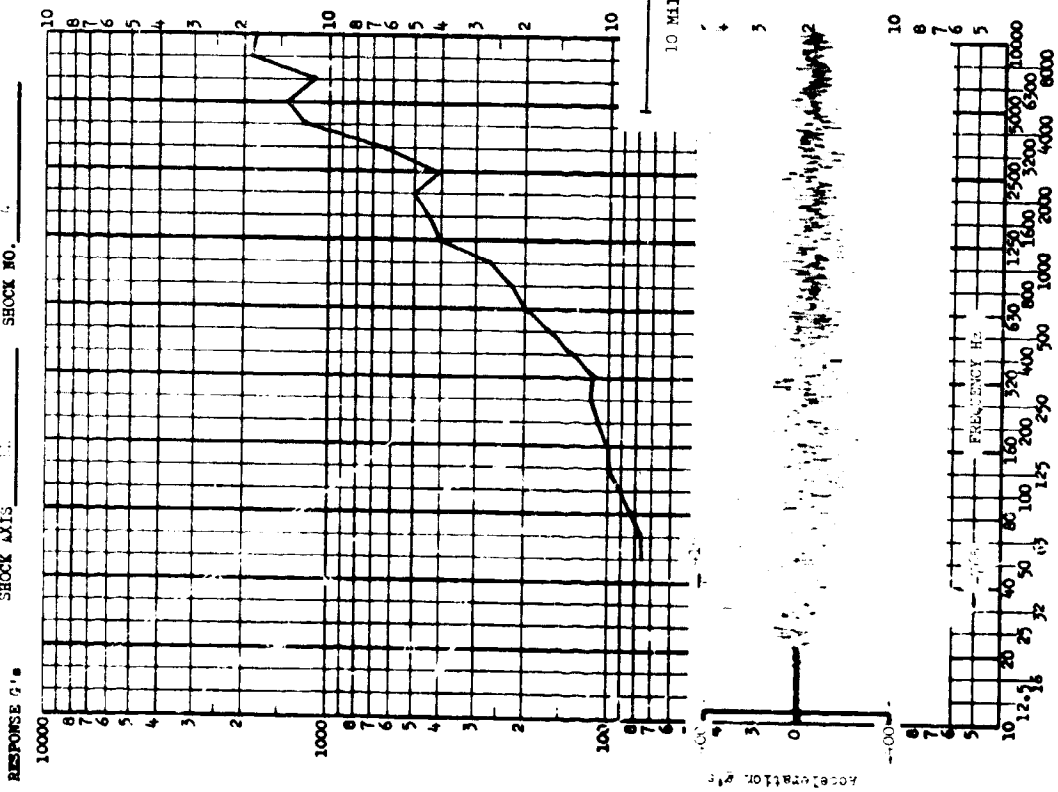


FIGURE 11.8.3-32

TEST ITEM Aluminum Alloy Truss Shock Test
 ACCEL. NO. 1 TEST DATE 1-19-68
 SHOCK AXIS MI SHOCK NO. 1



TEST ITEM Titanium Plywood Truss Shock Test
 ACCEL. NO. 2 TEST DATE 1-19-68
 SHOCK AXIS MI SHOCK NO. 4

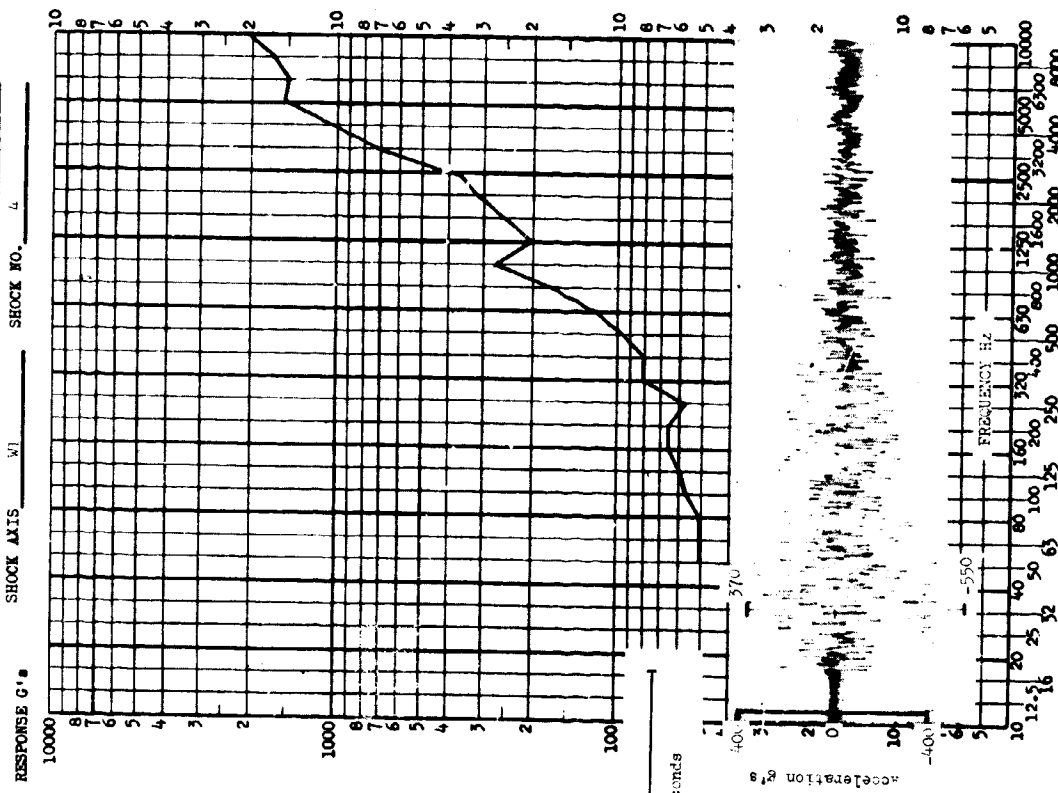


FIGURE 11.B.3-33

TEST ITEM _____
 ACCEL. NO. _____ TEST DATE _____
 SHOCK AXIS _____ EL. _____ SHOCK NO. _____

TEST ITEM _____
 ACCEL. NO. _____ TEST DATE _____
 SHOCK AXIS _____ EL. _____ SHOCK NO. _____

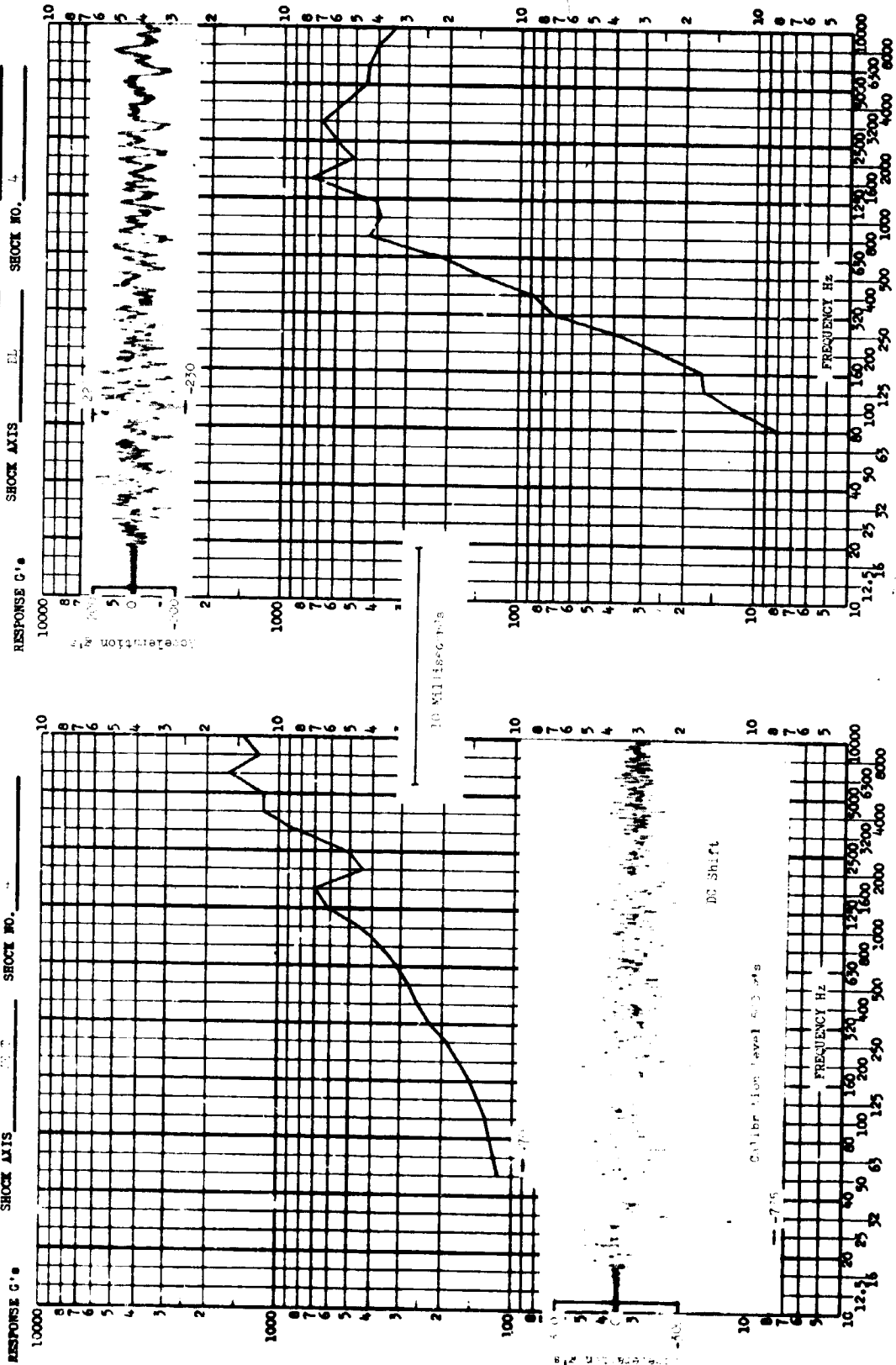
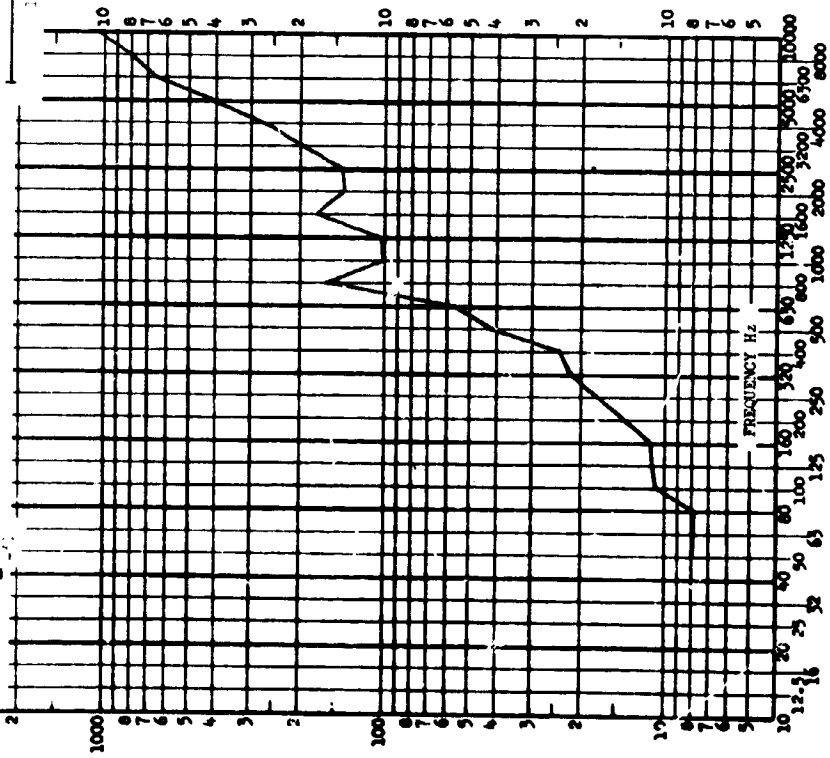
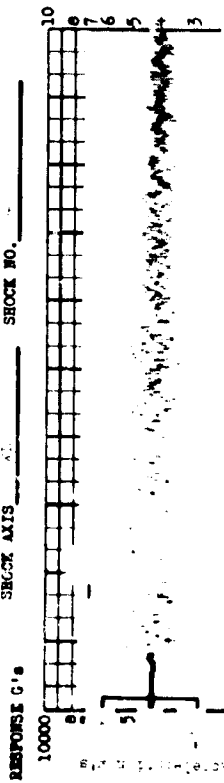


FIGURE II.B.3-34

TEST ITEM 118 C Explosive Charge Shock Test
 ACCEL. NO. 1 TEST DATE 1-15-66
 SHOCK AXIS VERT SHOCK NO. 1



TEST ITEM 118 C Explosive Charge Shock Test
 ACCEL. NO. 2 TEST DATE 1-19-66
 SHOCK AXIS VERT SHOCK NO. 2

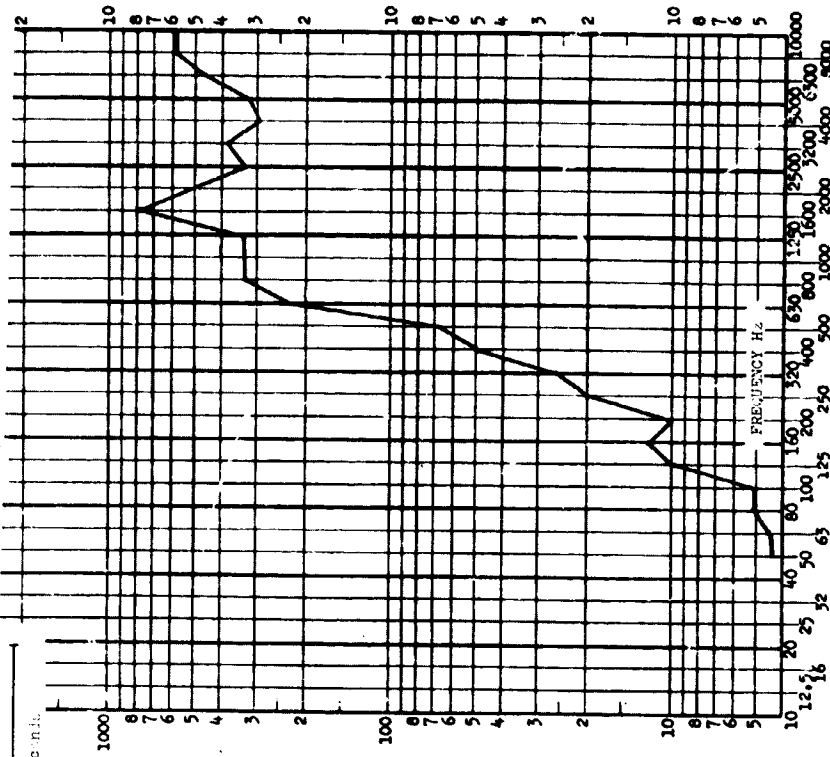
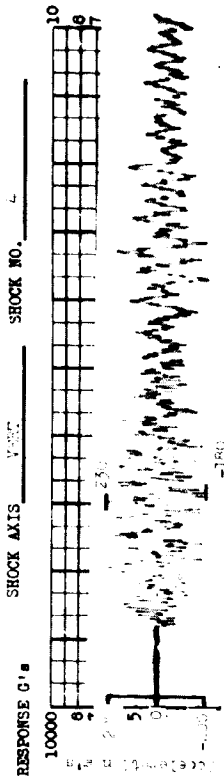
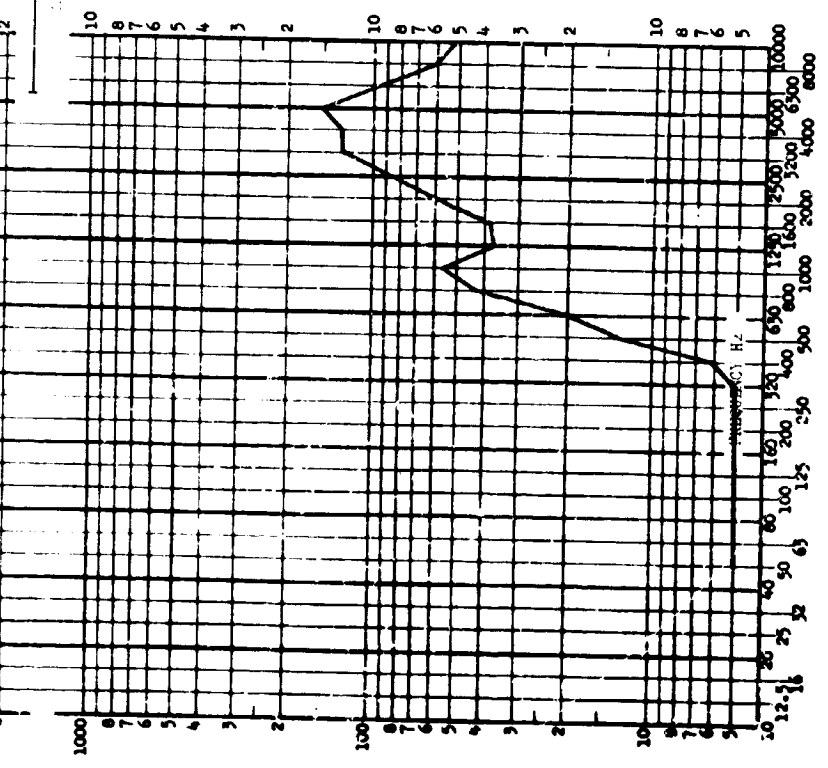
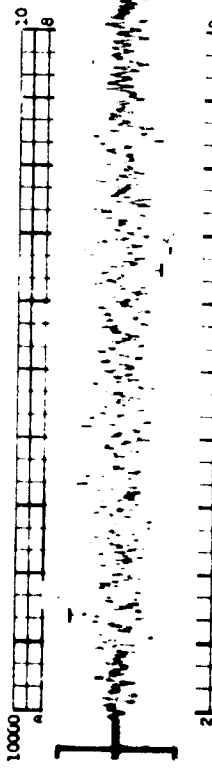


FIGURE 11.B.3-35

TEST ITEM _____ TEST DATE 3-19-57
 MODEL NO. _____ SHOCK AXIS _____
 RESPONSE G's _____



TEST ITEM Titan 1110 Payload Truss Shock Test
 MODEL NO. 9 TEST DATE 3-19-57
 SHOCK AXIS XL SHOCK NO. 7
 RESPONSE G's _____

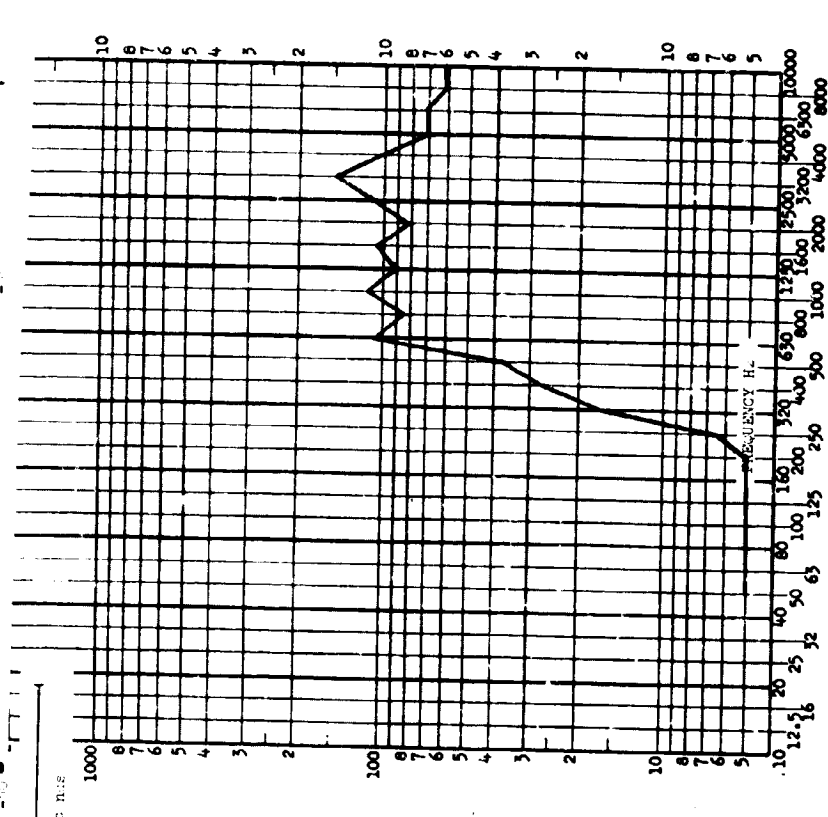
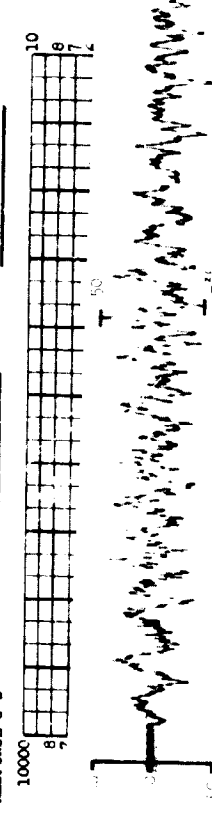
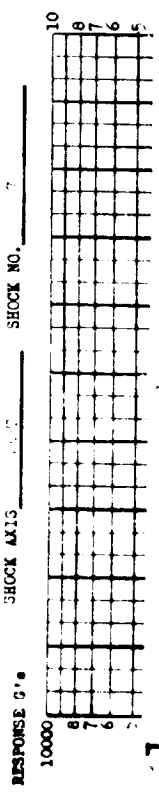


FIGURE 11.B.3-36

TEST ITEM _____
 ACCEL. NO. _____ TEST DATE 4-14-68
 SHOCK AXIS _____ SHOCK NO. 7



TEST ITEM _____
 ACCEL. NO. 10 TEST DATE 4-14-68
 SHOCK AXIS EL SHOCK NO. 7

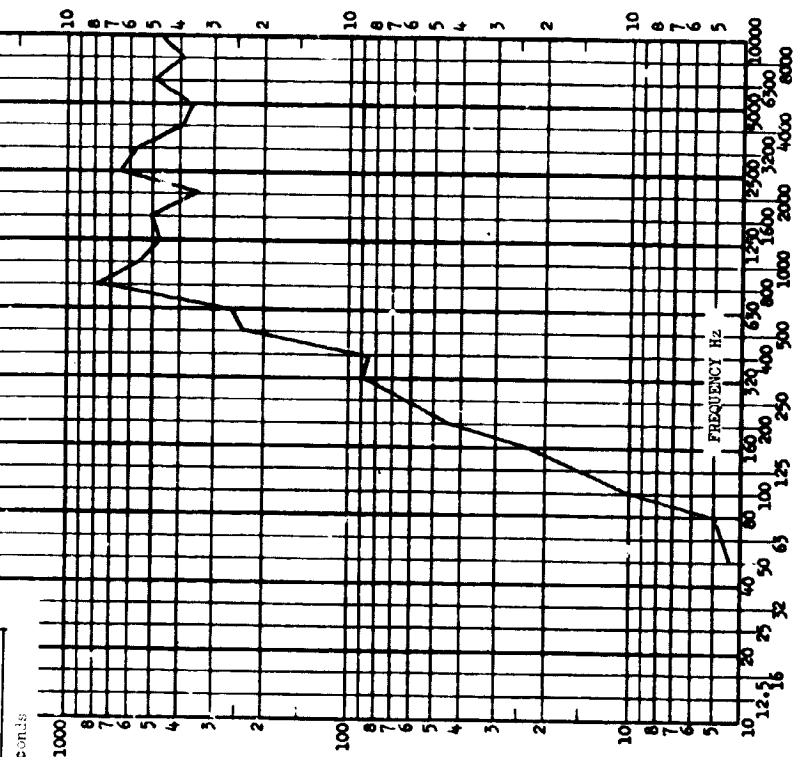
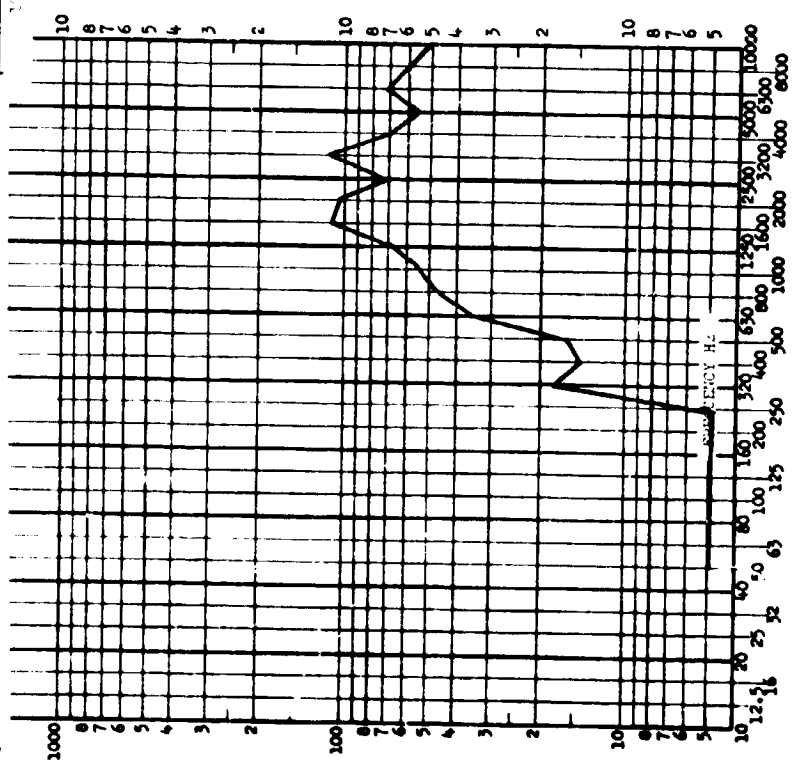
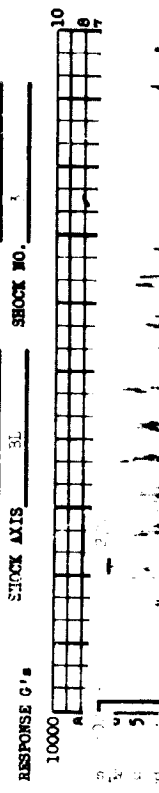
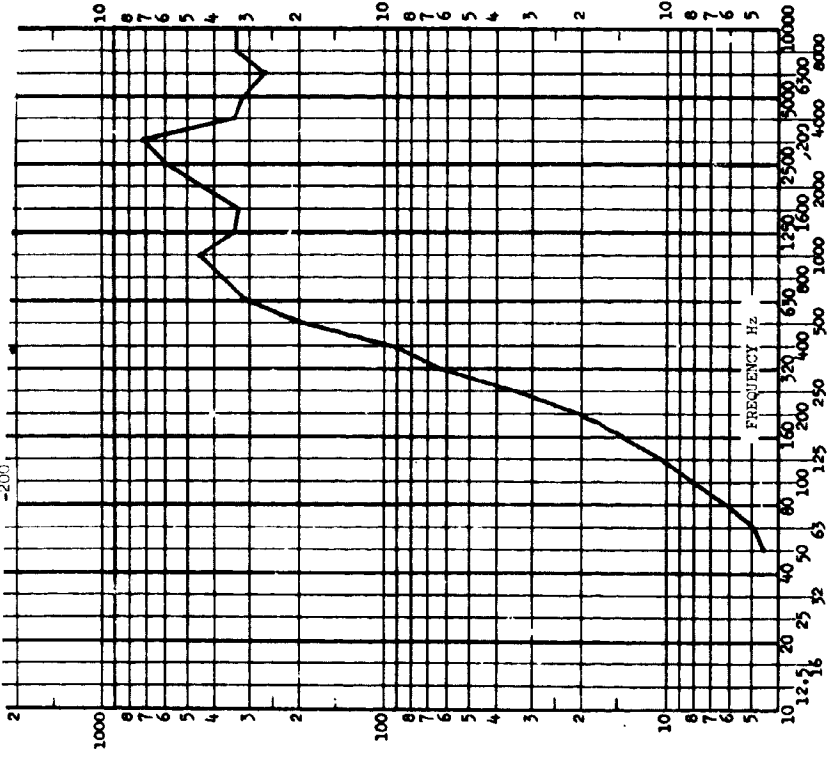
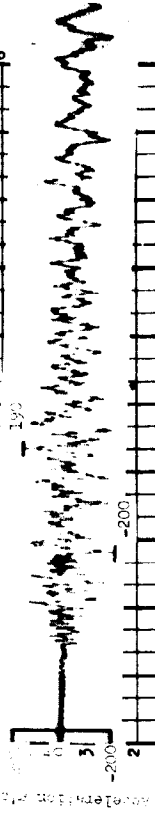
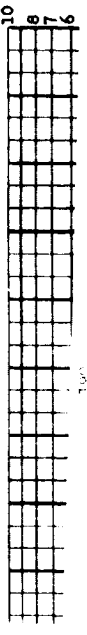


FIGURE 11.B.3-37

TEST ITEM Urban VTC Pav. Load Shock Test
 ACCEL. NO. 10 TEST DATE 1-19-66
 SHOCK AXIS VERT SHOCK NO. 3

RESPONSE G's



TEST ITEM Urban VTC Pav. Load Shock Test
 ACCEL. NO. 10 TEST DATE 1-19-66
 SHOCK AXIS VERT SHOCK NO. 7

RESPONSE G's

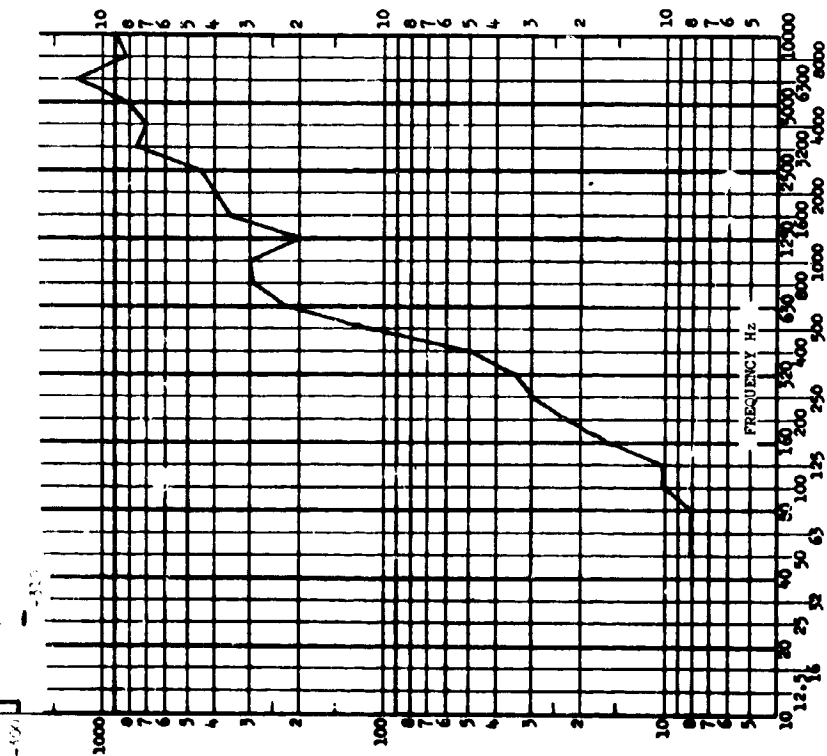
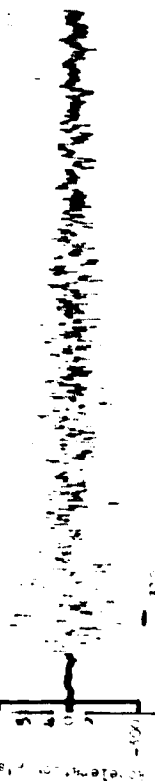
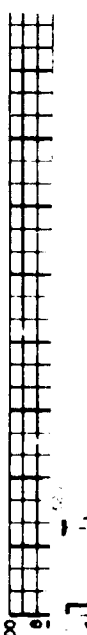
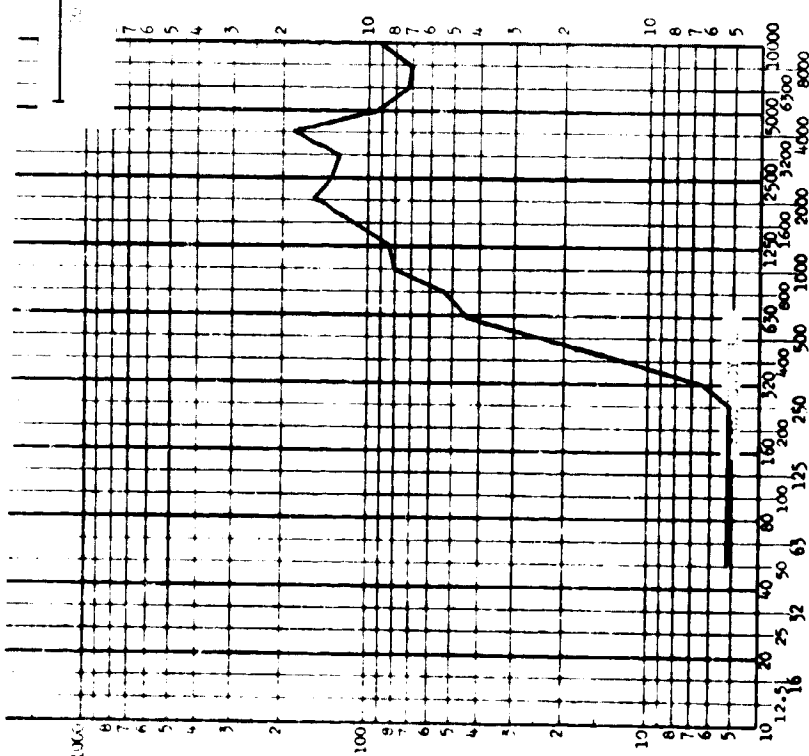
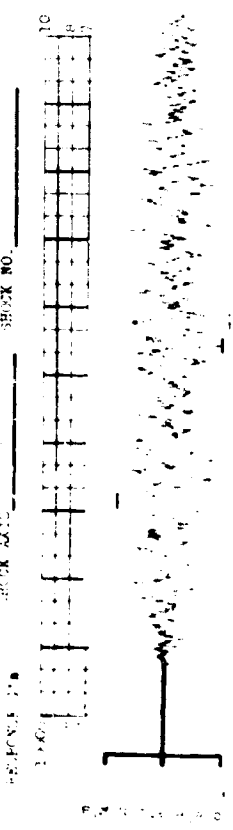


FIGURE 11.B.3-38

TEST ITEM: 11.101.101.101 Shock Test
 ACCEL. NO.: 11 TEST DATE: 1-1-68
 SHOCK AXIS: XL SHOCK NO.: 7



TEST ITEM: 11.101.101.101 Shock Test
 ACCEL. NO.: 11 TEST DATE: 1-1-68
 SHOCK AXIS: XL SHOCK NO.: 7

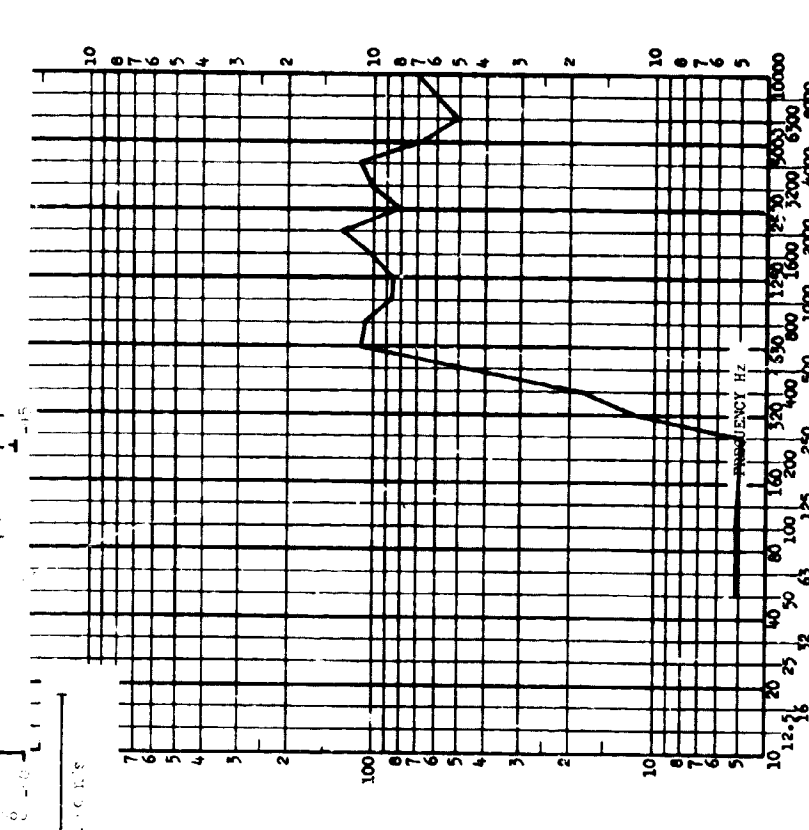
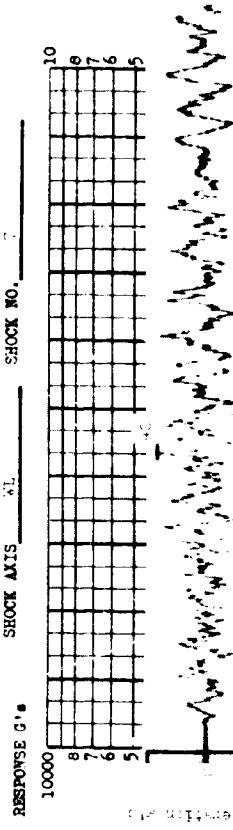
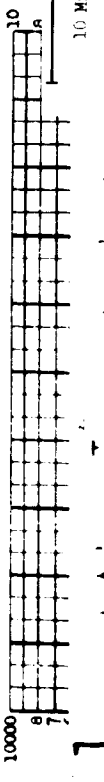


FIGURE II.B.3-39

TEST ITEM Titan IIC Payload Truss Shock Test
 ACCEL. NO. 11 TEST DATE 4-19-64
 SHOCK AXIS EAST SHOCK NO. 7

RESPONSE G's



TEST ITEM Titan IIC Payload Truss Shock Test
 ACCEL. NO. 12 TEST DATE 3-19-66
 SHOCK AXIS BL SHOCK NO. 6

RESPONSE G's

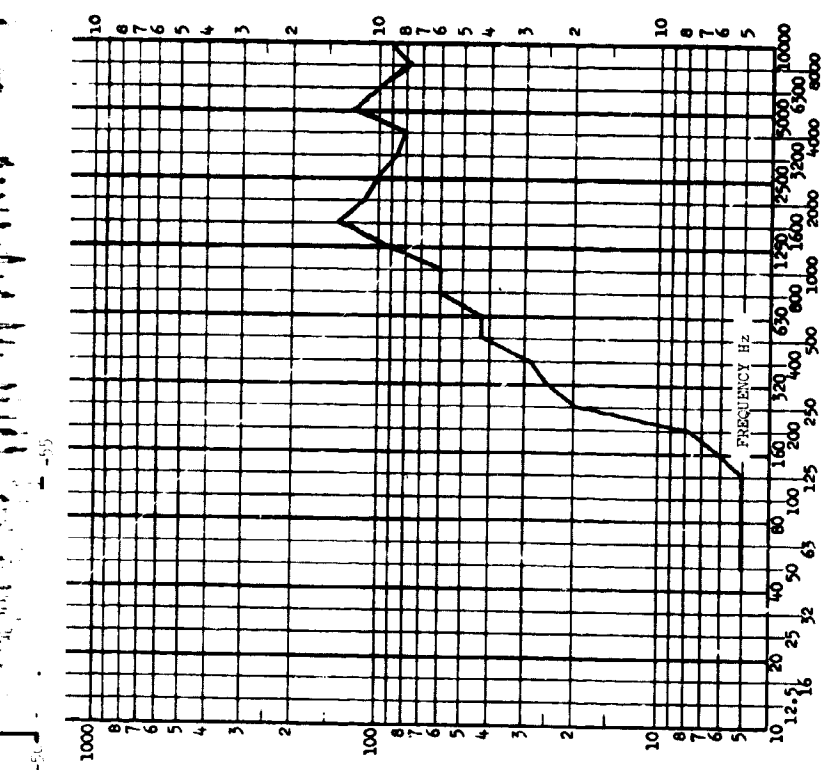
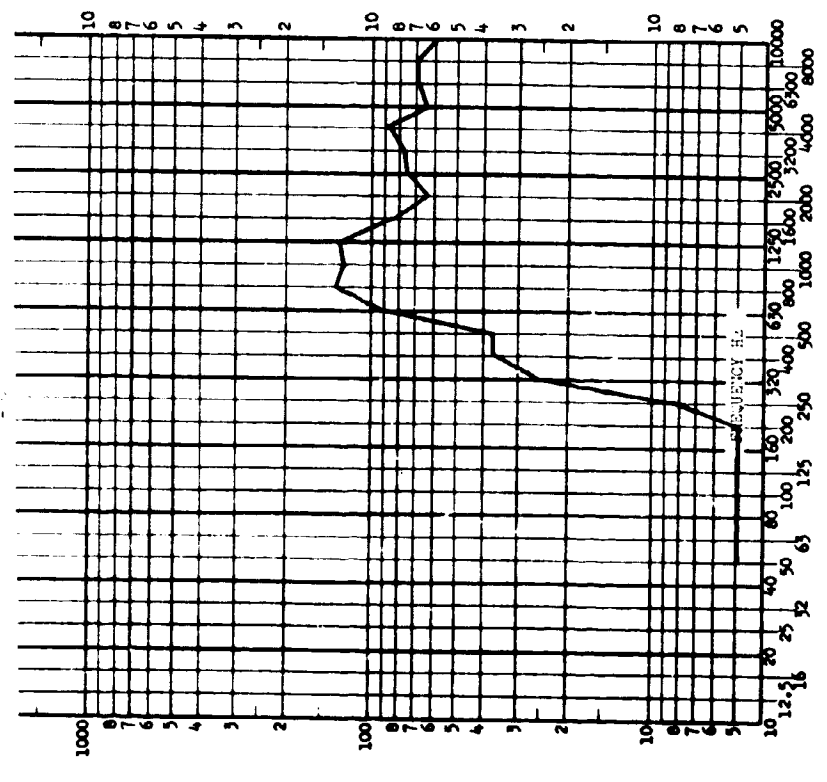
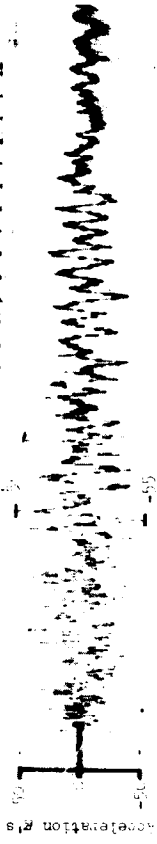
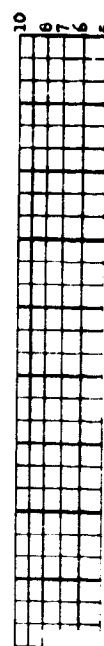


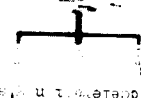
FIGURE 11.B.3-40

TEST ITEM: TITAN IIC Payload Truss Shock Test

APPL. NO. 12 TEST DATE 7-10-66

SHOCK AXIS WEST SHOCK NO. 2

RESPONSE G's



Calibration Level 100 g's

1 Millisecons

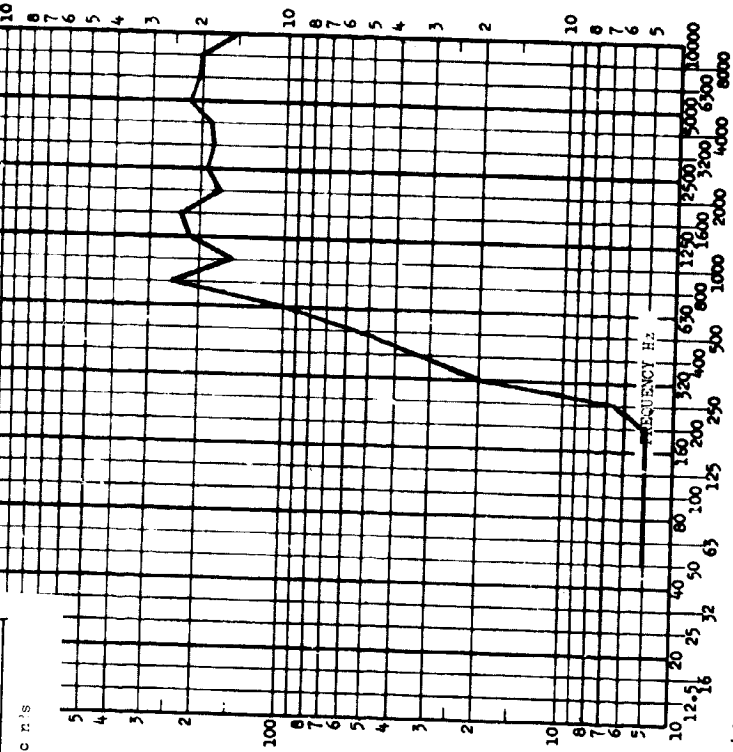
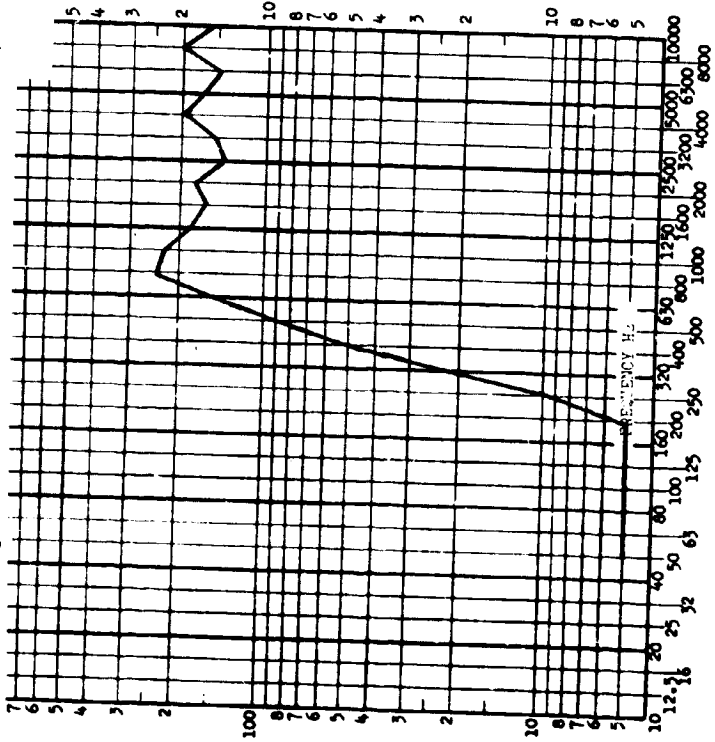


FIGURE II.B.3-41

TEST ITEM Titan III Payload Truss Shock Test
 ACCEL. NO. 13 TEST DATE 3-19-68
 SHOCK AXIS WL SHOCK NO. 6

RESPONSE C's

TEST ITEM Titan III Payload Truss Shock Test
 ACCEL. NO. 13 TEST DATE 3-19-68
 SHOCK AXIS WL SHOCK NO. 6

RESPONSE C's

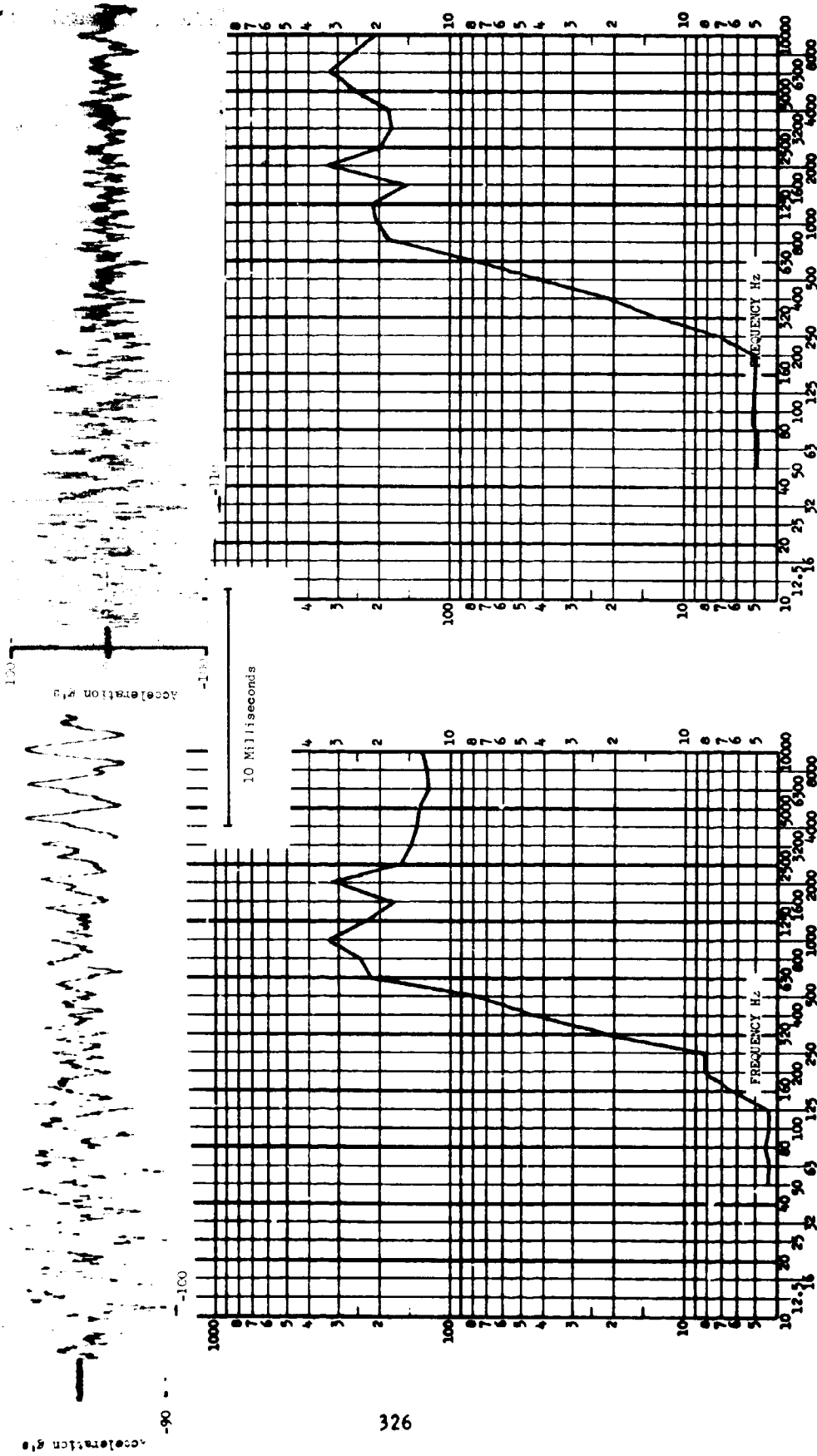


FIGURE 11.B.3-42

TEST ITEM Missile Taylor Cross Shock Test
 SERIAL NO. 17 TEST DATE 4-19-50
 SHOCK AXIS Z-ACC SHOCK NO. 5

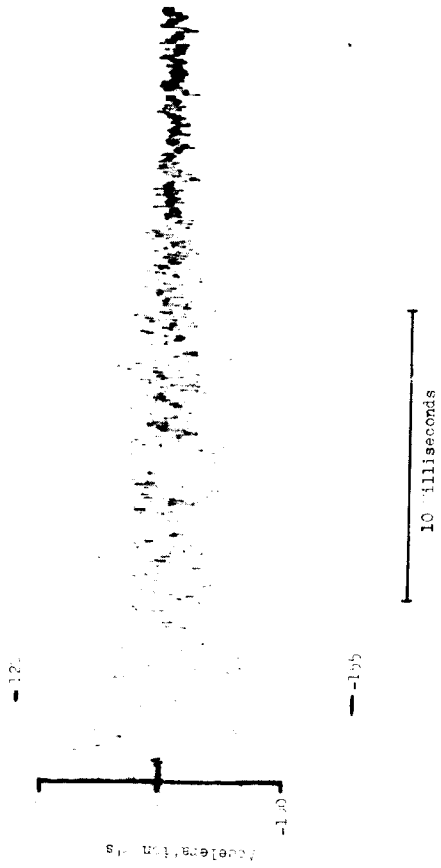
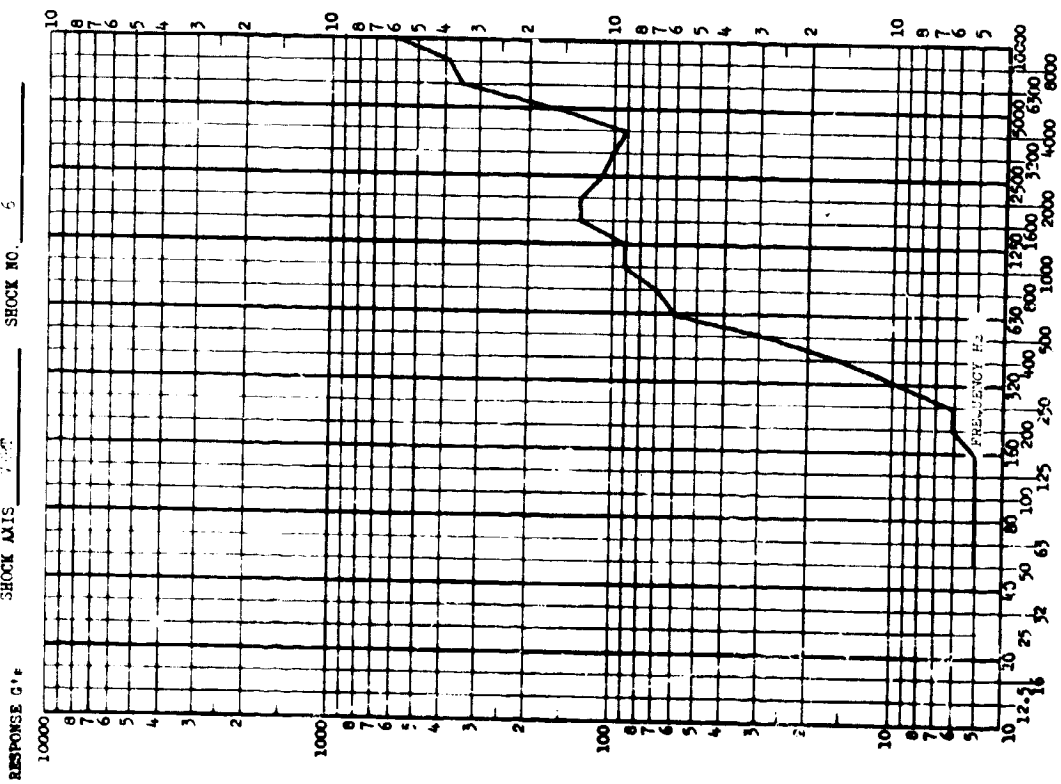


FIGURE 11.B.3-43

PART II.C

PYROTECHNIC SHOCK DATA COMPILED FOR
EXPLOSIVE NUTS AND BOLTS ON
STRUCTURES OTHER THAN SKIN-RING-FRAME OR TRUSS

LOCATION OF ADDITIONAL DATA

Additional pyrotechnic shock data compiled for explosive nuts and bolts with propagation in structures other than truss or skin-ring-frame may be found in the following sections of this volume:

- IV.A.1 Entire section
- IV.A.4 Entire section
- IV.B.1 Entire section
- IV.B.2 Entire section
- V.1 Entire section
- V.2 Figure 6

LOCATION OF RELATED LOCKHEED DATA

Additional pyrotechnic shock data for explosive nuts with propagation in truss structures may be found in the following section of the Lockheed data compilation:

II.A.4

DIVISION III

CARTRIDGE ACTUATED DEVICES

FOREWORD TO DIVISION III

Division III contains pyrotechnic shock data associated with cartridge actuated devices (other than cartridge actuated separation nuts) on truss and spacecraft structures. Part A contains references to shock data from skin-ring-frame structures presented in other sections of this report and in the Lockheed data volumes. Parts B and C contain 6 sections of data from various types of spacecraft shock tests which used cartridge actuated pin pullers and bolt cutters.

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DIVISION III

CARTRIDGE ACTUATED DEVICES

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Skin-Ring-Frame Structures

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Location of Related Lockheed Data	336

PART II.B

Truss Structures

Section	Title	Pyrotechnic Device	Number Shock Spectra	
III.B.1	Satellite Release Tests	Pin Puller	32	338
III.B.2	Separation Shock Tests of TOS-M Spacecraft	Bolt Cutter	68	360
III.B.3	OA0 Separation Test	Bolt Cutter	23	378
Location of Additional Data				

PART II.C

Structures Other Than Skin-Ring-Frame or Truss

III.C.1	IDCSP/A Development Model 2 Separation Test	Bolt Cutter	6	411
III.C.2	ATS Separation Test	Bolt Cutter	14	423
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Location of Additional Data				450
Location of Related Lockheed Data				451

PART III.A

**PYROTECHNIC SHOCK DATA COMPILED FOR
CARTRIDGE ACTUATED DEVICES IN
SKIN-RING-FRAME STRUCTURES**

LOCATION OF ADDITIONAL DATA

Additional pyrotechnic shock data compiled for cartridge actuated devices for propagation in skin-ring-frame structure may be found in the following sections of Volume II:

I.A.5 Figure 7 through 58

I.B.3 Figures 10, 11 and 22 through 33.

LOCATION OF RELATED LOCKHEED DATA

Additional pyrotechnic shock data for cartridge actuated devices propagation in skin-ring-frame structures may be found in the following sections of the Lockheed data compilation:

II.B.1

II.B.2

PART III.B

**PYROTECHNIC SHOCK DATA COMPILED FOR
CARTRIDGE ACTUATED DEVICES IN
TRUSS STRUCTURES**

SECTION III.B.1

OV5-2 SATELLITE EJECTION TESTS

PURPOSE OF TESTS

The objective of these tests was to obtain the shock levels associated with the OV5-2 satellite ejection.

DESCRIPTION OF EVENT

The OV5-2 satellite depicted in Figures III.B.1-1 and III.B.1-2 was ejected by a pin puller, located as shown in Figures III.B.1-6 and III.B.1-7, pulls a pin which releases a pre-loaded compression spring. Following release, the OV5-2 satellite would be ejected free of the payload truss into orbit. However, during the three tests performed the release mechanism only pushed the satellite 4 to 6 inches its motion was arrested by friction with the mounting canister.

DESCRIPTION OF DATA

No. of time histories	30
No. of shock spectra	30
Type of analysis	analog
Analog system	Ling SSA-100
Frequency range	to 10,000 Hz
Frequency increment	3 points per octave
Damping	Q = 10

These shock spectra are presented along with their corresponding time histories as Figures II.B.1-8 through III.B.1-19.

DESCRIPTION OF PYROTECHNIC

The pressure cartridge actuated pin-puller system uses two PD60S0129-505 pressure cartridges (manufactured by McCormick-Selph Associates). The charges contained in each pressure cartridge are as follows:

Prime charge: 90 mg pressed zirconium
Base charge: 346 mg boron and potassium nitrate
Booster charge: 86 mg boron and potassium nitrate
Sustainer charge: 193 mg ammonium nitrate and
rubber

Although both pressure cartridges fired during testing, only one cartridge is required, while the presence of the second cartridge is to insure satellite release in the event of a misfire.

DESCRIPTION OF STRUCTURE

Aluminum truss structure and satellite mounting bracket. See Figures III.B.1-3 through III.B.1-7.

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorder: Ampex ES-100 (0-20,000 Hz
frequency response)

Amplifiers: Kistler 504A (0-100,000 Hz frequency
response)

TABLE III.B.1-1

DESCRIPTION OF OV5-2 SHOCK MEASUREMENTS

<u>Accelerometer Number</u>	<u>Location</u>	<u>Shot No.</u>	<u>Sensitive Axis</u>	<u>Distance from source (Inches)</u>	<u>Figure No.</u>
1	Canister base opposite pin puller	1	45° off BL (pin puller axis)	5	III.B.1-8
2	OV5-2 side of truss ring (rt. side)	2,3	BL	13	III.B.1-9
3	OV5-2 side of truss ring (rt. side)	1,2,3	WL	13	III.B.1-10
4	OV5-2 side of truss ring (FWD side)	1,2,3	BL	15	III.B.1-11
5	OV5-2 side of truss ring (FWD side)	1,2,3	FWD	15	III.B.1-12
6	LES-6 side, cylinder flange (right side)	1,2,3	BL	8.5	III.B.1-13
7	LES-6 side, cylinder flange (right side)	1,2,3	WL	8.5	III.B.1-14
8	LES-6 side, cylinder flange (FWD side)	2,3	BL	11	III.B.1-15
9	LES-6 side, cylinder flange (FWD side)	1,2,3	FWD	11	III.B.1-16
10	LES-6 side, cylinder flange (left side)	2,3	BL	8.5	III.B.1-17
11	LES-6 side, equipm't platform (right side)	1,2,3	BL	38	III.B.1-18
12	LES-6 side equipm't platform (right side)	1,2,3	WL	38	III.B.1-19



Figure 11.8.1-1. Payload Truss with OV5-2 and LES-6 Satellites Installed

OF

7902



3.6

4



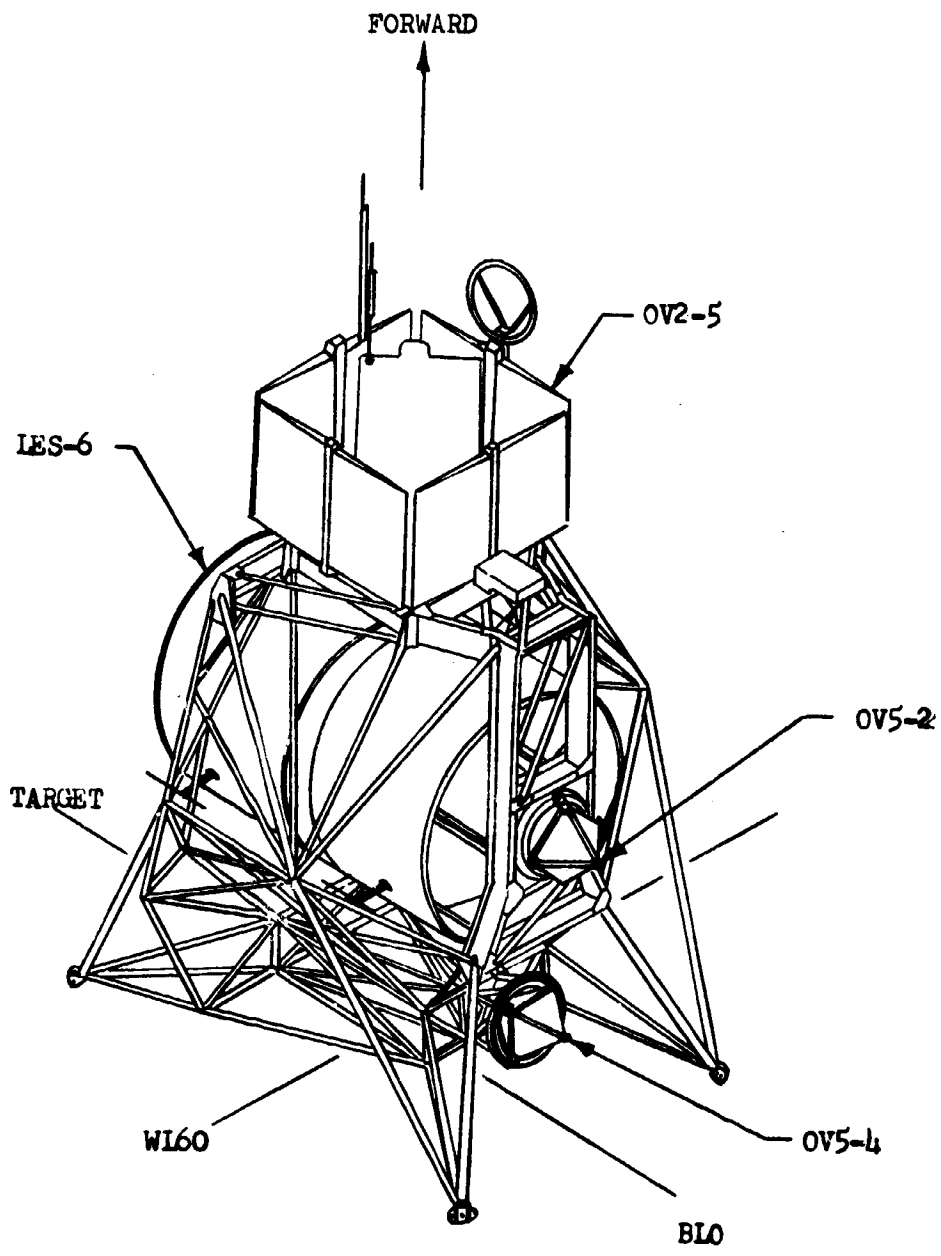


Figure III.B.1-2. Payload Truss - Showing Satellite Locations

VII



Figure III.B.1-3 OV5-2 Mounting Flange

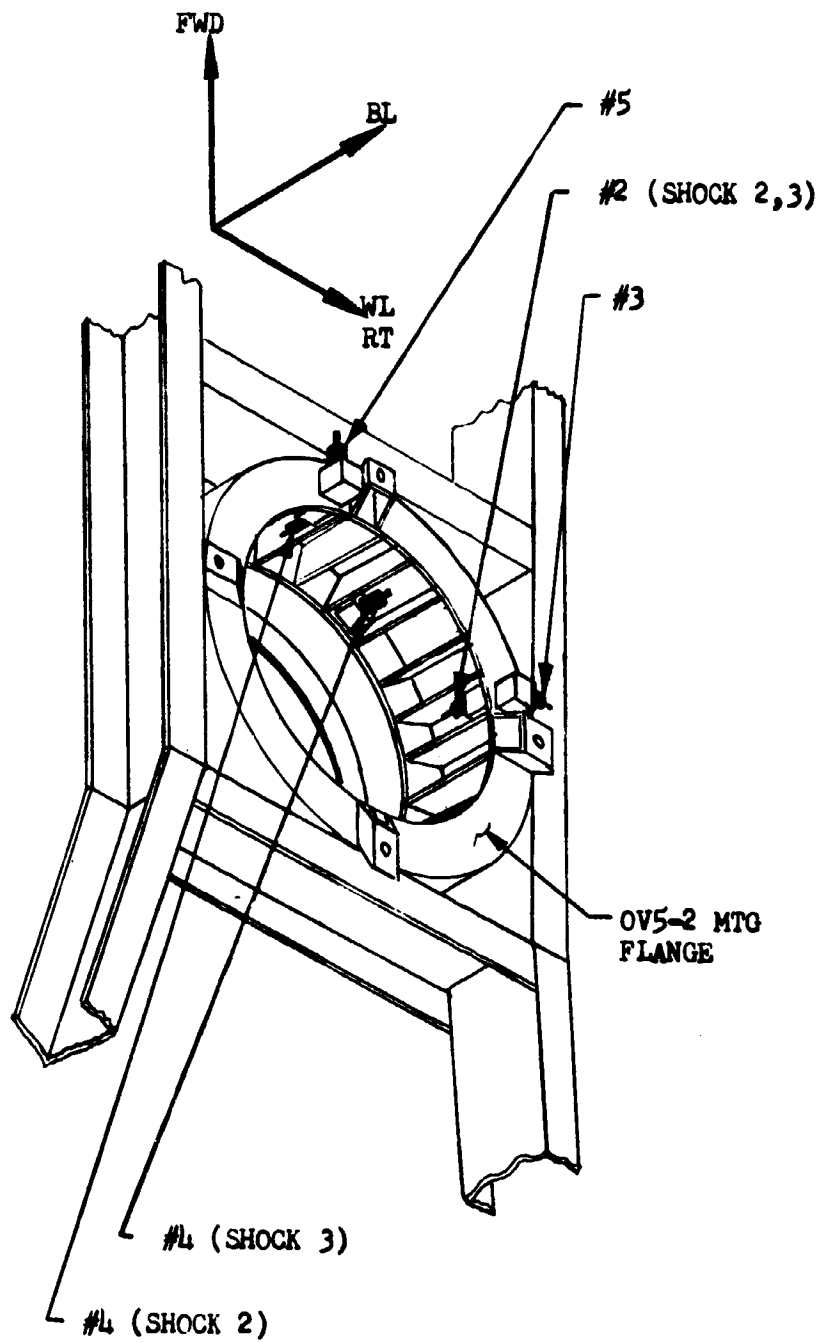


Figure III.B.1-4. Accelerometer Location for OV5-2 Satellite Release Shock Test

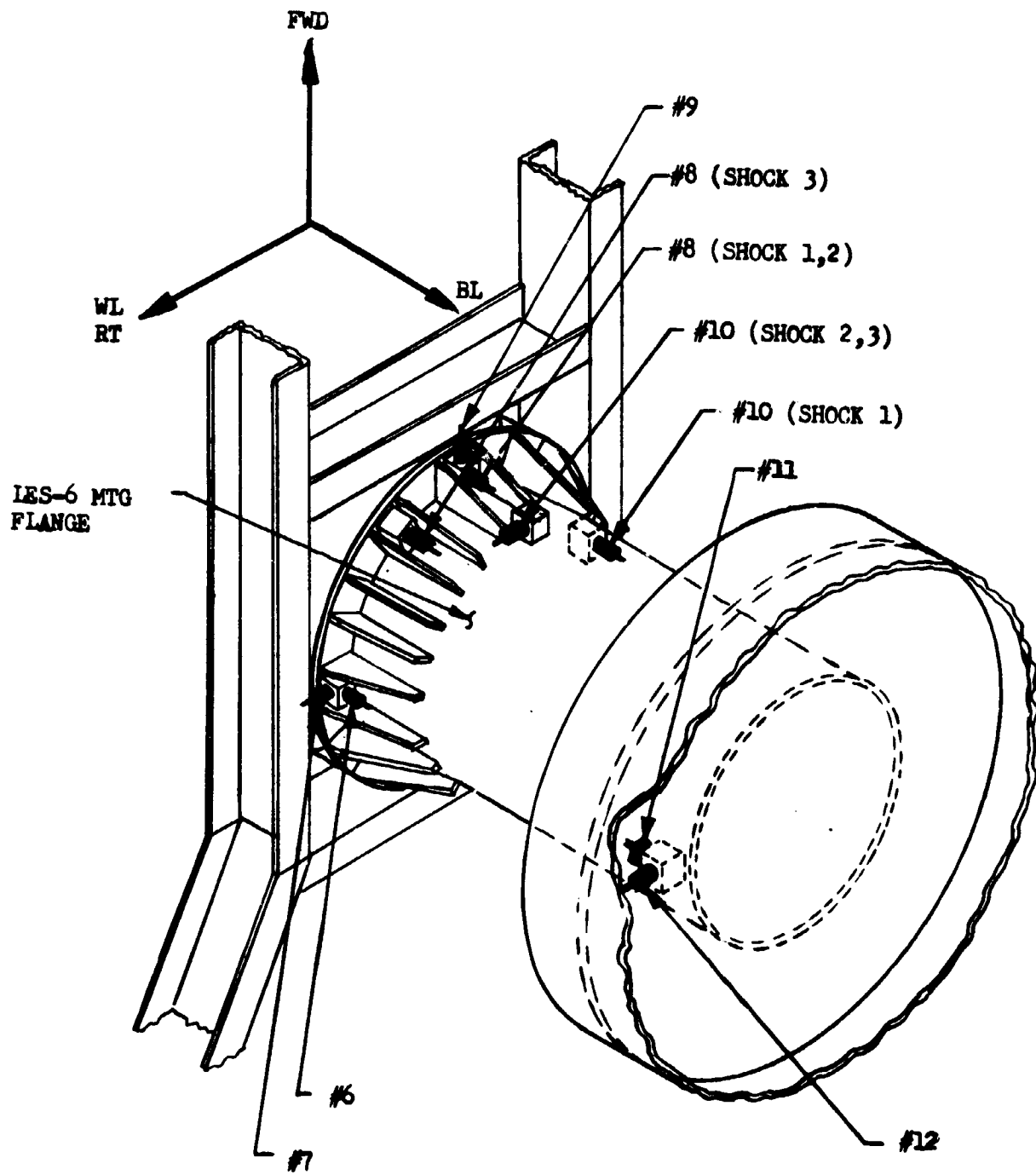


Figure III.B.1-5. Reverse Side of OV5-2 Mtg. Flange (LES-6 Mtg. Pedestal)

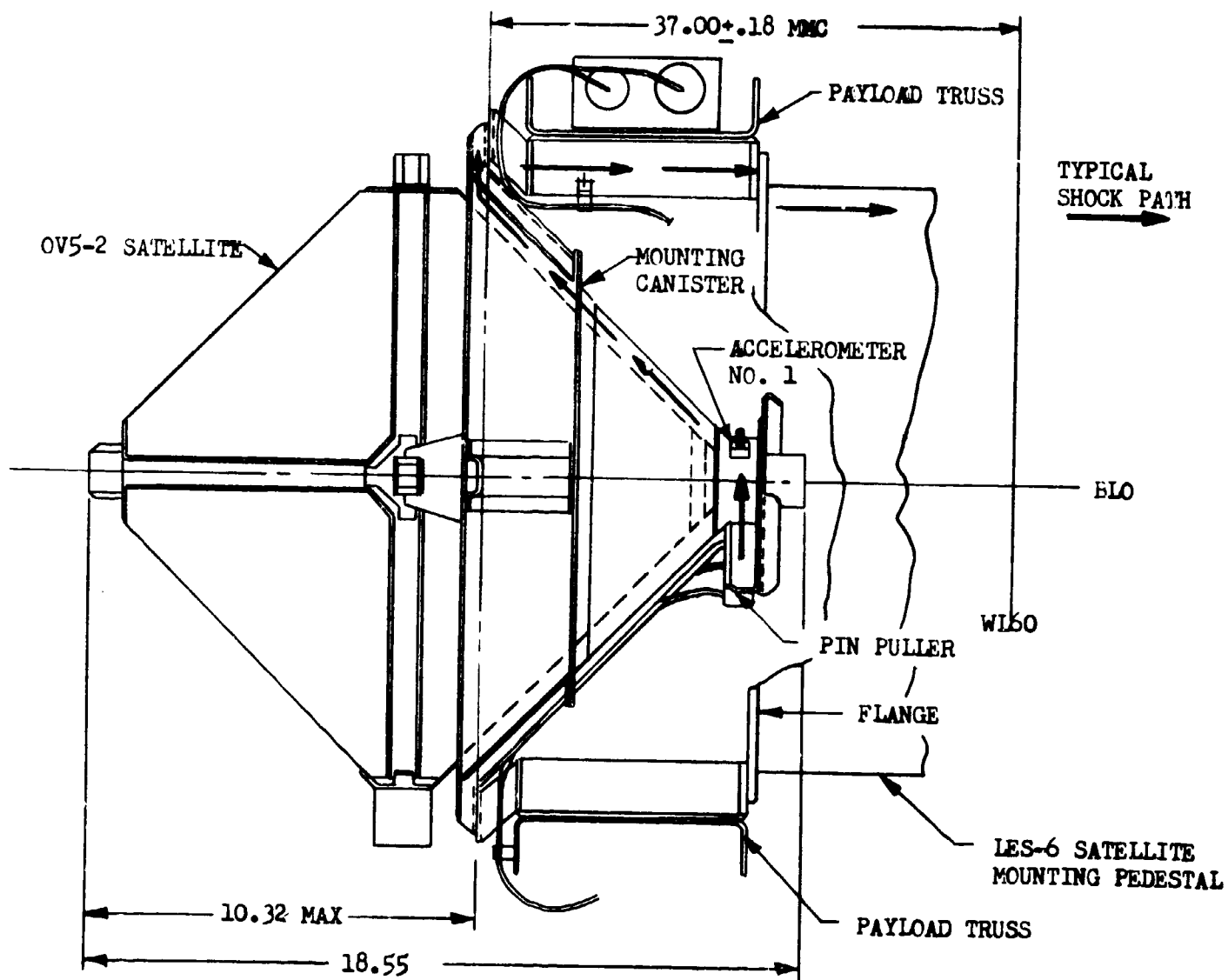


Figure III.B.1-6. OV5-2 Satellite Installation and Release Mechanism, Top View

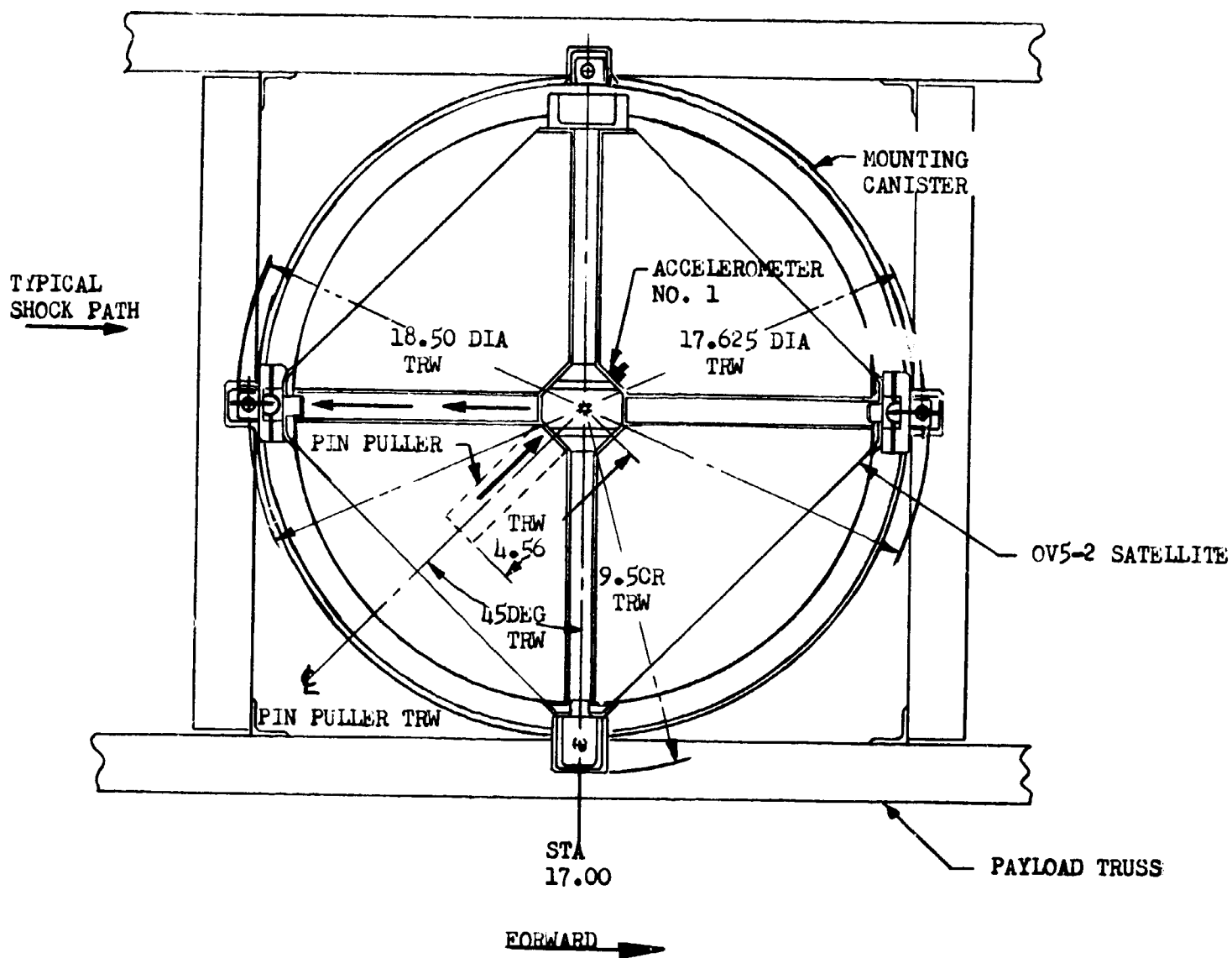


Figure III.B.1-7. OV5-2 Satellite Installation and Release Mechanism, Front View

TEST ITEM OV-10 Par. 1.1.1.1 Ejection
 ADEL. NO. 47001 #1 TEST DATE March 1968
 SHOCK AXIS 45° off BL AXIS SHOCK NO. 1

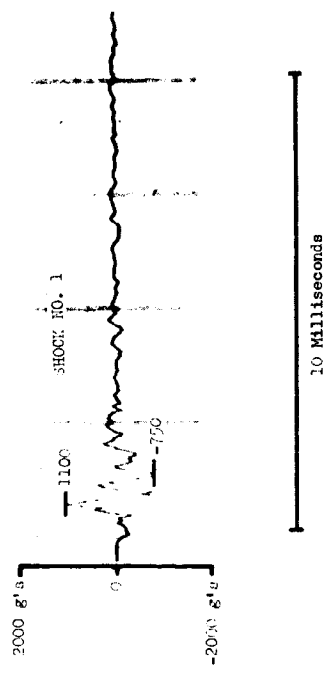
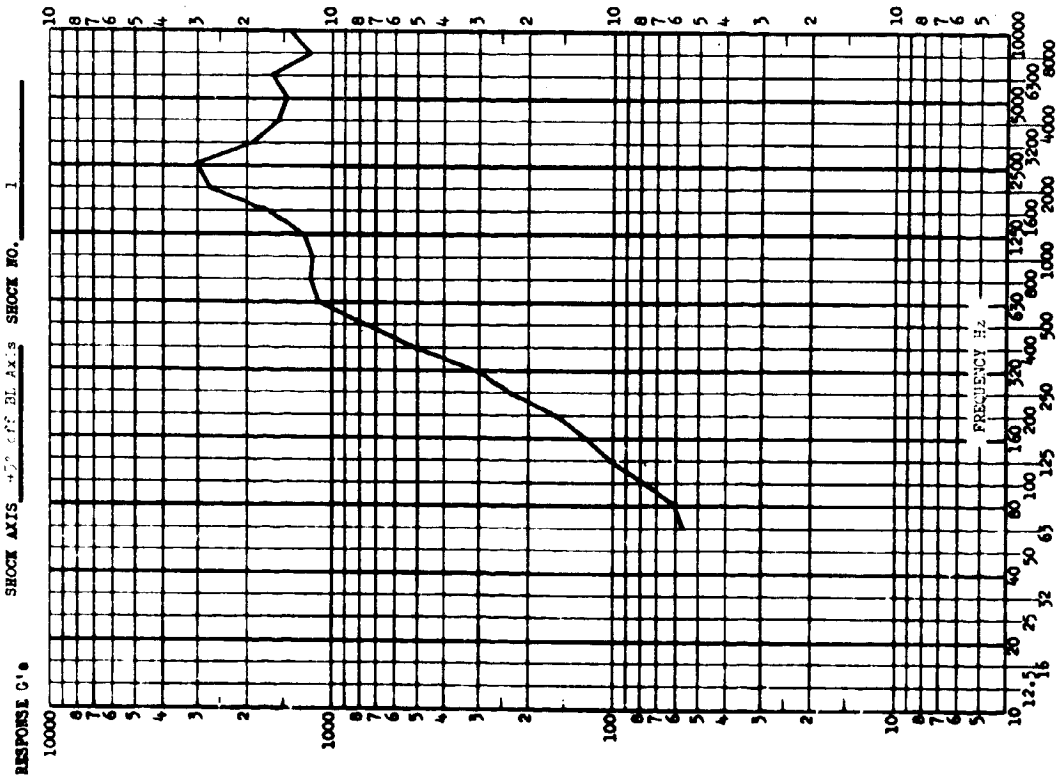


FIGURE III.B.1-8

TEST ITEM _____
 TEST DATE _____
 SHOCK AXIS _____
 SHOCK NO. _____

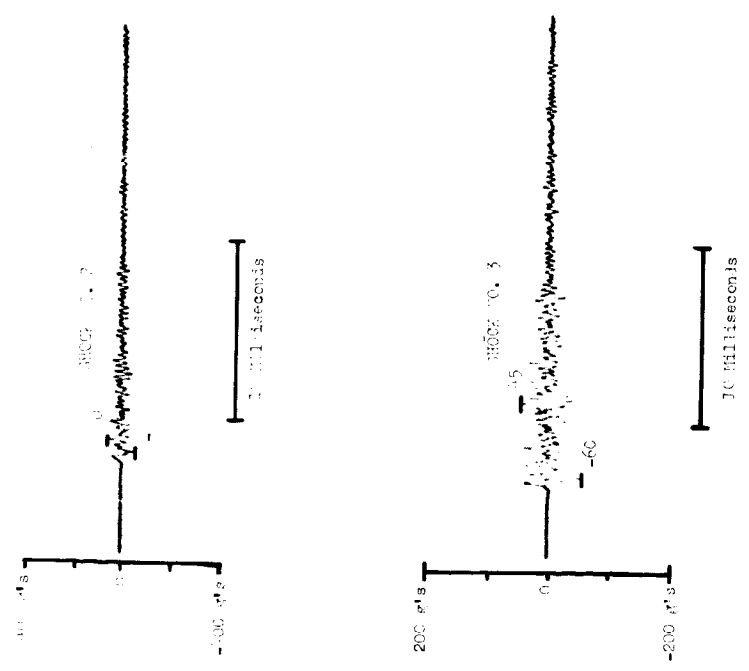
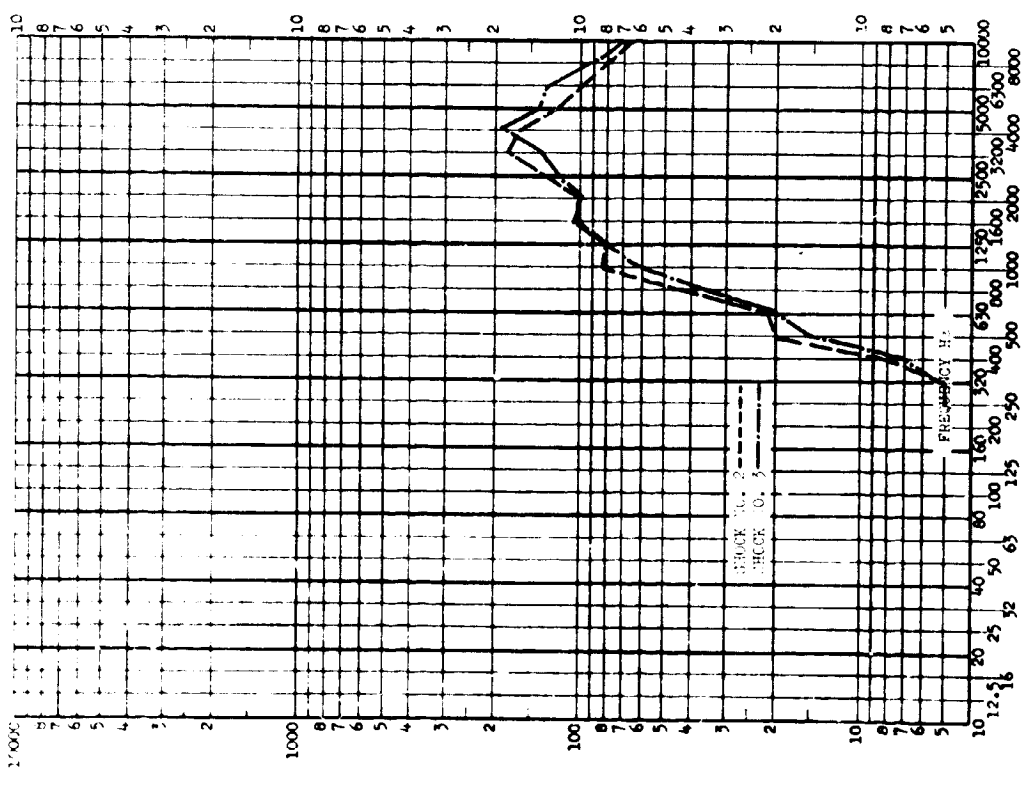


FIGURE III.B.1-9

TEST ITEM W-1 Satellite Repeater
 TEST NO. 110 TEST DATE March 1966
 SHOCK AXIS 1, 2, 3 SHOCK NO. 1, 2, 3

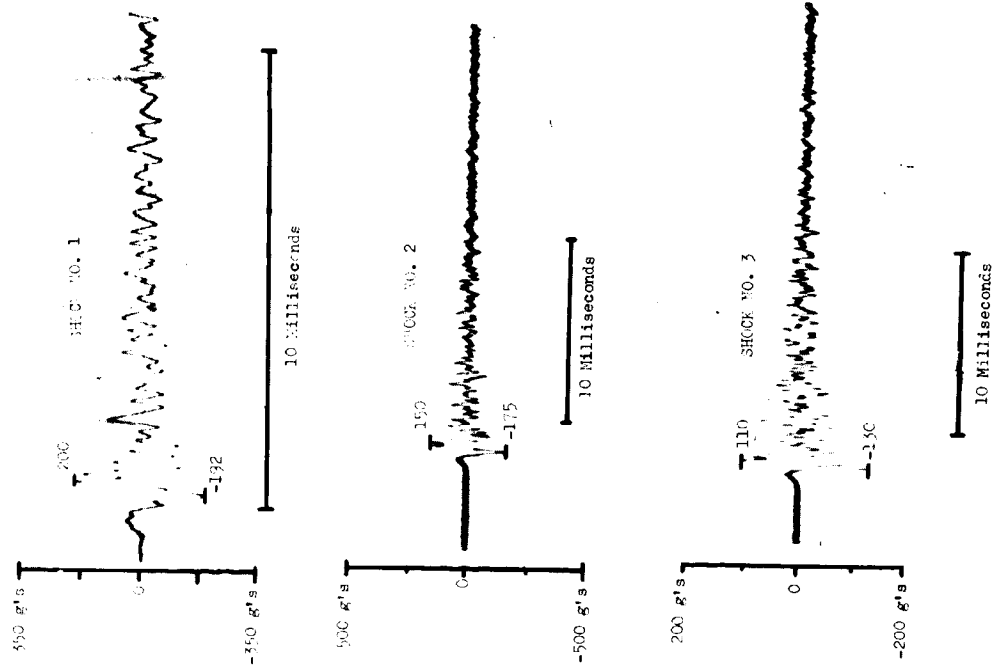
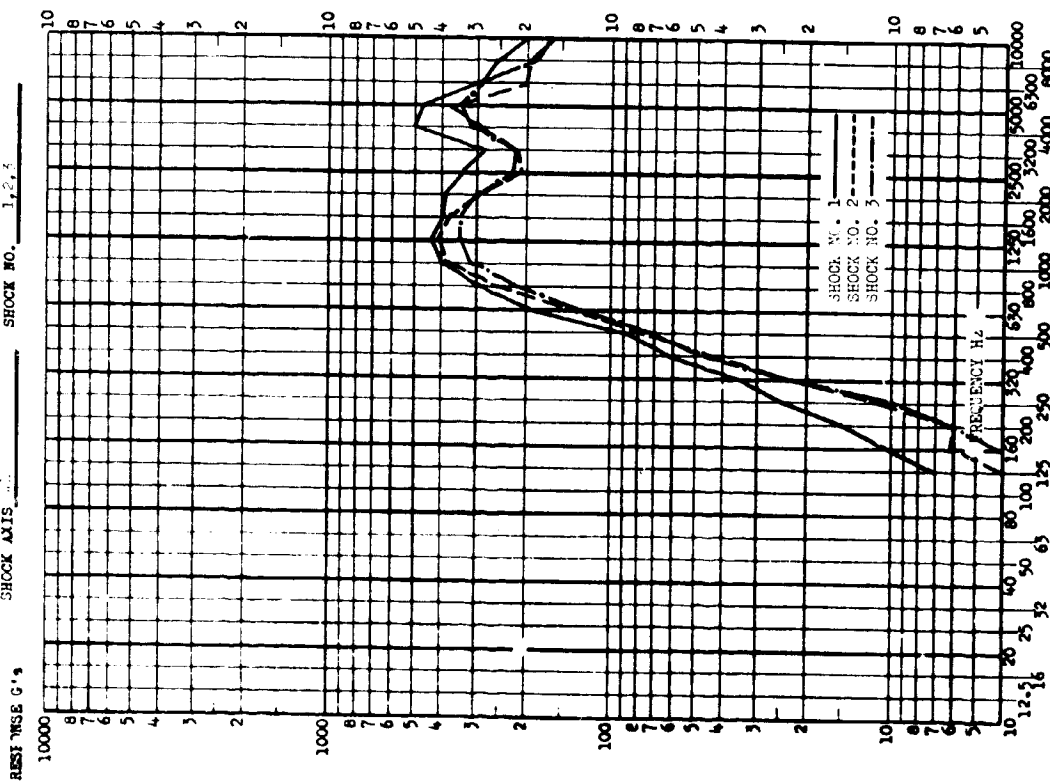


FIGURE III.B.1-10

TEST ITEM _____
 TEST DATE _____
 SHOCK AXIS #1 _____
 SHOCK NO. _____

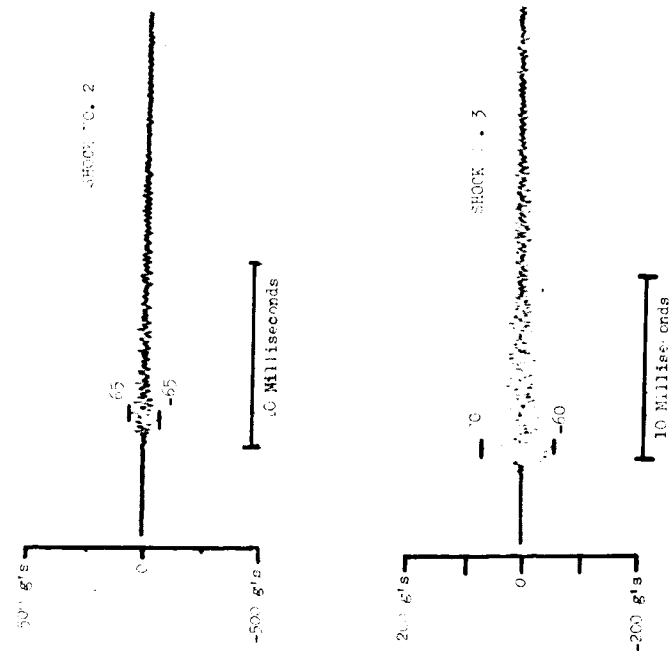
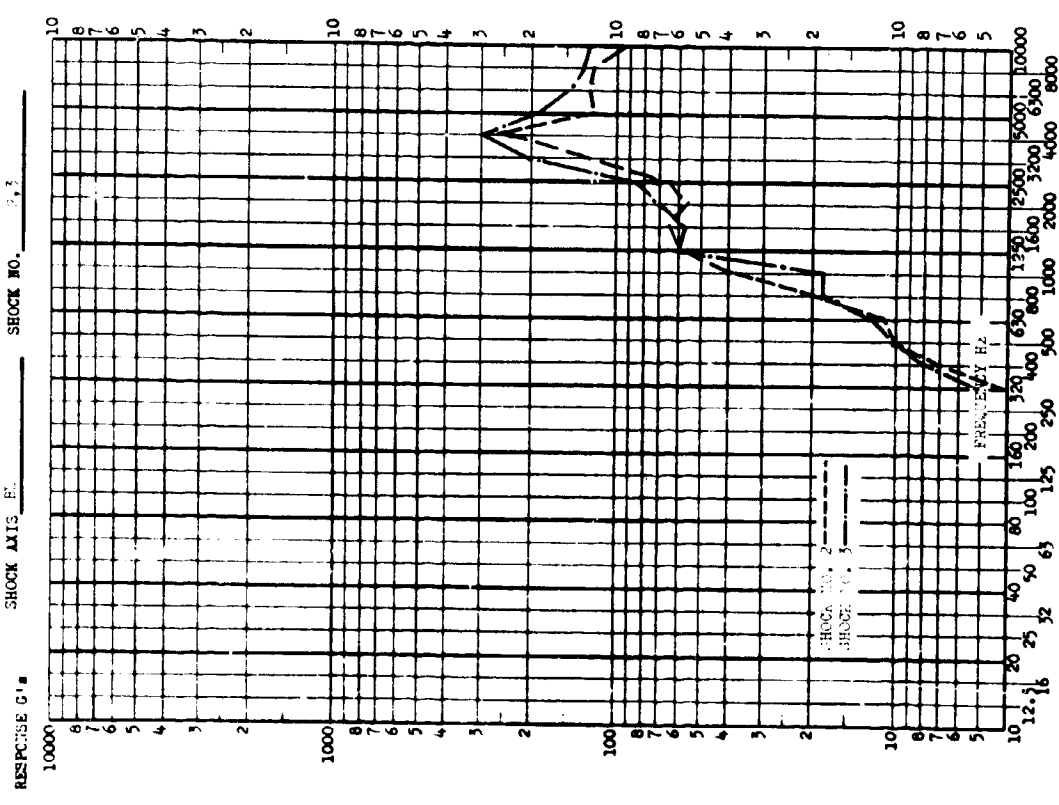


FIGURE III.B.1-11

TEST ITEM OV5-2 Satellite Ejection
 TEST DATE March 1968
 SHOCK AXIS Forward
 SHOCK NO. 1, 2, 3

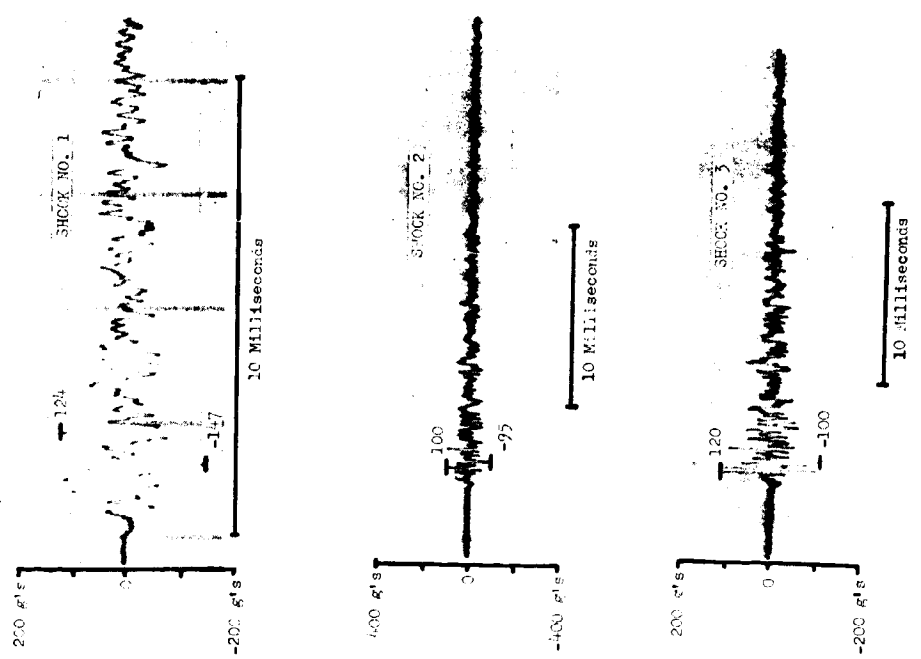
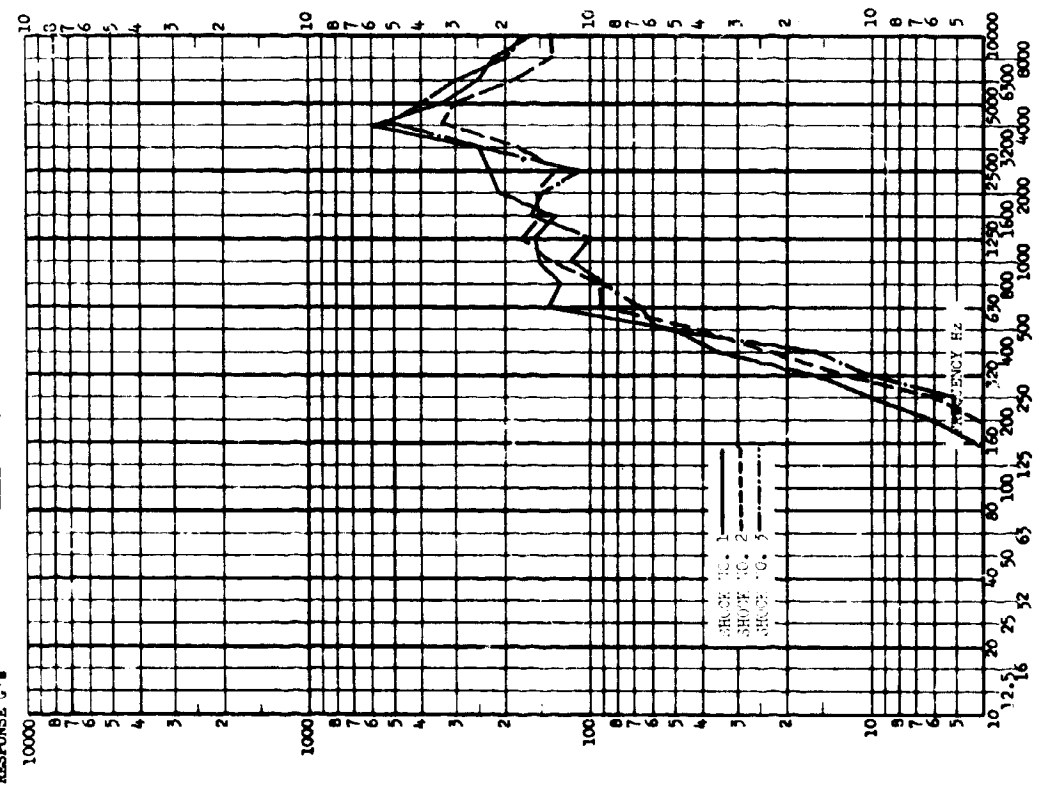


FIGURE III.B.1-12

TEST ITEM _____ TEST DATE _____
 SHOCK A.M.I.C. _____ SHOCK NO. _____

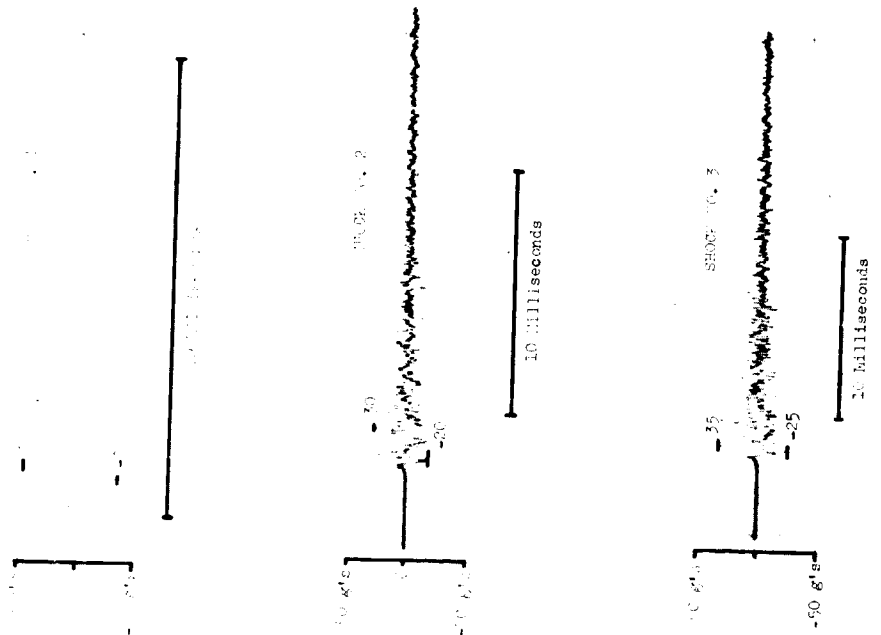
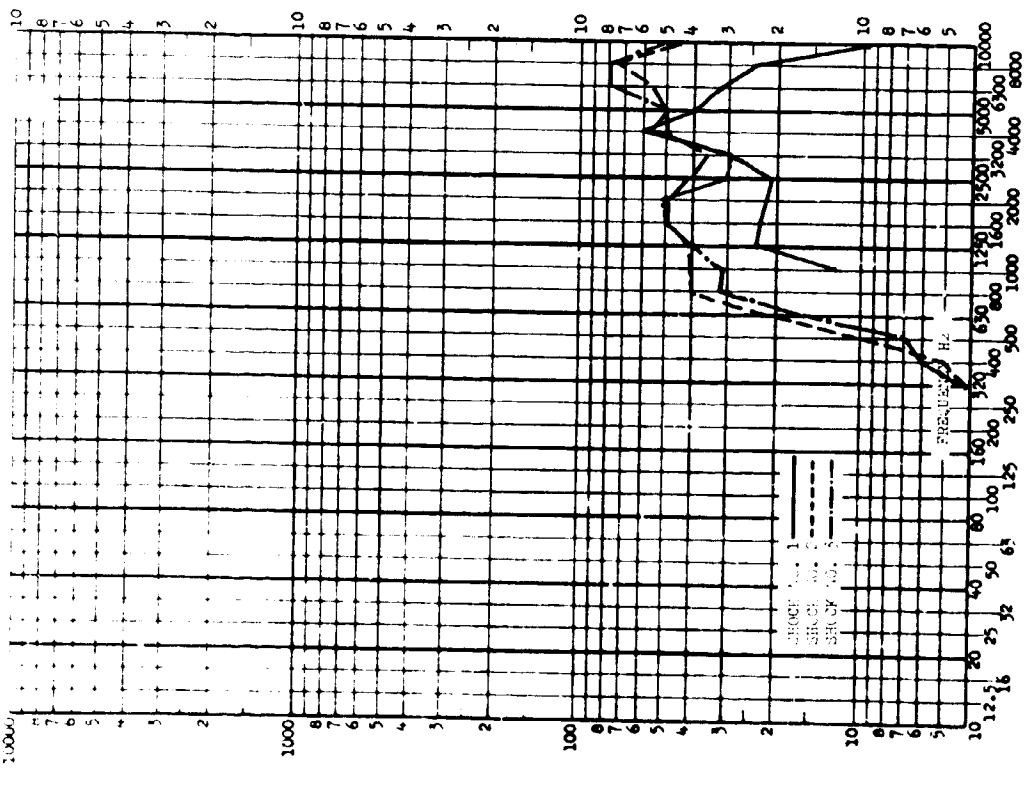


FIGURE III.B.1-13

TEST ITEM C7- Satellite Section
 TEST NO. 44387 TEST DATE March 1968
 SHOCK AXIS X SHOCK NO. 1, 2, 3

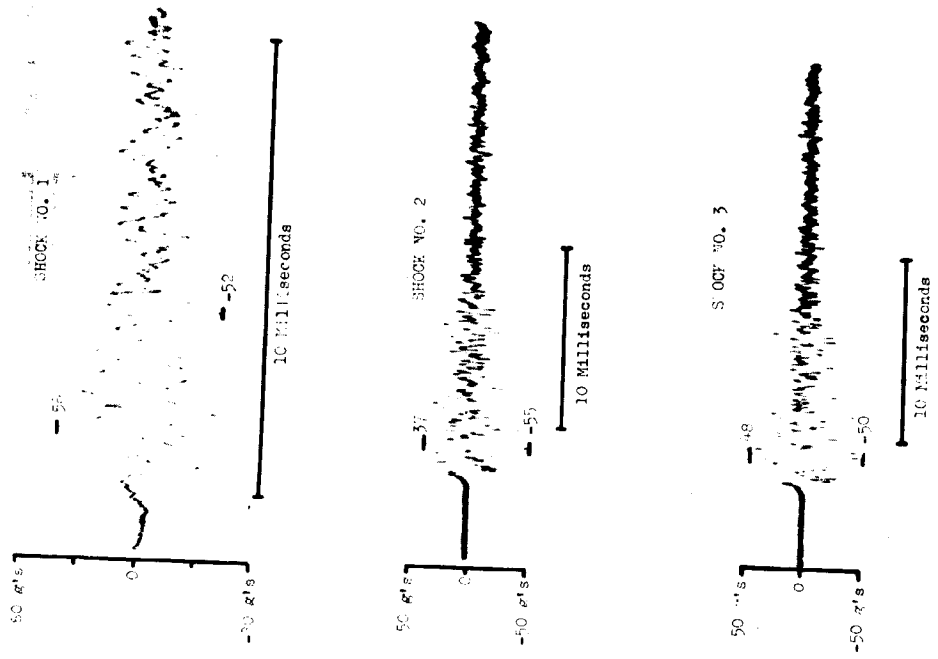
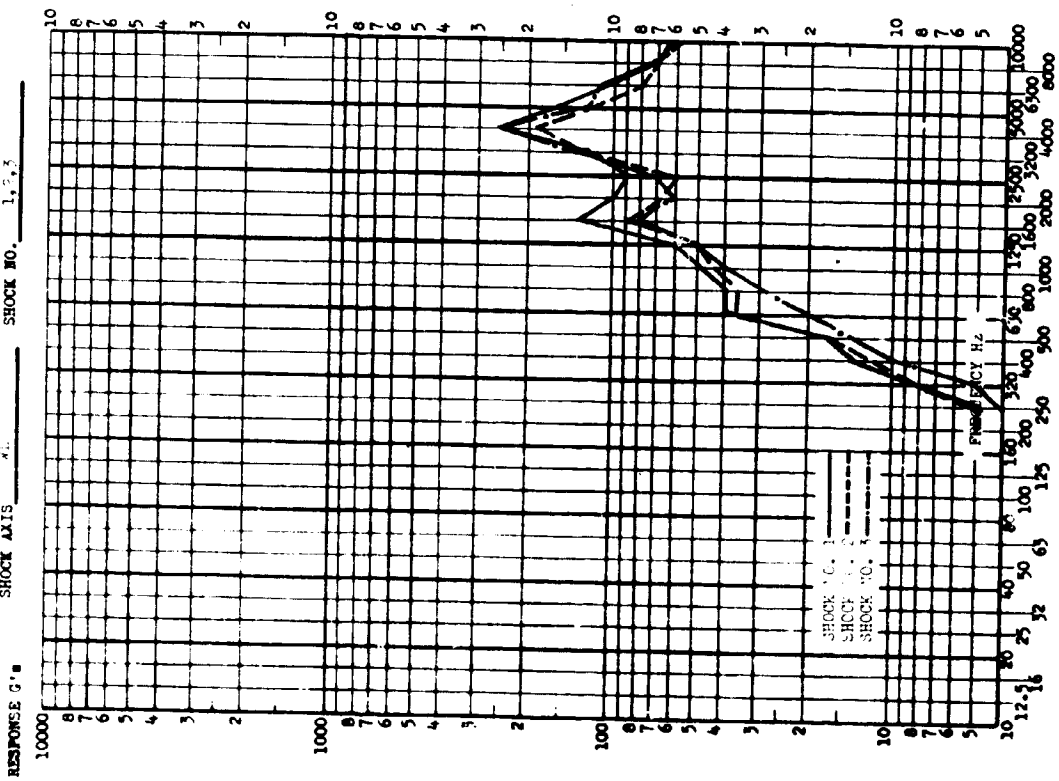


FIGURE III.B.1-14

TEST ITEM _____
 TEST DATE _____
 SHOCK AXIS _____
 SHOCK NO. _____

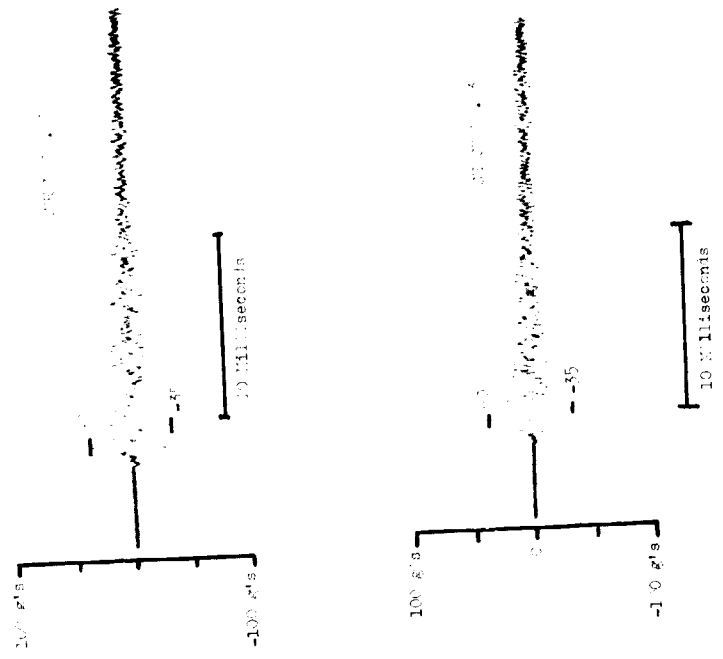
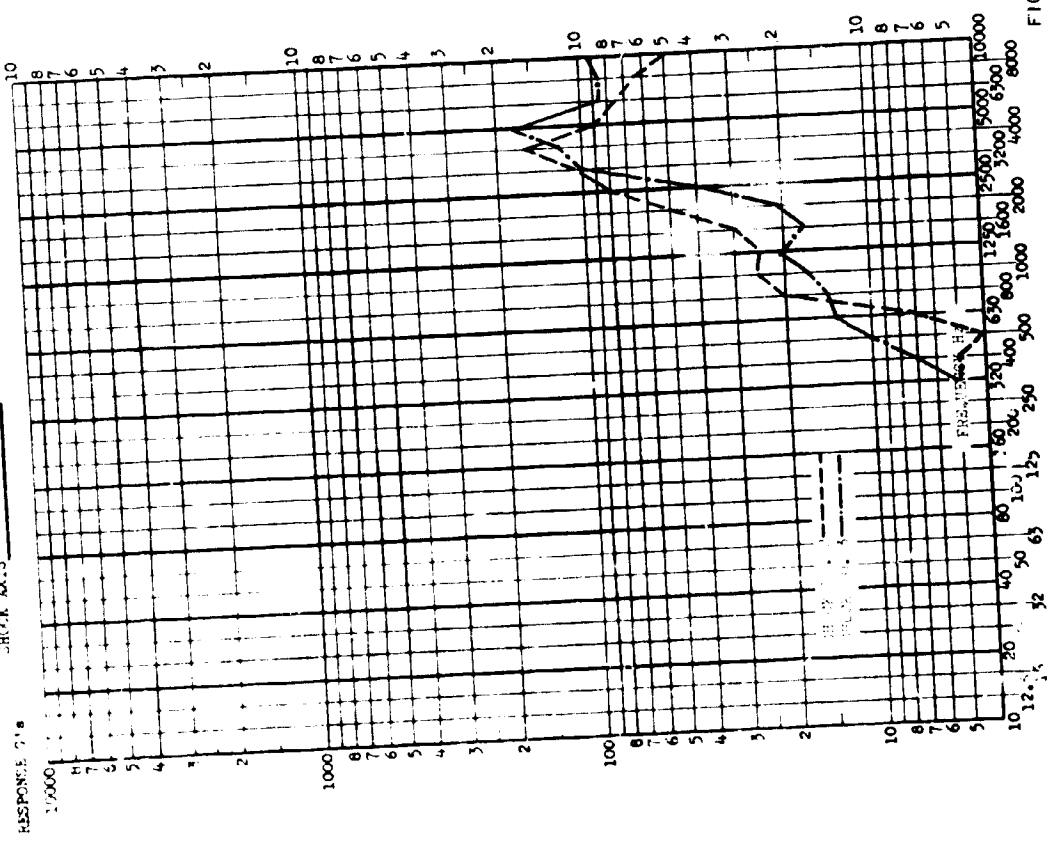


FIGURE III.B.1-15

TEST ITEM: Atlas Satellite Reaction

TEST NO.: 40001 TEST DATE: March 1968
 SHOCK AXIS: Forward SHOCK NO.: 1, 2, 3

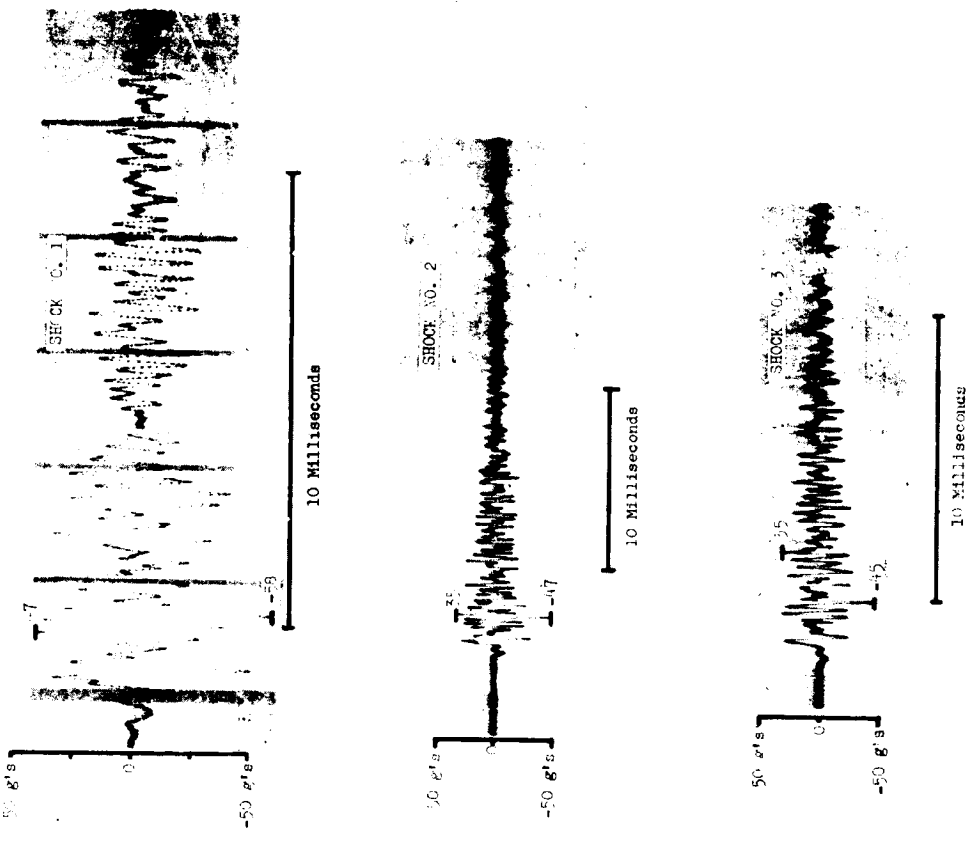
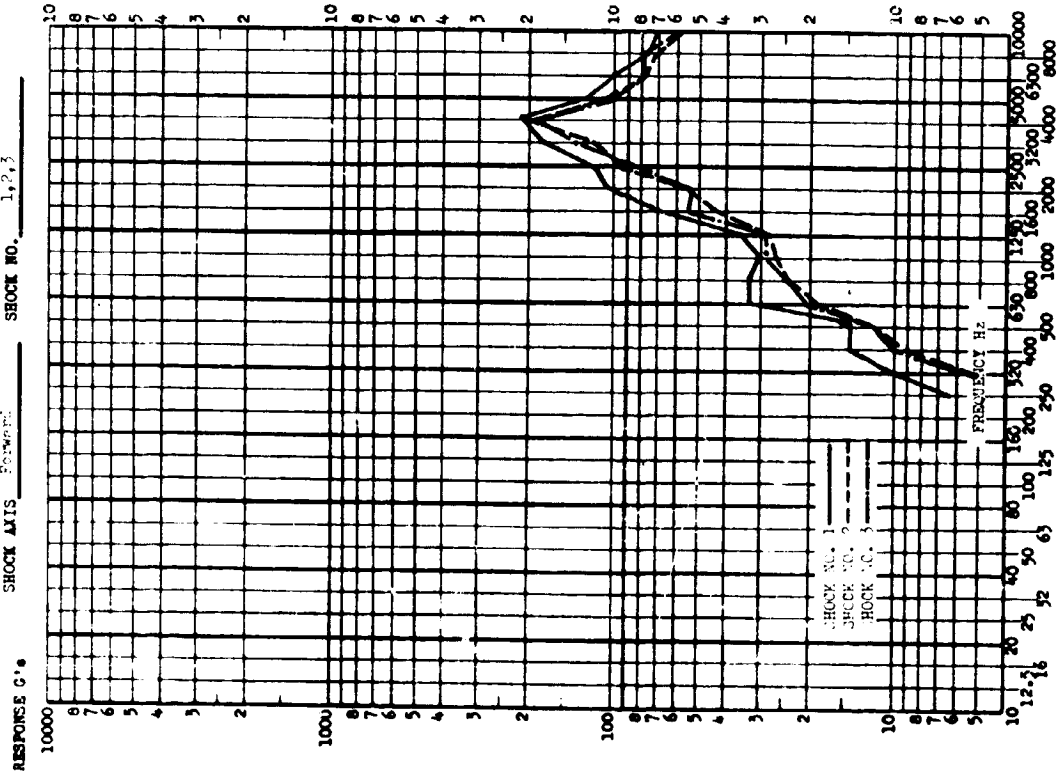


FIGURE III.8.1-16

TEST ITEM _____
 TEST DATE _____
 SHOCK AXIS _____
 SHOCK NO. _____

RESPONSE G's

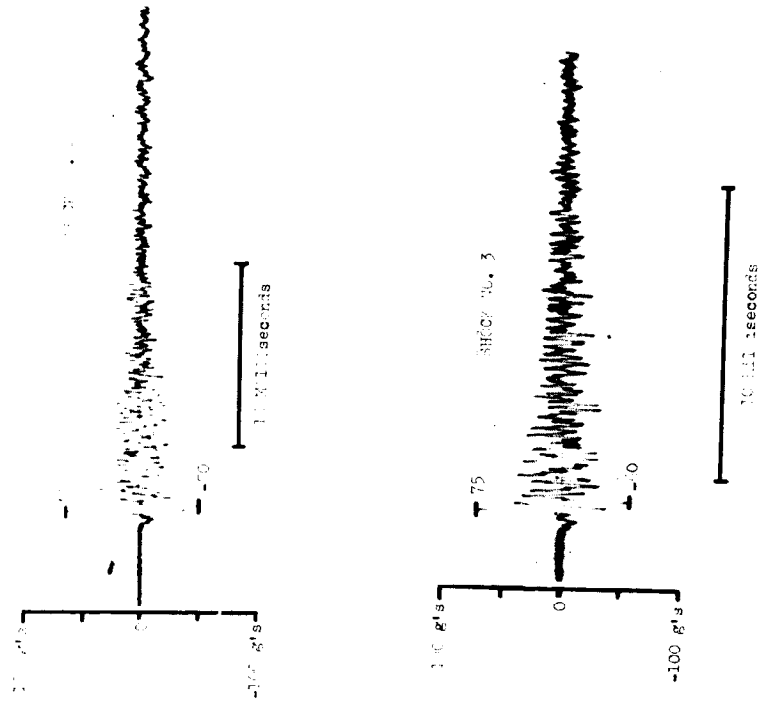
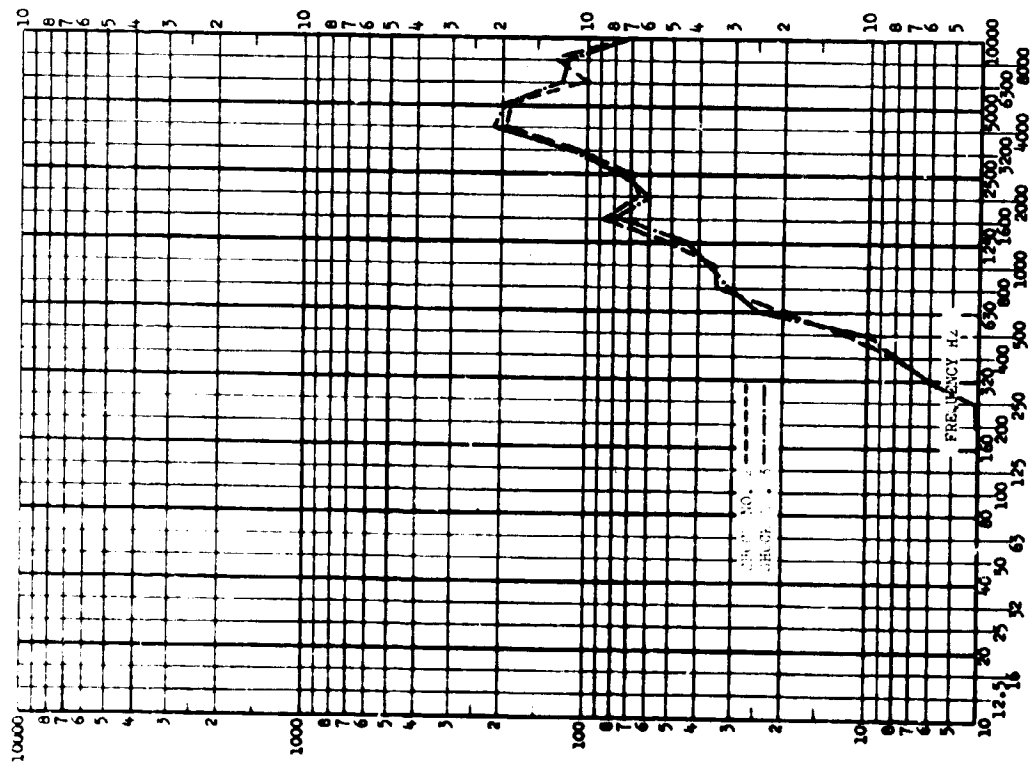


FIGURE III.B.1-17

TEST ITEM UVF-1 satellite detector
 TEST DATE March 1966
 SHOCK AXIS z SHOCK NO. 1, 2, 3

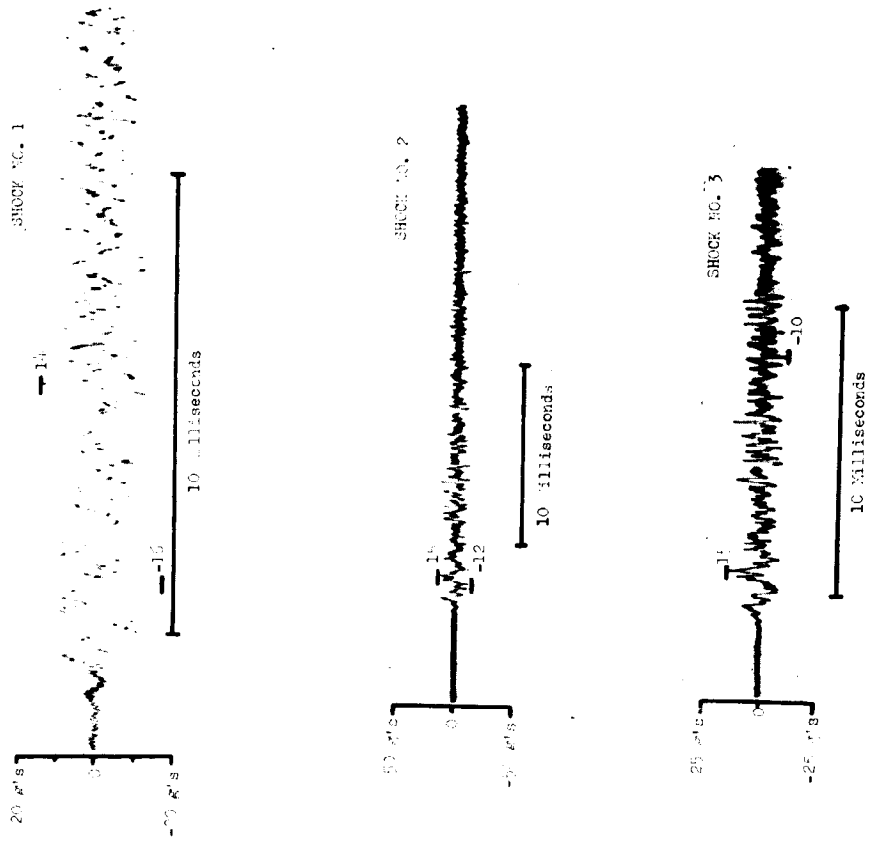
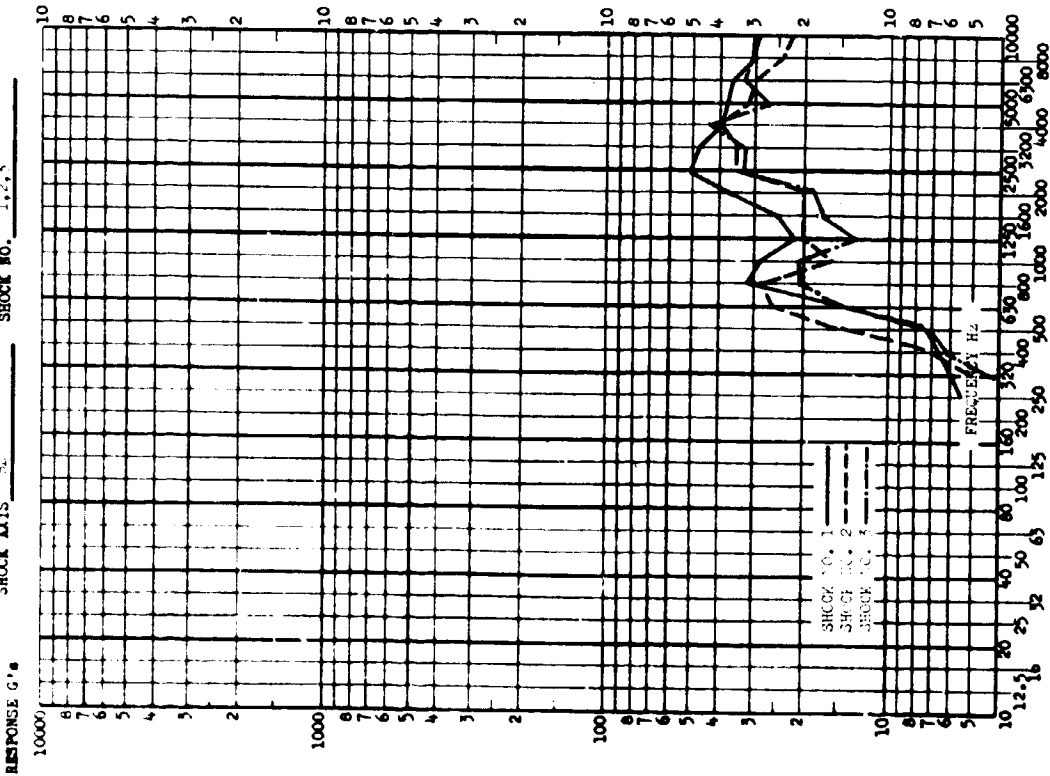


FIGURE III.B.1-18

TEST ITEM _____ TEST DATE _____
 . NO. _____ SHOCK AXIS _____ SHOCK NO. _____
 RESPONSE G's _____

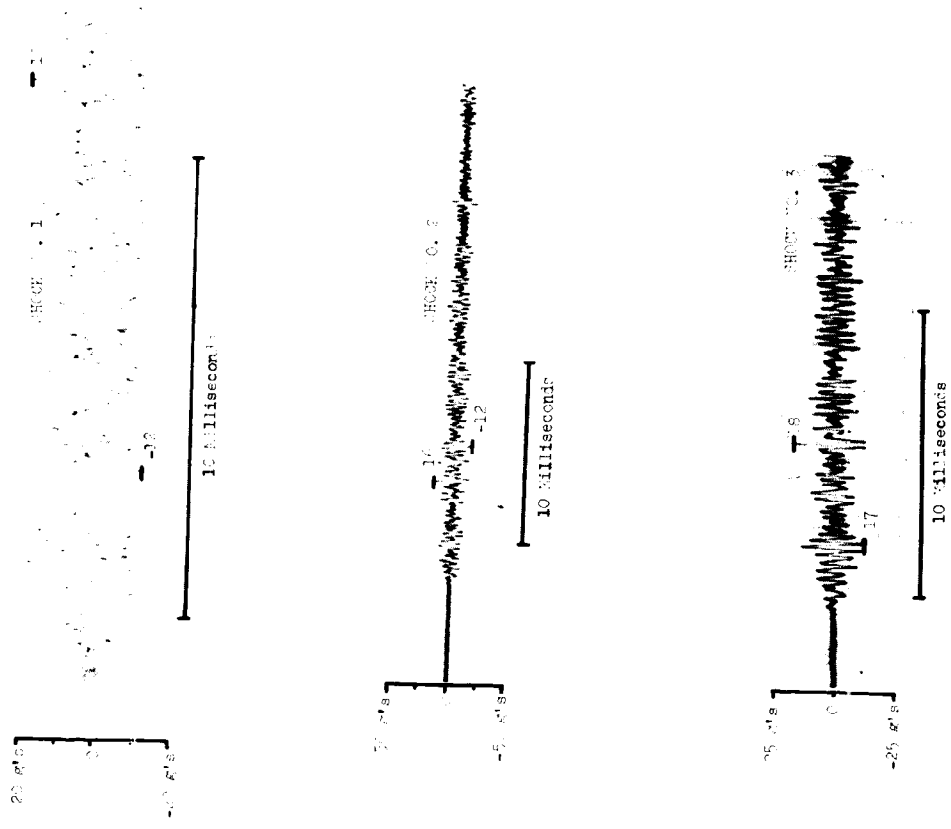
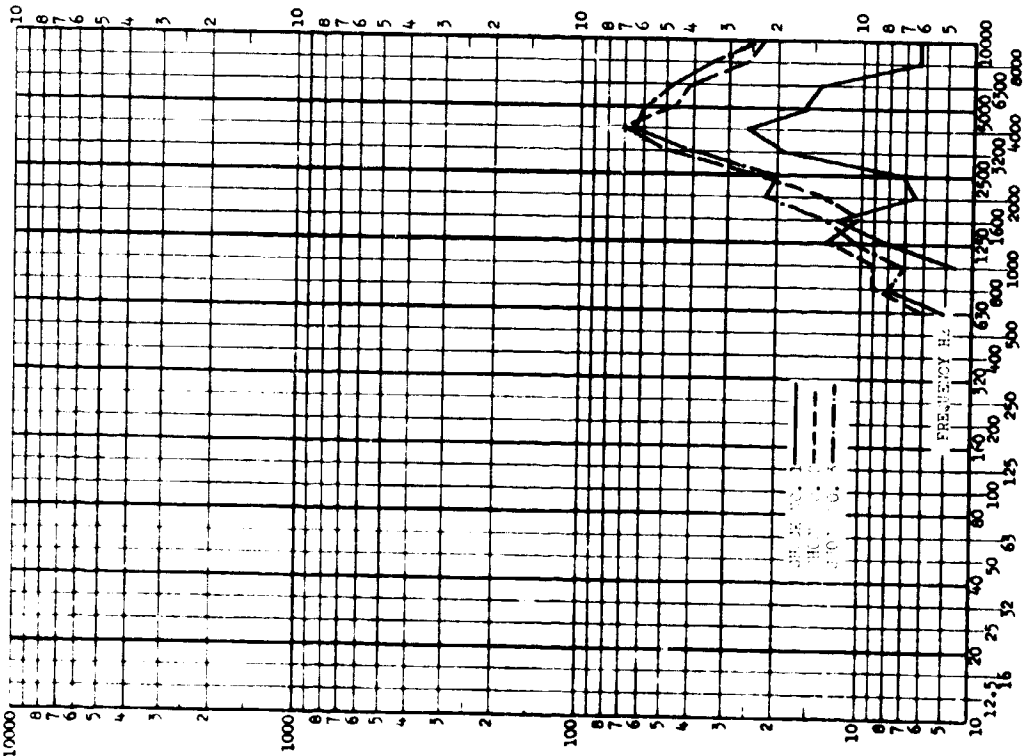


FIGURE III.B.1-19

SECTION III.B.2

SEPARATION SHOCK TESTS OF TOS-M SPACECRAFT

PURPOSE OF TESTS

The objective of these tests was to determine the typical shock environment associated with TOS-M spacecraft separation from the third stage booster of the Thor/Delta launch vehicle.

DESCRIPTION OF EVENTS

For these tests the TOS-M Dynamic Test Unit, shown in Figure III.B.2-1, was suspended by counter weight/hoist suspension system. A 37-inch diameter attach fitting simulating the Delta third stage was mounted to the bottom of the Dynamic Test Unit by means of a separation attach clamp. The separation event was simulated by actuating the two ordnance bolts cutters integrated into the attach clamp system. Following the action of the bolt cutters, separation springs and gravity forced the simulated third stage with the attach fitting away from the spacecraft without further interaction. Ten such tests were conducted; however, tests 5,6,7 and 10 used only one bolt cutter instead of the normal two.

DESCRIPTION OF DATA

Twelve different accelerometer locations were monitored during testing. Either five or six shock spectra are

presented for each measurement location.

No. of time histories	12
No. of shock spectra	68
Type of analysis	digital
Sample rate	20,000/second
Frequency range	10-7,500 Hz
Frequency increment	20 points per octave
Damping	Q=10

These shock spectra are presented along with the time histories for Separation Test No. 1 as Figures III.B.2-3 through III.B.2-14. Table III.B.2-1 is an index indicating which test afforded data for the various accelerometer locations.

DESCRIPTION OF PYROTECHNIC

Ordnance bolt cutters integrated into attach clamp assembly as illustrated in Figure III.B.2-2 were used. The explosive cutter is defined by DAC drawing 1B20802-1.

DESCRIPTION OF STRUCTURE

Figure III.B.2-2

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225

Locations: Table III.B.2-1 and Figure III.B.2-2

Axis of sensitivity: Table III.B.2-1 and Figure III.B.2-2

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorder: Sangamo Model 471-RB

Amplifiers: Unholtz Dickie Model 8PNCV charge amplifiers

TABLE III.B.2-1

INDEX OF MEASUREMENTS PRESENTED AND THEIR LOCATIONS

<u>Accelerometer No.</u>	<u>Location</u>	<u>Test Nos.</u>	<u>Sensitive Axis</u>	<u>Figure No</u>
1	Adapter ring, inside flange	1,7,8,9,10	radial	III.B.2-3
2	Adapter ring, inside flange	1,7,8,9,10	axial	III.B.2-4
3	Adapter ring, inside flange	1,7,8,9,10	radial	III.B.2-5
4	Adapter ring, inside flange	1,7,8,9,10	axial	III.B.2-6
5	Baseplate, rib 5	1-6	radial	III.B.2-7
6	Baseplate, rib 5	1-6	axial	III.B.2-8
7	Baseplate, rib 5	1-6	tangential	III.B.2-9
8	Baseplate, rib 5	1-6	radial	III.B.2-10
9	Baseplate, rib 5	1-6	axial	III.B.2-11
10	Baseplate, rib 5	1-6	tangential	III.B.2-12
11	Back panel, top center	1-6	axial	III.B.2-13
12	Back panel, top center	1-6	lateral	III.B.2-14

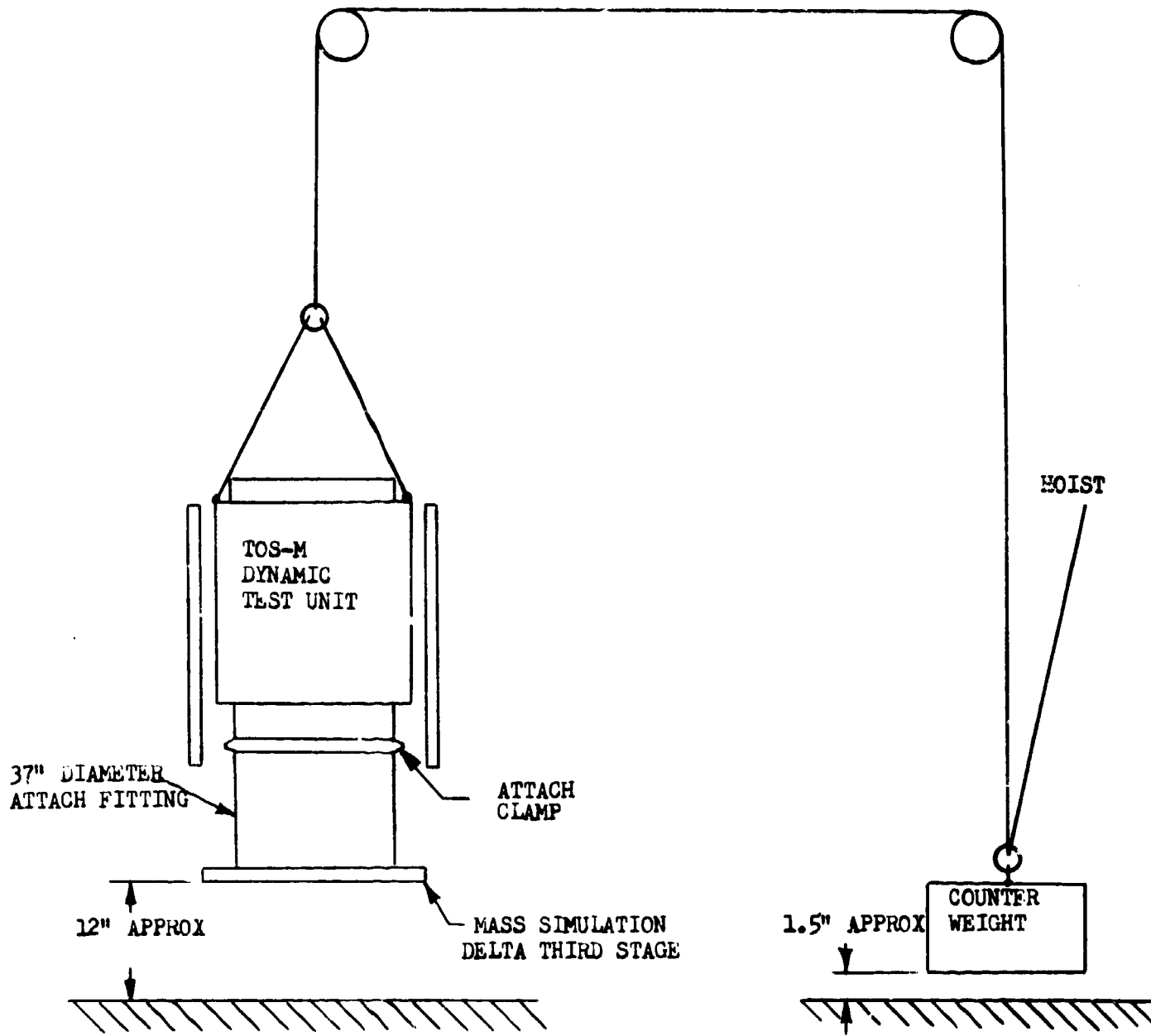
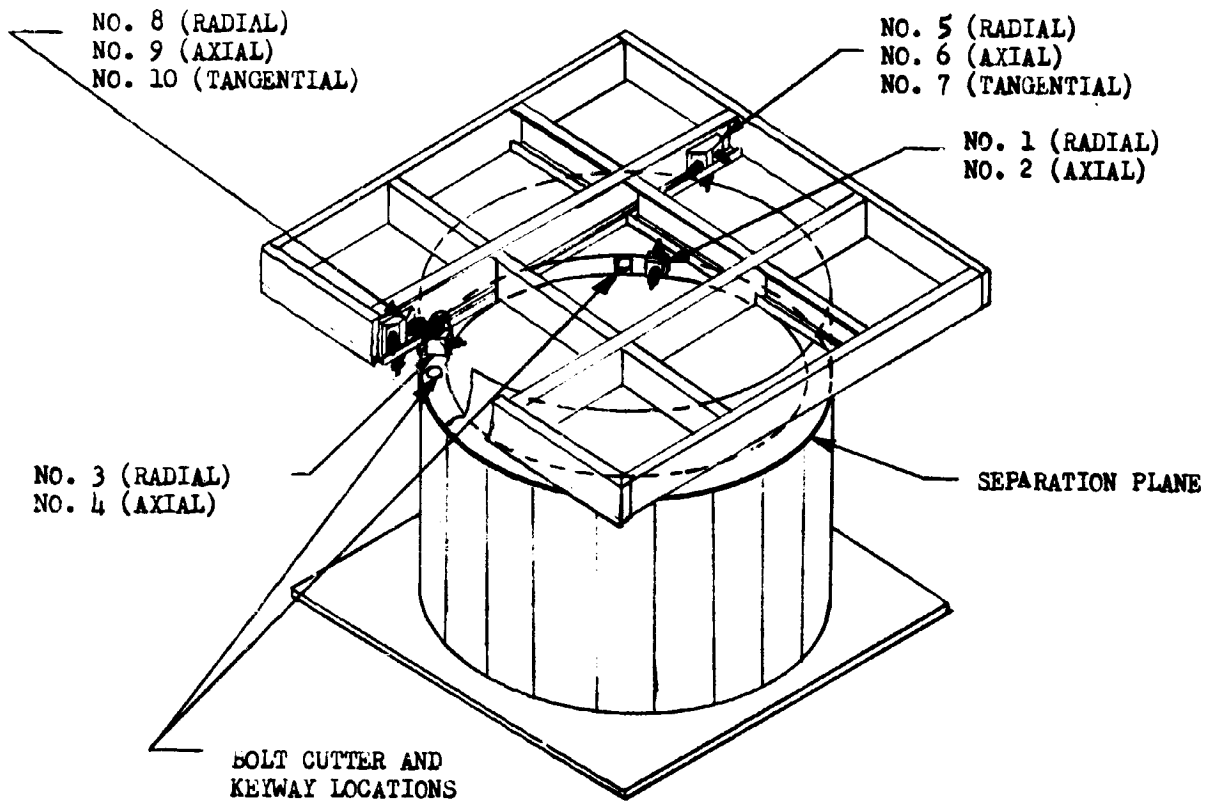


FIGURE III.B.2-1
 DIAGRAM OF TOS-M DYNAMIC TEST SET-UP



SECTION A-A

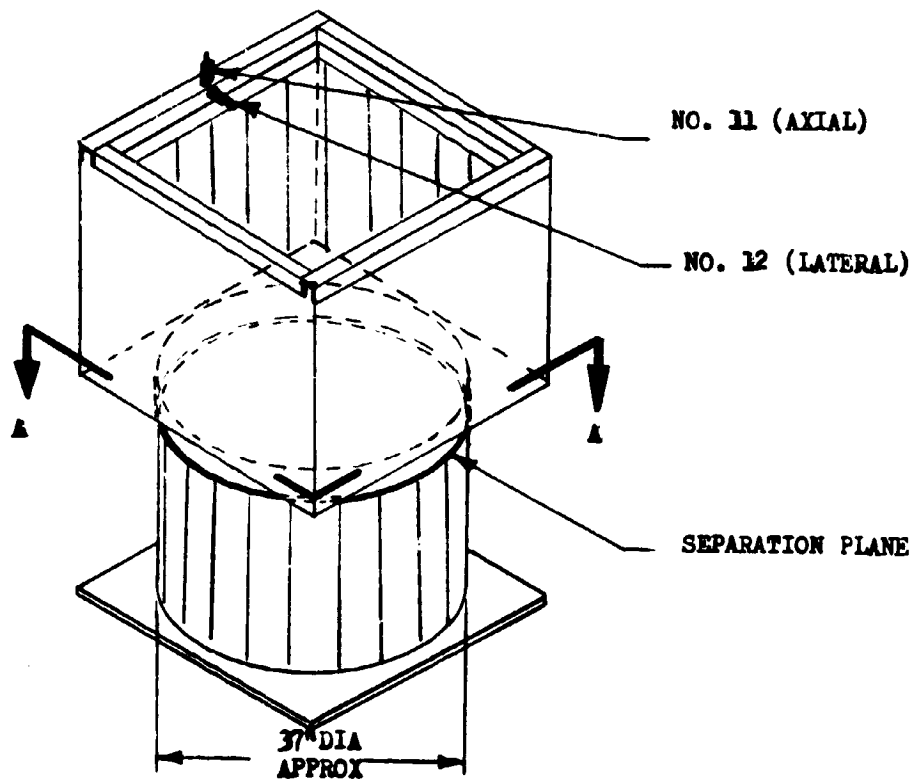


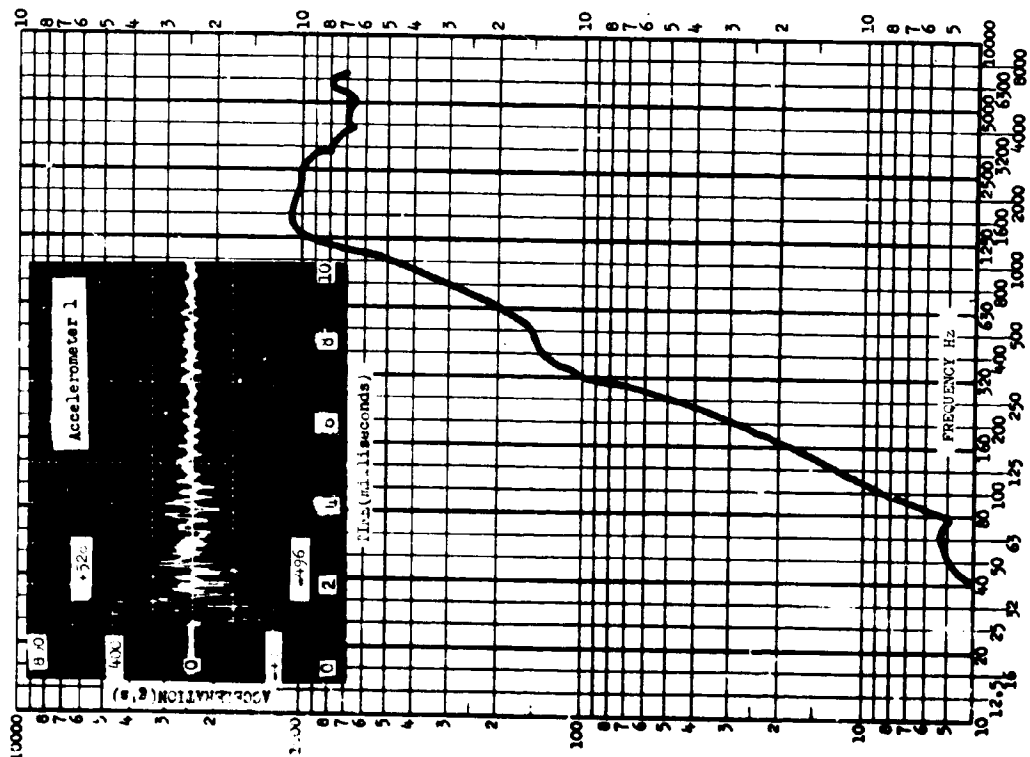
FIGURE III.B.2-2
LOCATION OF ACCELEROMETERS FOR TOS-1 DYNAMIC TESTS
365

TEST ITEM Separation of TOS-M Spacecraft

ACCEL. NO. 1 TEST DATE February 16, 1968

SHOCK AXIS Radial SHOCK NO. 1

RESPONSE G's



TEST ITEM Separation of TOS-M Spacecraft

ACCEL. NO. 1 TEST DATE February, 1968

SHOCK AXIS Radial SHOCK NO. 7, 8, 9, and 10

RESPONSE G's

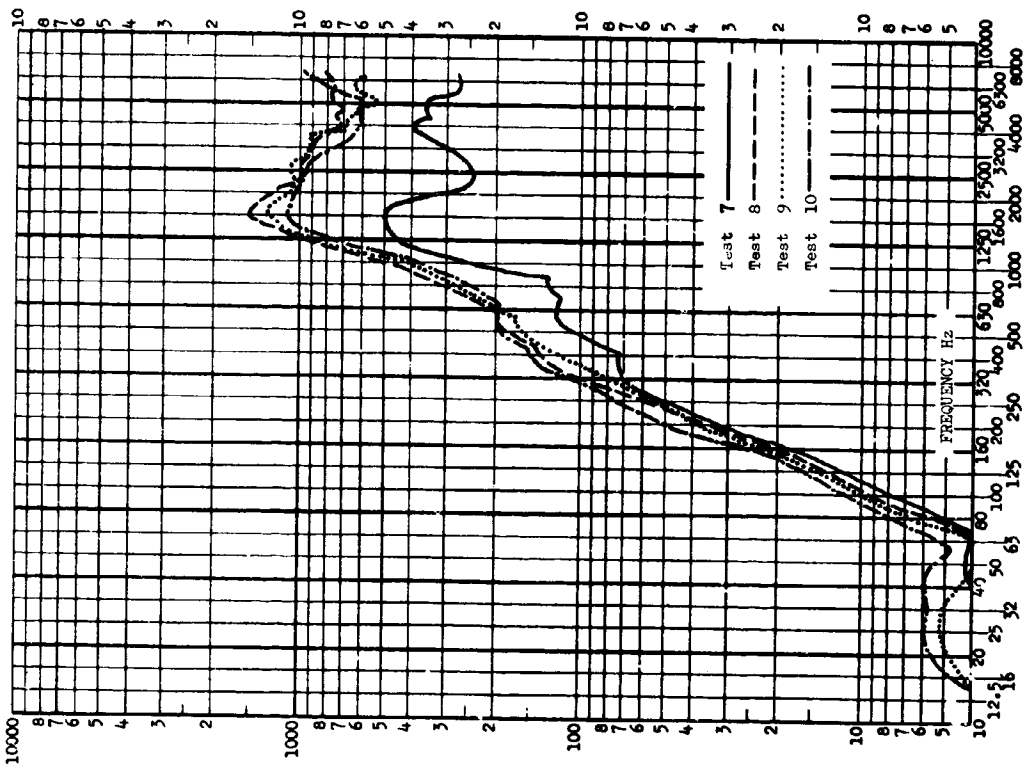
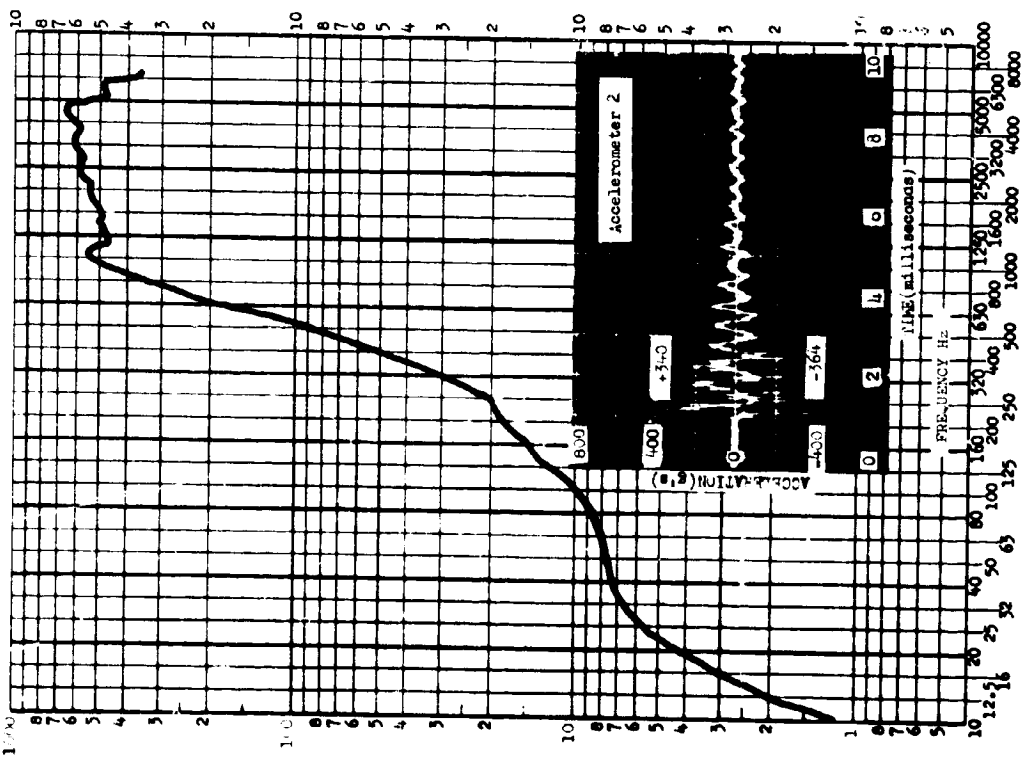


FIGURE III.B.2-3

TEST ITEM Separation of TOS-8 spacecraft
 ACCEL. NO. _____ TEST DATE February 13, 1968
 SHOCK AXIS Axial SHOCK NO. 2
 RESPONSE G's



TEST ITEM Separation of TOS-8 spacecraft
 ACCEL. NO. 2 TEST DATE February, 1968
 SHOCK AXIS Axial SHOCK NO. 7, 8, 9, and 10
 RESPONSE G's

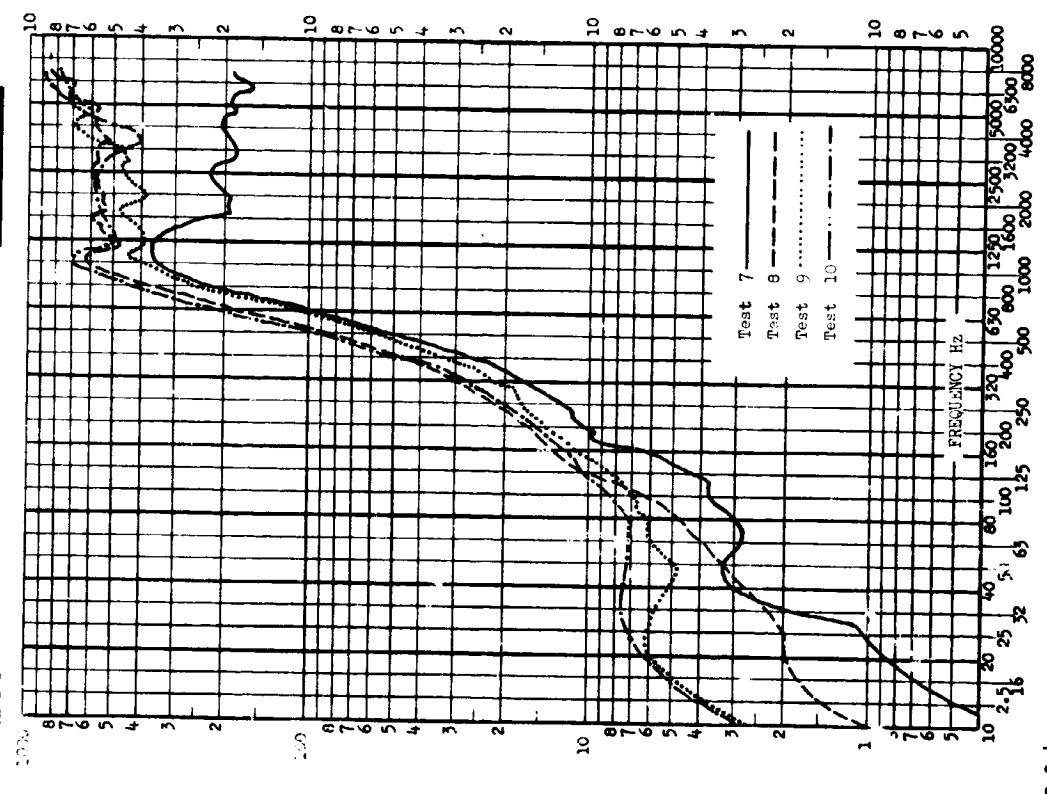
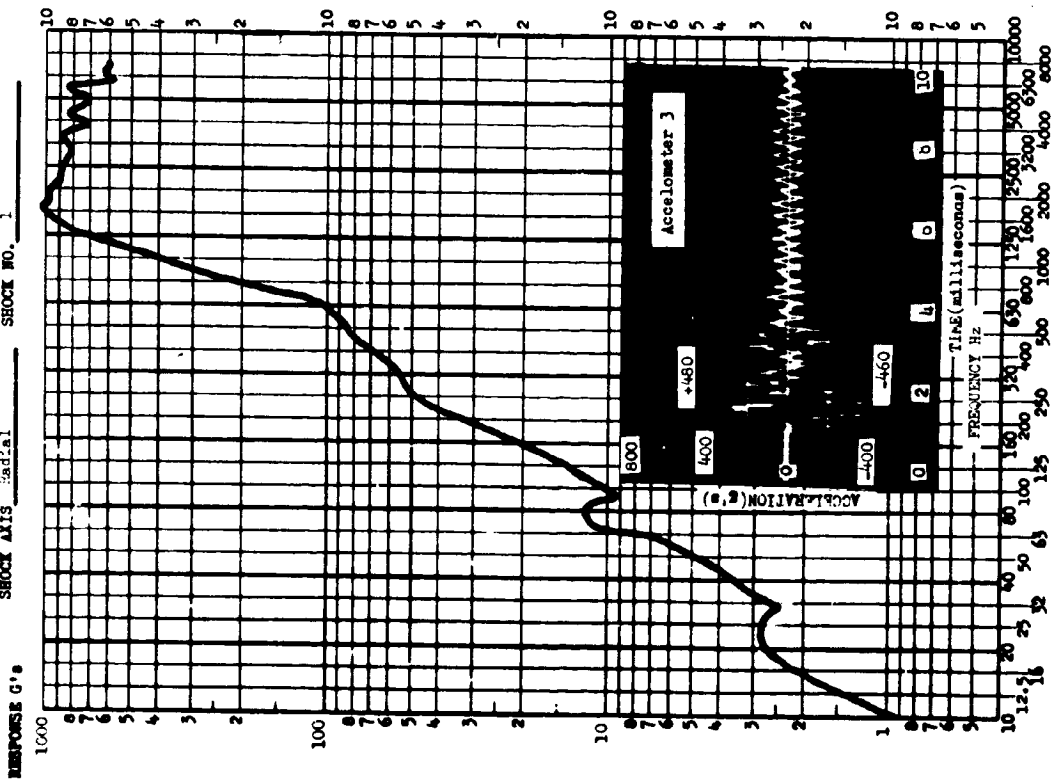


FIGURE III.B.2-4

TEST ITEM Separation of TOS-M Spacecraft
 ACCEL. NO. 3 TEST DATE February 13, 1968
 SHOCK AXIS Radial SHOCK NO. 1



TEST ITEM Separation of TOS-M Spacecraft
 ACCEL. NO. 3 TEST DATE February, 1968
 SHOCK AXIS Radial SHOCK NO. 7, 8, 9, and 10

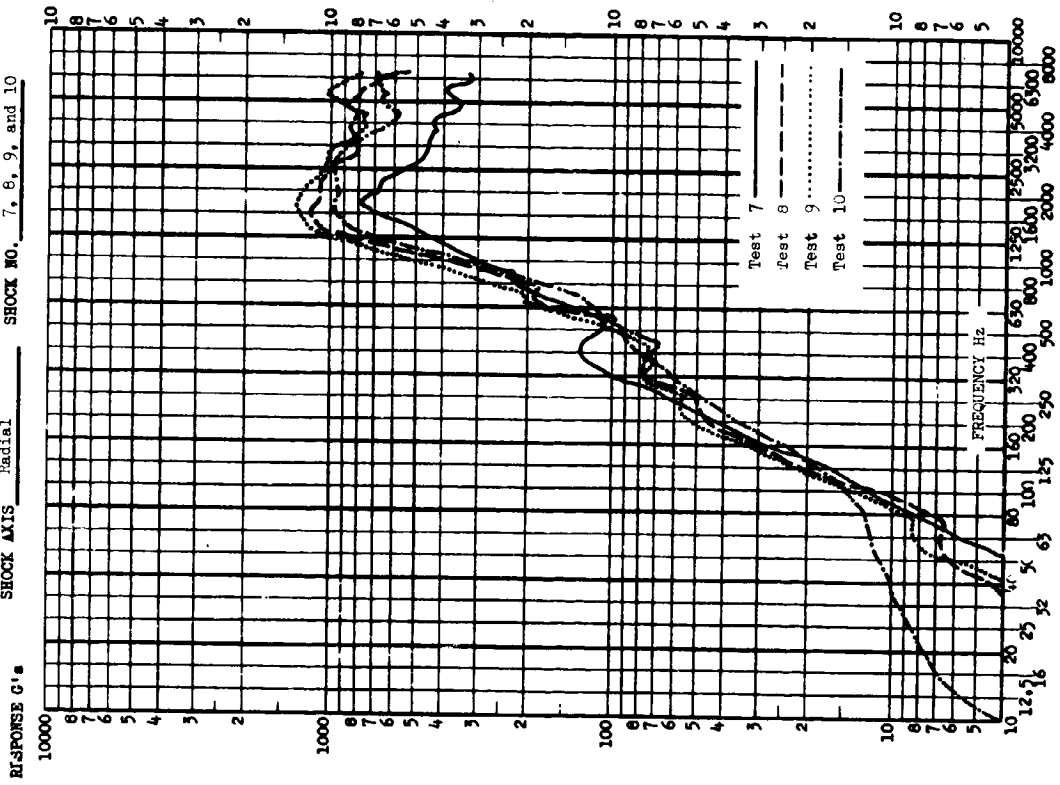
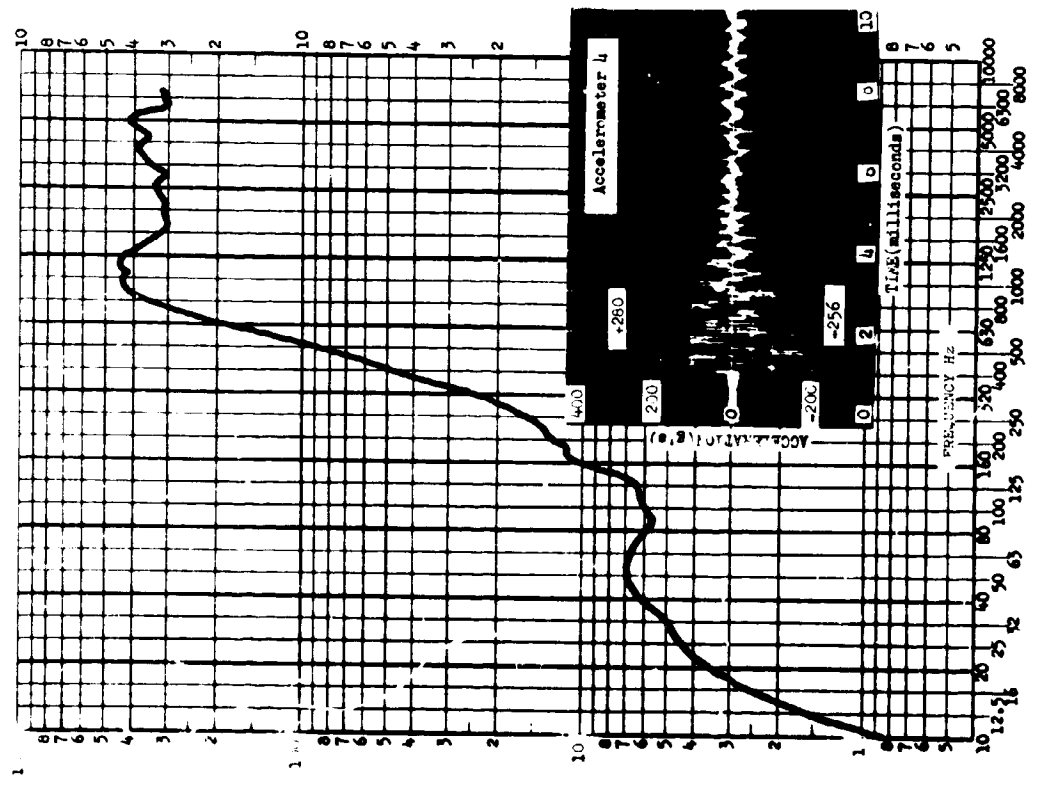


FIGURE III.B.2-5

TEST ITEM _____
 ACCEL. NO. _____
 SHOCK AXIS _____

TEST DATE _____
 SHOCK NO. _____

RESPONSE G's _____



TEST ITEM Separation of P-38 Aircraft
 ACCEL. NO. 4
 SHOCK AXIS Axial

TEST DATE February, 1968
 SHOCK NO. 7, 8, 9, and 10

RESPONSE G's _____

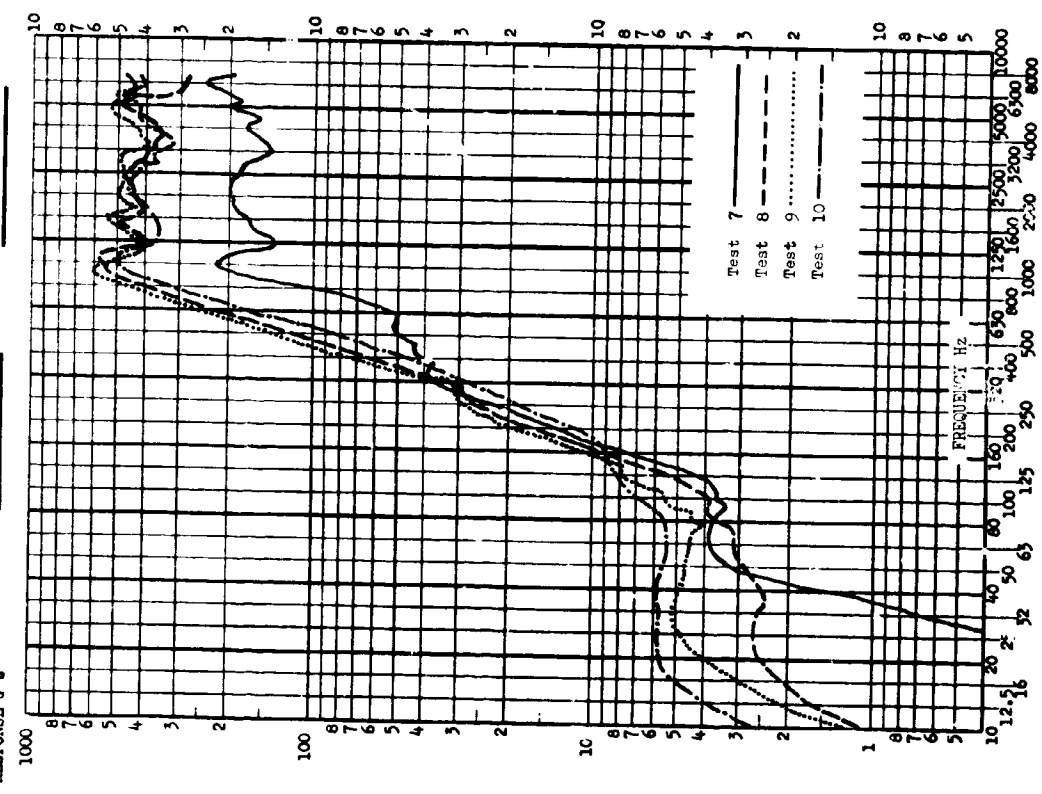
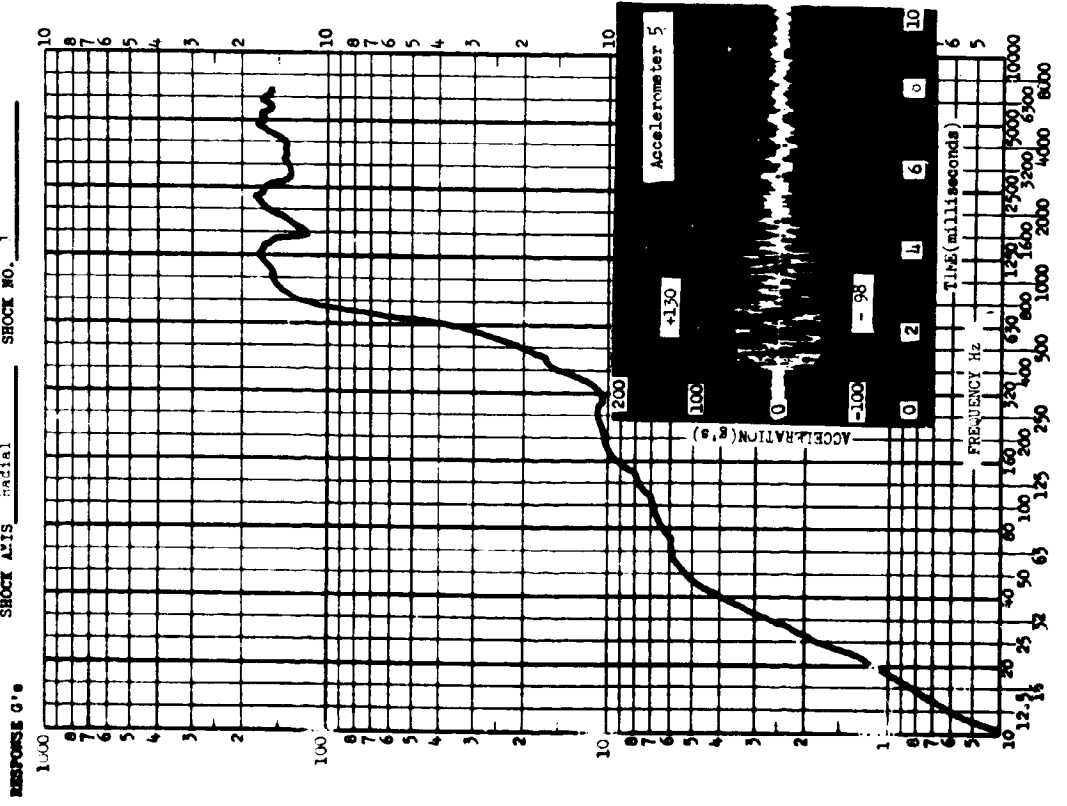


FIGURE III.B.2-6

TEST ITEM Separation of TOS-4 Spacecraft
 ACCEL. NO. 5 TEST DATE February 11, 1966
 SHOCK AXIS Radial SHOCK NO. 1



TEST ITEM Separation of TOS-M Spacecraft
 ACCEL. NO. 5 TEST DATE February, 1968
 SHOCK AXIS P-dial SHOCK NO. 2, 3, 4, 5, and 6

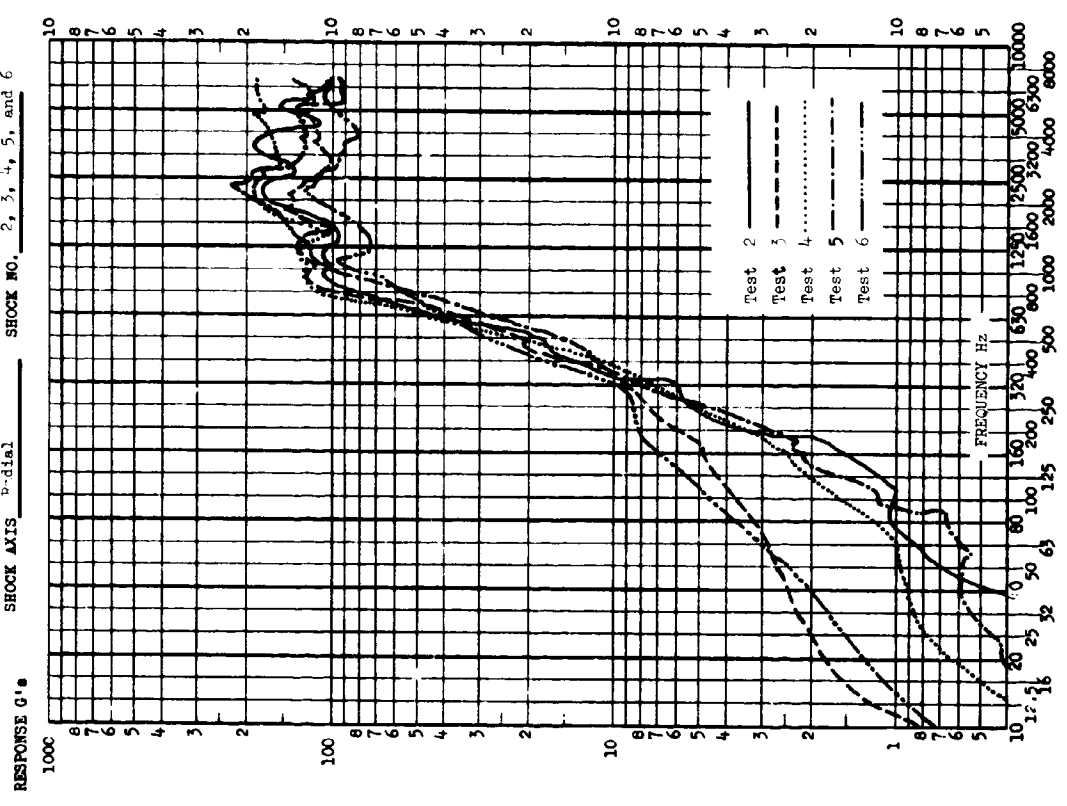
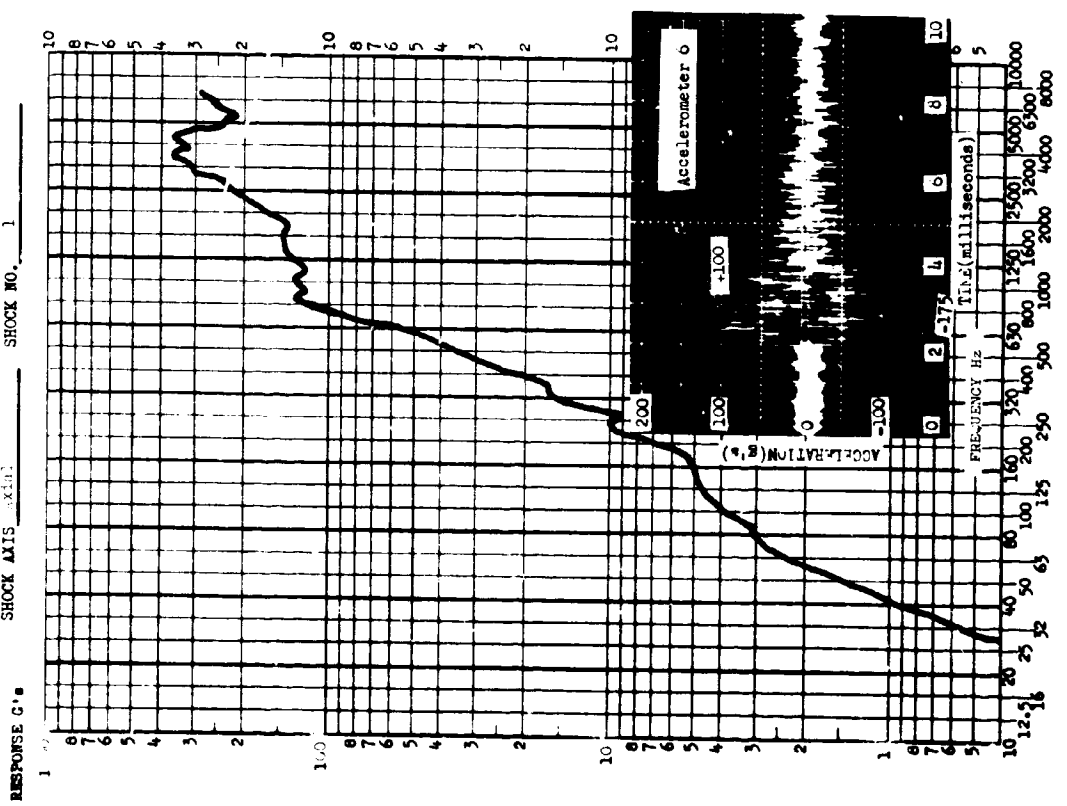


FIGURE III.B.2-7

TEST ITEM Separation of TCG-M Spaceraft
 ACCEL. NO. 6
 TEST DATE February, 1966
 SHOCK AXIS axial
 SHOCK NO. 1



TEST ITEM Separation of TCG-M Spaceraft
 ACCEL. NO. 6
 TEST DATE February, 1966
 SHOCK AXIS axial
 SHOCK NO. 2, 3, 4, 5, and 6

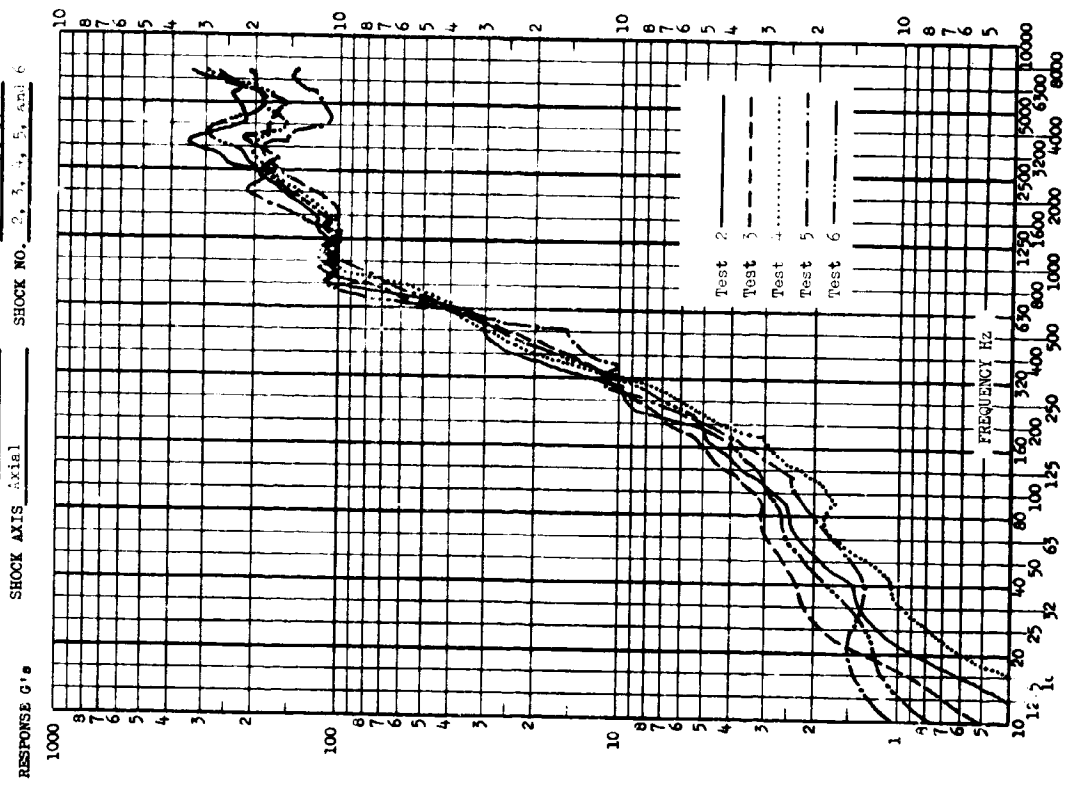
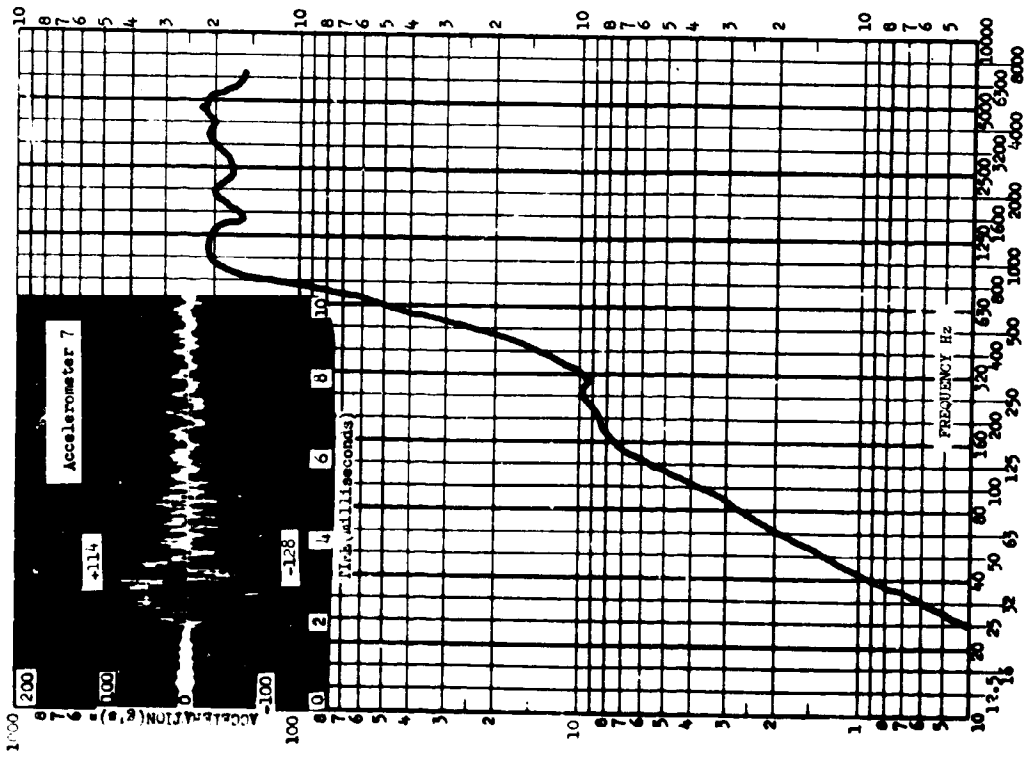


FIGURE III.B.2-8

TEST ITEM Separation of TOS-M Spacecraft
 ACCEL. NO. 7 TEST DATE February 13, 1968
 SHOCK AXIS Tangential SHOCK NO. 1



TEST ITEM Separation of TOS-M Spacecraft
 ACCEL. NO. 7 TEST DATE February, 1968
 SHOCK AXIS Tangential SHOCK NO. 2, 3, 4, 5, and 6

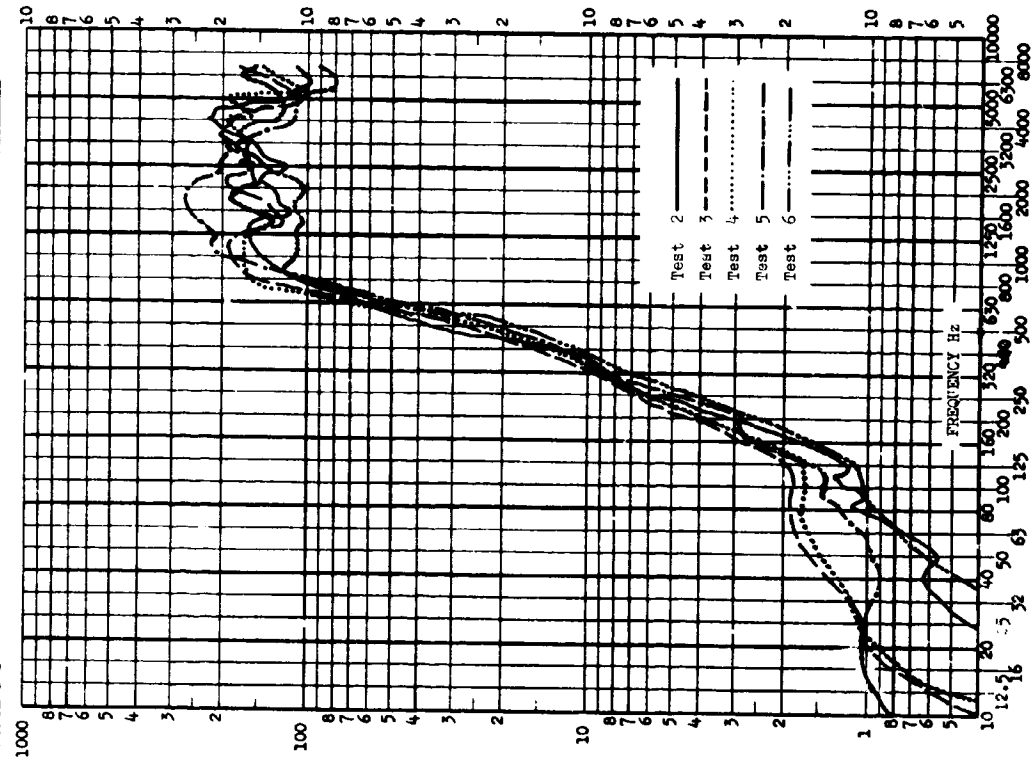
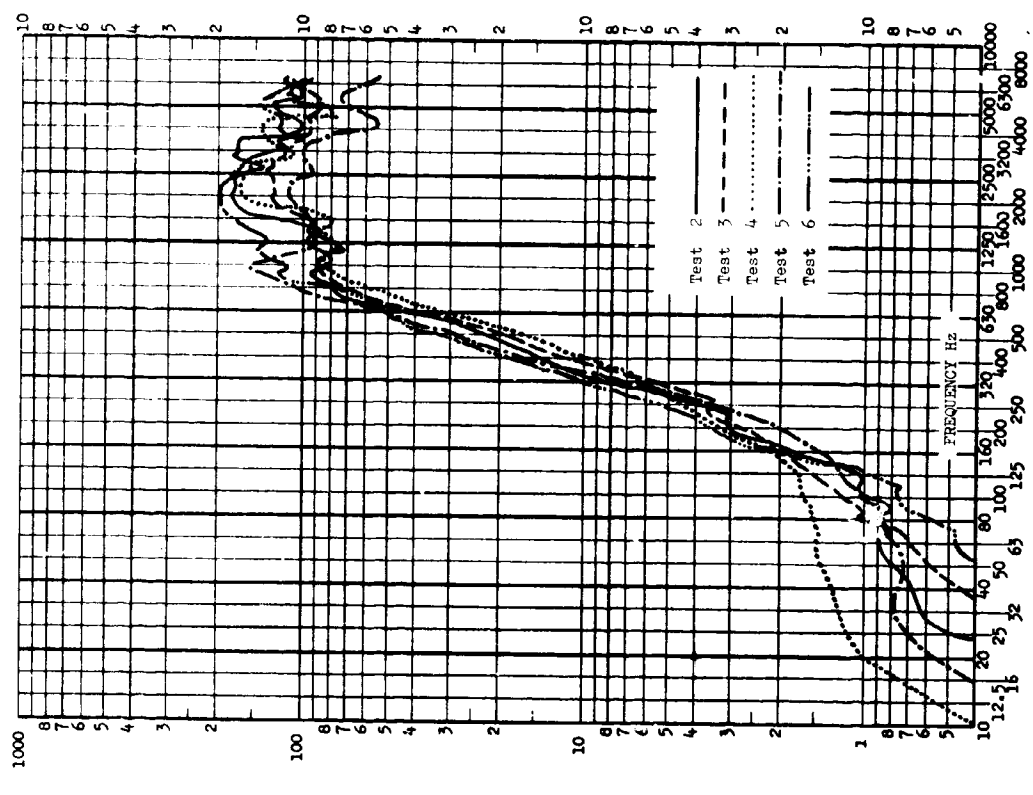


FIGURE III.B.2-9

TEST ITEM Separation of T.O.M. Sparcraft
 ACCEL. NO. 1
 TEST DATE February 1966
 SHOCK AXIS Radial
 SHOCK NO. 2, 3, 4, 5, 6



TEST ITEM Separation of T.O.M. Sparcraft
 ACCEL. NO. 1
 TEST DATE February 1966
 SHOCK AXIS Radial
 SHOCK NO. 2, 3, 4, 5, 6

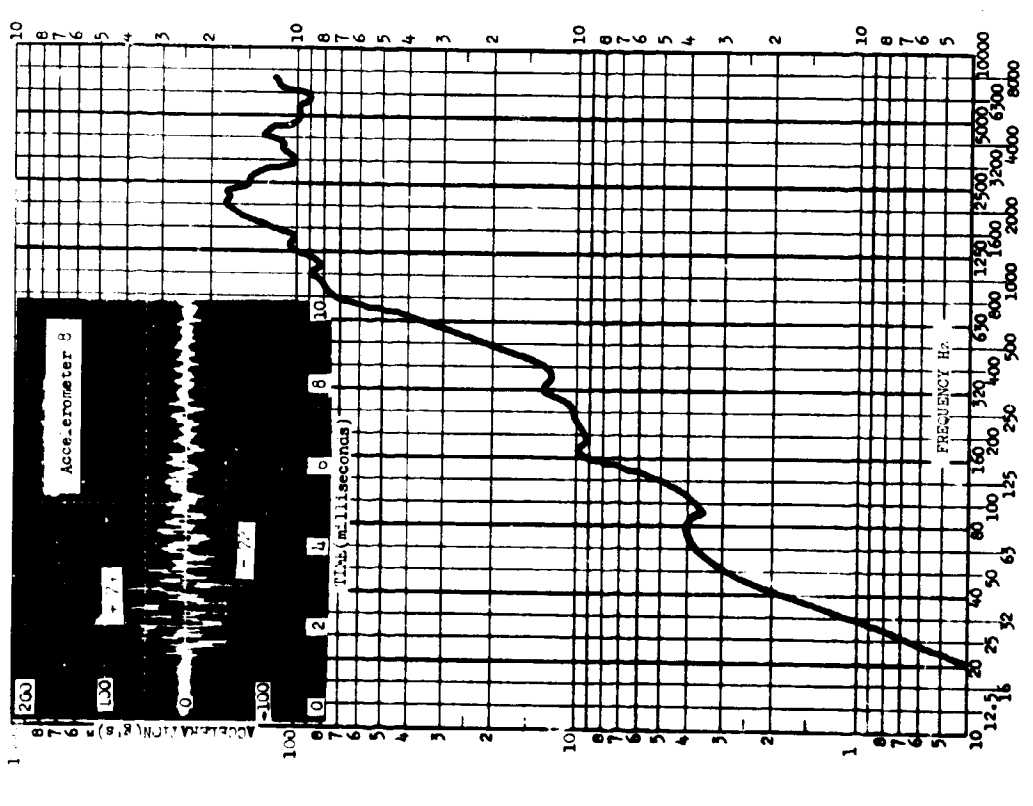
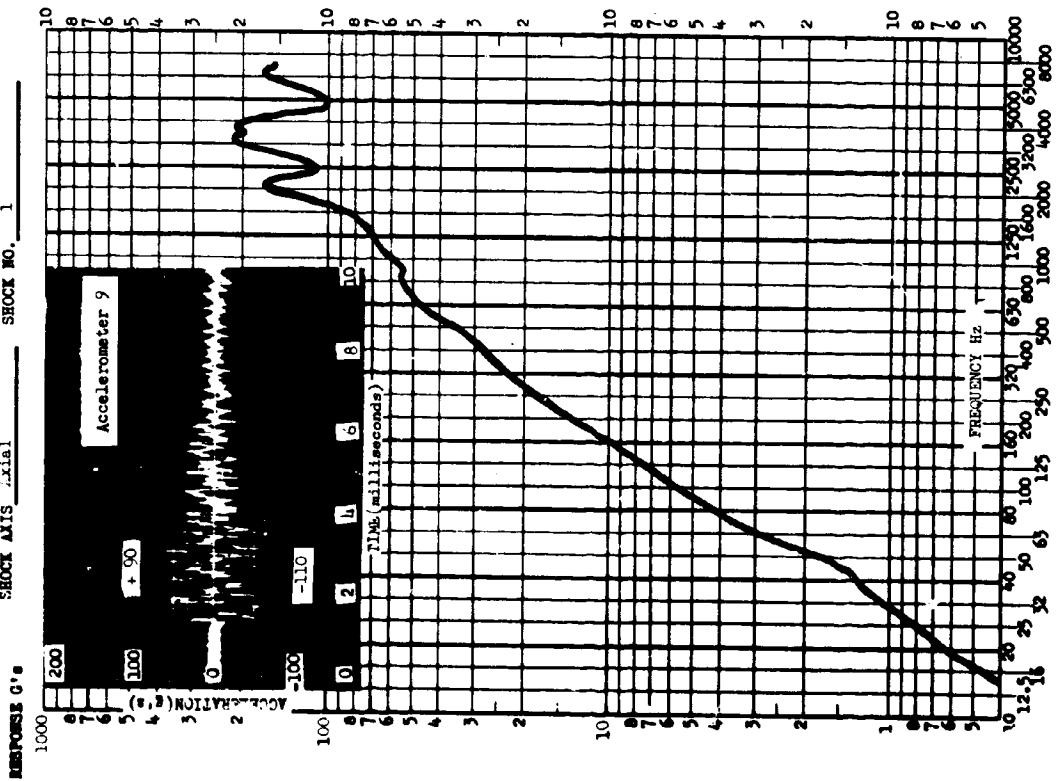


FIGURE III.B.2-10

TEST ITEM Separation of TOS-M Spacecraft
 ACCEL. NO. 9 TEST DATE February 13, 1966
 SHOCK AXIS Axial SHOCK NO. 1



TEST ITEM Separation of TOS-M Spacecraft
 ACCEL. NO. 9 TEST DATE February, 1968
 SHOCK AXIS Axial SHOCK NO. 2, 3, 4, 5, and 6

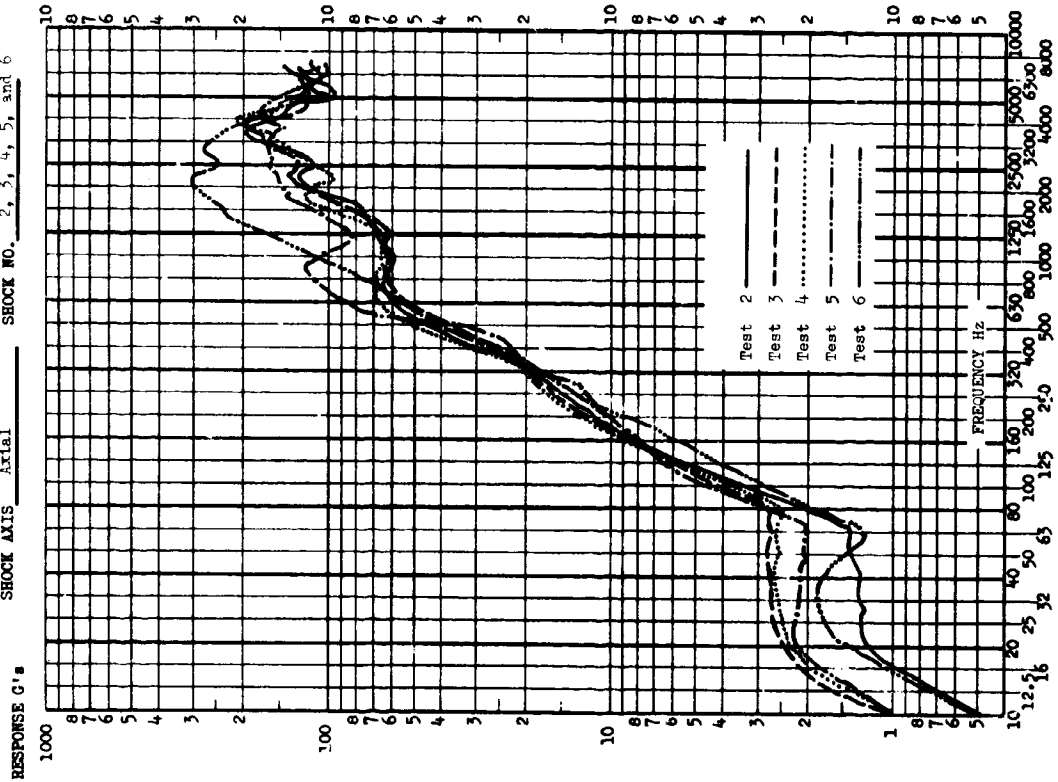
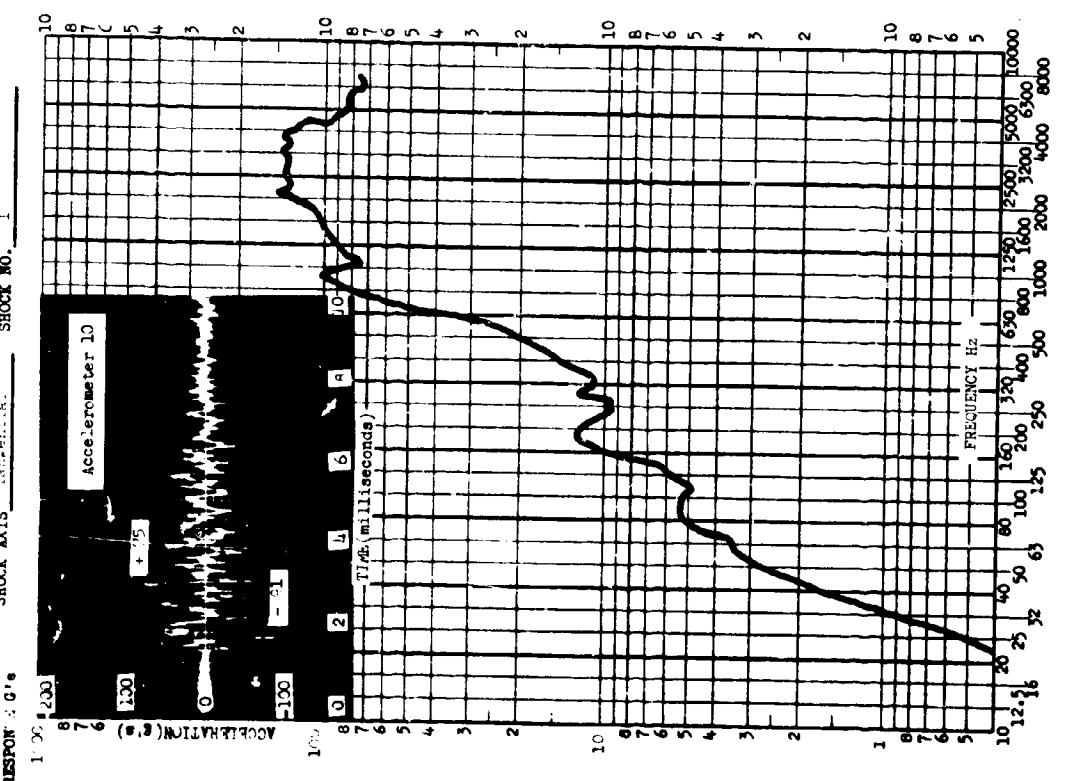


FIGURE III.8.2-11

TEST ITEM Separation of T-34M Spacecraft
 ACCEL. NO. 10 TEST DATE February 13, 1966
 SHOCK AXIS Tangential SHOCK NO. 1



RESPONSE G's

TEST ITEM Separation of T-34M Spacecraft
 ACCEL. NO. 10 TEST DATE February 1966
 SHOCK AXIS Tangential SHOCK NO. 2, 3, 4, 5, and 6

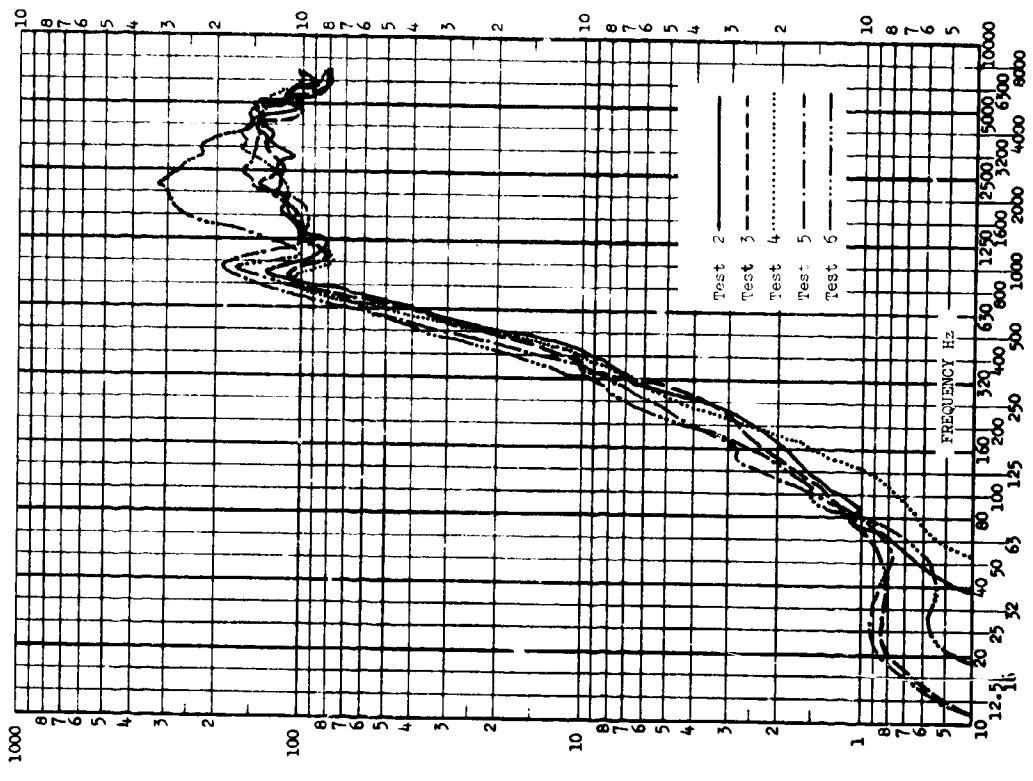
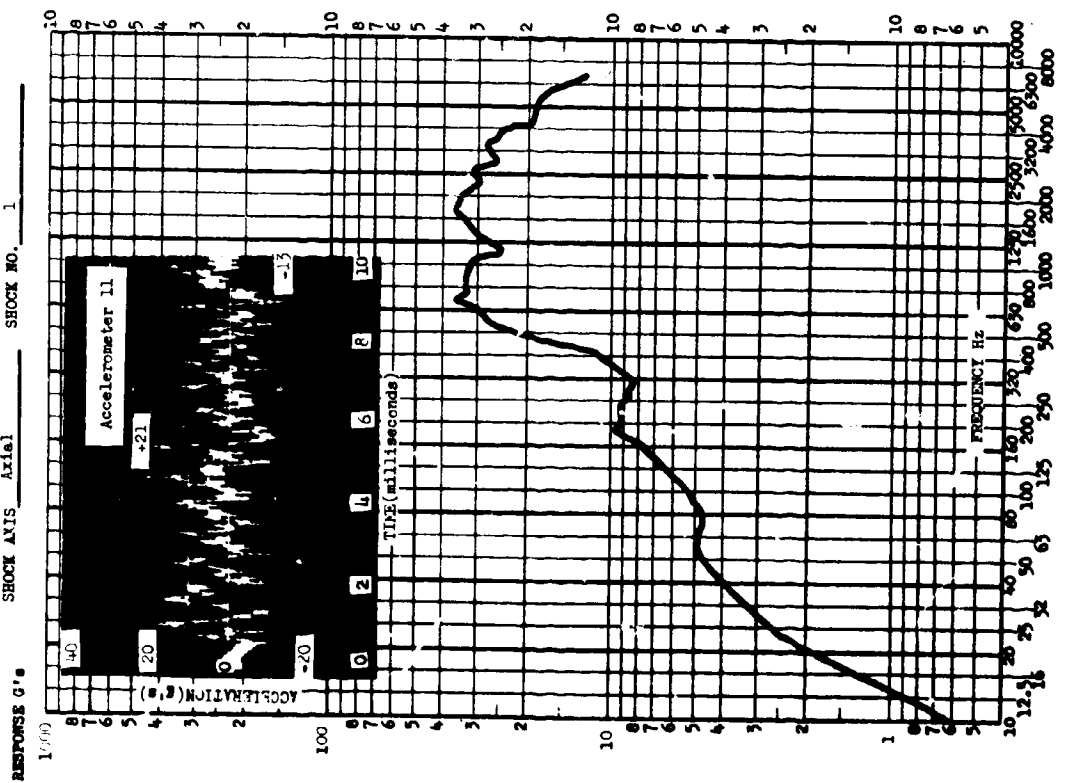


FIGURE III.8.2-12

TEST ITEM Separation of TOS-M Spacecraft
 ACCEL. NO. 11 TEST DATE February 13, 1968
 SHOCK AXIS Axial SHOCK NO. 1



TEST ITEM Separation of TOS-M Spacecraft
 ACCEL. NO. 11 TEST DATE February, 1968
 SHOCK AXIS Axial SHOCK NO. 2, 3, 4, 5, and 6

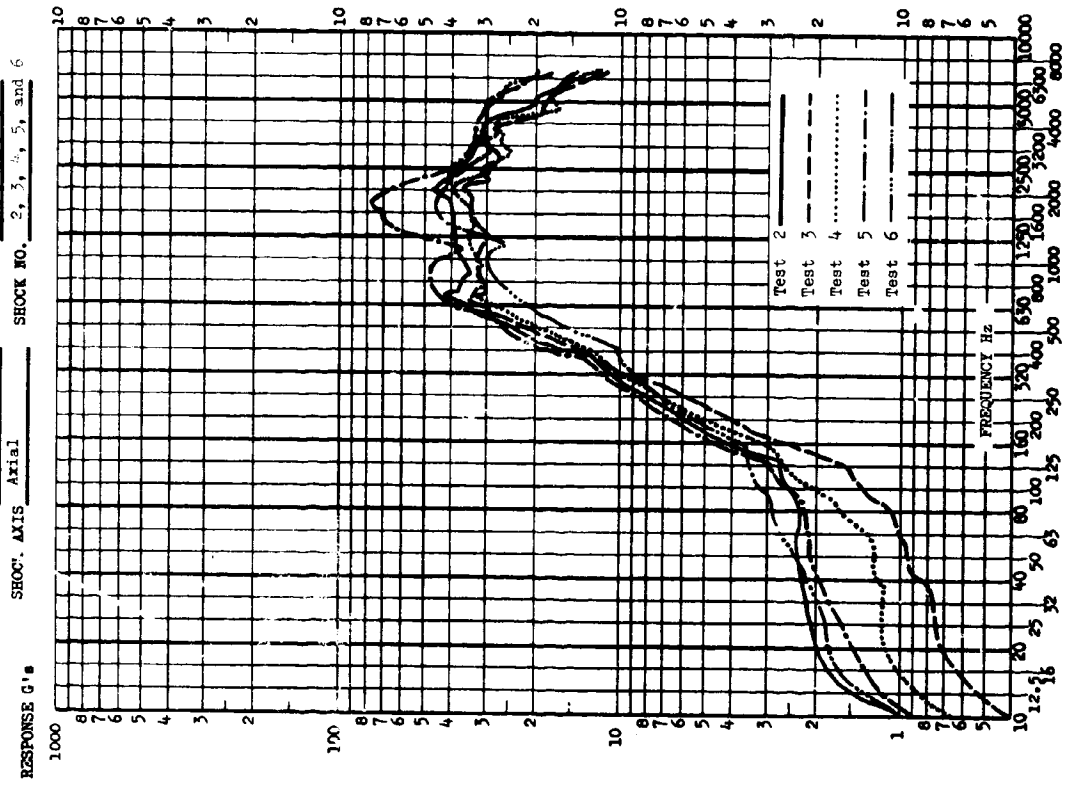
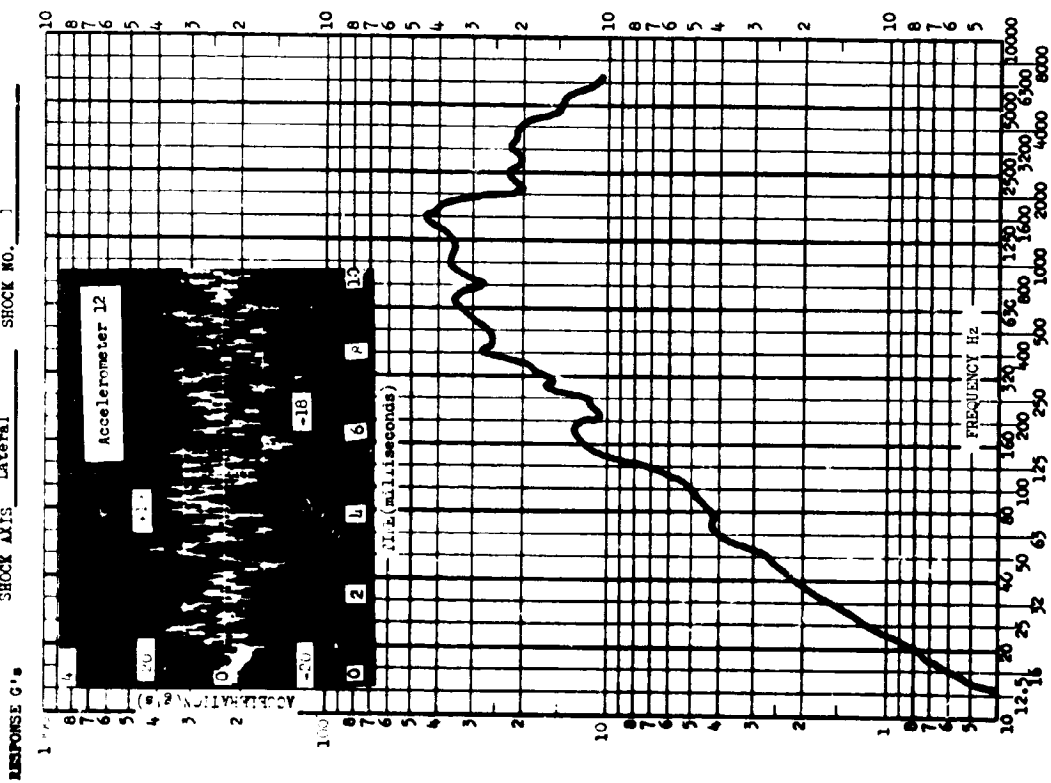


FIGURE III.B.2-13

TEST ITEM Separation of TOS-1 spacecraft
 ACCEL. NO. 1 TEST DATE February 11, 1965
 SHOCK AXIS Lateral SHOCK NO. 1



TEST ITEM Separation of TOS-1 spacecraft
 ACCEL. NO. 12 TEST DATE February 1965
 SHOCK AXIS Lateral SHOCK NO. 2, 3, 4, 5, and 6

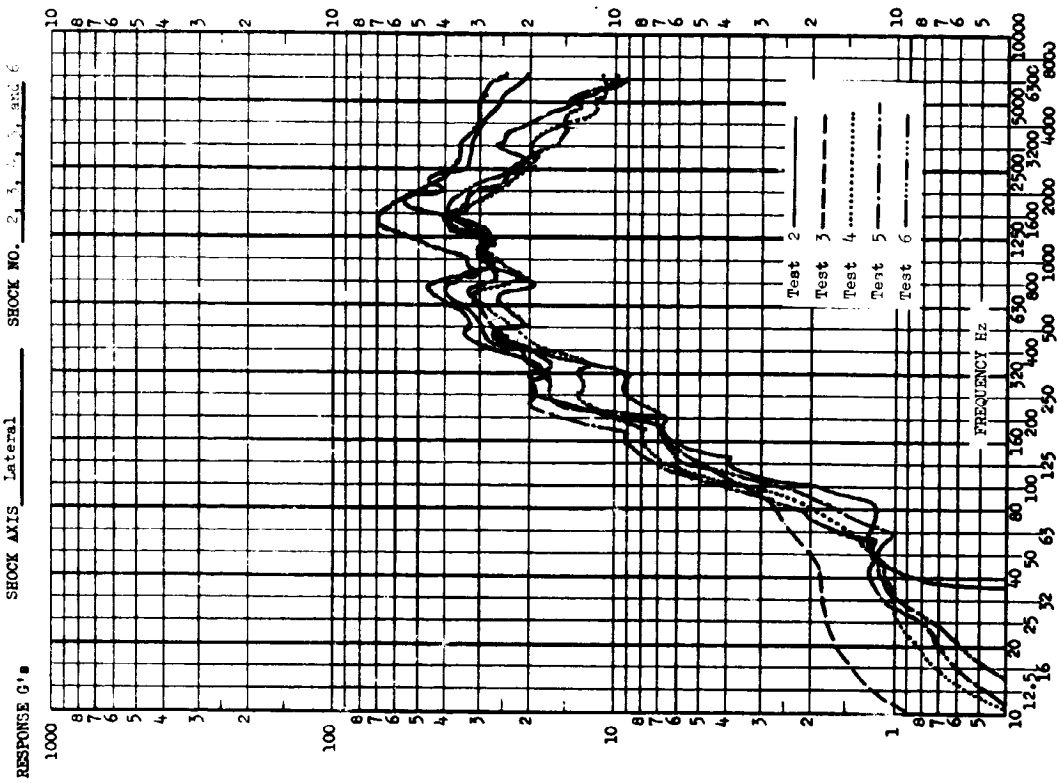


FIGURE III.8.2-14

SECTION III.B.3

ORBITING ASTRONOMICAL OBSERVATORY (OAO) SEPARATION TEST

PURPOSE OF TEST

The objective of this test was to determine the shock levels produced in the OAO spacecraft by the spacecraft separation event.

DESCRIPTION OF EVENT

The OAO spacecraft in flight configuration as illustrated in Figure III.B.3-1 was suspended with an adapter section attached to the aft end. The separation mechanism was a marmon clamp having 4 bolt cutters located (90° apart) around the spacecraft/adapter interface. The bolt cutter locations are shown in Figures III.B.3-2 and III.B.3-4. After detonation of the bolt cutters, the adapter section fell freely away from the spacecraft and was brought to rest by a net as depicted in Figure III.B.3-3.

DESCRIPTION OF DATA

No. of time histories	23
No. of shock spectra	23
Type of Analysis	digital
Sample rate	12,500/second
Duration	see time histories

Frequency range	20-5000 Hz
Frequency increment	10 Hz
Damping	Q=10

These shock spectra are presented along with their corresponding time histories as Figures III.B.3-5 through Figure III.B.3-27

DESCRIPTION OF PYROTECHNIC

Each of the four bolt cutter assemblies is released by the detonation of a pressure cartridge that shears the heads off four bolts at each location. However, the attachment assembly consists of a hinge type fitting such that the large load carrying bolt is not cut, but smaller bolts (approximately No. 10 screws) were severed to affect spacecraft separation.

The pressure cartridge used was a McCormick-Selph part No. 5401.

DESCRIPTION OF STRUCTURE

The OAO spacecraft is a structure of octagonal cross section consisting of a central cylindrical shell surrounded by a region of truss structure where all the experiments are housed. A truss type structure divides the outer region into eight longitudinal bays with letter names as indicated in Figure III.B.3-4. A longitudinal truss member separating two bays is denoted by the letters of the two adjacent

bays. In other words, the members between bays A and B would be cited as "truss AB". Furthermore, there are two longitudinal truss members associated with the description "truss AB": an outer member at the corner of the octagon and an inboard member at the junction of the central cylinder.

The structure also subdivides each bay into six segments (shelves) stacked one above the other. These segments are designated by numbers from 1 to 6, numbering from the top down. Hence, the next to the bottom segment in Bay D would be designated as location "D-5". Figure III.B.3-1 presents a view of the entire structure.

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2221C

Locations: Table III.B.3-1 and Figure III.C.3-4

Axis of Sensitivity: Table III.B.3-1 with the coordinate system in Figure III.B.3-4.

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorder: Ampex FR1200

Amplifiers: Charge type amplifiers manufactured by Endevco, Dynamics and Unholtz-Dickie.

COMMENTS

Due to the rather low sampling rate of 12,500 samples per second, the shock spectra are considered to lose validity at frequencies above 1250 to 1600 Hz.

TABLE III.B.3-1
DESCRIPTION OF ACCELEROMETERS

<u>Accelerometer Location No.</u>	<u>Location</u>	<u>Station</u>	<u>Sensitive Axis</u>	<u>Figure No(s).</u>
11	EMT* Bay B-1	45	X	III.B.3-5
16	EMT Bay B-6	150	X,Y	-6,-7
35	EMT Bay D-6	150	X,Y,Z	-8,-9,-10
49	EMT Bay F-1	50	X,Z	-11,-12
58	EMT Bay F-6	156	X,Y,Z	-13,-14,-15
73	EMT Bay H-6	150	X,Y	-16,-17
90	Inboard Truss EF	156	X,Y	-18,-19
100	Outter Truss EF	138	X,Y,Z	-20,-21,-22
106	Outter Truss EF	80	X,Z	-23,-24
121	Inboard Truss AB	120	X,Y,Z	-25,-26,-27

*EMT = equipment mounting point on a truss structure called
the star tracker frame.



FIGURE III.B.3-1. Overall View of OAO Test Configuration

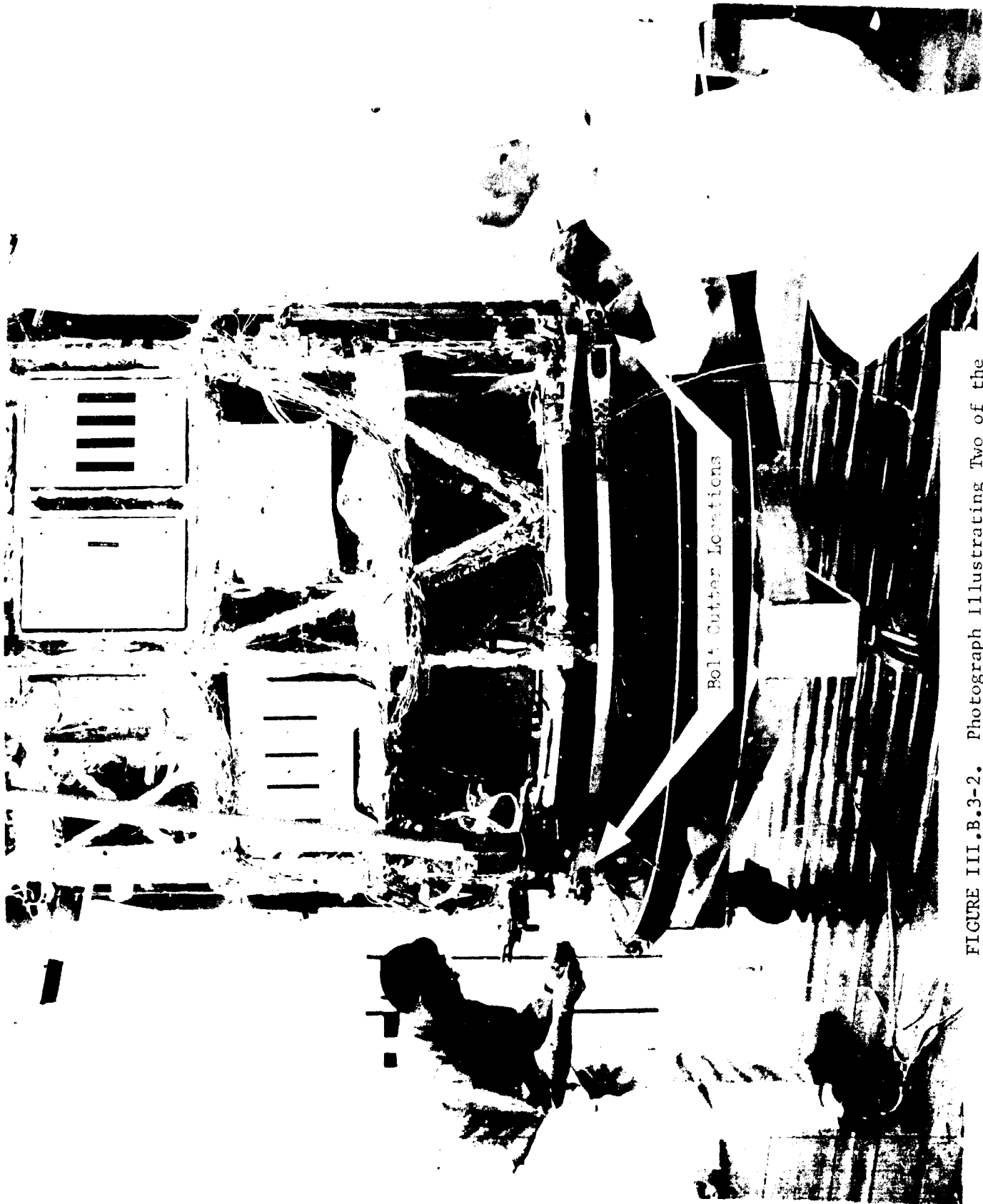


FIGURE III.B.3-2. Photograph Illustrating Two of the Four Bolt Cutter Locations

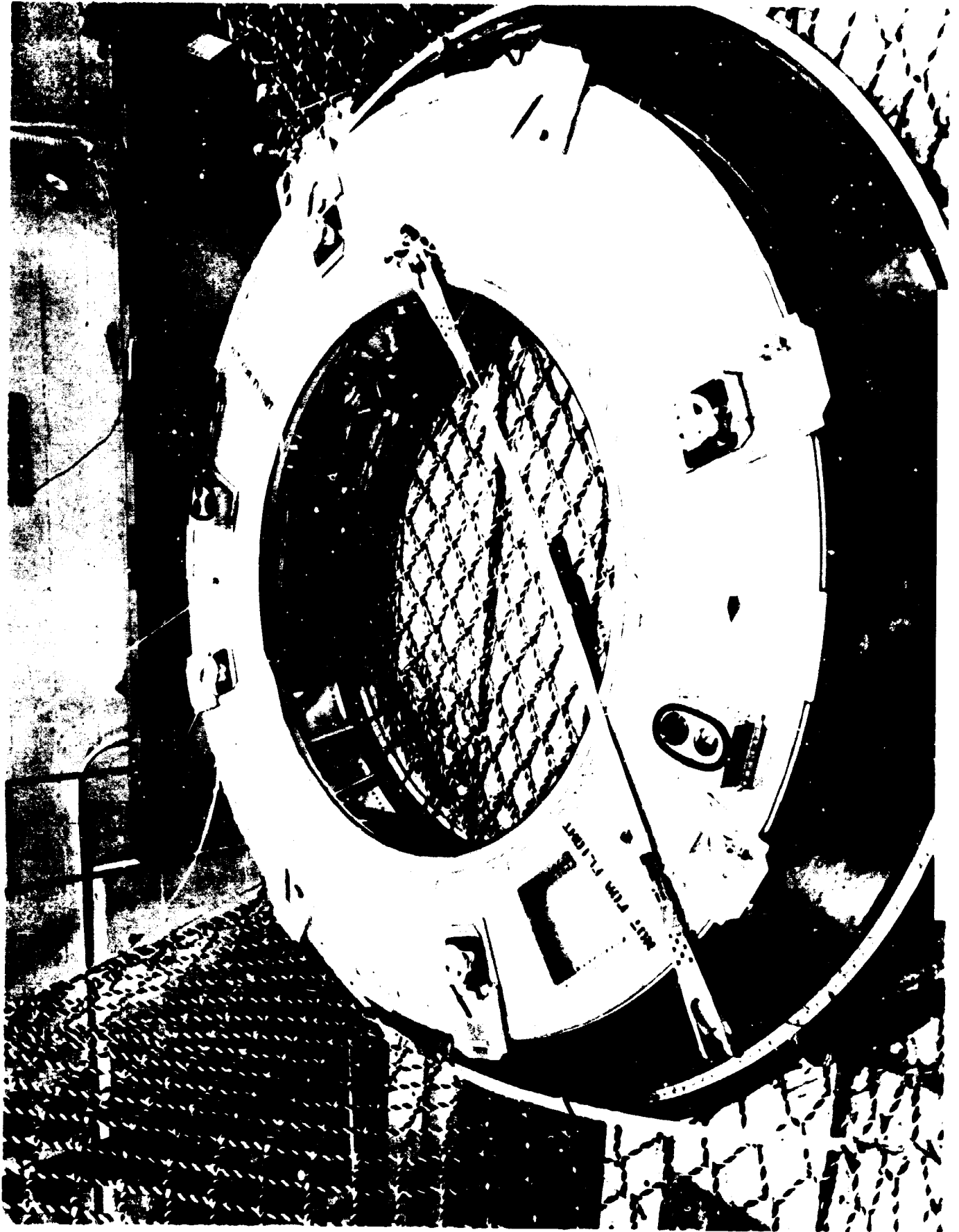
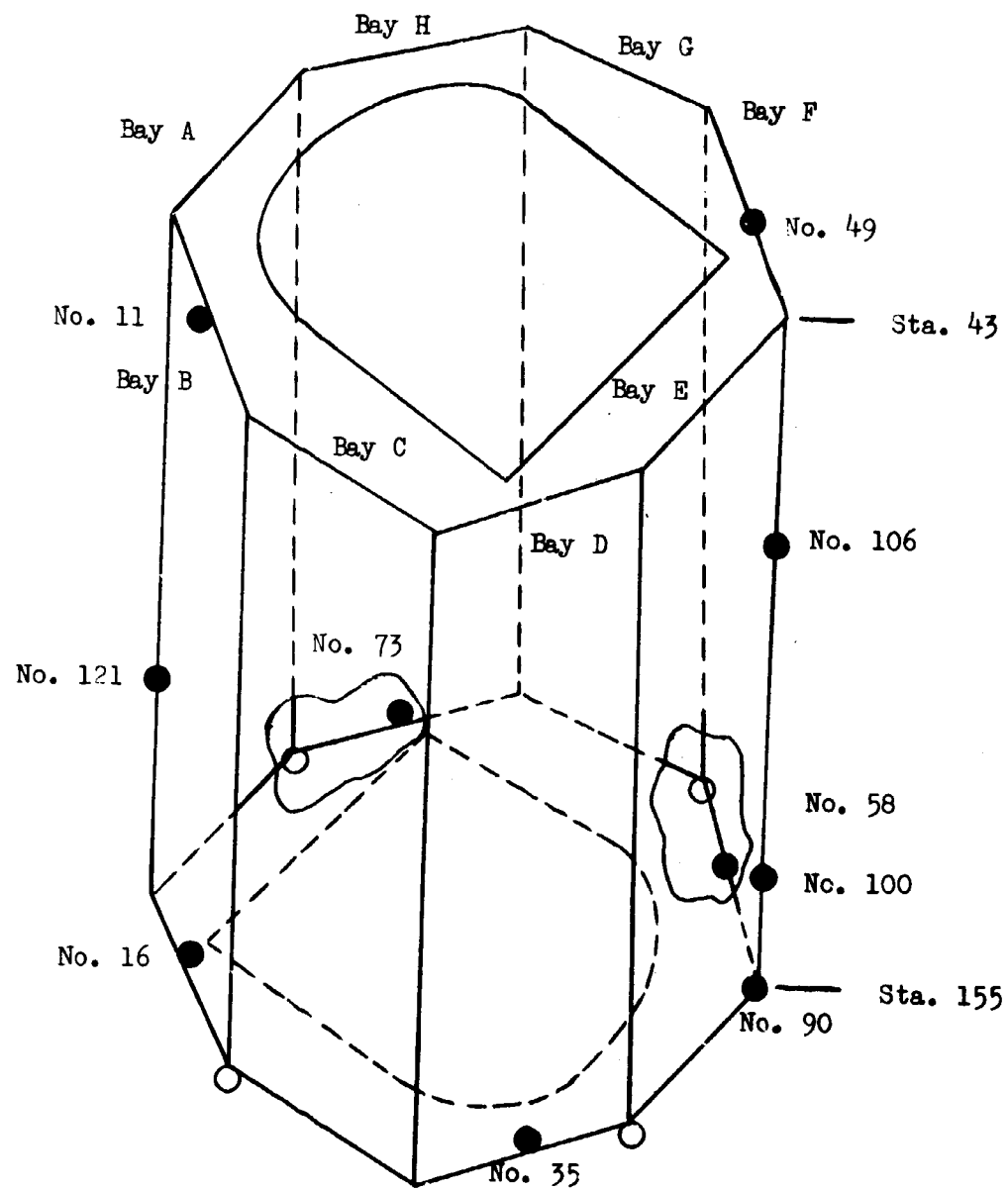


FIGURE III.B.3-3. View of Separated Adapter Section



- Approximate Accelerometer Locations
- Bolt Cutter Locations at Station 160

Figure III.B.3-4. Schematic of Accelerometer Locations

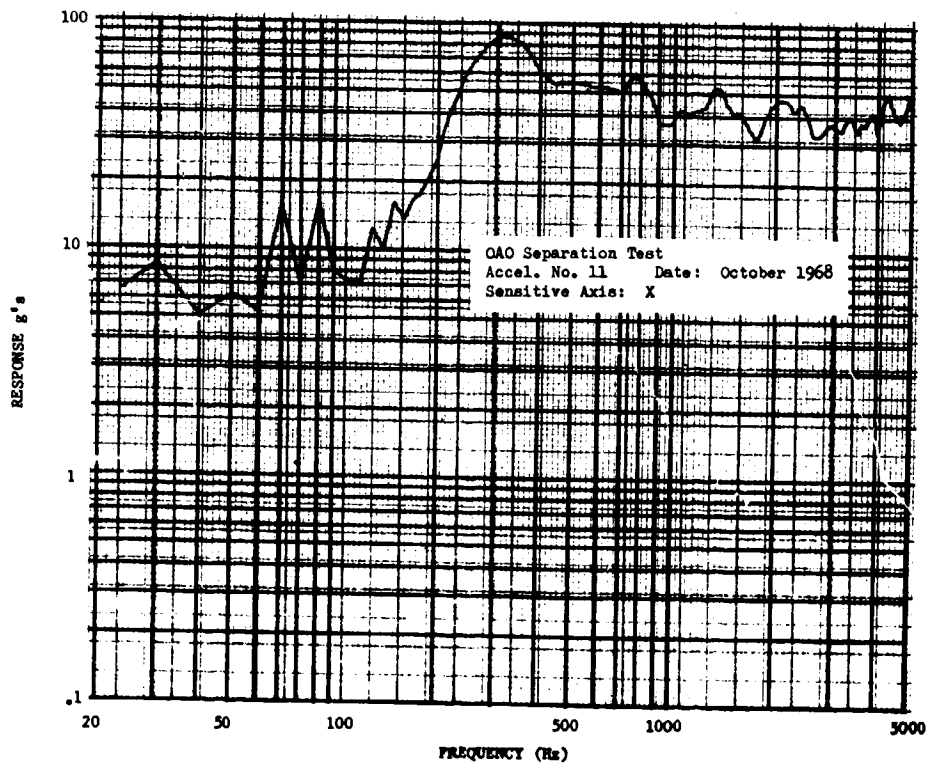
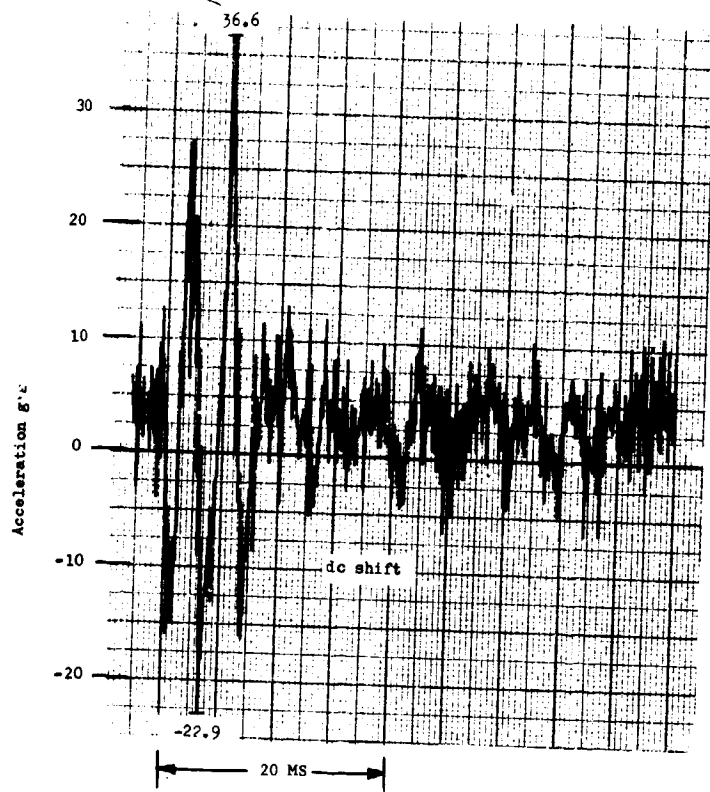


FIGURE III.B.3-5

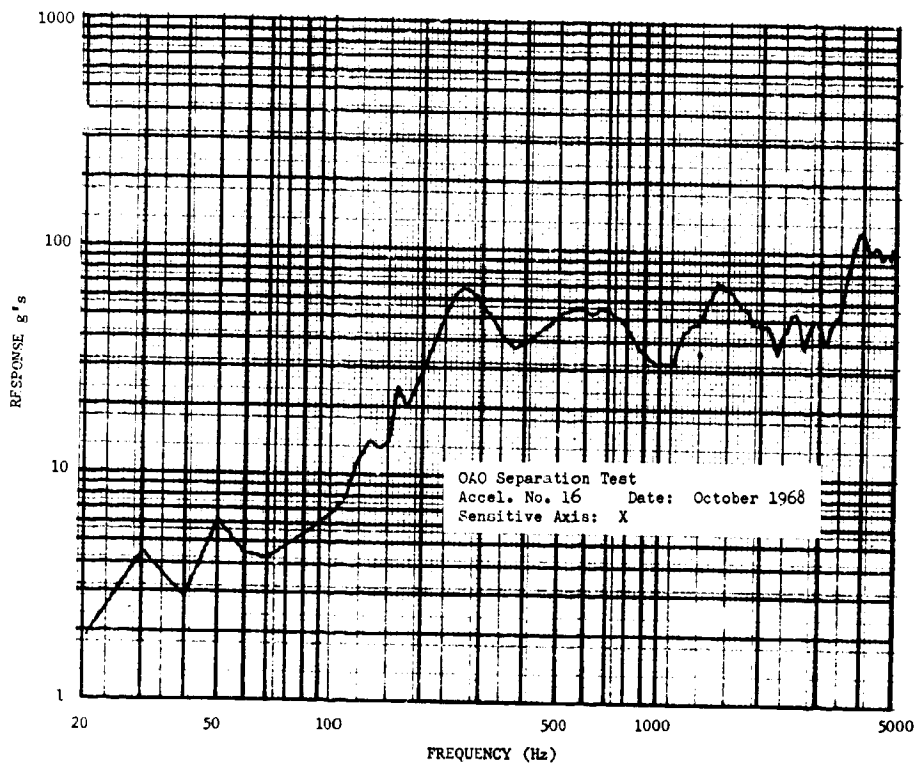
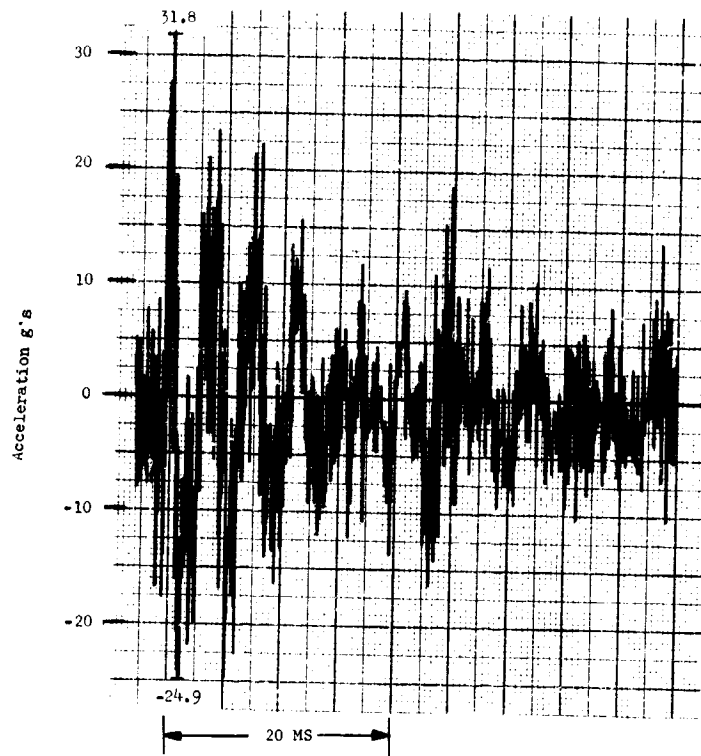


FIGURE III.B.3-6

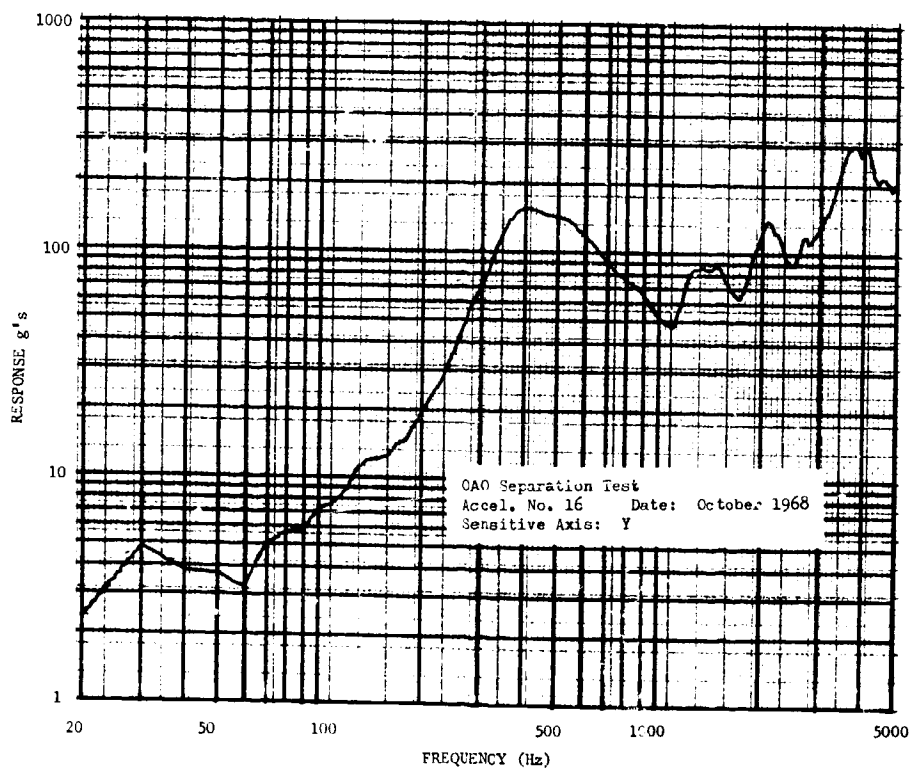
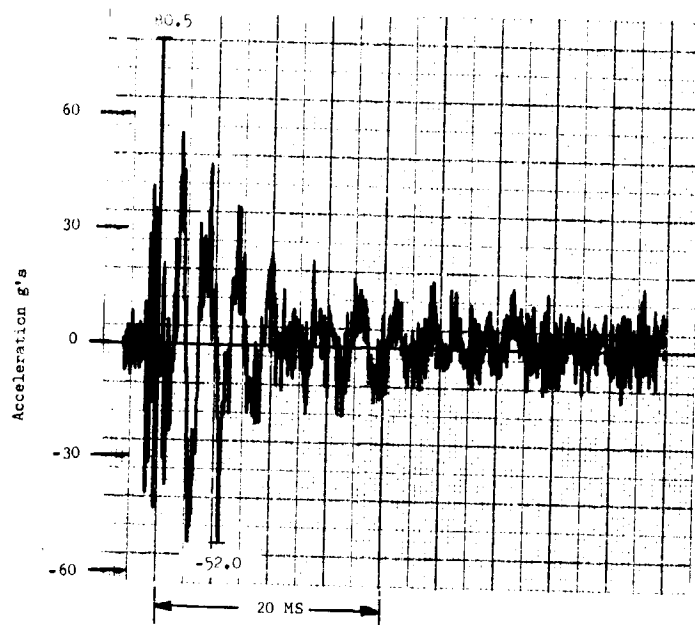


FIGURE III.B.3-7

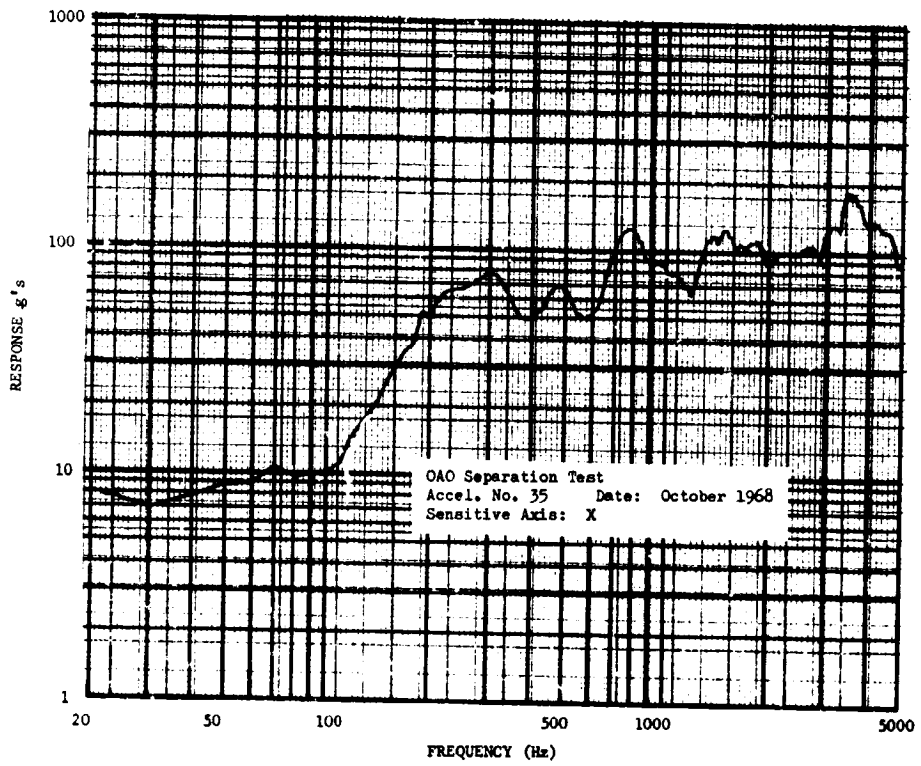
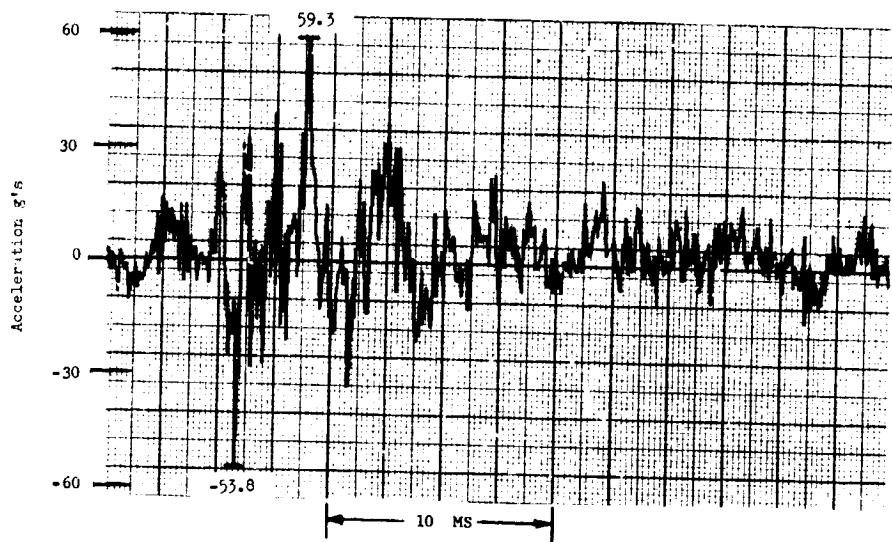


FIGURE III.B.3-8

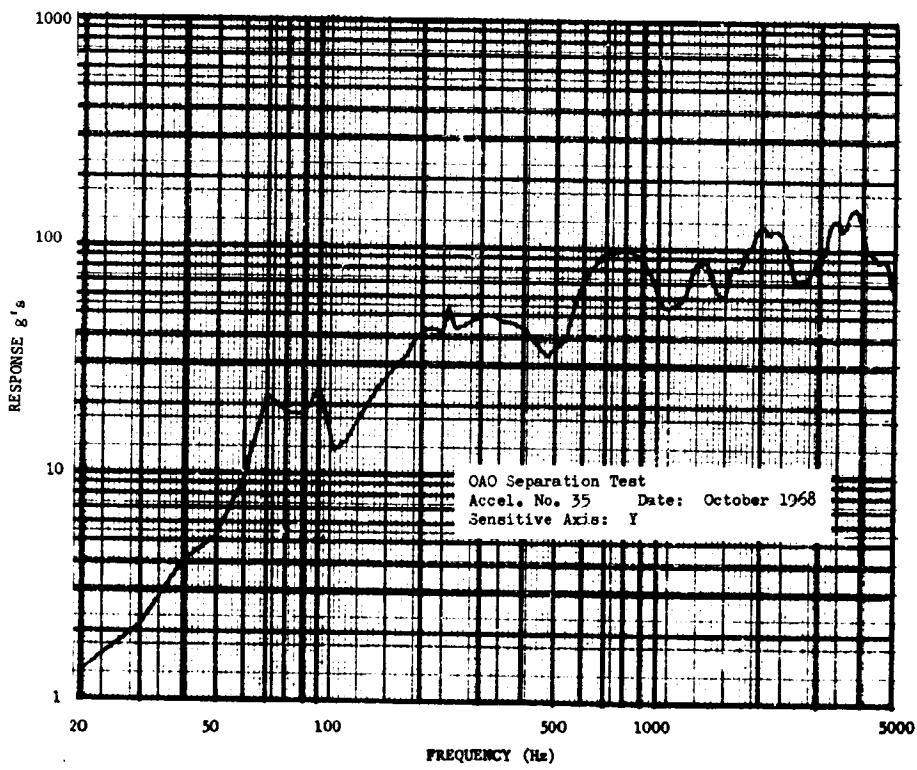
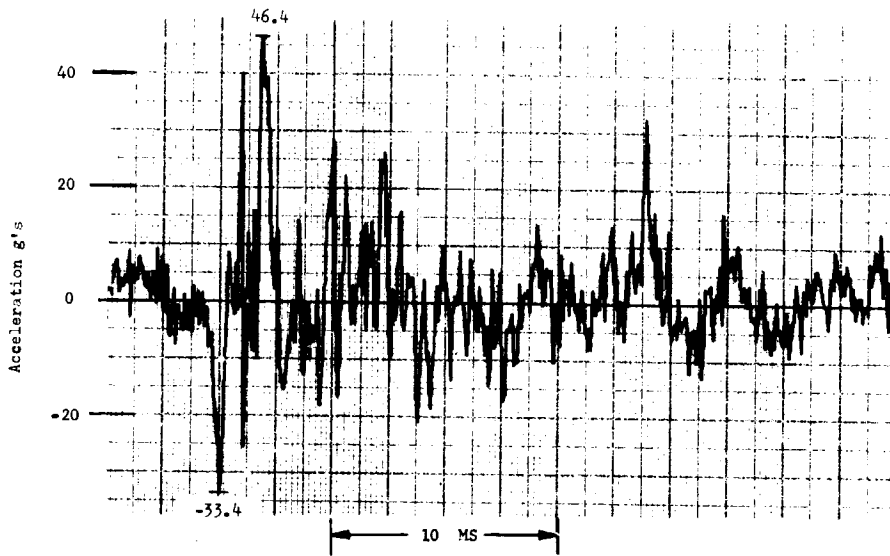


FIGURE III.B.3-9

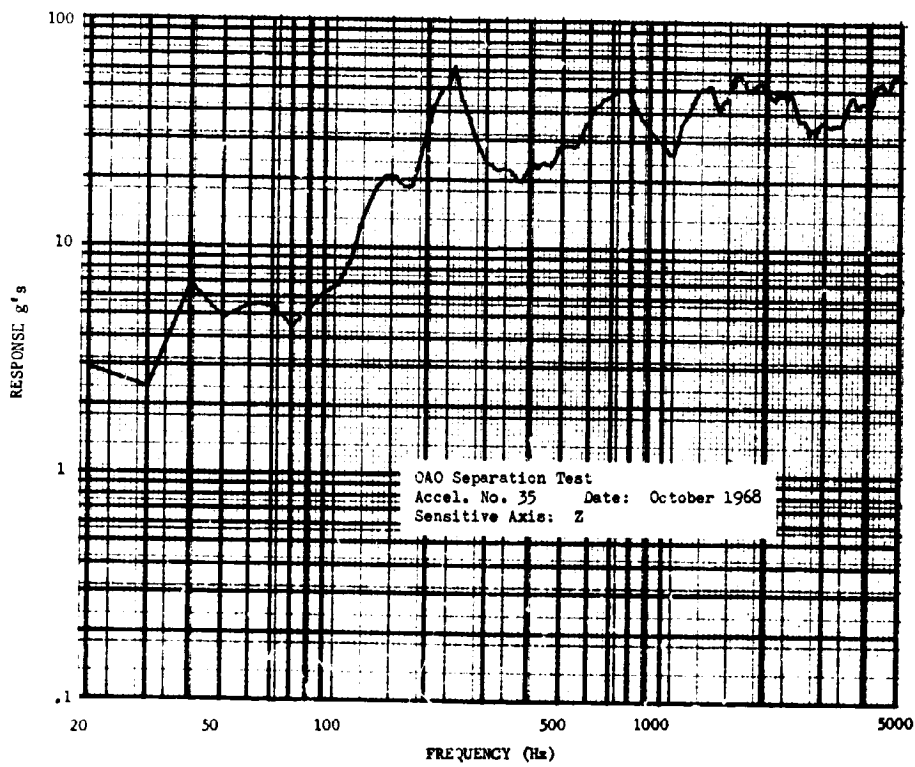
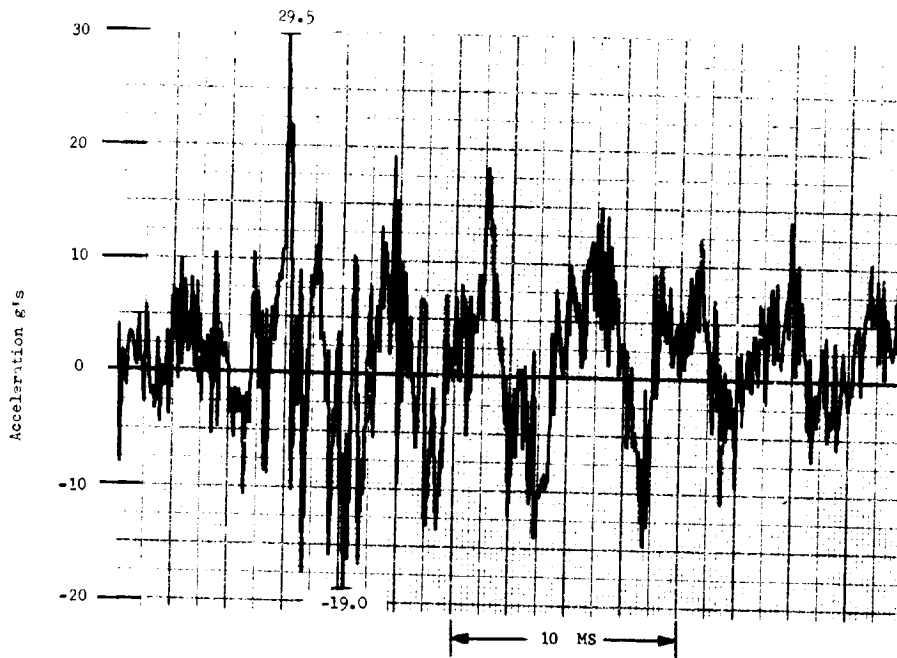


FIGURE III.B.3-10

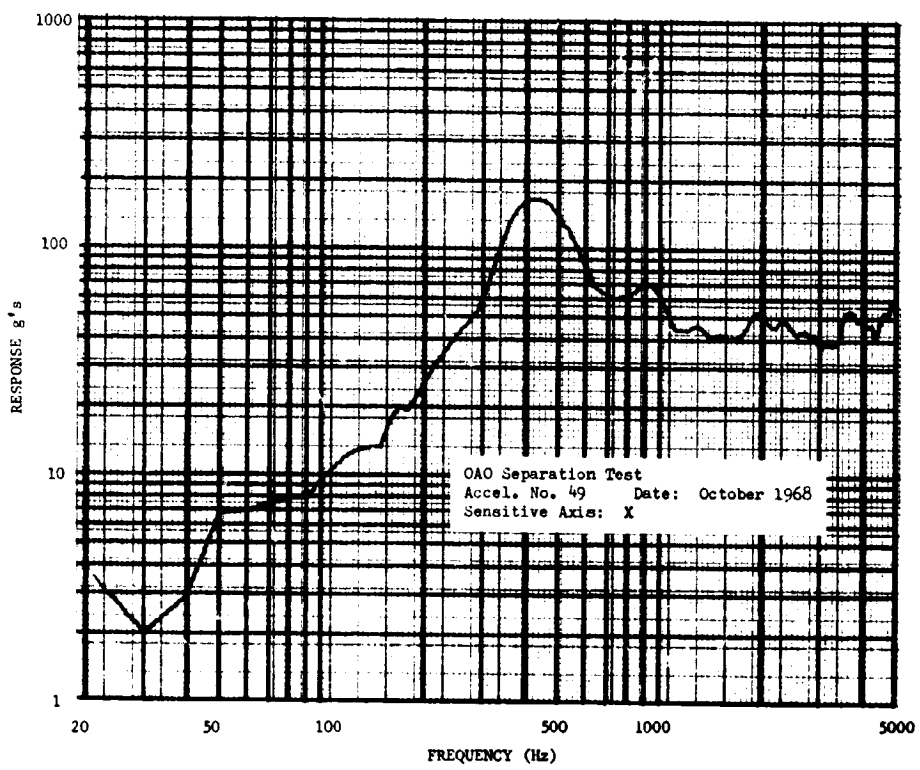
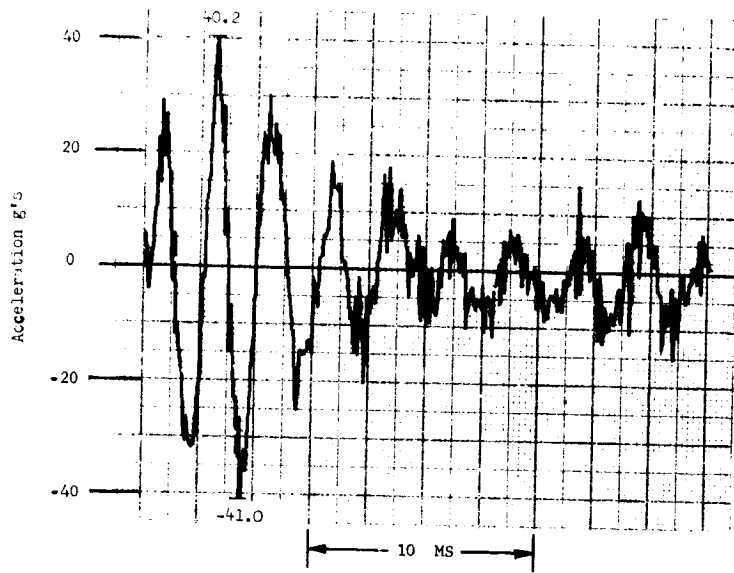


FIGURE III.8.3-11

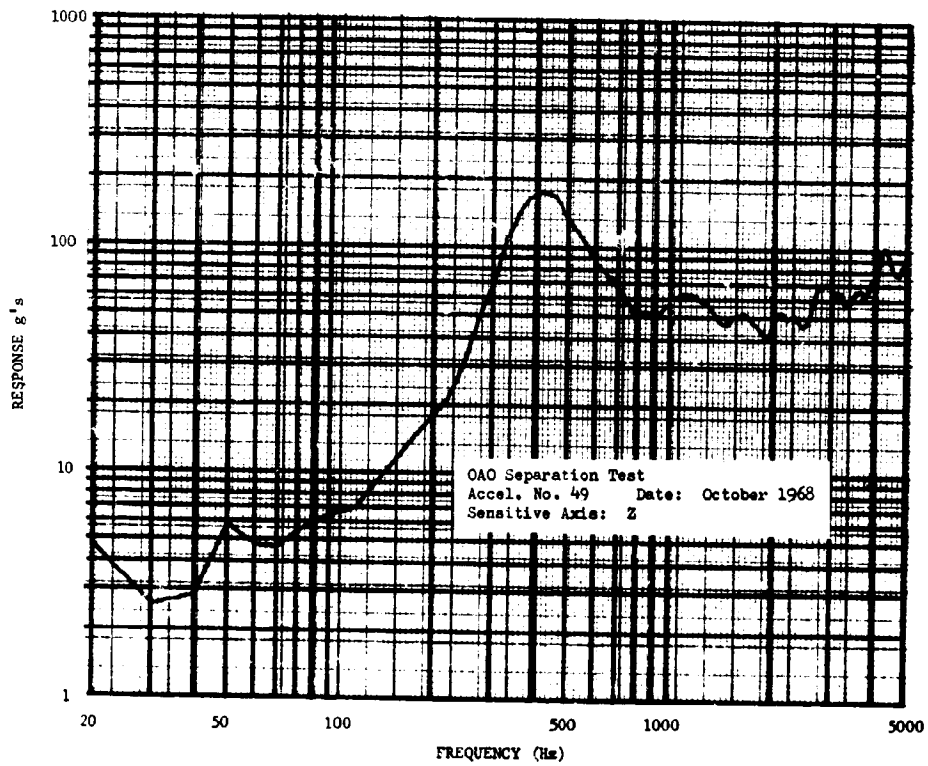
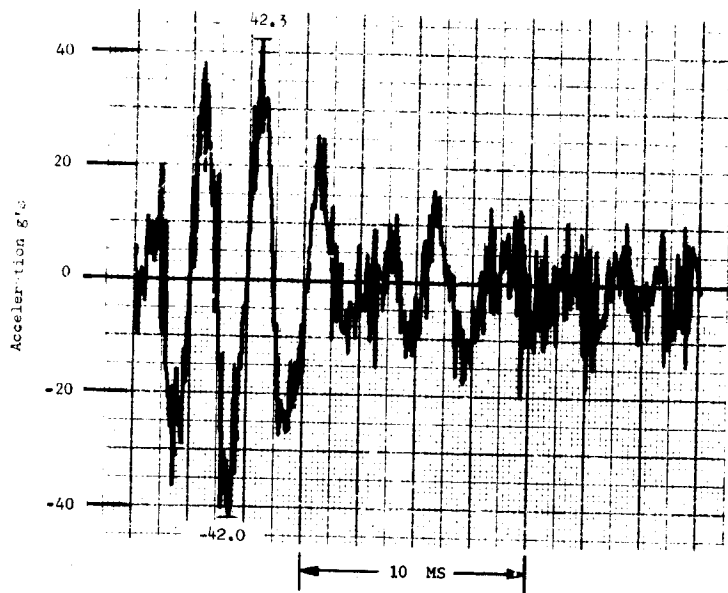


FIGURE III.B.3-12

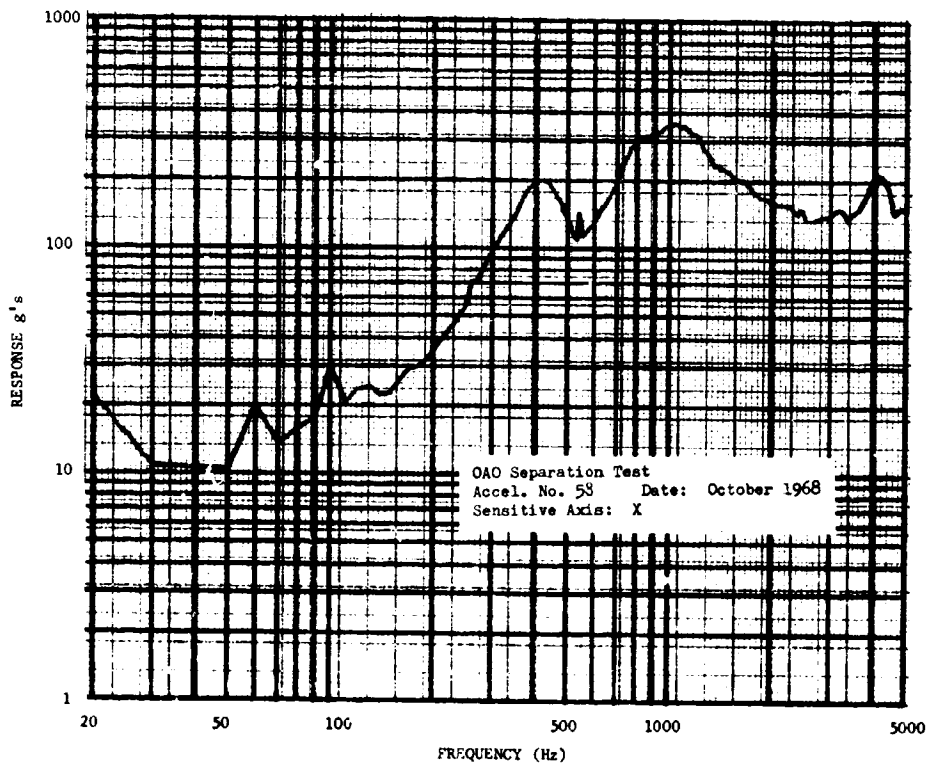
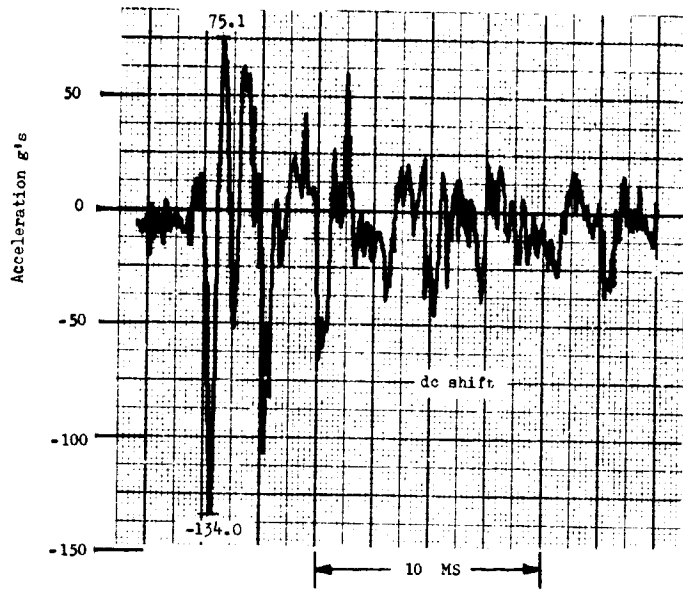


FIGURE III.B.3-13

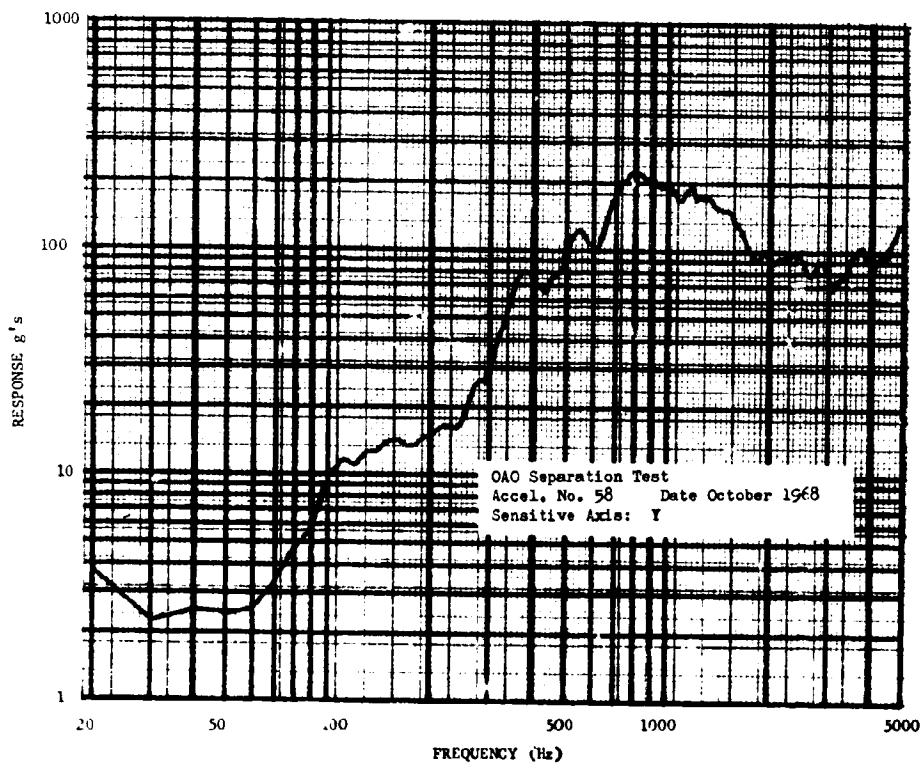
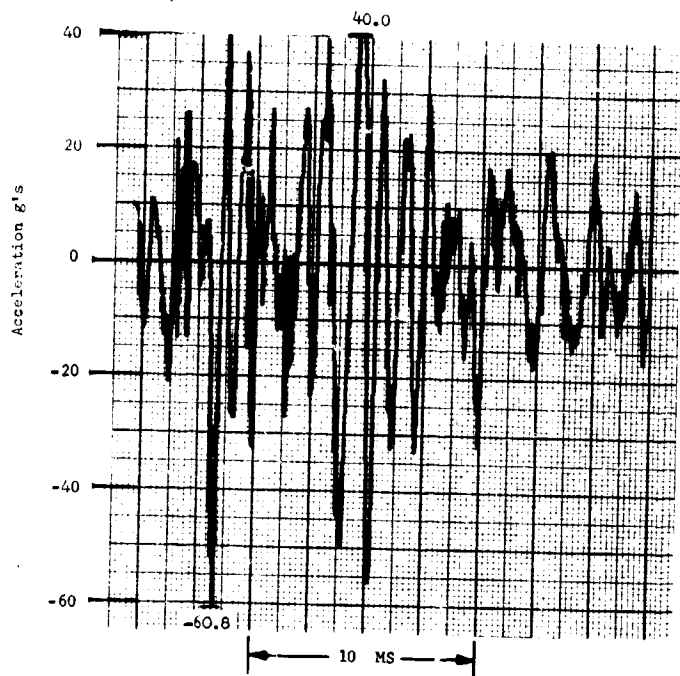


FIGURE III.B.3-14

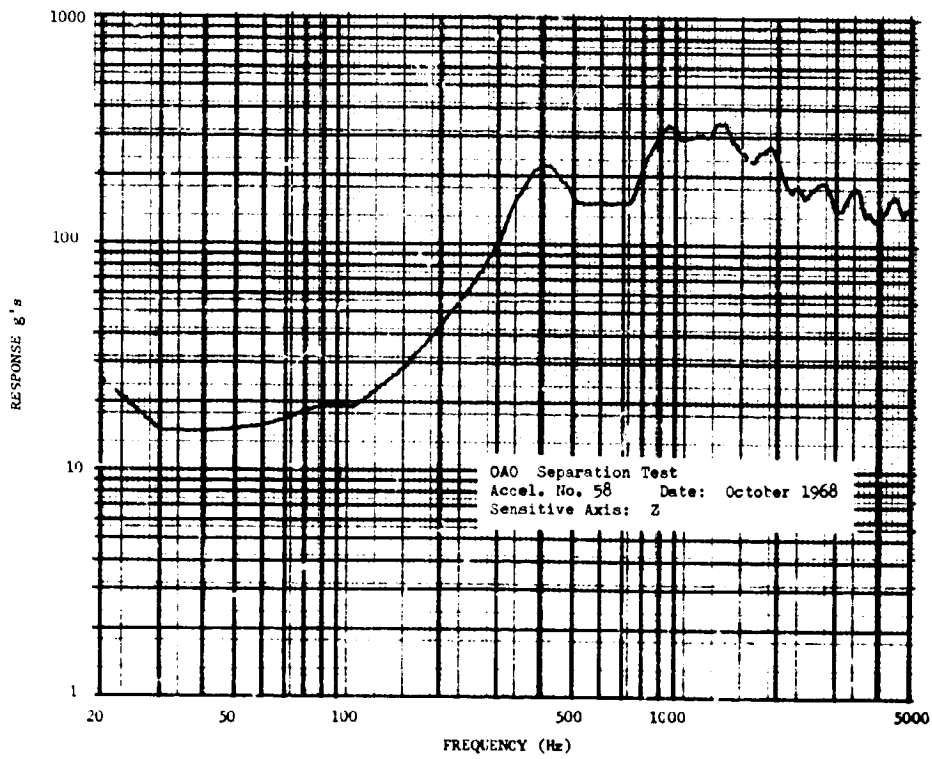
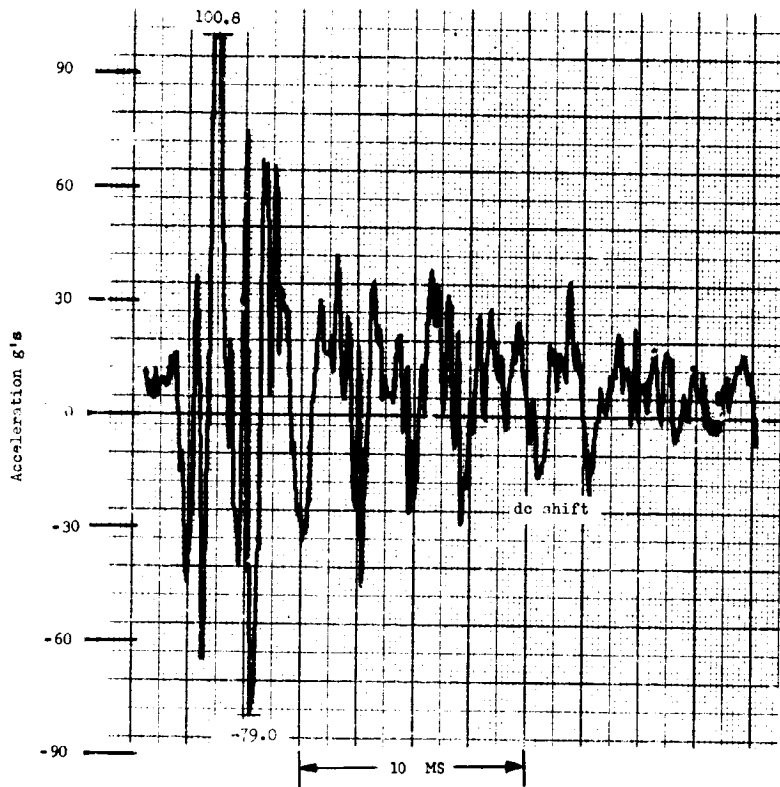


FIGURE III.B.3-15

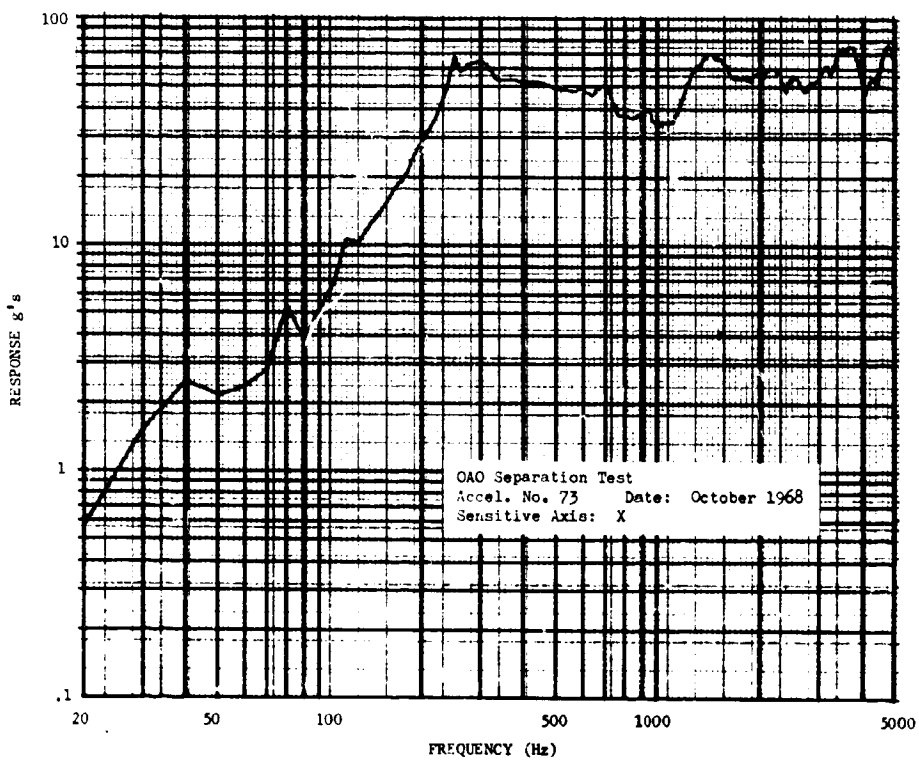
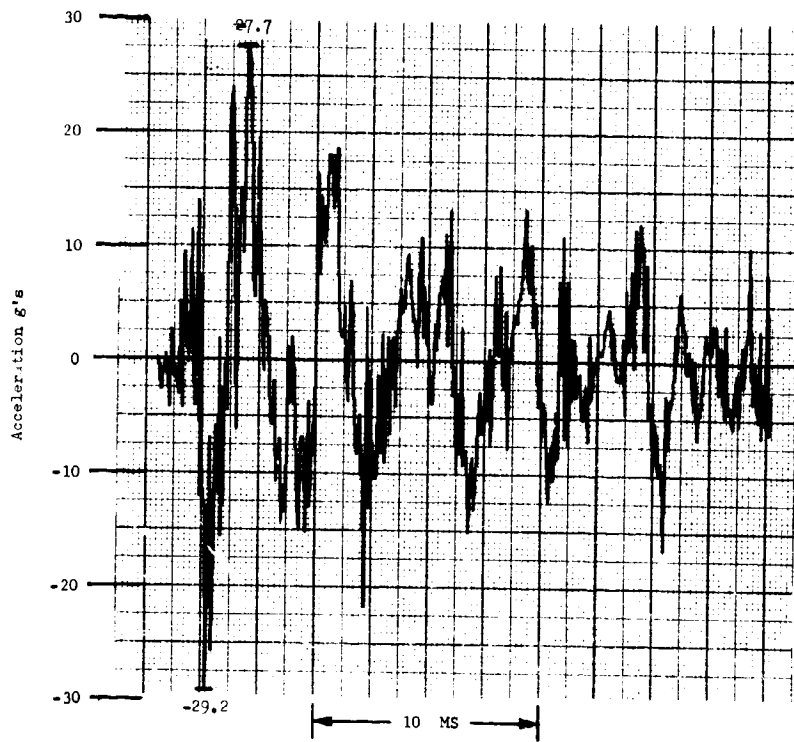


FIGURE III.B.3-16

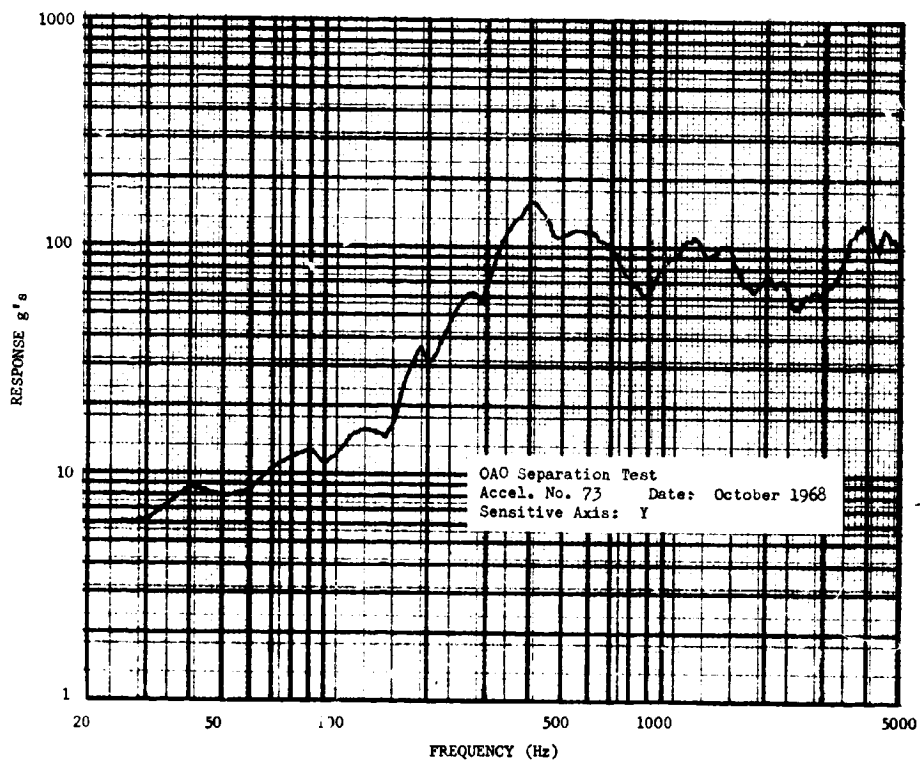
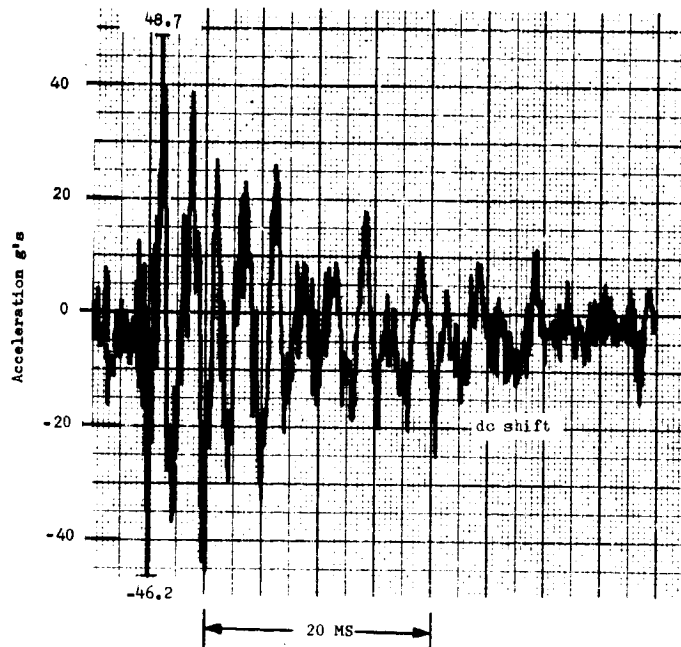


FIGURE III.B.3-17

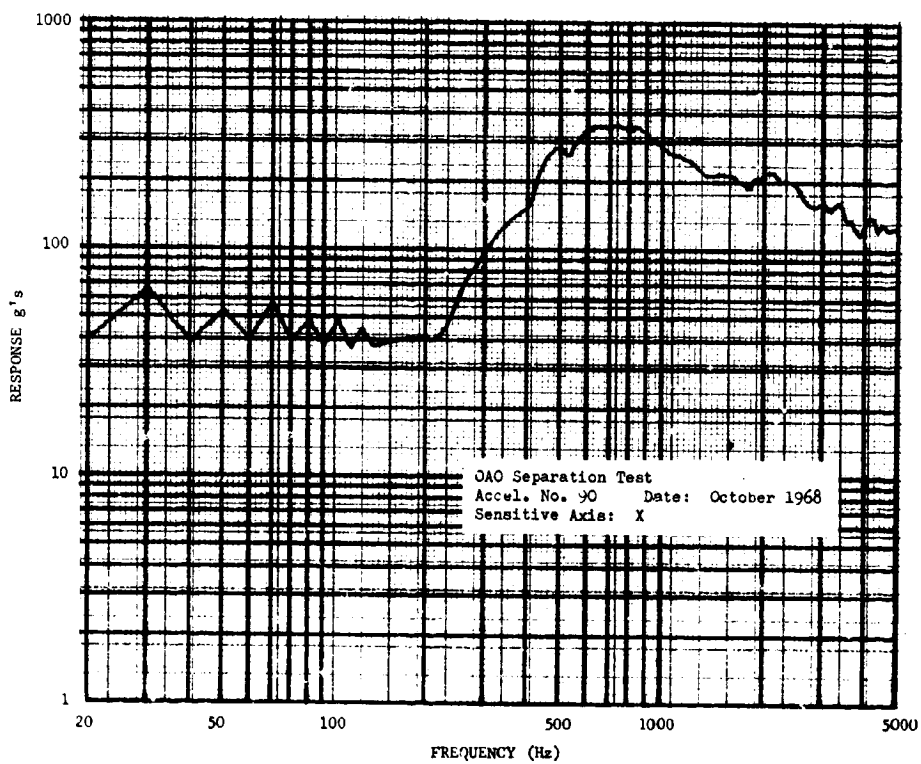
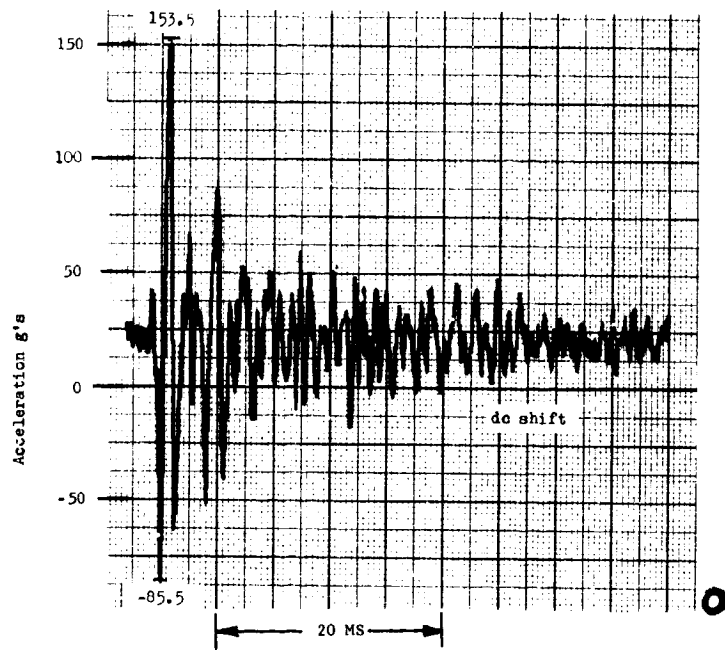


FIGURE III.B.3-18

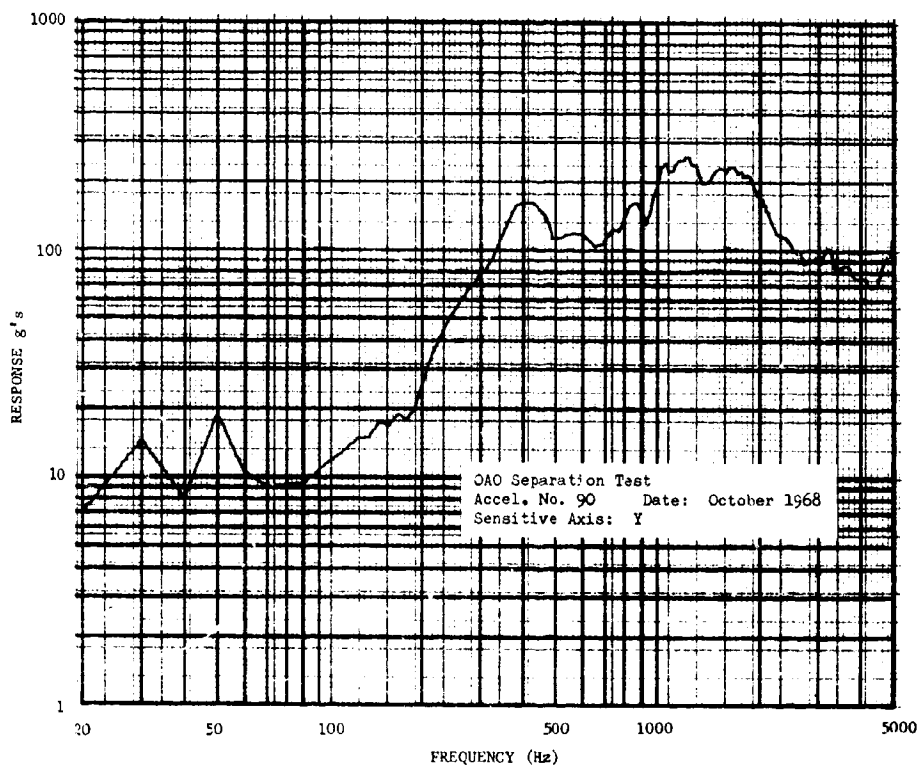
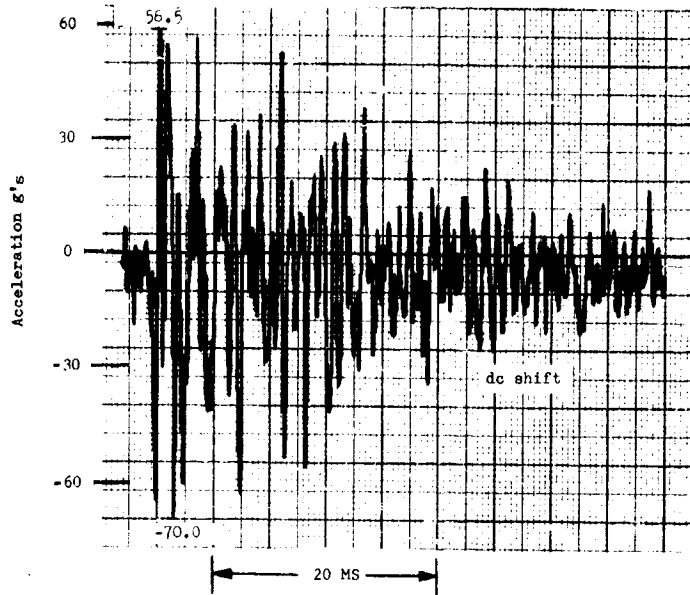


FIGURE III.8.3-19

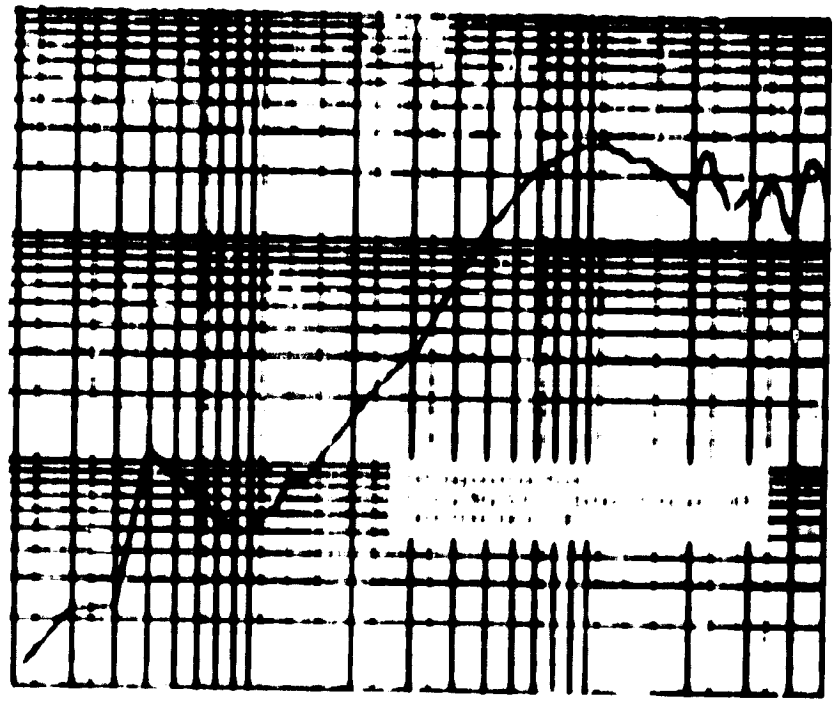
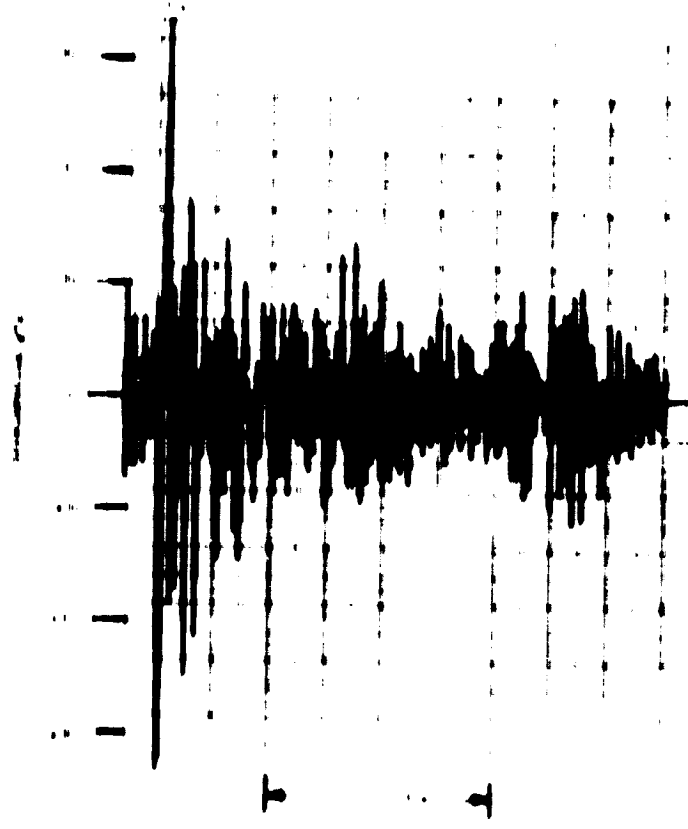


Figure 1000 Page 0

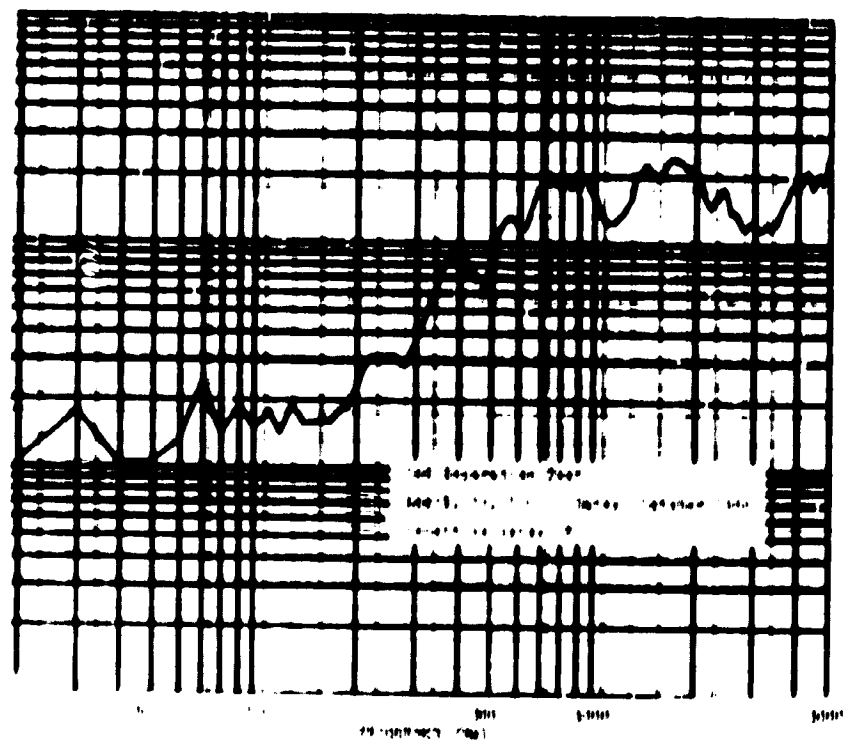
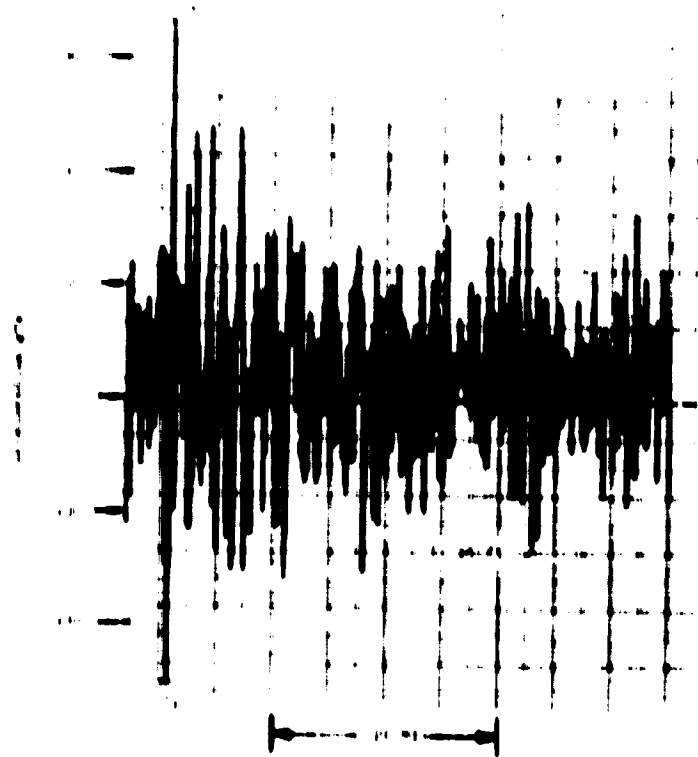


FIGURE 11.0.1-11

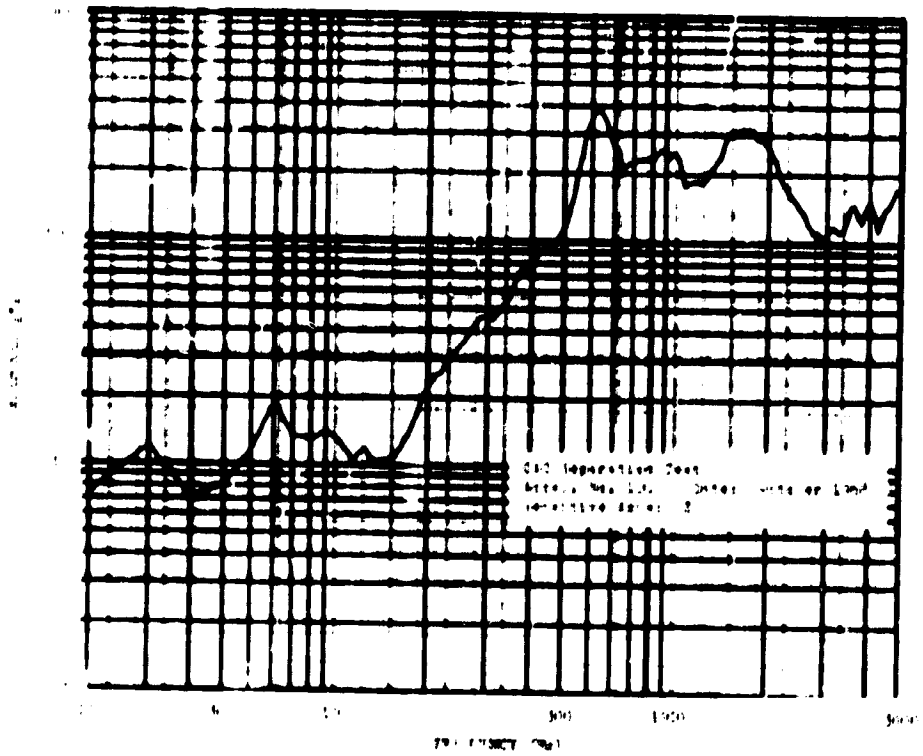
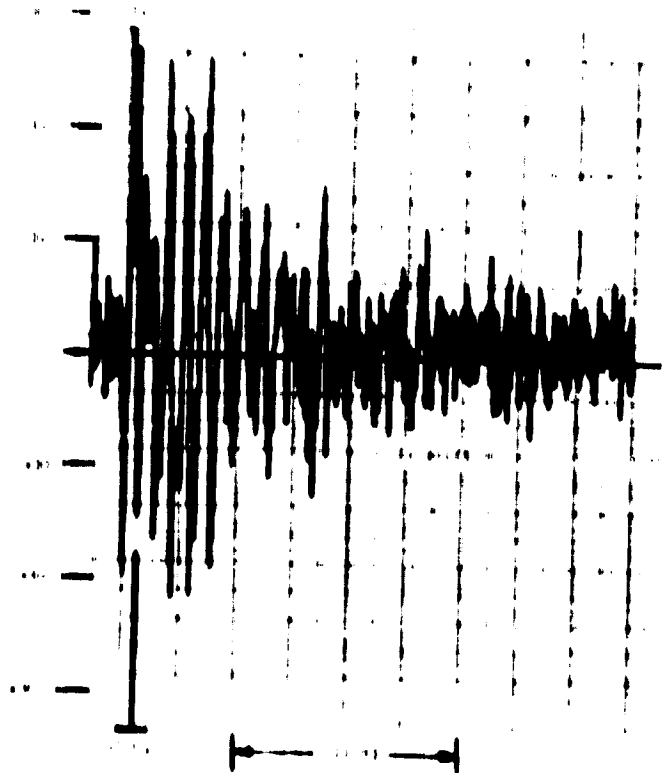


FIGURE 111.8.1-22

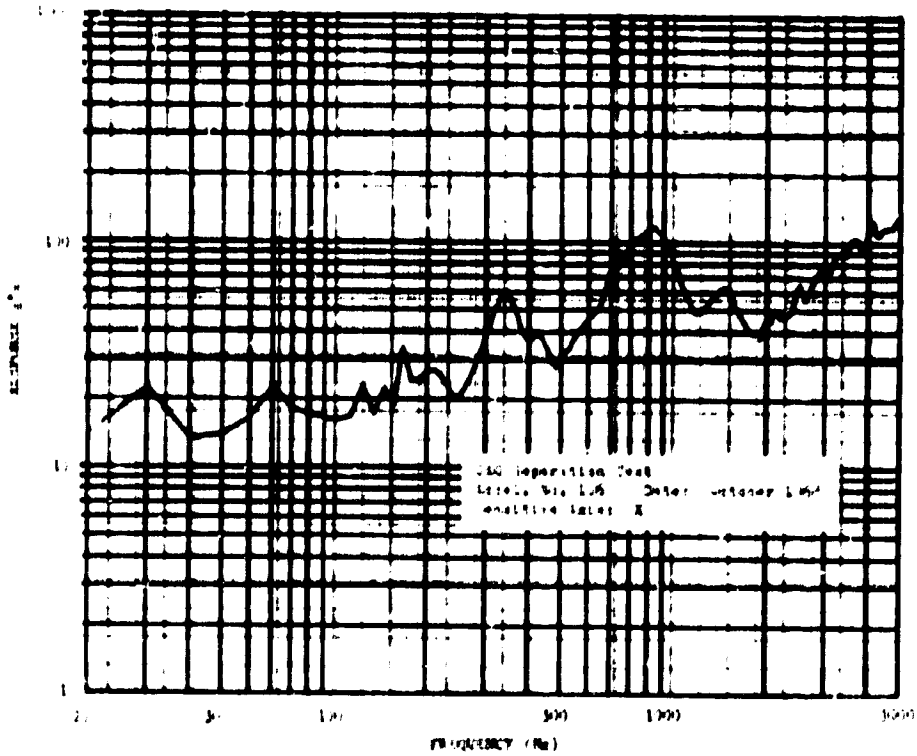
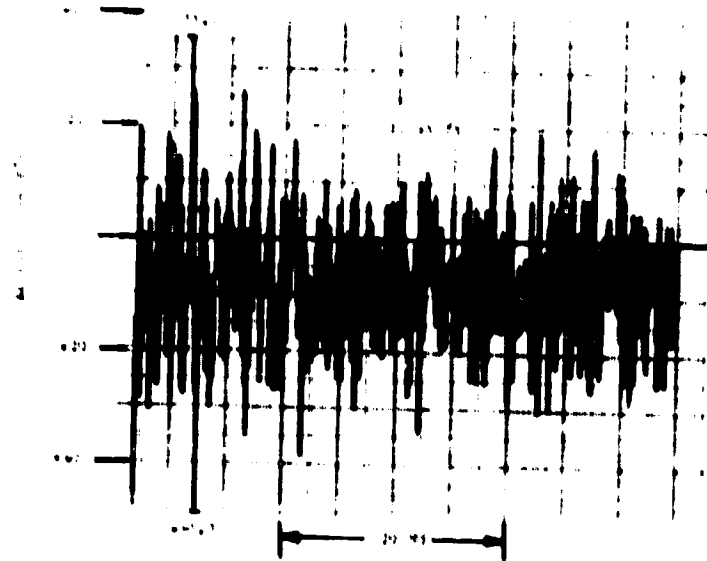


FIGURE 111.0.3-23

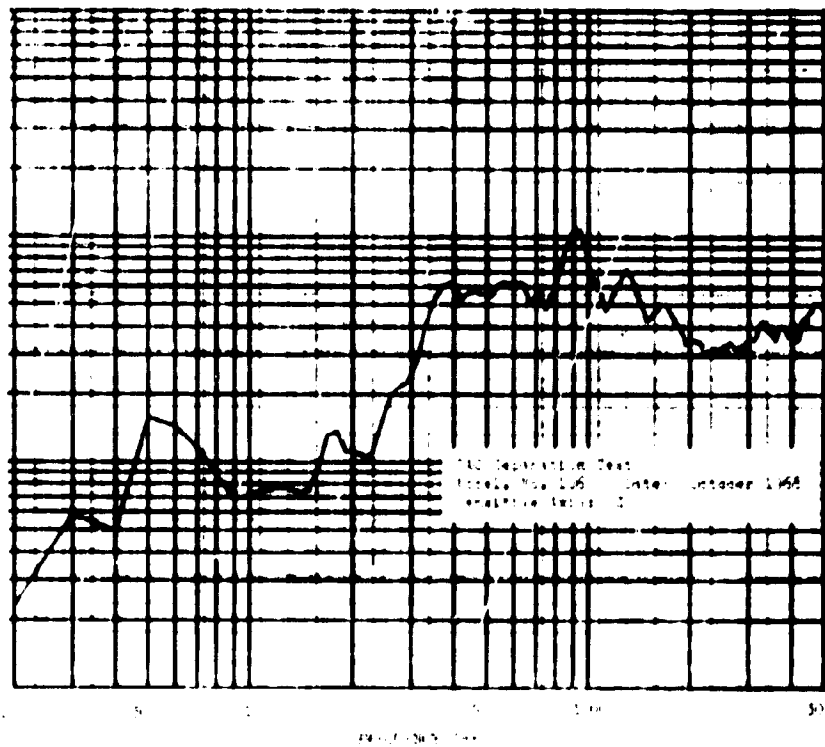
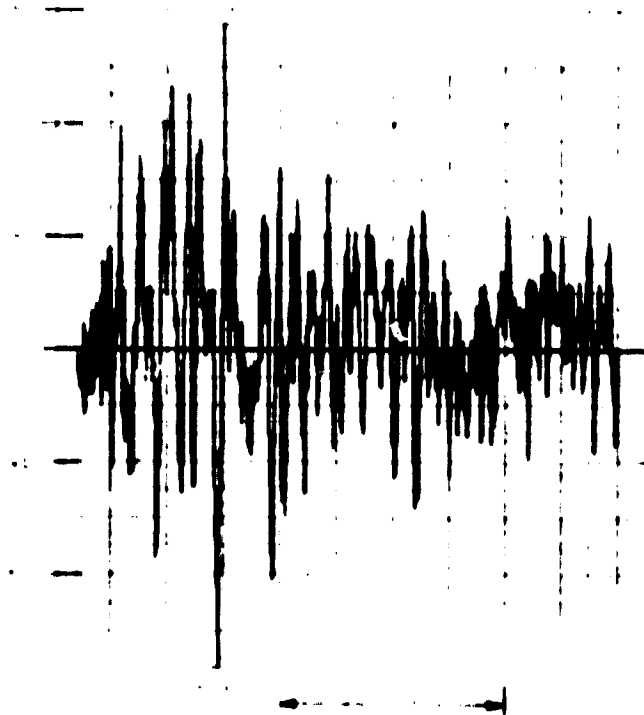


FIGURE 119.0.3-24

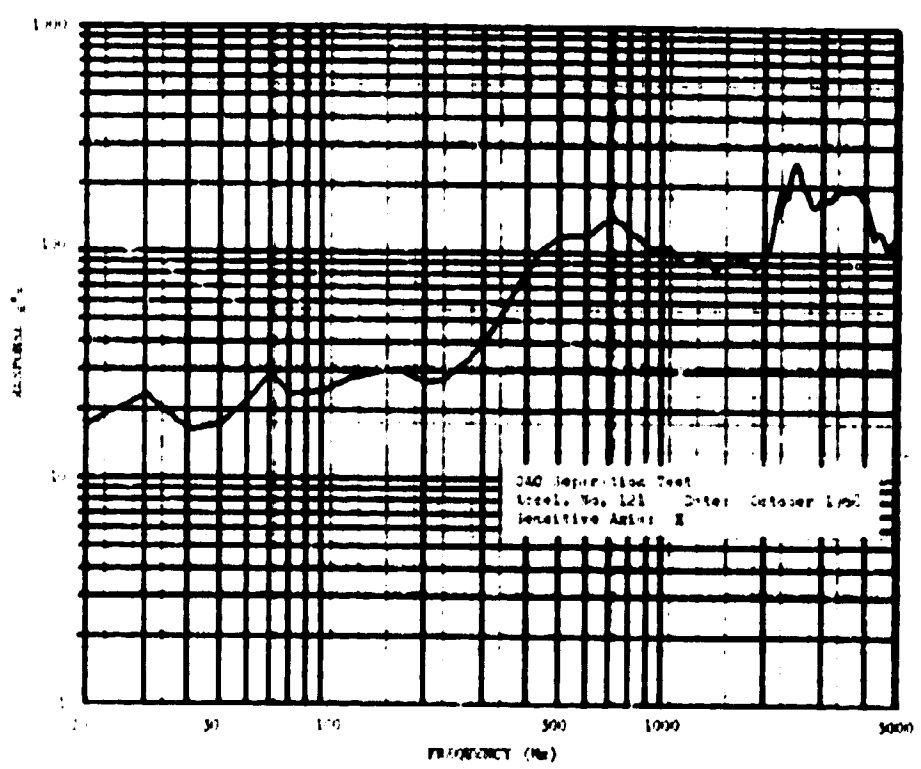
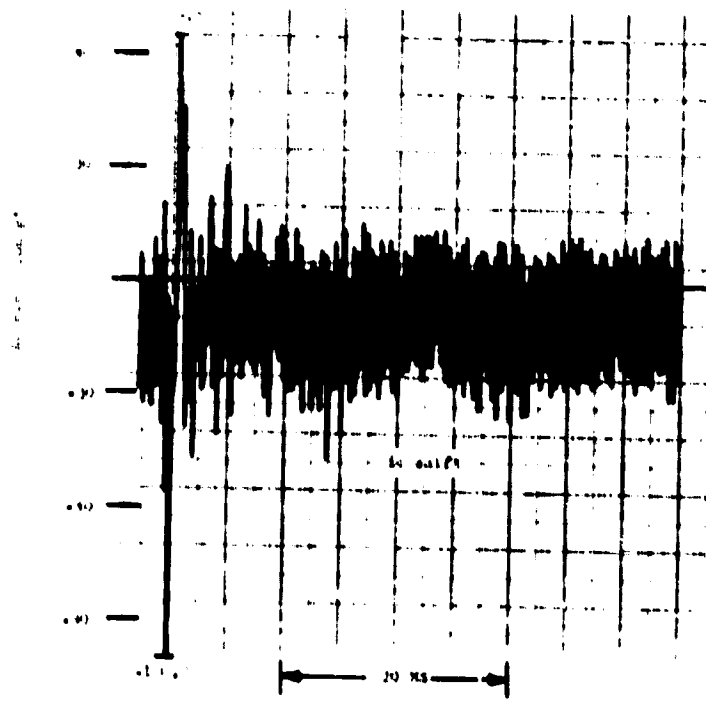


FIGURE III.0.3-25

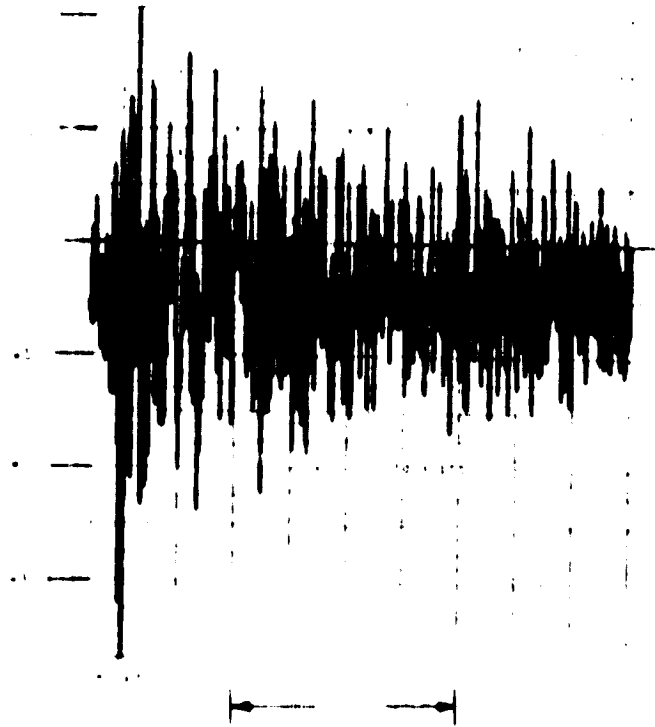


FIG. 111, R. 1-26

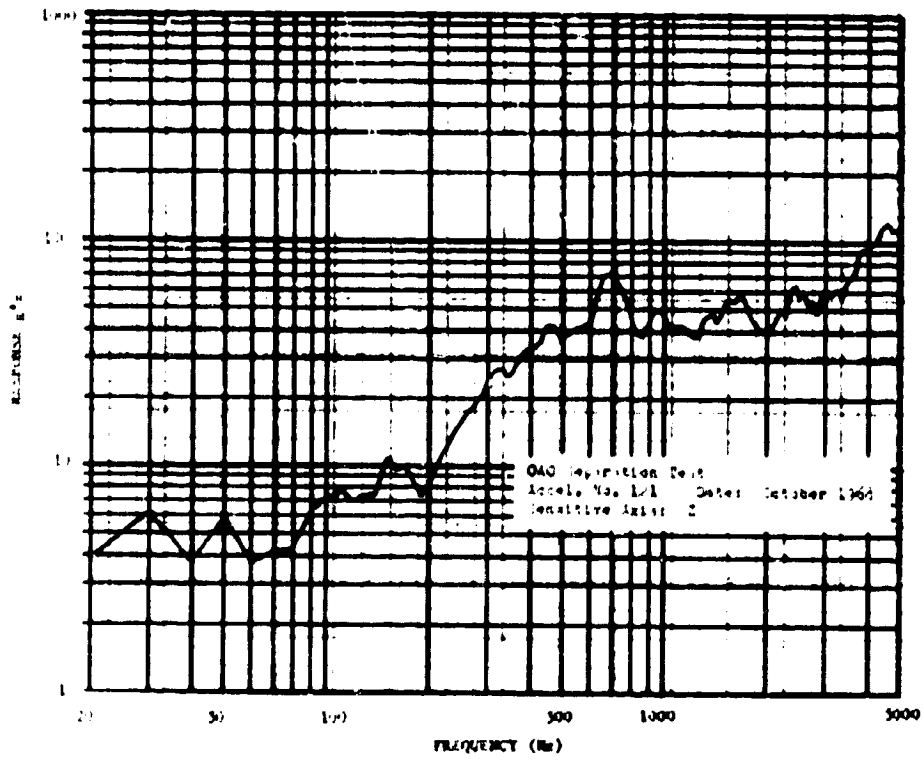
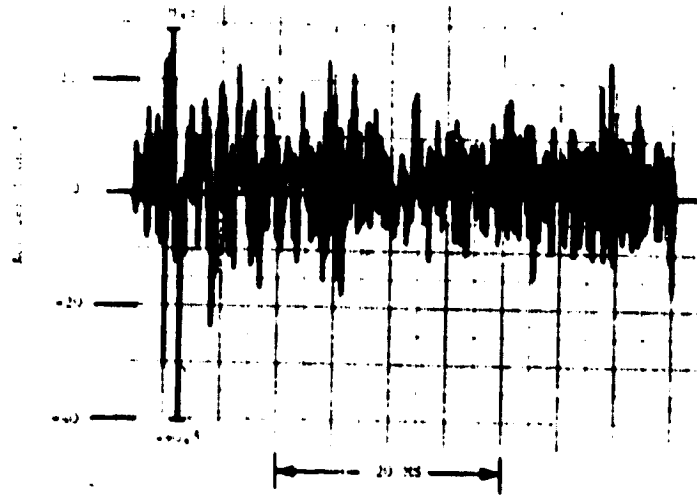


FIGURE III.B.3-27

LOCATION OF ADDITIONAL DATA

Additional pyrotechnic shock data compiled for cartridge actuated devices for propagation in truss structure may be found in the following section of Volume II:

I.B.3 Figures 12 through 21

PART III.C

**PYROTECHNIC SHOCK DATA COMPILED FOR
CARTRIDGE ACTUATED DEVICES IN
STRUCTURES OTHER THAN SKEL.-RING-FRAME
OR TRUSS**

SECTION III.C.1

1DCSP/A DEVELOPMENT MODEL 2 SEPARATION SHOCK TEST

PURPOSE OF TEST

The primary objective of the test was to develop and verify shock testing techniques for use in follow-on qualification tests on the apogee boost motor and the qualification spacecraft.

DESCRIPTION OF EVENT

The test configuration depicted in Figure III.C.1-1 consisted of the 1DCSP/A Development Model 3 Spacecraft supported by a spring suspension system from the ceiling of the test chamber. A marmon attach clamp identical to the flight article connected the adapter section, simulating the expanded third stage booster, to the aft end of the spacecraft. Separation consisted of the firing of two ordnance bolts cutters which severed their respective bolts to allow the release of the marmon clamp. Upon separation, the adapter section fell freely for three feet, a fall which was arrested by a foam pad on the floor.

DESCRIPTION OF DATA

No. of time histories	6
Duration	0.10 seconds (approx.)
No. of shock spectra	6

Type of analysis	Digital
Sample rate	10,000/second
Frequency range	to 10,000 Hz
Valid frequency range	not above 2,000 Hz
Display	(7-10)

These shock spectra are presented along with their corresponding time histories as Figures III.C.1-1 through III.C.1-6.

DESCRIPTION OF FIXTURES

Two ordnance bolt cutters located in the margin attach clamp as shown in Figure III.C.1-2.

DESCRIPTION OF STRUCTURE

The structure is illustrated in Figure III.C.1-1. The weights of the two primary components are as follows:
 Spacecraft = 525 lb.
 Adapter section = 155 lb.

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225
 Locations: Table III.C.1-1 and Figures III.C.1-1 and III.C.1-2
 Axis of sensitivity: Table III.C.1-1

DISCUSSION

The time histories in Figures III.C.1-4 and III.C.1-7 appear to have a DC offset. The effect of this offset can be observed as a constant acceleration in the low frequency range on the shock spectra.

Due to the rather low sampling rate of 1,000 per second the shock spectra are not considered valid for frequencies above 1,000 to 2,000 Hz.

TABLE III.C.1-1

IDENTIFICATION AND LOCATION OF ACCELEROMETERS

<u>Accelerometer No.</u>	<u>Location</u>	<u>Sensitive Axis</u>	<u>Figure No.</u>
7	Separation flange at bolt cutter between -Y and -Z axes	axial	III.C.1-3
8	Separation flange at bolt cutter between -Y and -Z axes	tangential	III.C.1-4
9	Separation flange at bolt cutter between -Y and -Z axes	radial	III.C.1-5
10	Separation flange 90° from bolt cutter between +Y and -Z axes	tangential	III.C.1-6
11	Separation flange 90° from bolt cutter between +Y and -Z axes	axial	III.C.1-7
12	Separation flange 90° from bolt cutter between +Y and -Z axes	radial	III.C.1-8

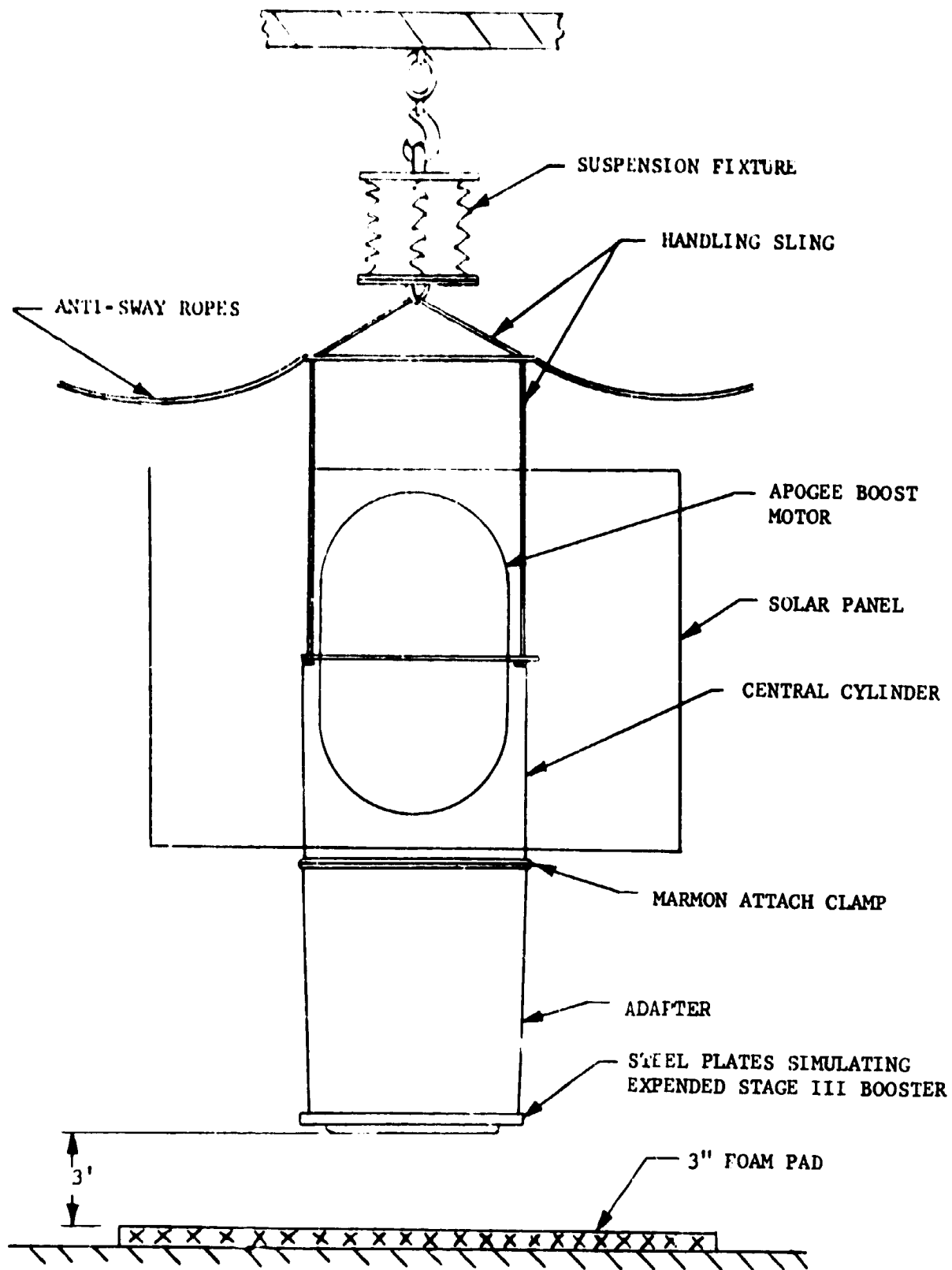


FIGURE III.C.1-1
 SEPARATION SHOCK TEST CONFIGURATION

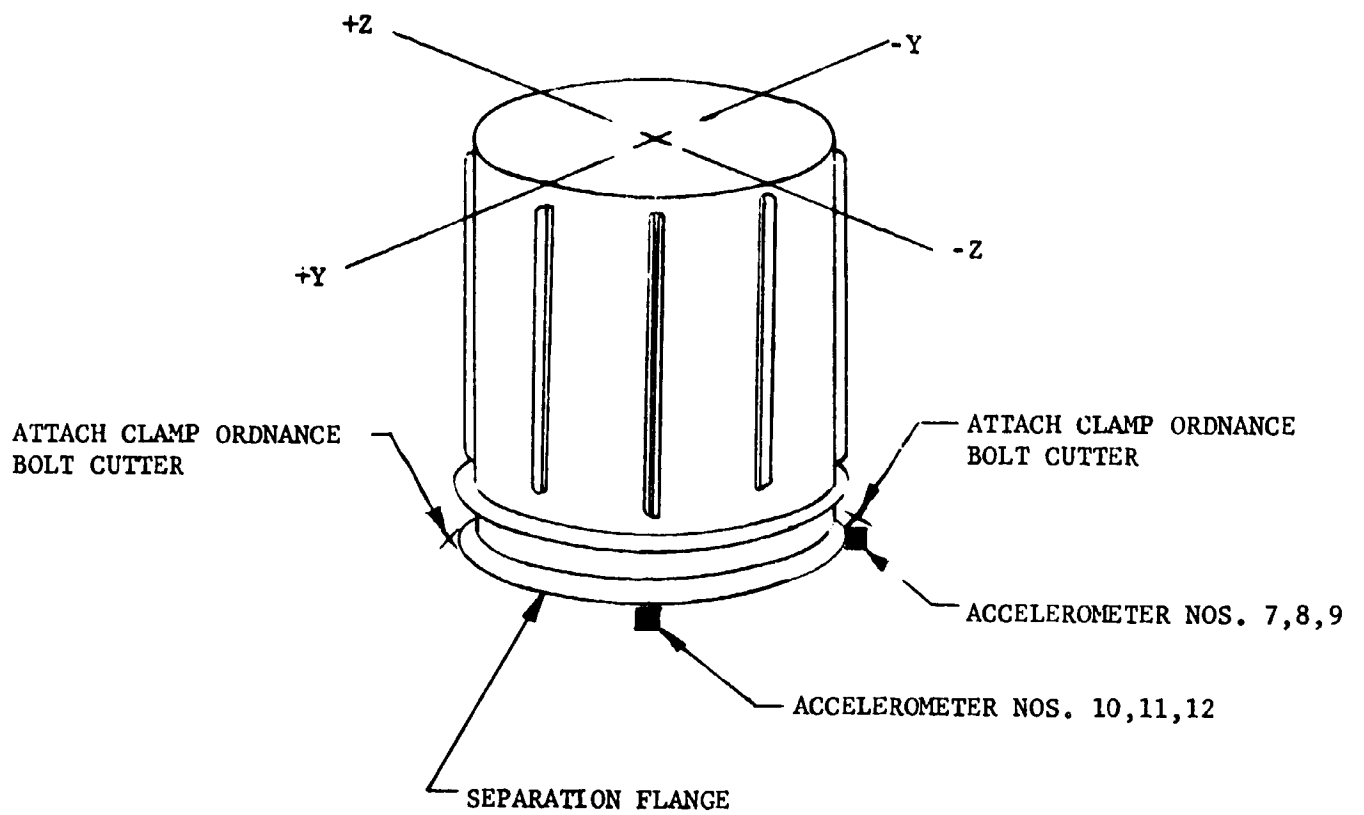


FIGURE III.C.1-2
 ACCELEROMETER LOCATIONS ON CENTRAL CYLINDER

TEST ITEM UCSP/A DEVELOPMENT MODEL 2 SPACECRAFT

ITEM NO. 7 TEST DATE APRIL 1968

SHOCK AXIS AXIAL SHOCK NO. _____

RESPONSE G's

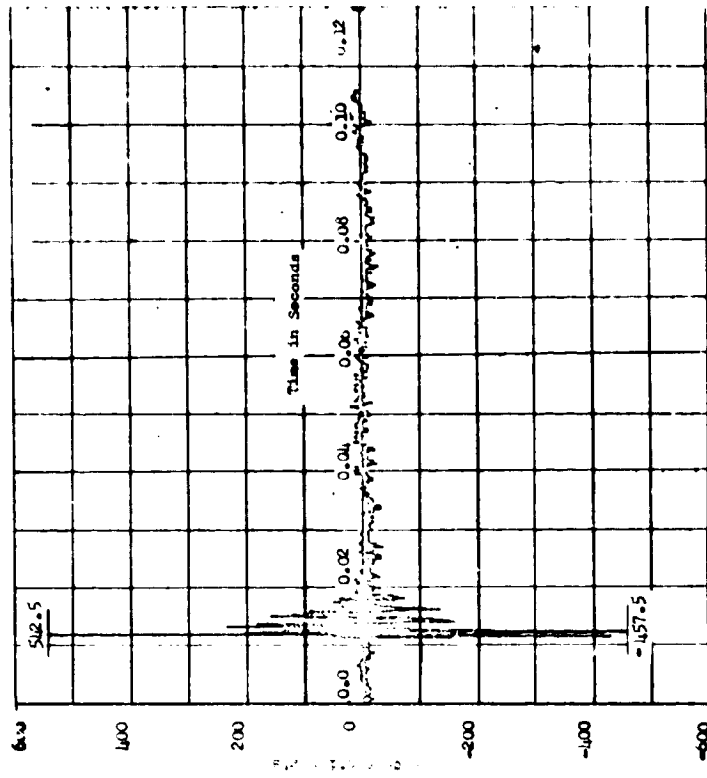
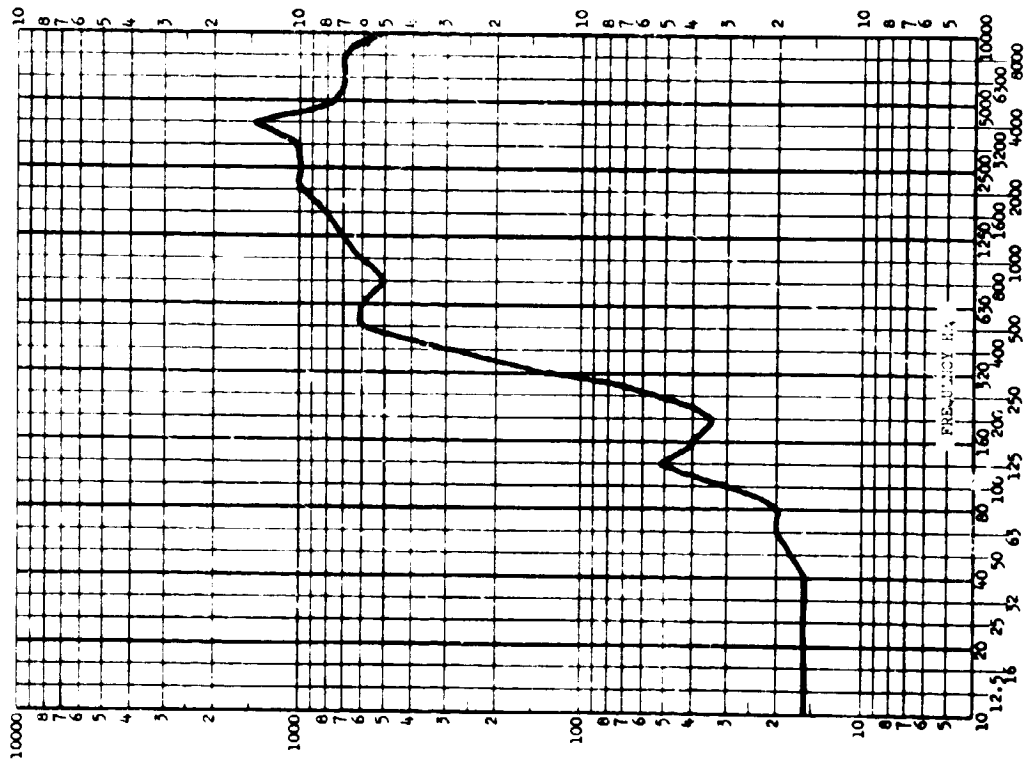


FIGURE III.C.1-3

TEST ITEM LCSP/A DEVELOPMENT MODEL 2 SPACECRAFT
 A.I.D. NO. 8 TEST DATE APRIL, 1968
 SHOCK AXIS TANGENTIAL SHOCK NO. _____

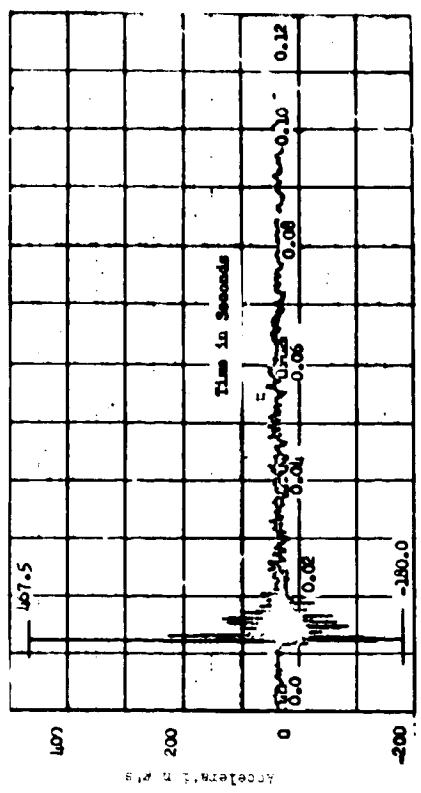
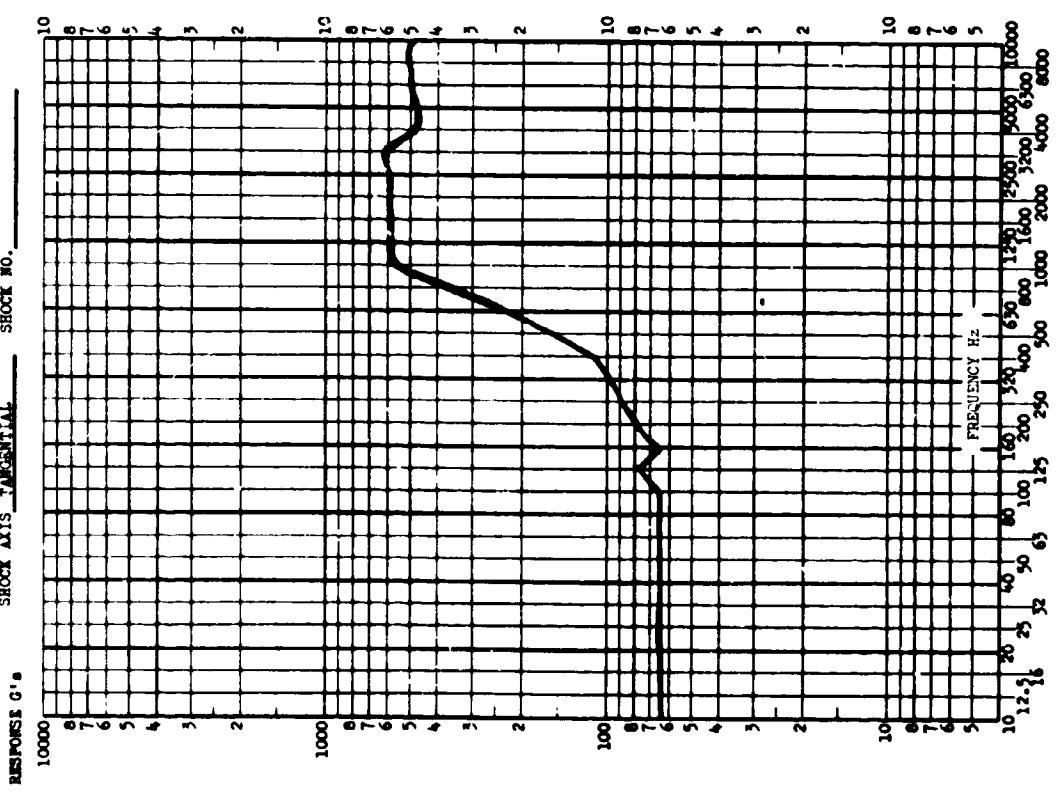


FIGURE III.C.1-4

TEST ITEM LUCSE/A DEVELOPMENT MODEL 2 SPACECRAFT
 SERIAL NO. 9 TEST DATE APRIL 1968
 SHOCK AXIS RADIAL SHOCK NO. _____

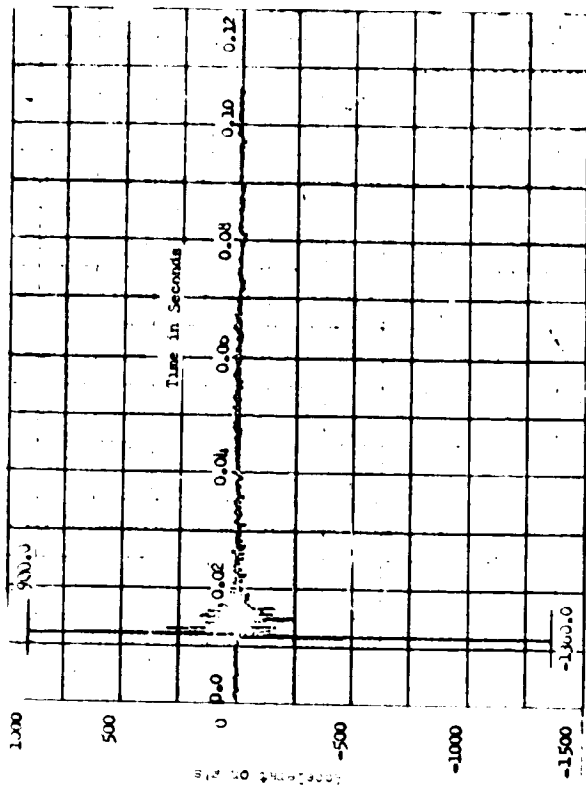
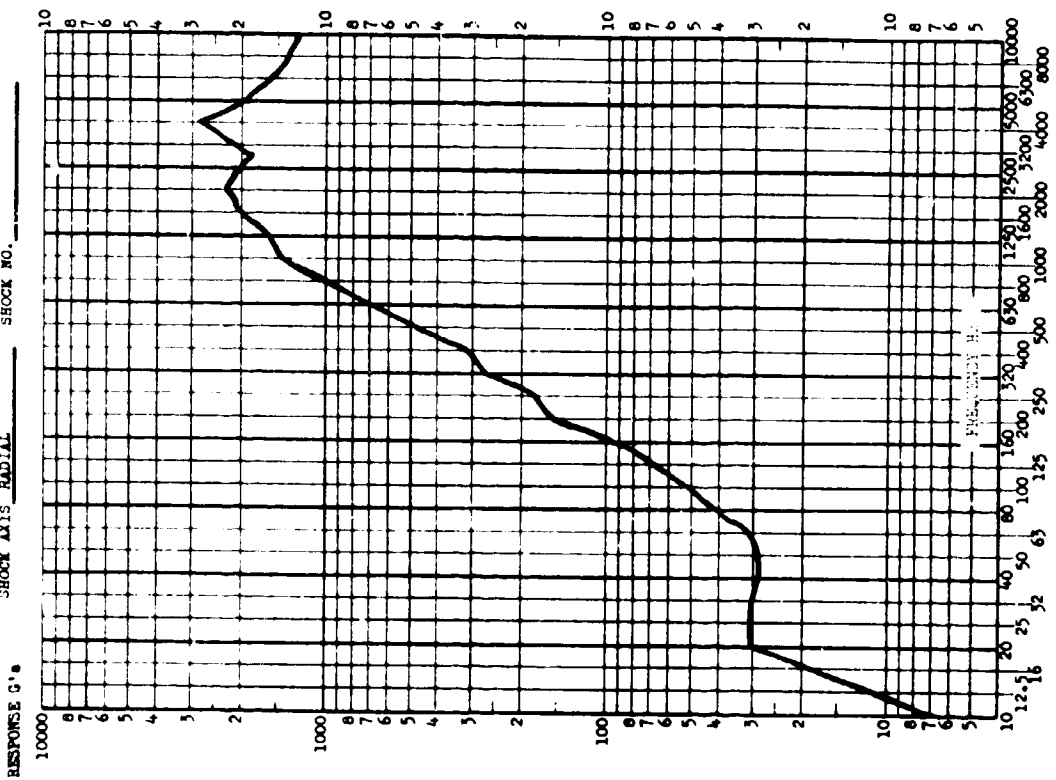


FIGURE III.C.1-5

TEST ITEM LCSB/A DEVELOPMENT MODEL 2 SPACECRAFT
 SERIAL NO. 10 TEST DATE APRIL 1968
 SHOCK AXIS TANGENTIAL SHOCK NO. _____

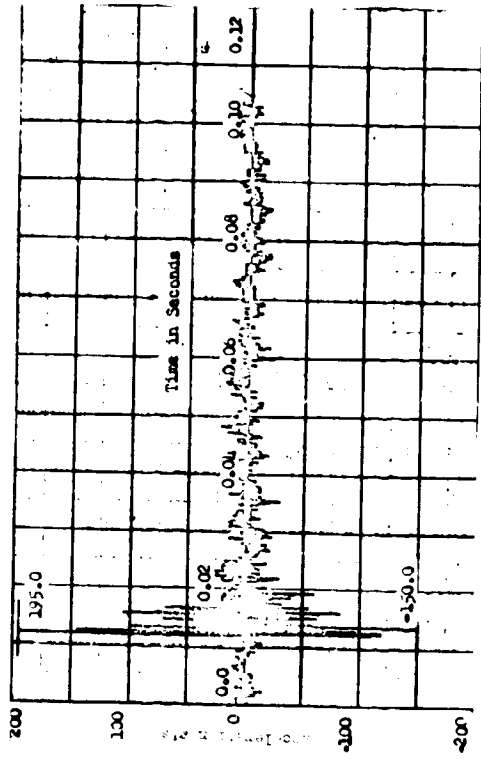
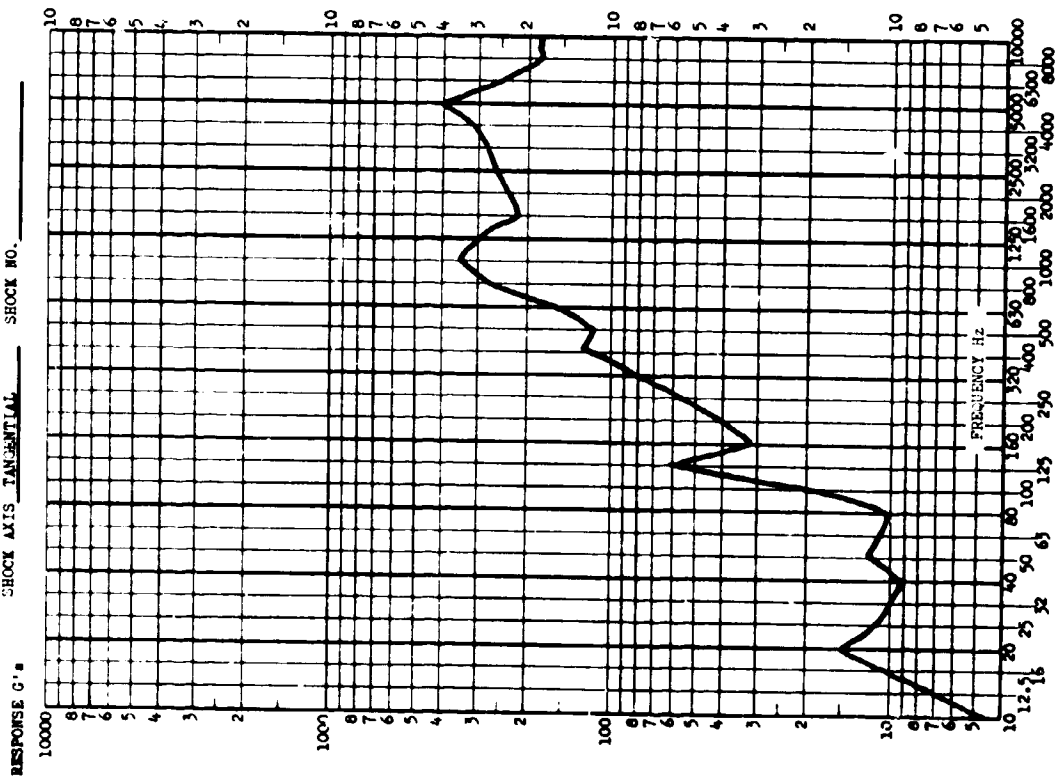


FIGURE III.C.1-6

TEST ITEM DCSP/A DEVELOPMENT MODEL 2 SPACECRAFT

TEST NO. 11

TEST DATE APRIL 1968

SHOCK AXIS AXIAL

SHOCK NO. _____

RESPONSE G's

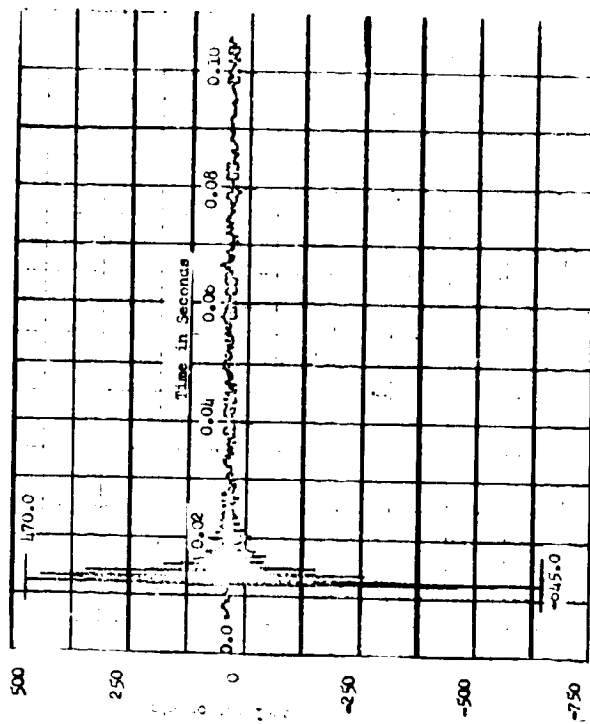
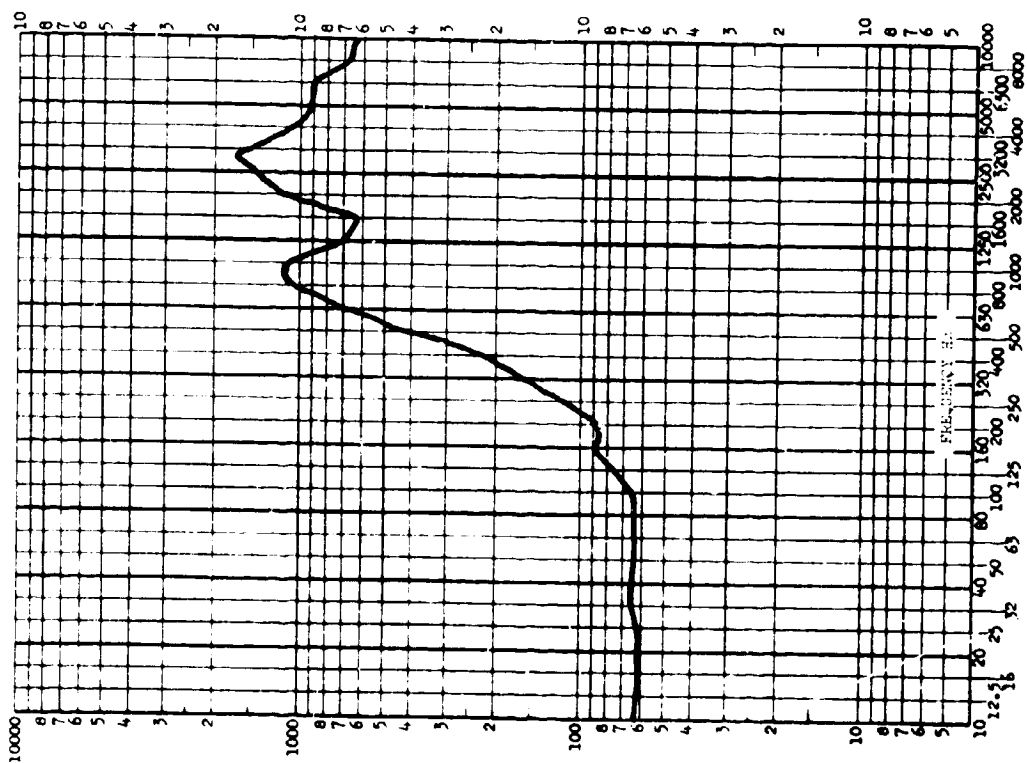


FIGURE III.C.1-7

TEST ITEM: LDSP/A DEVELOPMENT MODEL 2 SPACRAFT
 A/C/L. NO. 12 TEST DATE: APRIL 1968
 SHOCK AXIS: RADIAL SHOCK NO. _____

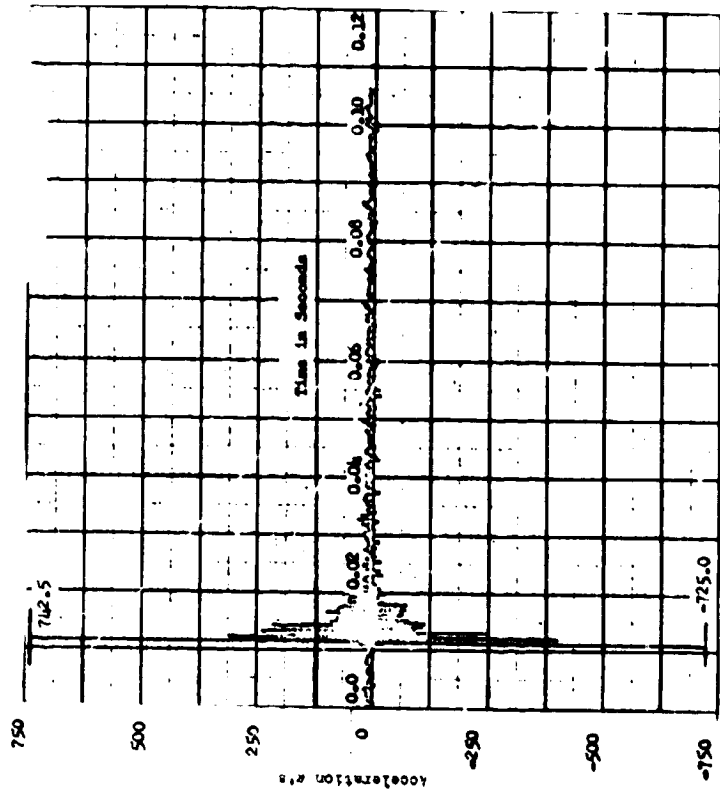
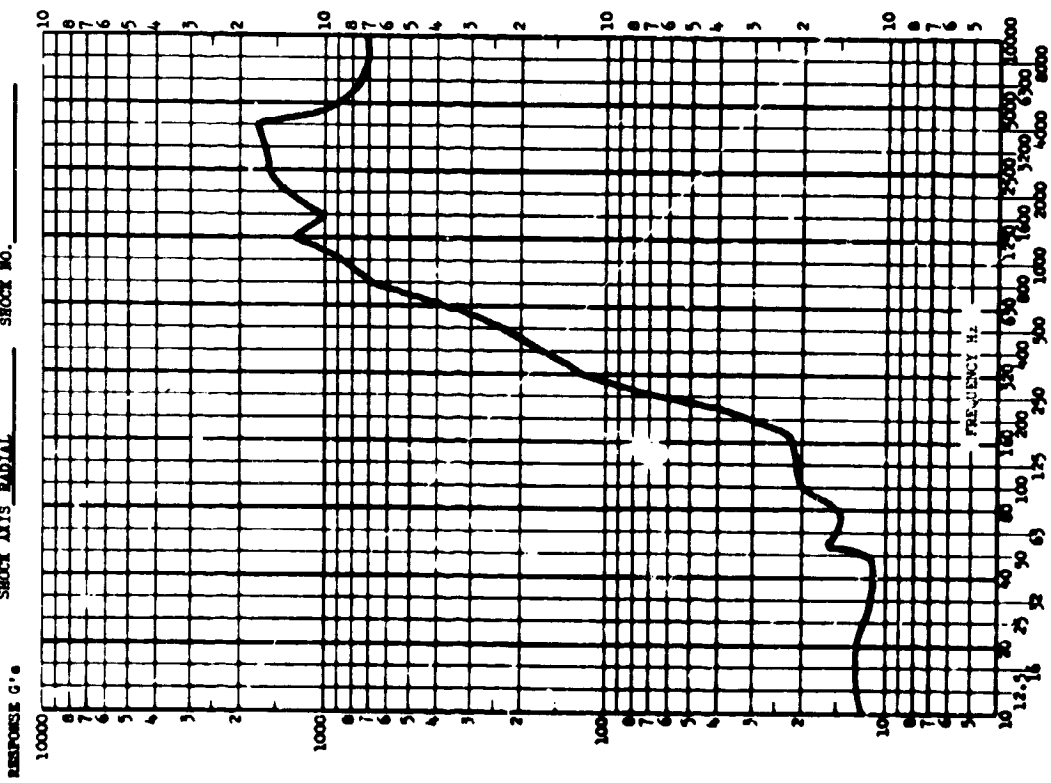


FIGURE III.C.1-8

SECTION III.C.2

ATS (APPLICATIONS TECHNOLOGY SATELLITE V) SEPARATION TEST

PURPOSE OF TEST

The objective of this test was to determine the shock levels produced in the ATS vehicle due to the booster separation event.

DESCRIPTION OF EVENT

The Applications Technology Satellite was suspended in the configuration depicted in Figure III.C.2-1. The satellite consisted of cylindrical solar arrays connected by a load carrying thrust tube. The lower stage adapter section was attached to the aft end of the satellite thrust tube by means of a V-band separation joint. The two self-contained (no fragments) separation bolts in the V-band assembly were detonated and allowed the release of preloaded spring actuators at the separation plane. Following separation, the adapter section containing the expended V-band was allowed to fall away from the satellite. Figure III.C.2-2 illustrates the separation plane (aft end of thrust tube) after the release event. In this photograph the majority of the lower solar array has been removed.

DESCRIPTION OF DATA

No. of time histories	14
No. of shock spectra	14
Type of analysis	digital
Sample rate	12,500/second
Frequency range	to 2000 Hz
Frequency increment	5 Hz
Sampling	$Q = 10$

These shock spectra are presented along with their corresponding time histories as Figures III.C.2-3 through III.C.2-9.

DESCRIPTION OF PYROTECHNIC

Each bolt was of 0.3 inch diameter (approx.) and required the use of a self-contained pressure cartridge/piston assembly to weaken and fail the bolt in tension. The pressure cartridge consisted of a 20 mg igniter charge and a main charge of 50 mg of Zerclo. The maximum pressure developed in the piston device was 4000 psi. The two separation bolts were located as shown in Figure III.C.2-1.

DESCRIPTION OF STRUCTURE

Both the upper and lower solar arrays are hollow cylinders of aluminum honeycomb roughly 1/2 inch thick connected together by means of the cylindrical thrust

tube forming a yo-yo appearing configuration. The thrust tube is the load carrying structure and supports numerous radial beams and panels containing the experiments and equipment associated with the ATS mission. A closer examination of the detail at the top of Figure III.C.2-2 reveals some of these equipment locations.

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2221

Locations: Figure III.C.2-1

Axis of Sensitivity: Table III.C.2-1

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorder: Ampex model 1300

Amplifiers: Endevco model 7302 PT charge type amplifiers

COMMENTS.

Due to the rather low sampling rate of 12,500 samples per second, the shock spectra are considered to loose validity at frequencies above 1250 to 1600 Hz.

TABLE III.C.2-1
INDEX OF DATA LOCATIONS

Accelerometer Location No.s	Sensitive Axis	Figure Number
3	Long., Rad.	III.C.2-3
4	Long., Rad.	III.C.2-4
5	Long., Rad.	III.C.2-5
6	Long., Rad.	III.C.2-6
7,8	Longitudinal	III.C.2-7
9	Long., Rad.	III.C.2-8
11	Long., Rad.	III.C.2-9

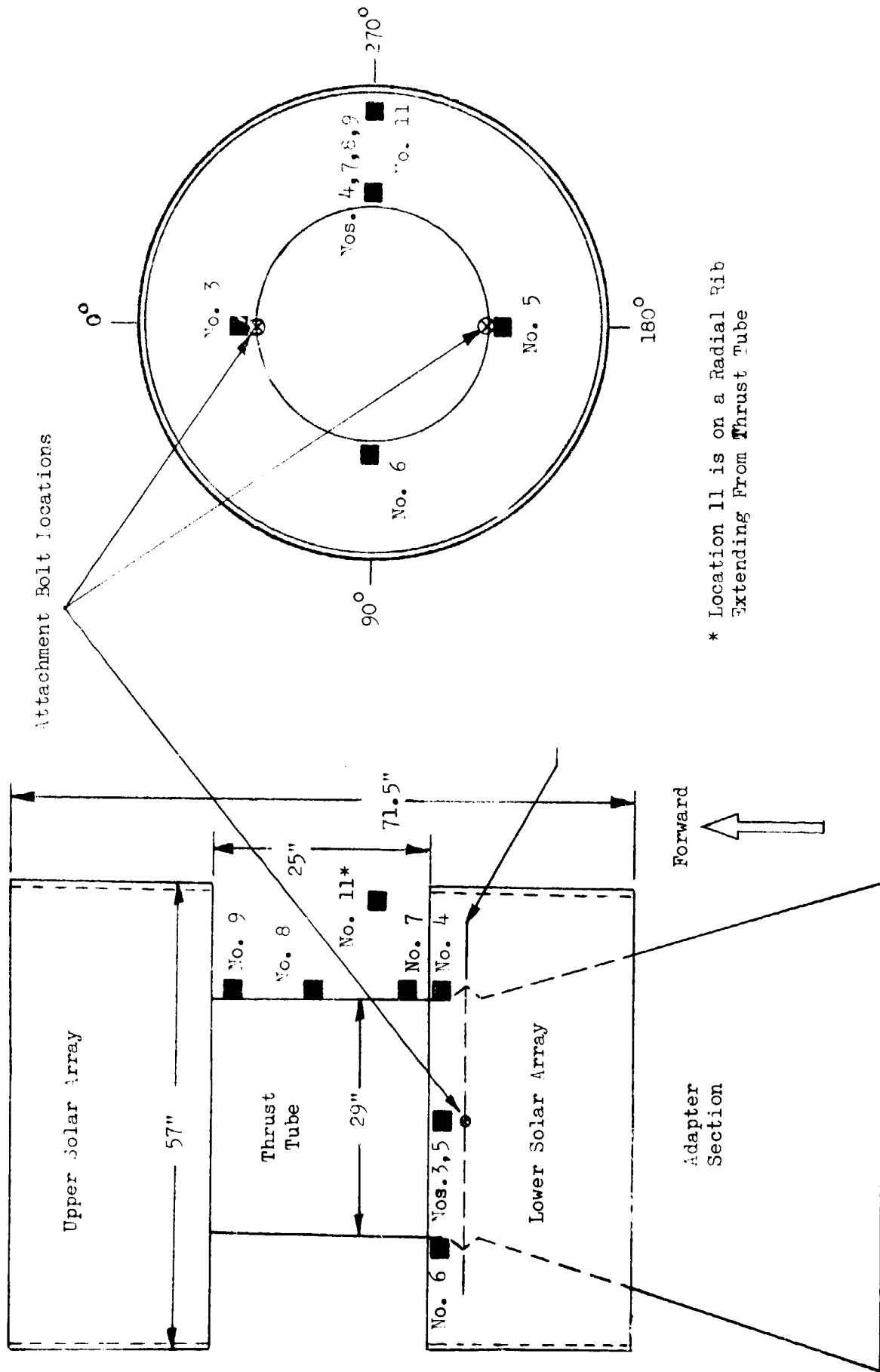
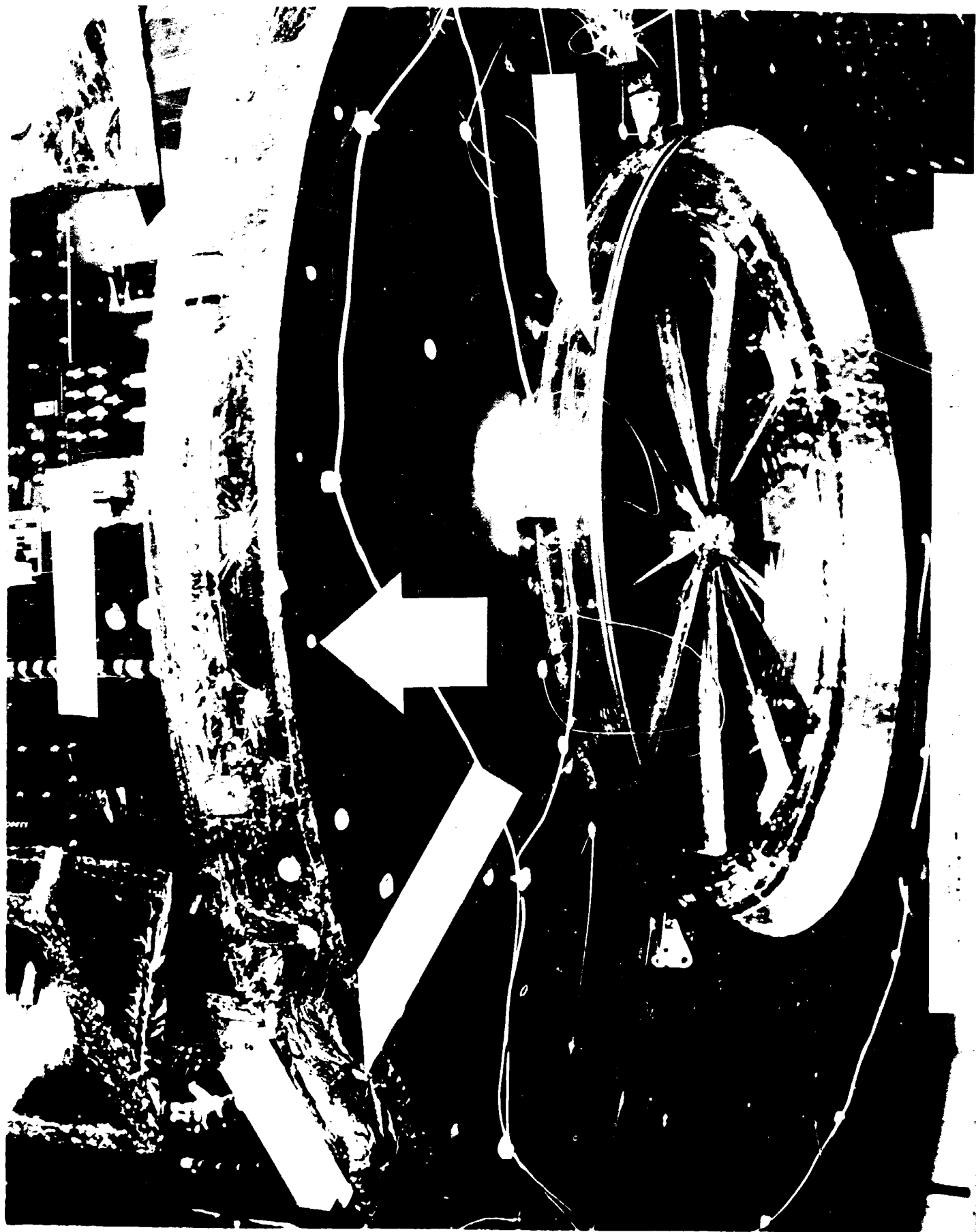
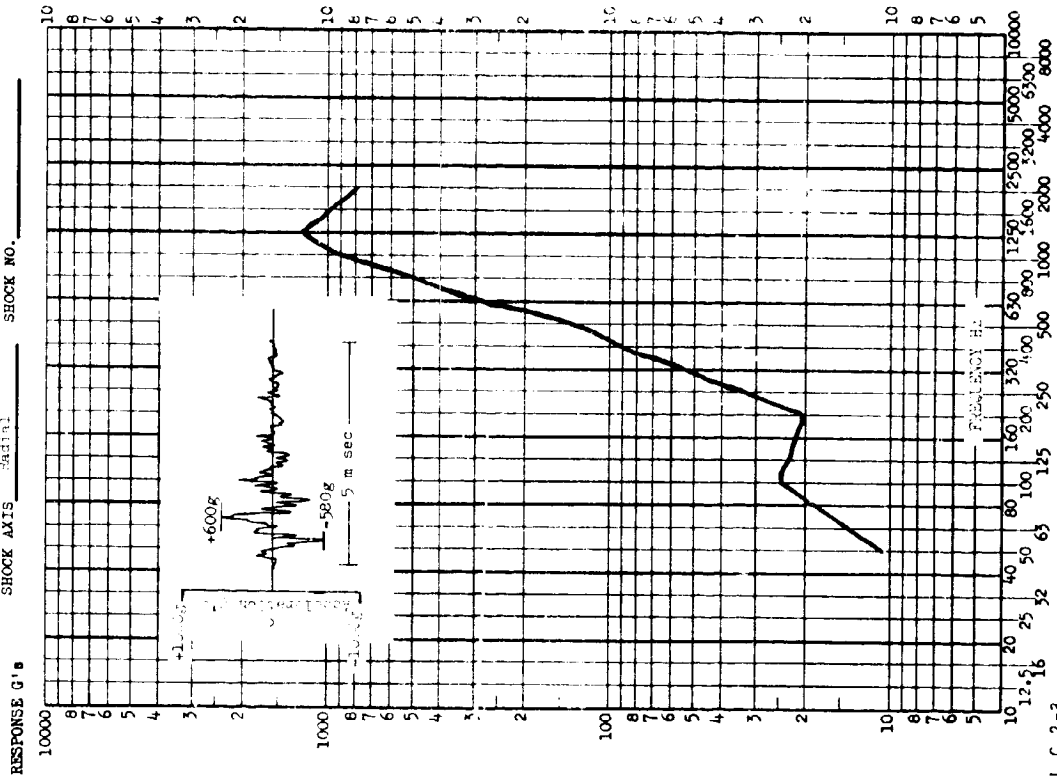


Figure IV.C.2-1. Test Configuration and Accelerometer Locations for ATS Separation Test



TEST ITEM: Anti-rotation
 ACC. NO.: 7 TEST DATE: March 1967
 SHOCK AXIS: Radial SHOCK NO.:



TEST ITEM: Anti-rotation
 ACC. NO.: 7 TEST DATE: March 1967
 SHOCK AXIS: Radial SHOCK NO.:

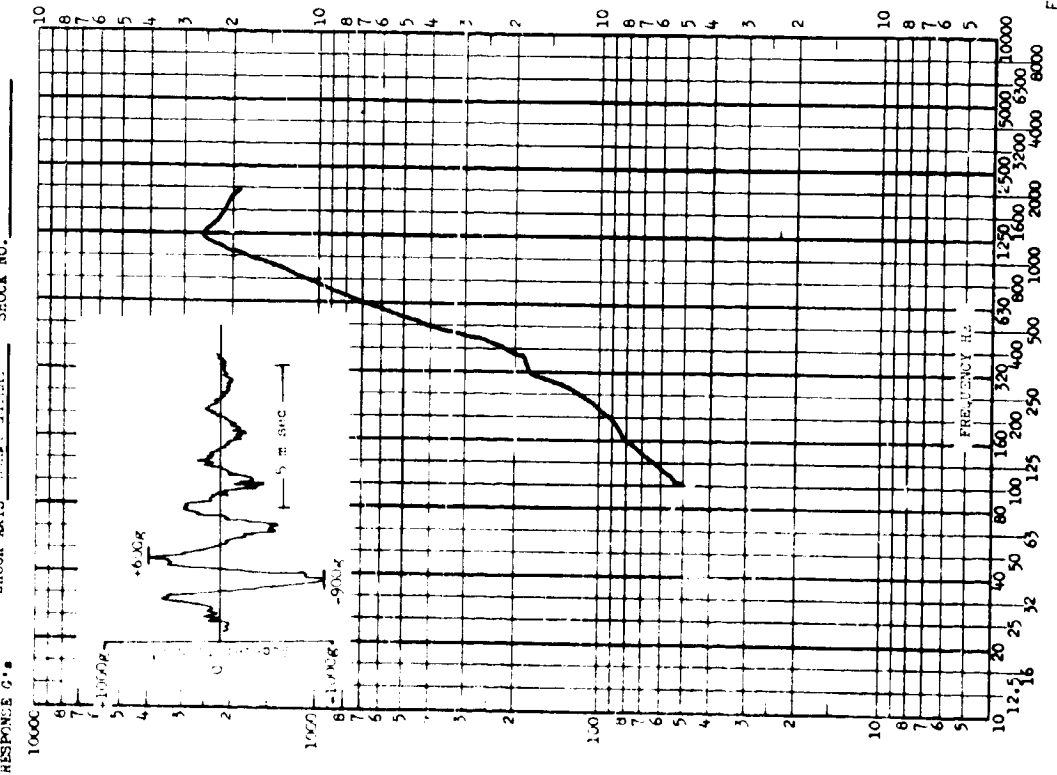
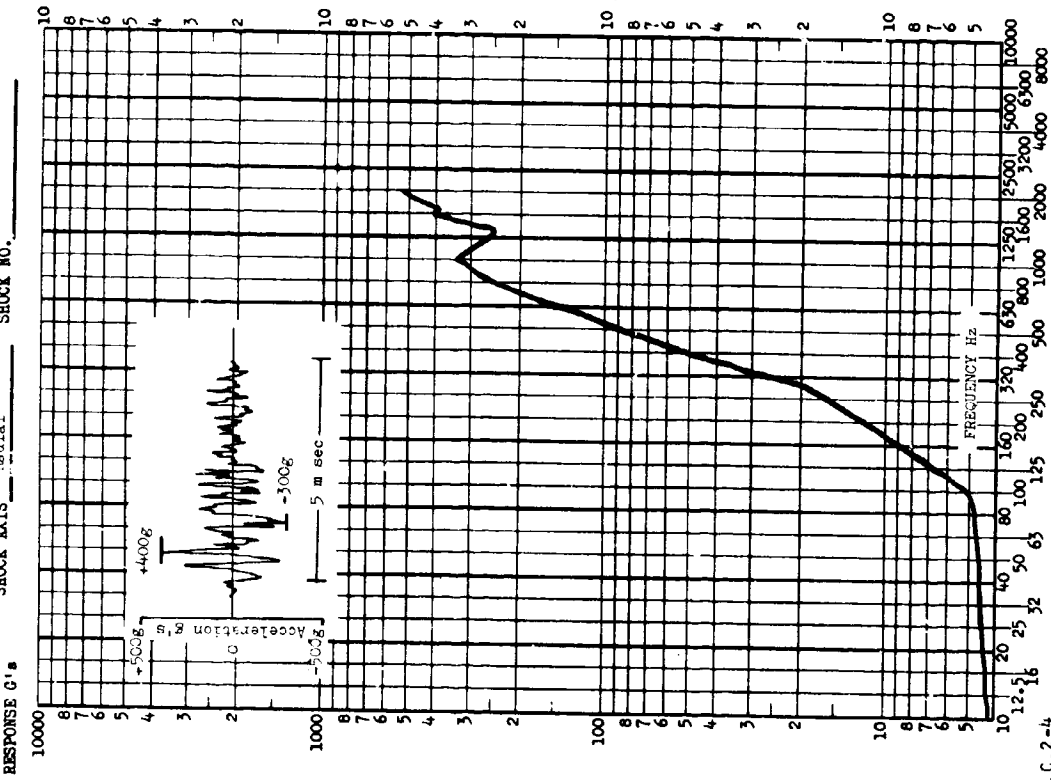


FIGURE III.C.2-3

TEST ITEM ATS Separation
 ACCEL. NO. + TEST DATE March 1967
 SHOCK AXIS Radial SHOCK NO.



TEST ITEM ATS Separation
 ACCEL. NO. + TEST DATE March 1967
 SHOCK AXIS Longitudinal SHOCK NO.

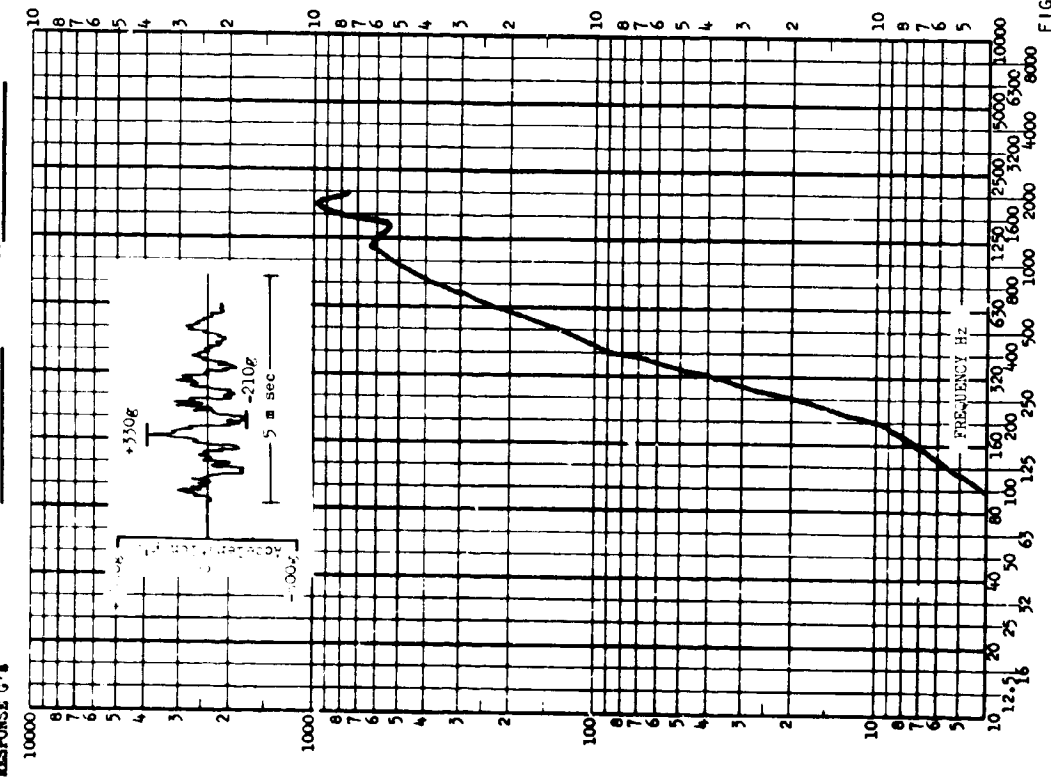
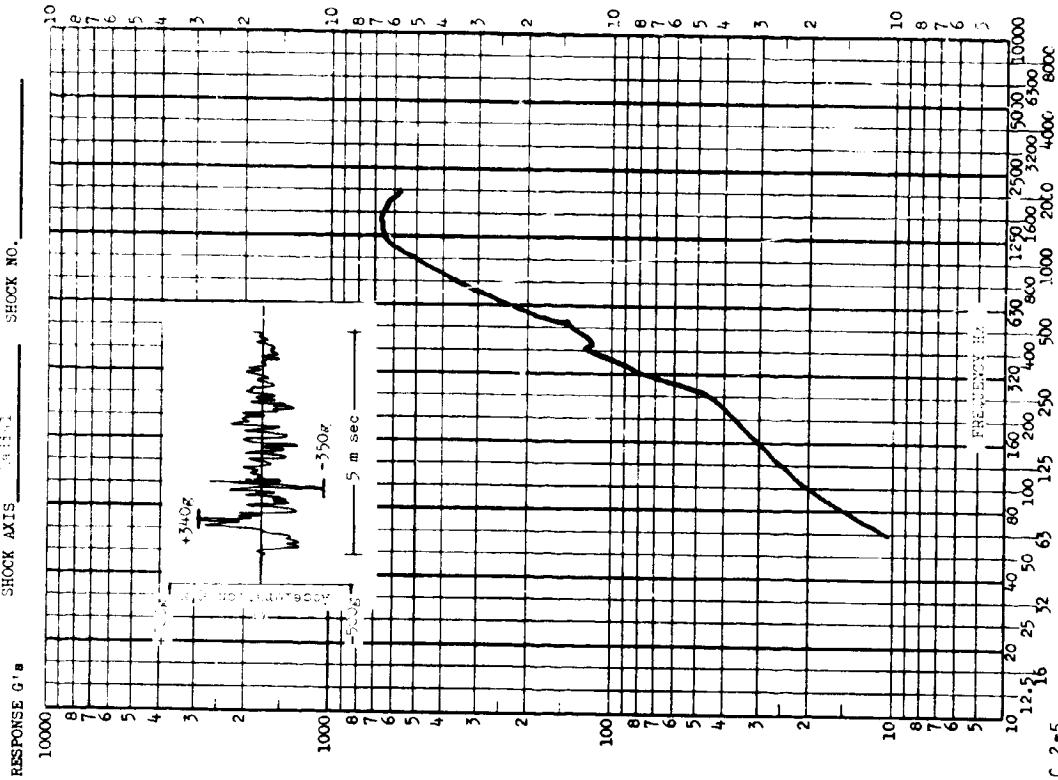


FIGURE III.C.2-4

TEST ITEM _____
 TEST NO. _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____



TEST ITEM _____
 TEST NO. _____ TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

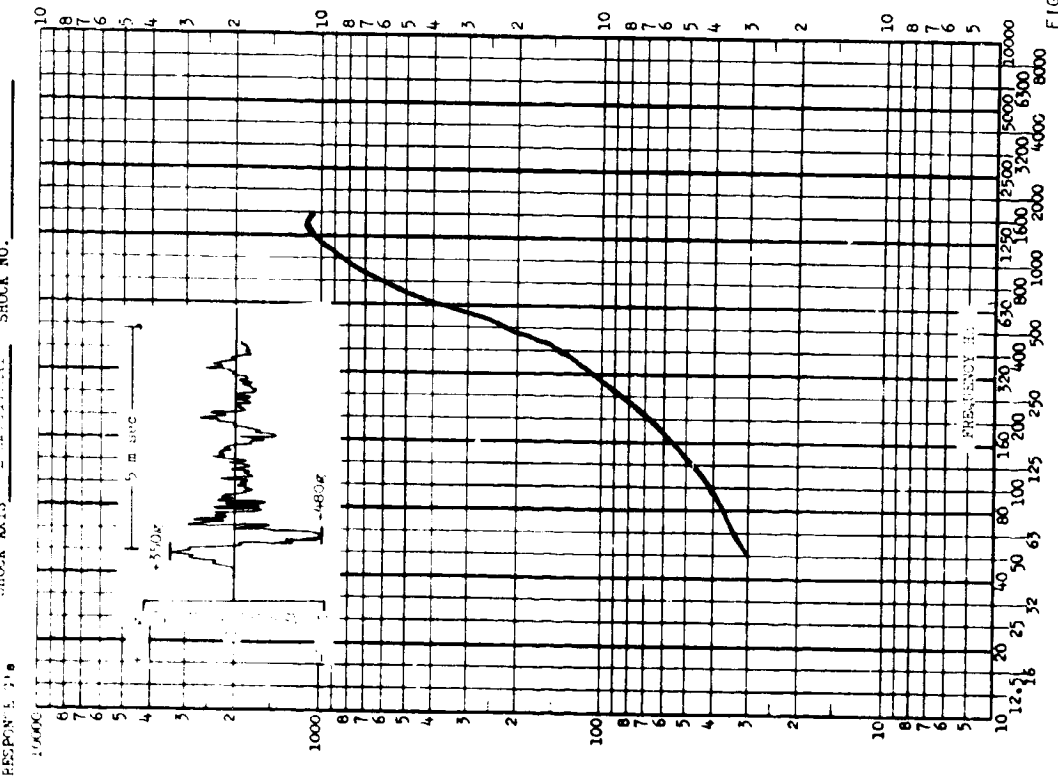
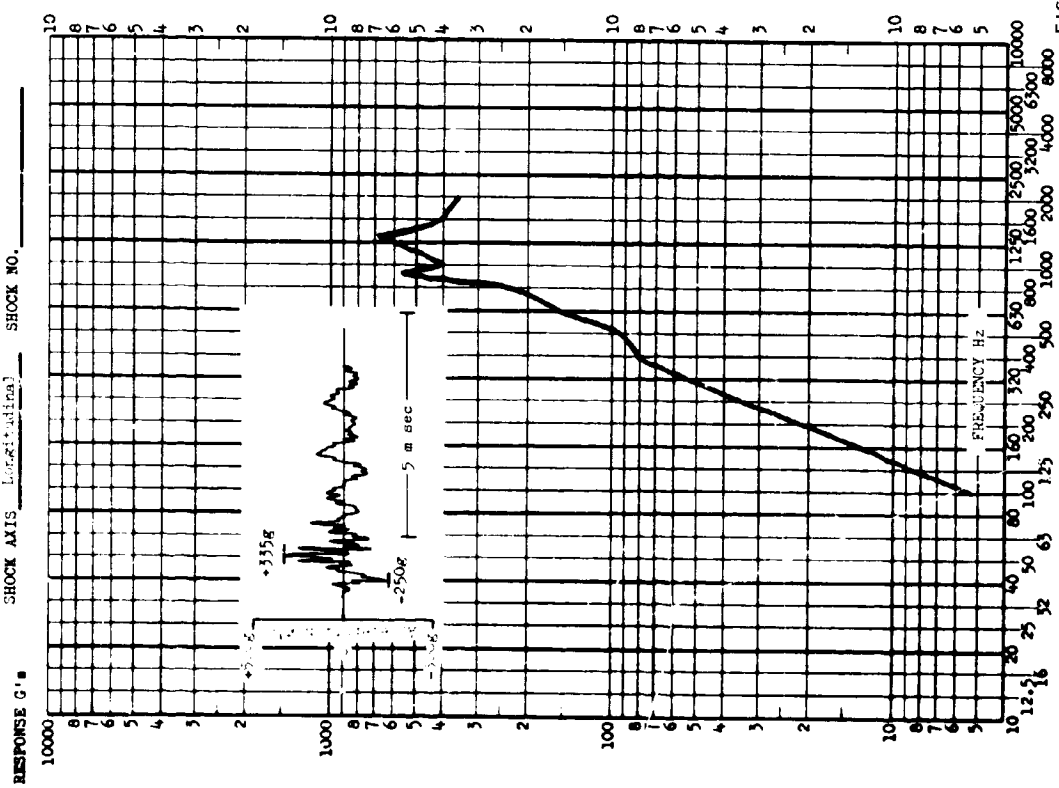


FIGURE III.C.2-5

TEST ITEM ATS Separation
 ACCEL. NO. 6 TEST DATE March 1967
 SHOCK AXIS Longitudinal SHOCK NO.



TEST ITEM ATS Separation
 ACCEL. NO. 6 TEST DATE March 1967
 SHOCK AXIS Radial SHOCK NO.

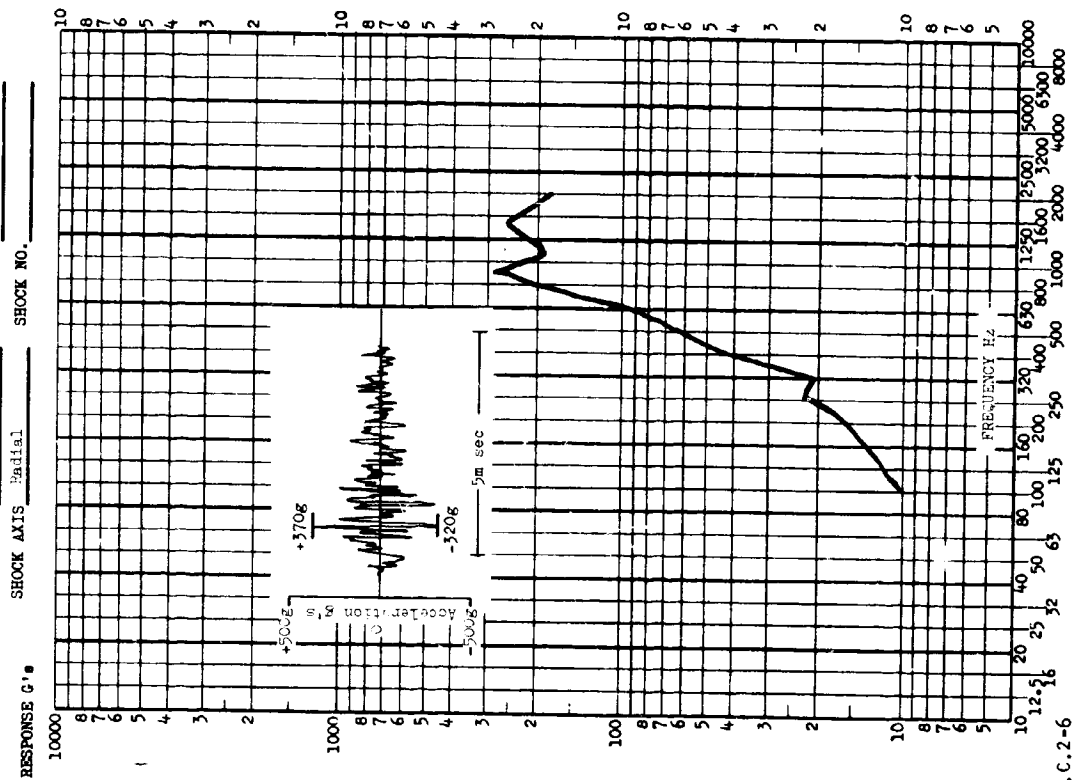
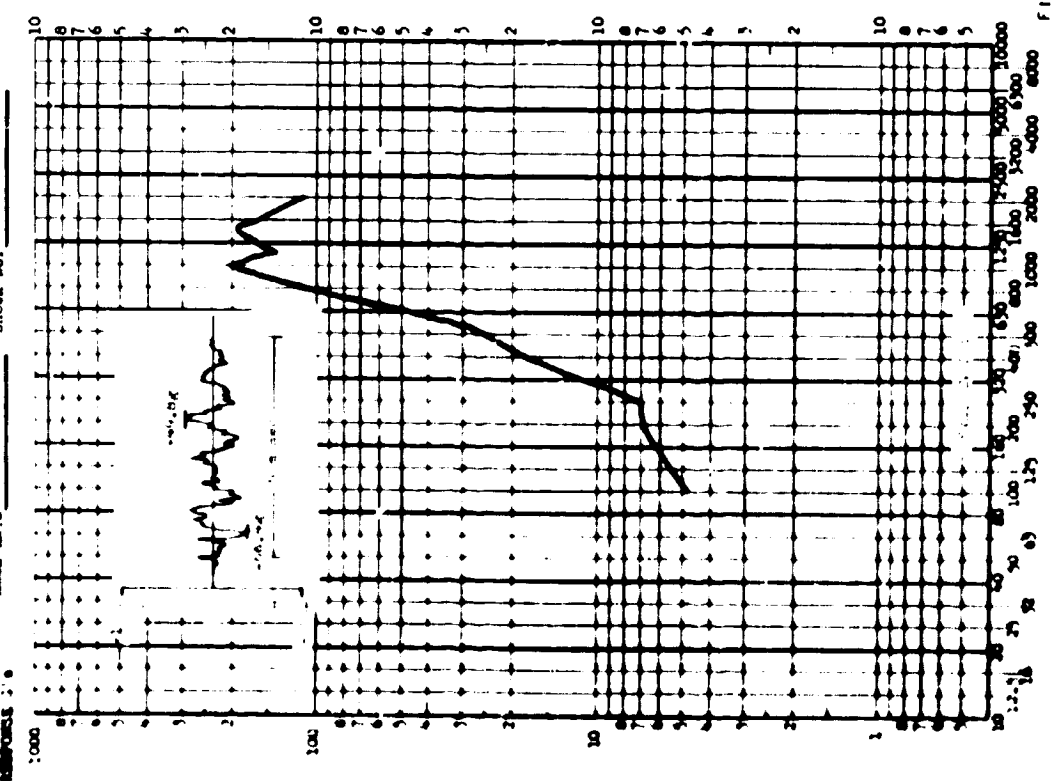


FIGURE III.C.2-6

TEST ITEM: _____
 SERIAL NO.: _____
 SHOCK AXIS: _____
 TEST DATE: _____
 SHOCK NO.: _____



TEST ITEM: _____
 SERIAL NO.: _____
 SHOCK AXIS: _____
 TEST DATE: _____
 SHOCK NO.: _____

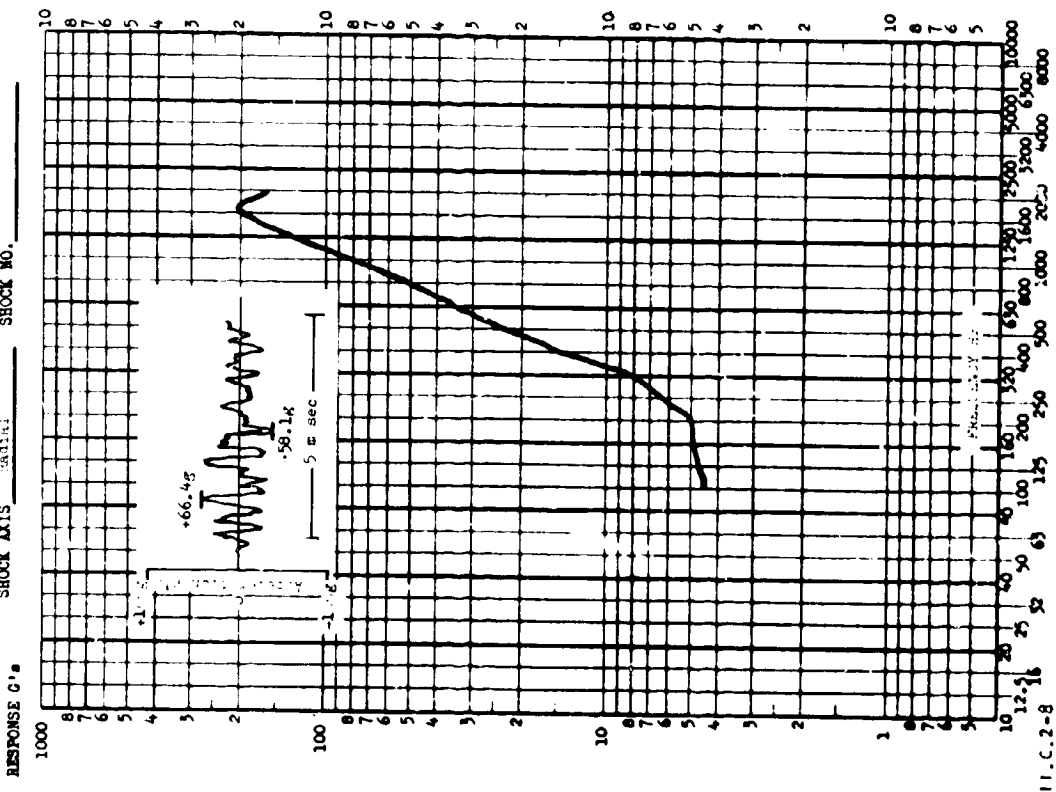
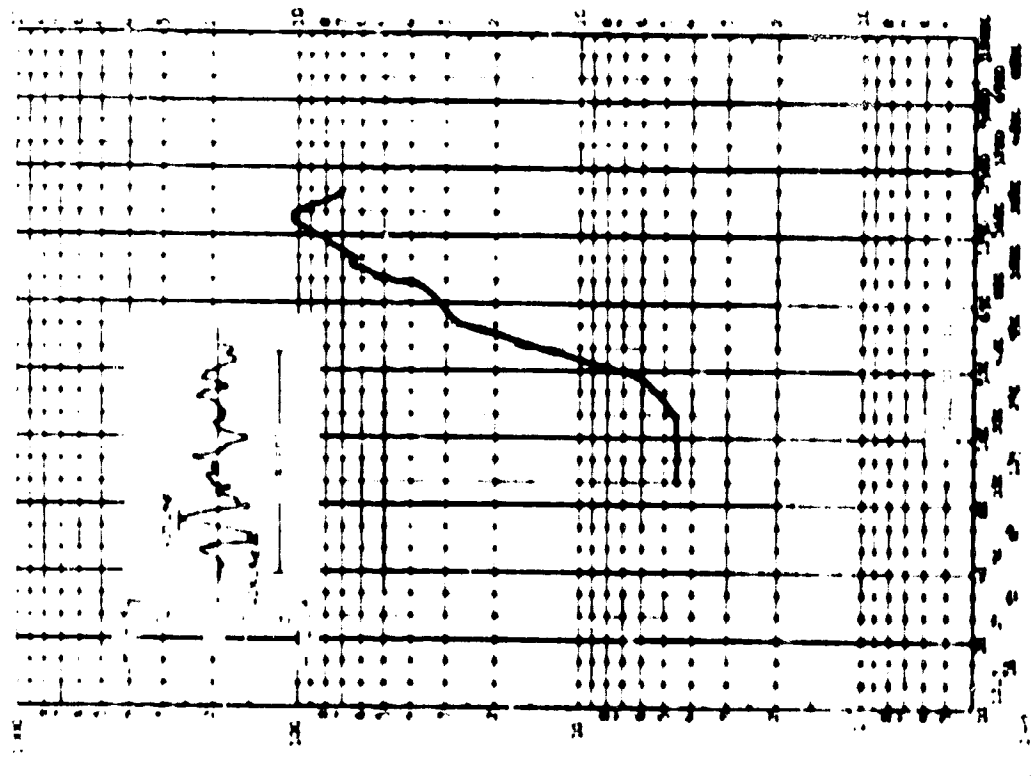
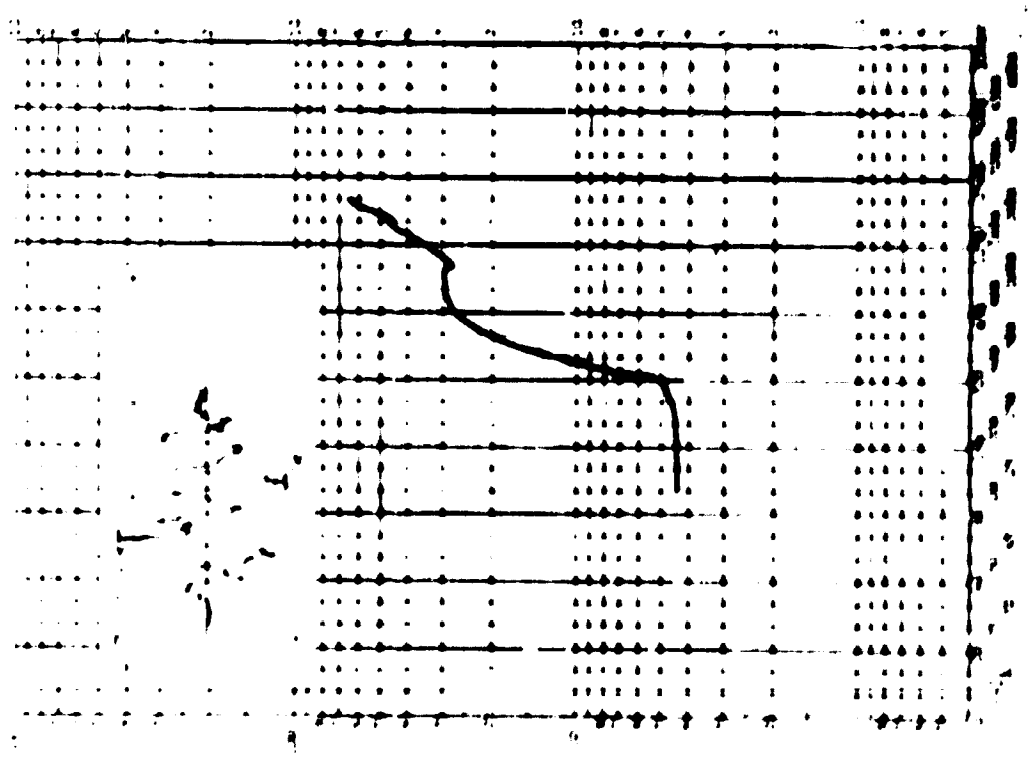


FIGURE III.C.2-8

REPORT NO. _____
DATE _____
PAGE NO. _____



REPORT NO. _____
DATE _____
PAGE NO. _____



SECTION III.C.3

OGO-F Antenna Ejection Test (Orbiting Geophysical Observatory)

PURPOSE OF TEST

The test objective was to measure the shock levels produced in the OGO-F search coils due to the OGO-F F-24 Antenna Ejection event.

DESCRIPTION OF EVENT

The OGO-F F-24 antenna ejection test item consisted of a mass model of the antenna and three search coils as shown in Figure III.C.3-1. The antenna and its fiberglass base are supported by four aluminum legs attached to a honeycomb panel. Two search coils are mounted in Delrin (a nylon - like material) which is attached to the honeycomb base. These two search coils are orthogonal, one above the other, parallel to the honeycomb panel, and diagonal to the four upright legs. The third coil is mounted upright near the edge of the honeycomb panel.

The separable portion of the antenna was held to the antenna base by two diagonally opposed shoes which received their clamping force from an interconnecting bolt. A bolt cutter freed the antenna, and separation was achieved by two separation springs and a counterweight suspension.

The antenna was slightly over counterweighted to achieve a good separation. The separated configuration is depicted in Figure III.C.3-2.

DESCRIPTION OF DATA

No. of time histories	8
No. of shock spectra	8
Type of analysis	digital
Sample rate	50,000 per second
Duration	see time histories
Frequency range	20-5000 Hz
Frequency increment	50 points per decade
Damping	Q = 10

These shock spectra are presented along with their corresponding time histories as Figures III.C.3-3 through Figure III.C.3-10.

DESCRIPTION OF PYROTECHNIC

The bolt cutter was a No. 2802 Horex Guillotine Cutter. It cut a bolt at the unthreaded part where the diameter was 0.138 inch. The bolt location is indicated in Figure III.C.3-2.

DESCRIPTION OF STRUCTURE

See Figure III.C.3-1 and III.C.3-2, Also,
see "Description of Event".

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225

Locations: Table III.C.3-1 and Figures III.C.3-1
and III.C.3-2.

Axis of Sensitivity: Longitudinal

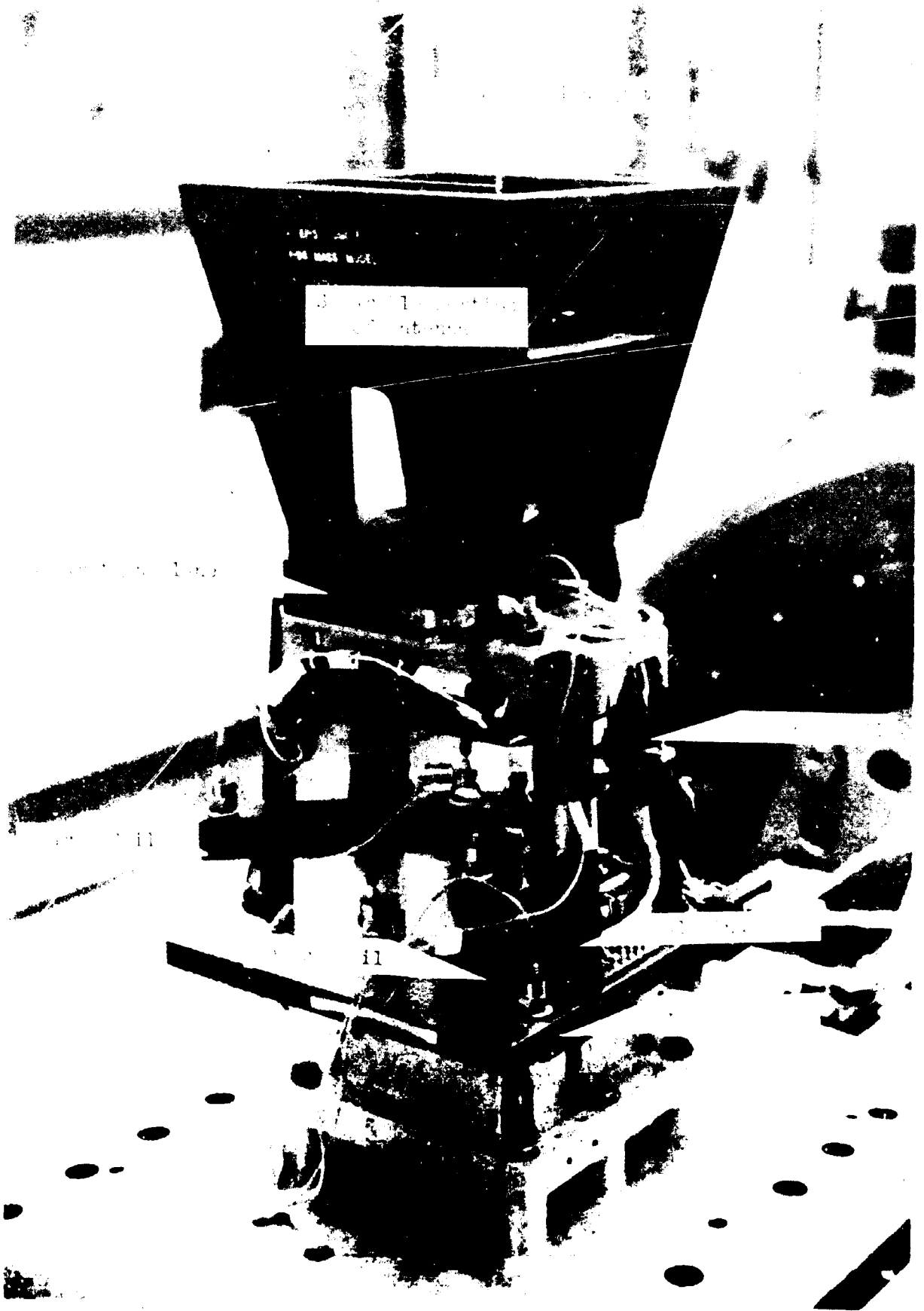
DESCRIPTION OF DATA ACQUISITION SYSTEM

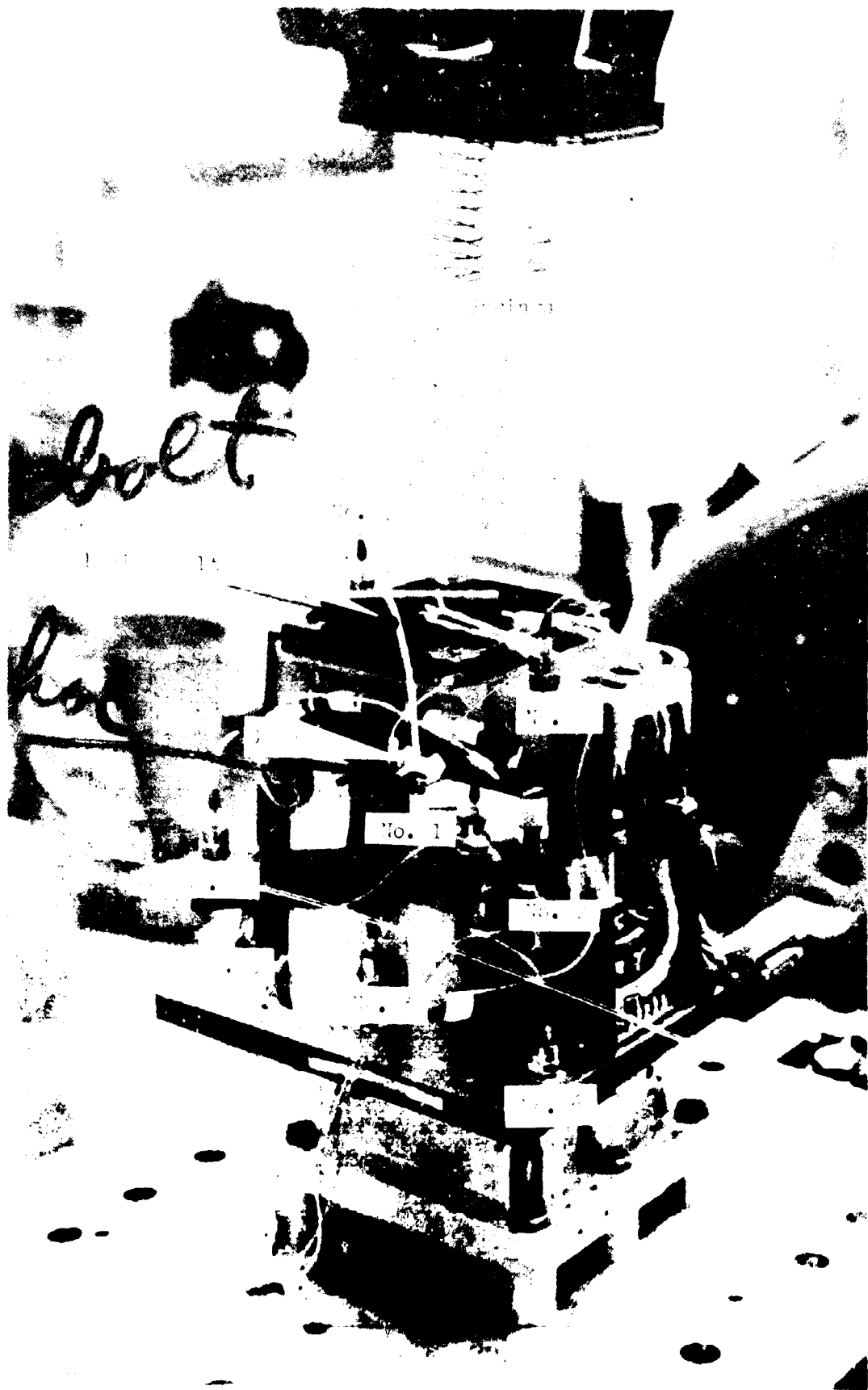
Tape recorder: Ampex FR 1300

Amplifiers: Unholtz-Dickie model 8P charge
amplifiers.

TABLE III.C.3-1
INDEX OF DATA LOCATIONS

Accelerometer Numbers	Accelerometer Locations	Figure Number
1	upper coil, center	III.C.3-3
2	lower coil, near center	III.C.3-4
3	lower deck, center	III.C.3-5
4	top, near separation plane	III.C.3-6
5	lower deck, near leg	III.C.3-7
6	lower deck, near leg	III.C.3-8
7	top, near separation plane	III.C.3-9
8	upper coil, near end	III.C.3-10





bolt

No. 1

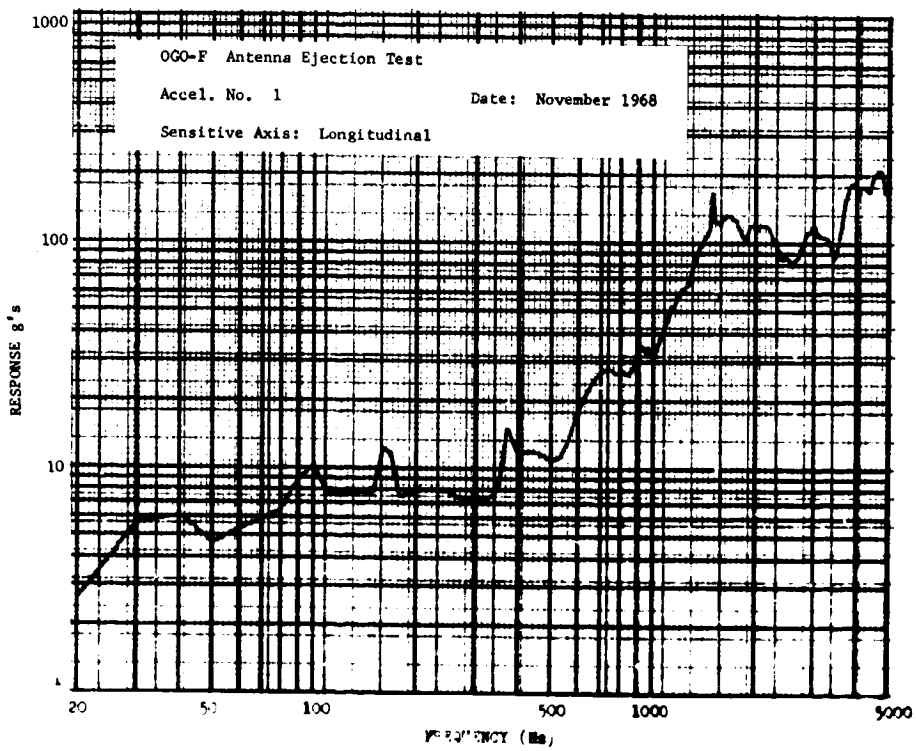
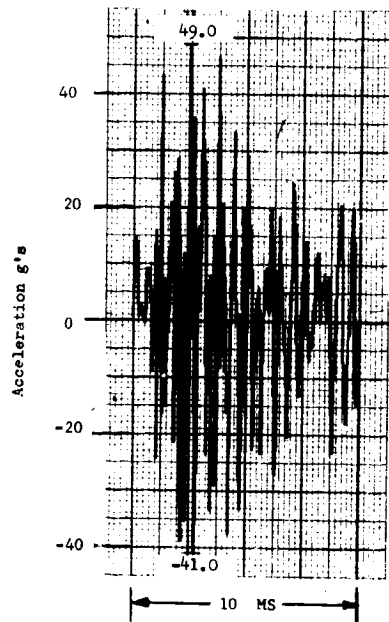


FIGURE III.C.3-3

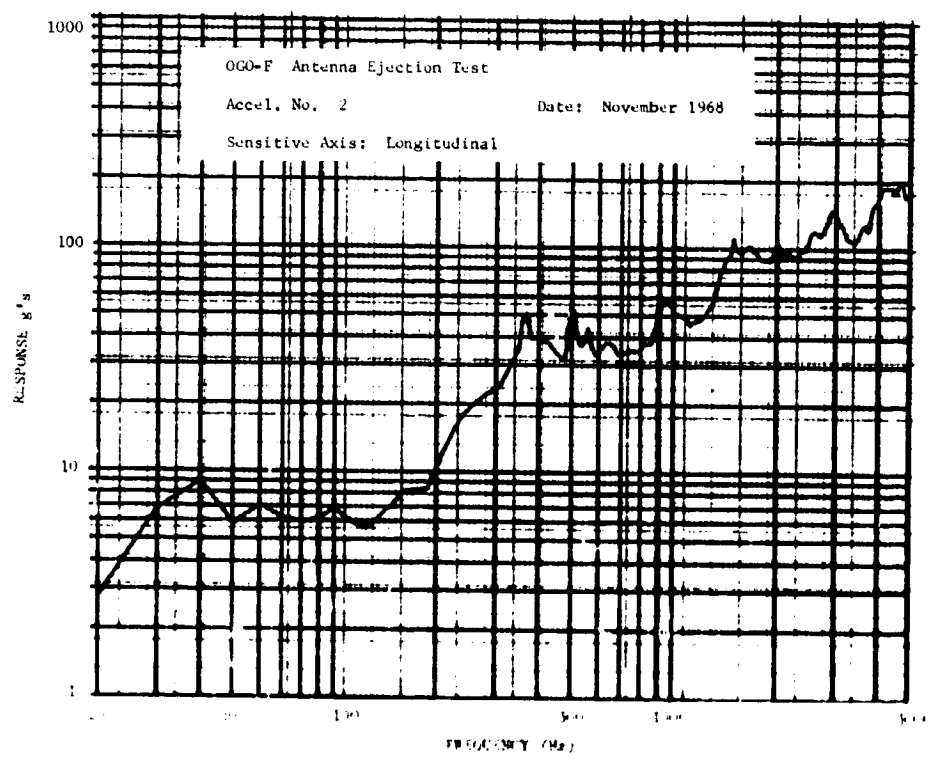
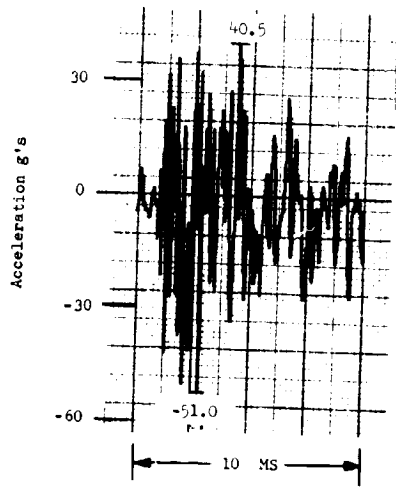
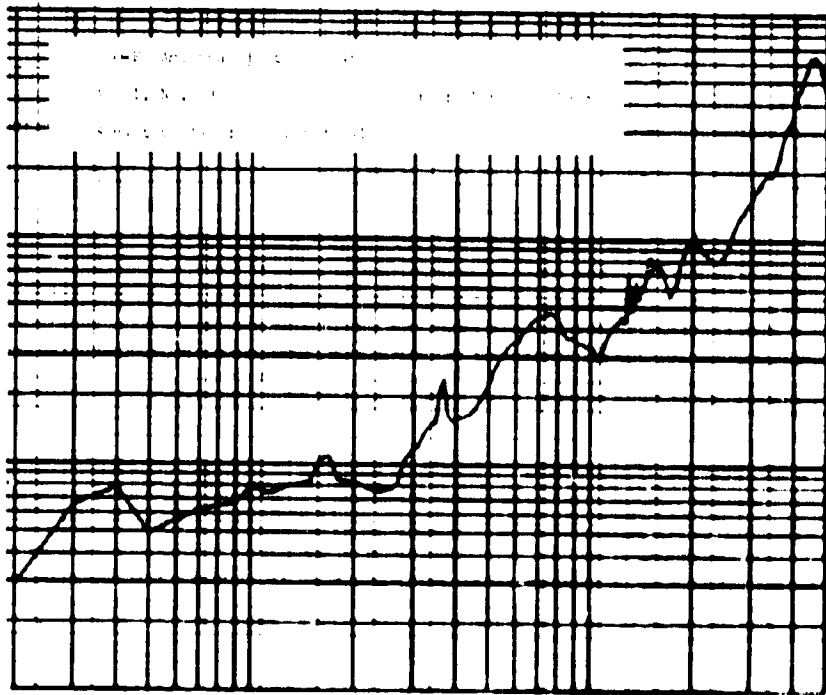
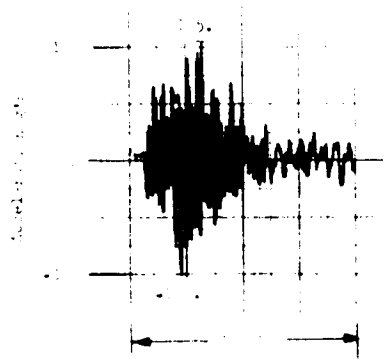
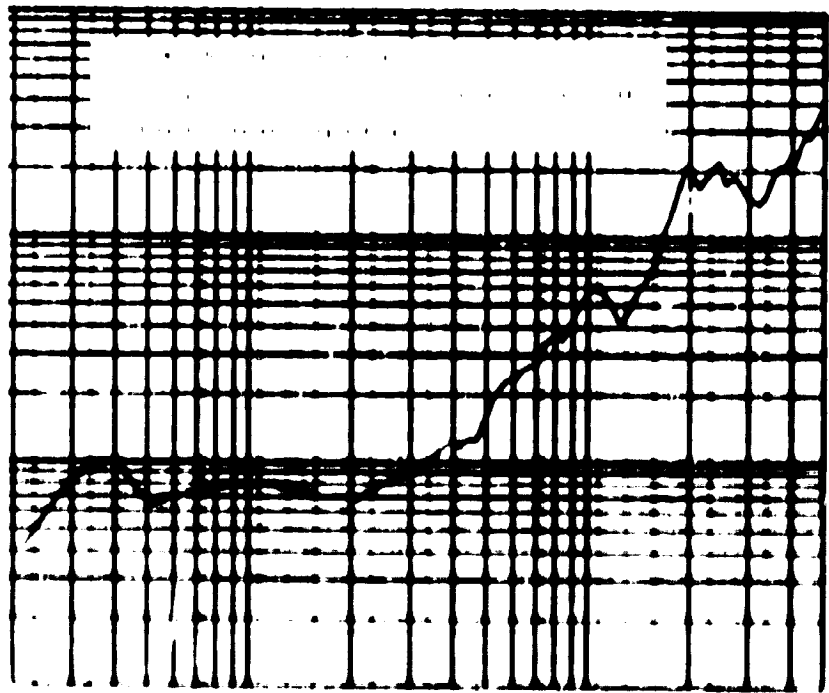
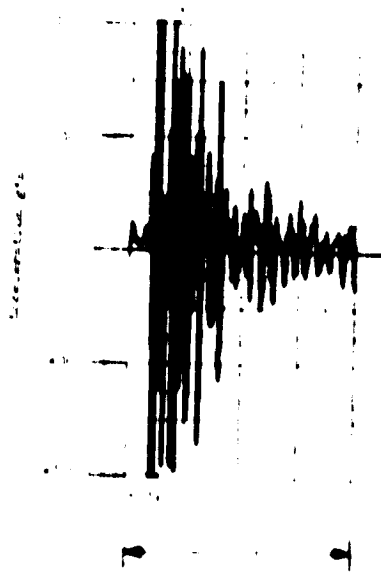
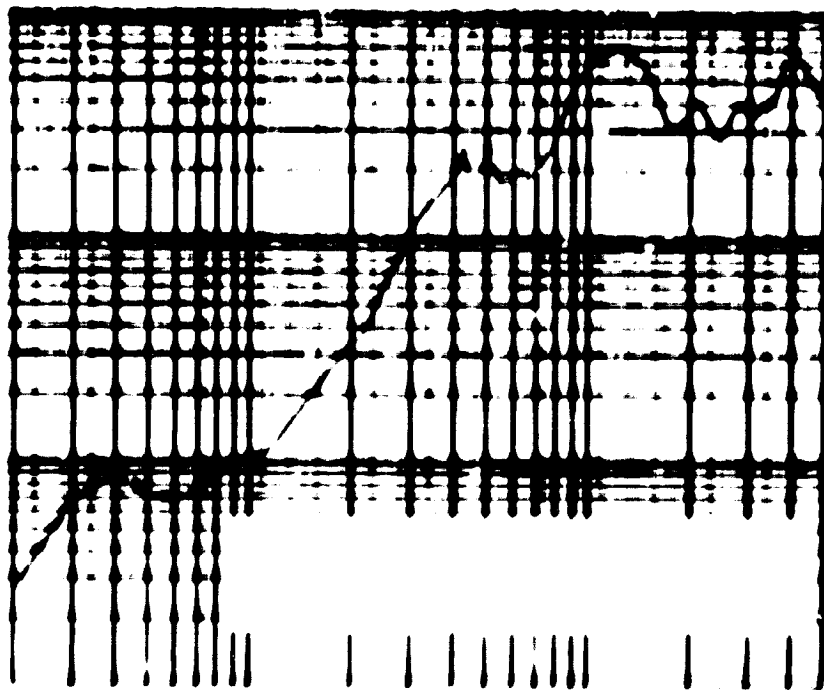
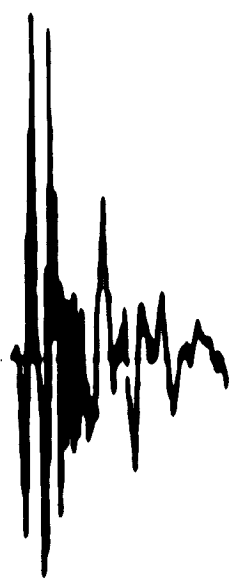
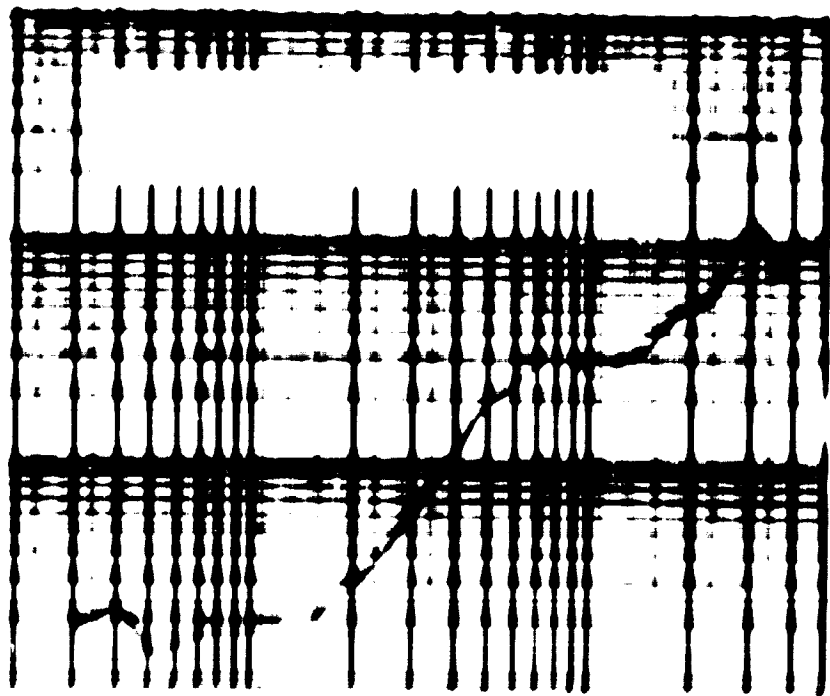


FIGURE III.C.3-4









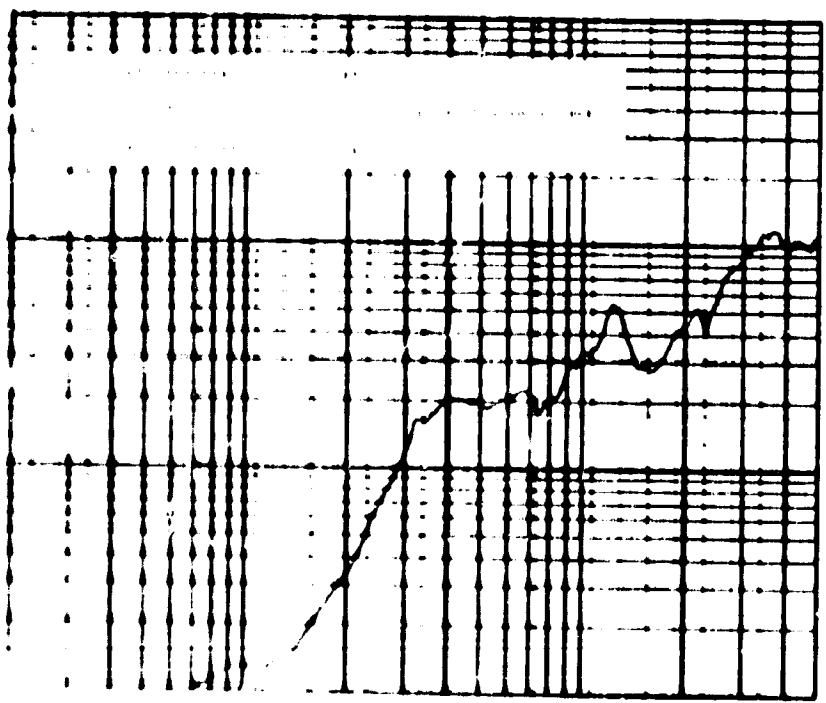
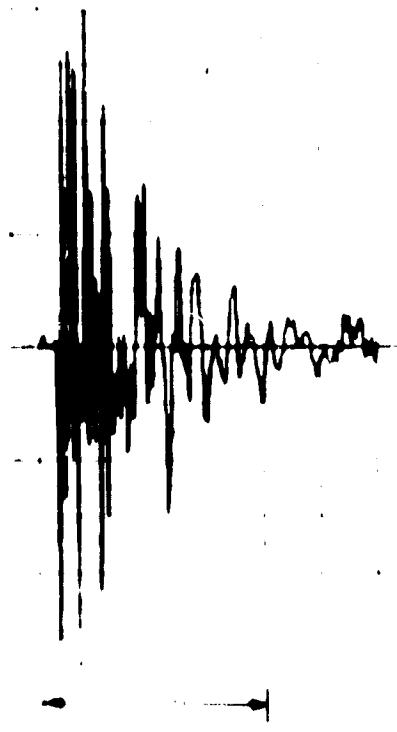


Figure 1.00

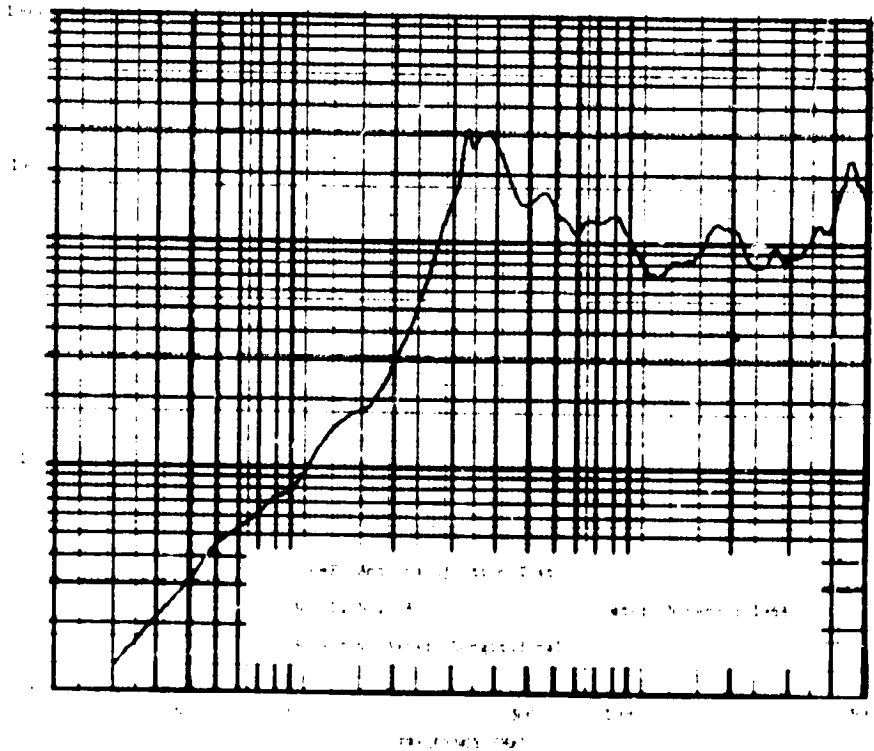
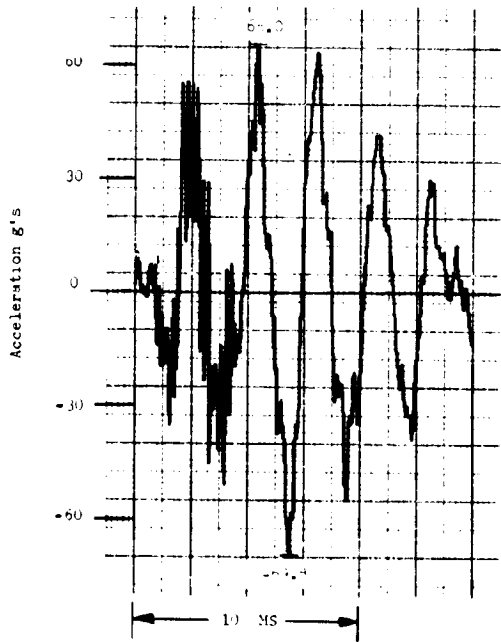


FIGURE III.C.3-10

LOCATION OF ADDITIONAL DATA

Additional pyrotechnic shock data compiled for cartridge actuated devices for propagation in structure other than skin-ring-frame or truss may be found in the following sections of this volume:

IV.A.3 Entire section

IV.B.3 Entire section

IV.B.4 Entire section

IV.B.5 Entire section

IV.B.6 Entire section

LOCATION OF RELATED LOCKHEED DATA

Additional pyrotechnic shock data for cartridge actuated devices propagating in structures other than skin-ring-frame or truss may be found in the following sections of the Lockheed data compilation:

II.A.2

II.C.1

II.C.2

DIVISION IV

SPACE VEHICLE TEST DATA

FOREWORD TO DIVISION IV

Division IV contains a comprehensive collection of shock data for several different pyrotechnic events associated with each of three space vehicles: the PRIME (lifting body, re-entry vehicle), the Mariner, and the Surveyor. These data are presented in a separate portion of the data compilation for two primary reasons:

- 1) Because of the diversity of the pyrotechnic events involved in these three programs, no other organizational scheme would be any more realistic.
- 2) Presenting these data in one location of the compilation provides the user with additional ease in comparing relative shock levels produced in any one of three structural configurations by a variety of pyrotechnic devices.

The Mariner and Surveyor data presented here also include some data for the non-pyrotechnic events which occur during the ascent and landing gear operation. These data are made available so that the relative effects of such non-pyrotechnic and other sources of mechanical shock can readily be compared.

TABLE OF CONTENTS

Prime Re-Entry Vehicle Shock Tests

Section	Event	Pyrotechnic Device	Number of Shock Spectra	
IV.A.1	Booster Separation	Explosive Bolt	27	107
IV.A.2	Parachute Hatch Separation	FLBC	59	108
IV.A.3	Drogue Chute Ejection Mortar	Mortar	25	109
IV.A.4	Drogue Chute Separation	Explosive Nut	33	110

PART IV.B

Mariner (Venus & Mars) '67 Flight Acceptance Test

Section	Event	Pyrotechnic Device	Number of Shock Spectra	
IV.B.1	Shroud Y-Band Release	Explosive Bolt	17	111
IV.B.2	Shroud Z-Band Release	FLBC	25	112
IV.B.3	Solar Panel Deployment	Explosive Bolt	22	113
IV.B.4	Post Injection Propulsion System Pyro 1	Explosive Bolt	17	114
IV.B.5	Post Injection Propulsion System Pyro 2	Explosive Bolt	17	115
IV.B.6	Antenna Deployment	Explosive Bolt	15	116
IV.B.7	Antenna Deployment	Explosive Bolt	17	117

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(CONT.)

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PART IV.C

Surveyor Pyrotechnic Acceptance Tests

Section	Event	Pyrotechnic Device	Number of Shock Spectra	
IV.C.1	Atlas/Contour Separation	FLAC	10	212
IV.C.2	Shroud Separation	Explosive Nuts	11	213
IV.C.3	Insulation Panel Jettison	MSW & FLAC	10	214
IV.C.4	Can Antenna Deploy	Thumper	10	215
IV.C.5	Flight Shock Transients		11	216

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FOR THE YEAR 1964 AND 1965
FOR THE YEAR 1966 AND 1967

PAGE 17, A

PROTODINIC SOUND VIBRATION TESTS ON THE SAME VEHICLE

RESULTS OF TESTS

Protodinic sound tests were performed on a test article of the same vehicle to experimentally determine the sound excitation levels induced by the major protodinic sources.

PARAMETERS OF TESTS

The four major protodinic sound sources were tested with the test program as listed below:

- 1. Exhaust operation (operating mode and configuration 17.2.1)
- 2. Protodinic hatch operation (configuration 17.2.1)
- 3. Weight shift operation (mode 1, configuration 17.2.1)
- 4. Weight shift operation (operating mode 1, configuration 17.2.1)

Figure 17.2.1 depicts the approximate locations of these protodinic sources.

Four series of tests were performed in each case and the results are presented in a table in the following. Using the test program described above, the sound excitation levels were determined as follows:

1. The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that this is essential for ensuring the integrity and transparency of the financial system.

2. The second part of the document outlines the various methods used to collect and analyze data. It highlights the need for consistent and reliable data sources to support the analysis.

3. The third part of the document describes the process of identifying trends and patterns in the data. It notes that this is a critical step in understanding the underlying factors that influence the system.

4. The fourth part of the document discusses the implications of the findings and the need for further research. It suggests that ongoing monitoring and evaluation are necessary to ensure the system remains effective and efficient.

4.2. Data Collection and Analysis

5. The first step in data collection is to identify the relevant variables and sources. This involves a thorough review of the available data and a determination of the most appropriate methods for collection.

6. The second step is to ensure the accuracy and reliability of the data. This is achieved through the use of standardized procedures and the implementation of quality control measures.

7. The third step is to analyze the data using appropriate statistical techniques. This allows for the identification of significant relationships and the testing of hypotheses.

8. The fourth step is to interpret the results and draw conclusions. This involves a careful examination of the findings and a consideration of the broader context in which they are being used.

9. The fifth step is to communicate the results to the relevant stakeholders. This is done through the preparation of reports and the presentation of findings at meetings and conferences.

10. The sixth step is to use the findings to inform decision-making and the development of policies. This ensures that the system is based on sound evidence and is able to respond to changing circumstances.

4.3. Data Interpretation and Reporting

11. The first part of this section discusses the importance of clear and concise reporting. It emphasizes that the results should be presented in a way that is easy to understand and that highlights the key findings.

12. The second part of this section discusses the need for transparency and accountability. It notes that the data and the methods used to analyze it should be made available to all interested parties.

13. The third part of this section discusses the role of the reporting process in the overall system. It suggests that regular reporting is essential for ensuring that the system is kept up to date and that any problems are identified and addressed promptly.

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thickness on the external surface of the vehicle
except for selected areas where the actual heat
shield was installed.

DESCRIPTION OF ACCELEROMETERS

Type: Endevco Model 2225

Locations: Figure IV.A-1 and IV.A-6

DESCRIPTION OF ACQUISITION SYSTEM

Tape recorders: CEC VR-3400

CEC 5-702

Amplifiers: 12 Endevco model 2713A charge
amplifiers

6 Endevco model 2702B voltage
amplifiers

2 Kistler 566 charge amplifiers

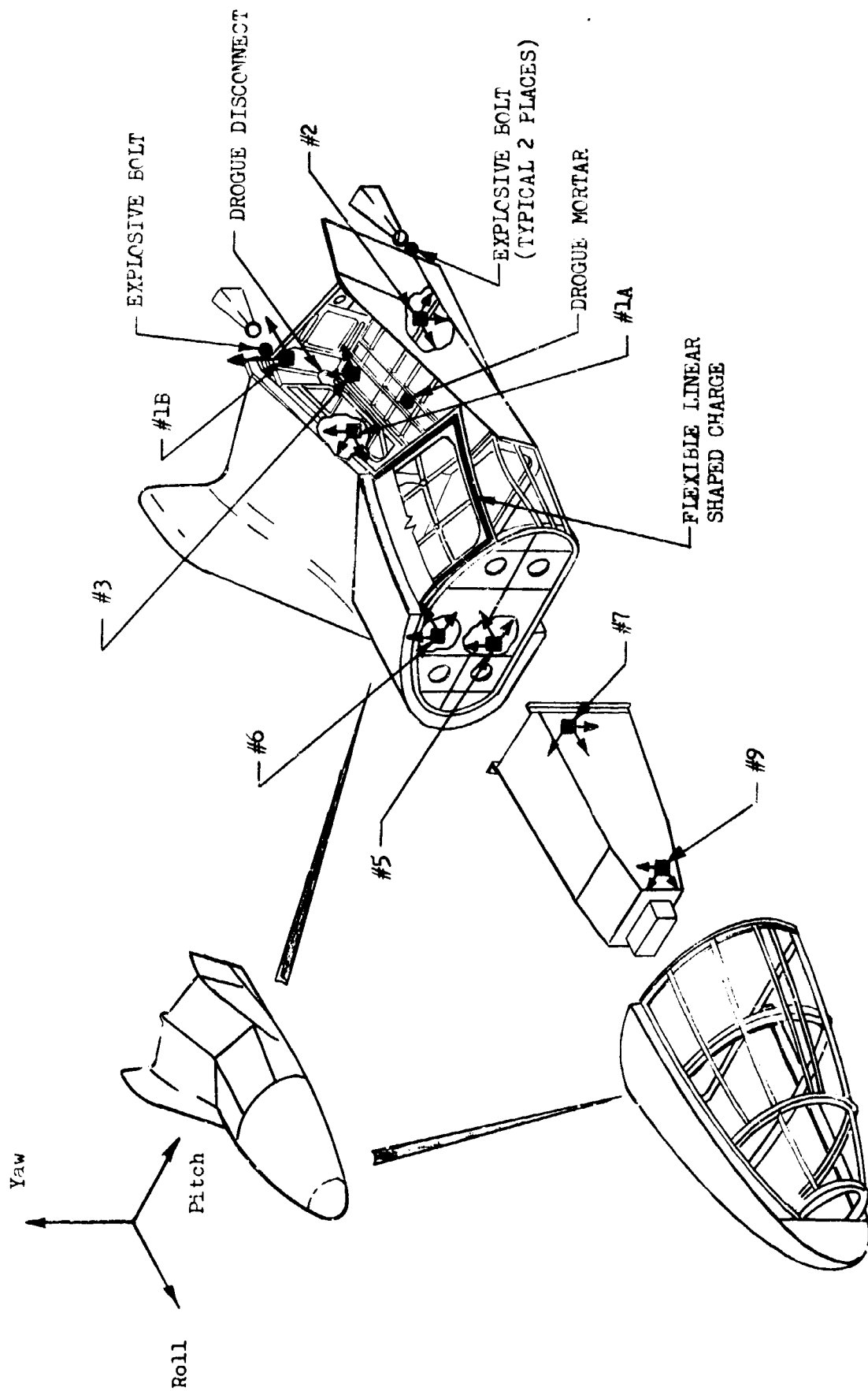
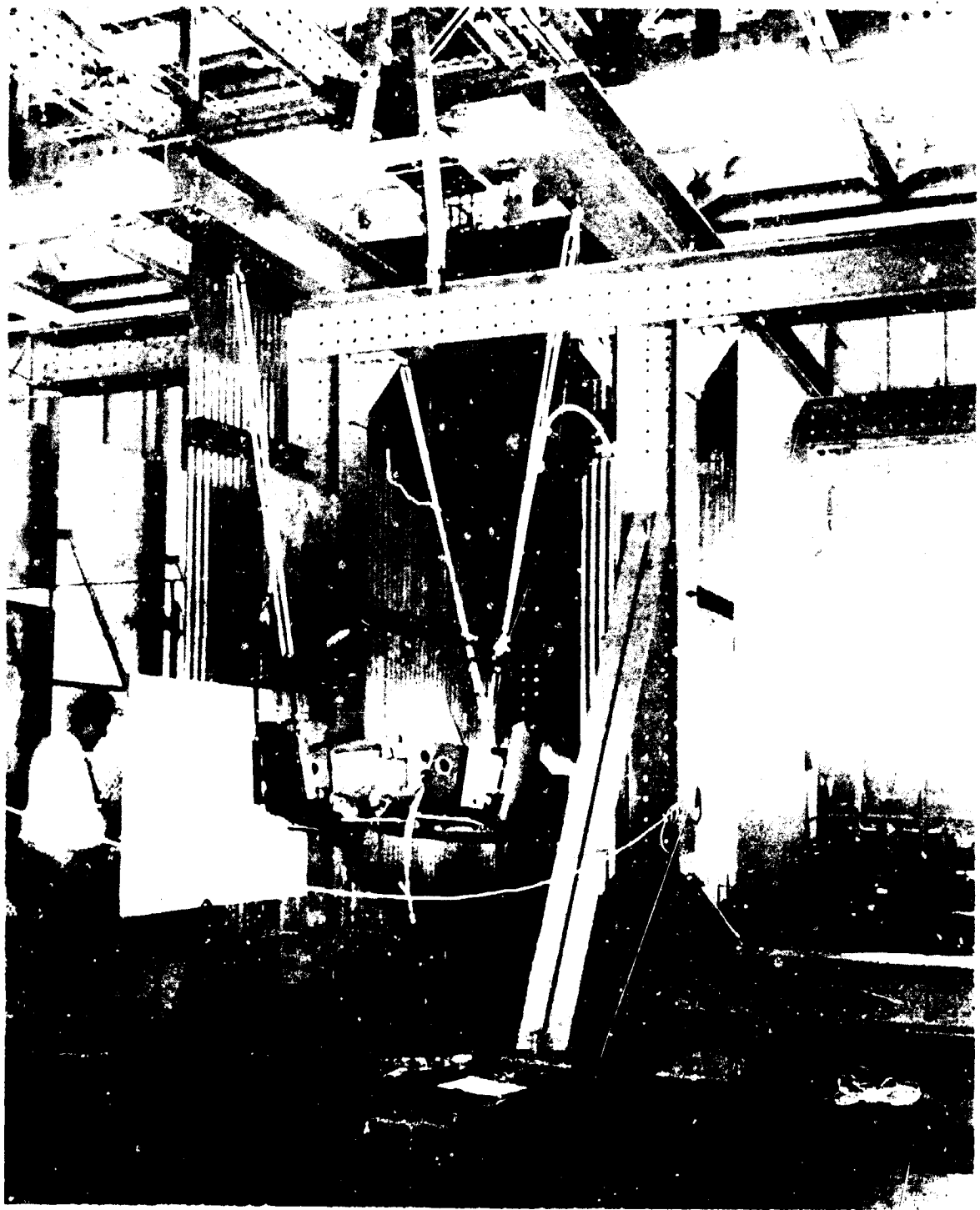
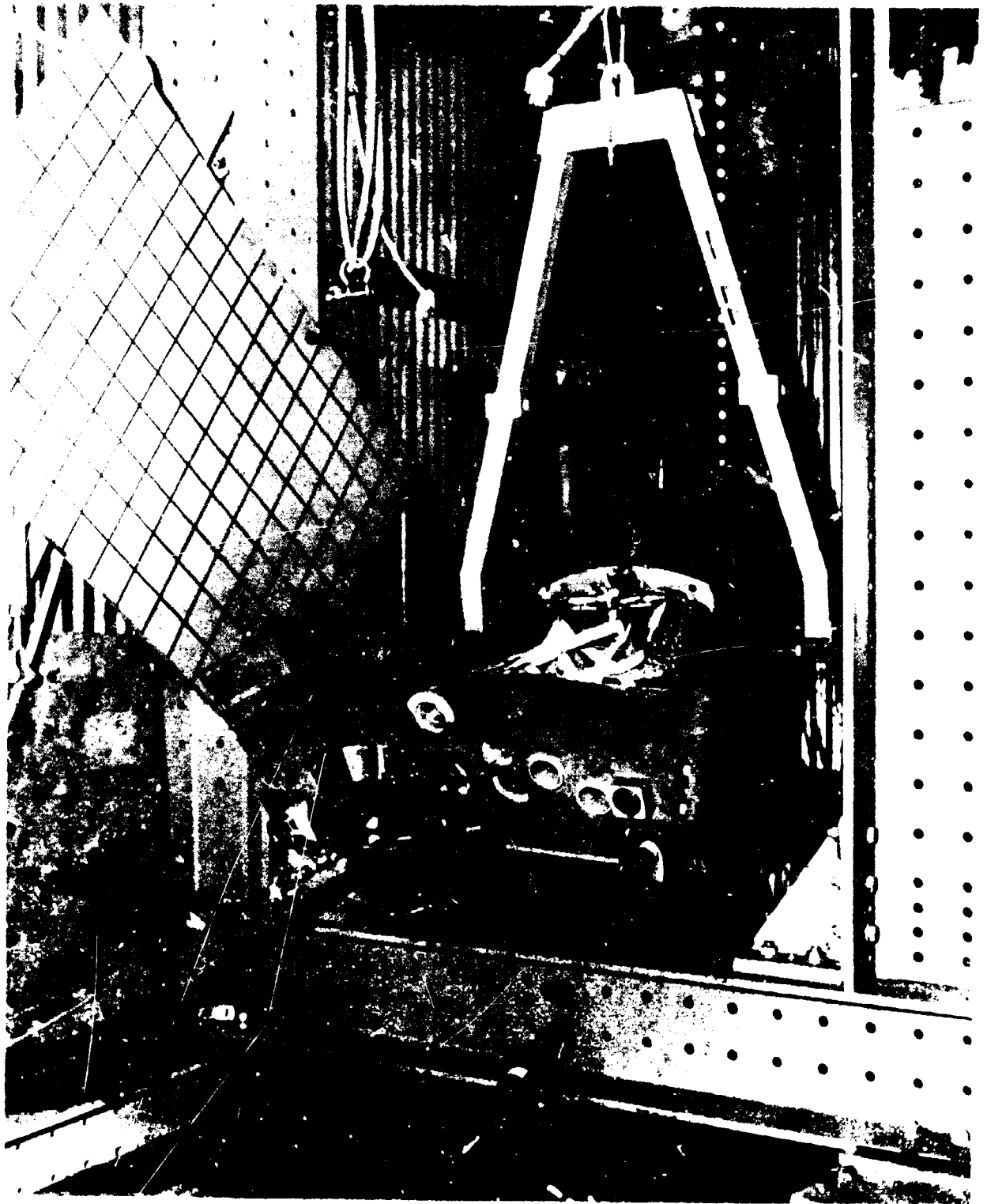
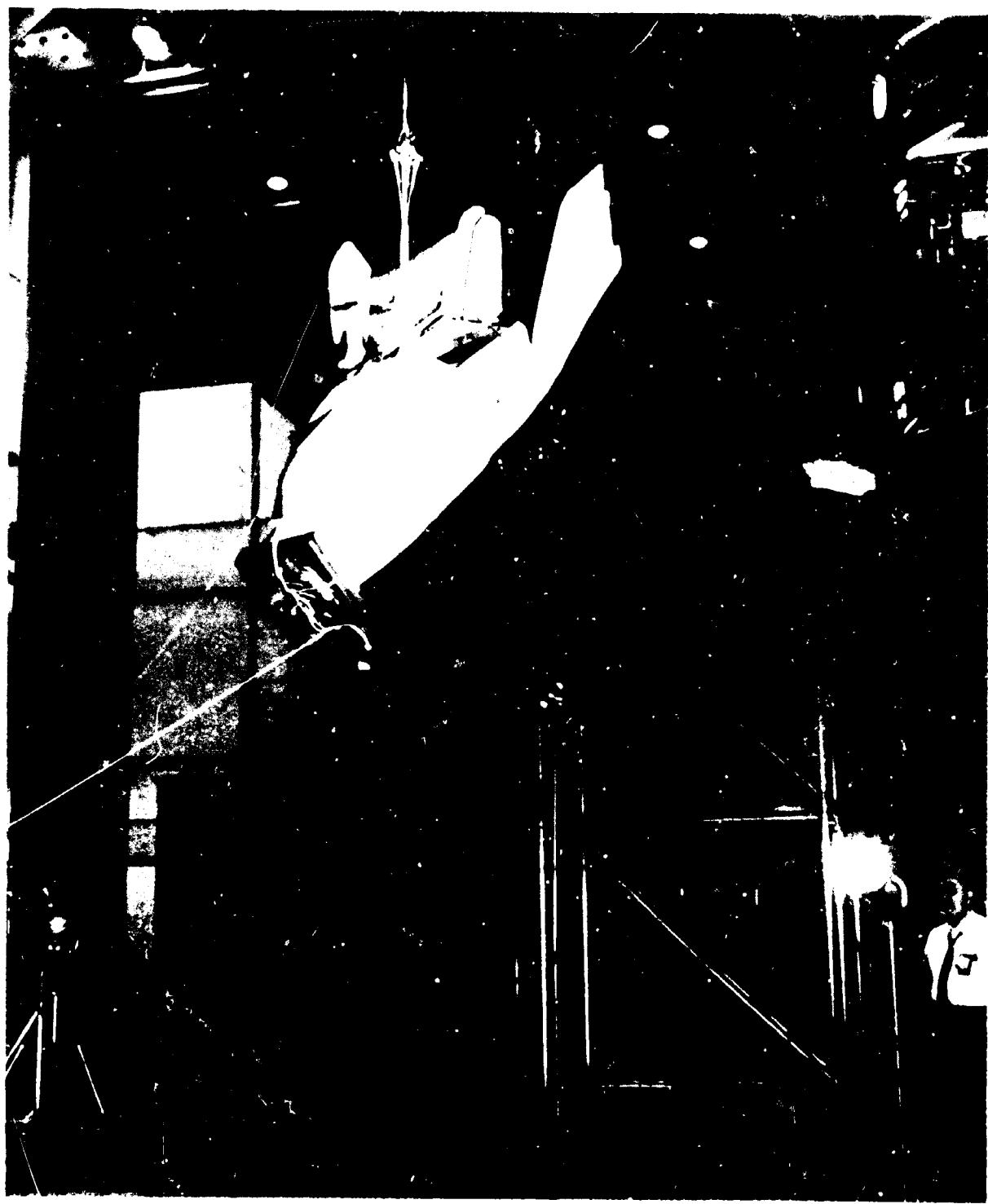


FIGURE IV.A-1. LOCATION OF PYROTECHNIC DEVICES AND ACCELEROMETERS FOR PRIME RE-ENTRY VEHICLE









SECTION IV.A.1

PRIME BOOSTER SEPARATION TESTS

DESCRIPTION OF PYROTECHNIC EVENTS

The test configuration for Shot 1 utilized three explosive bolts like the one depicted in Figure IV.A.1-1 with 3.1 lb/ft^3 honeycomb shock absorbers installed. The test results indicated that there was a time lag of approximately 12 milliseconds between the firing of the center bolt and that of the two outboard bolts. Each bolt produced a shock which occurred during ignition and a second shock which occurred approximately 1 to 2 milliseconds later. All honeycomb shock absorbers were completely crushed.

In an effort to find a way of attenuating the shock, a single bolt was fired in the center location using a high crushing force honeycomb absorber (5.7 lb/ft^3). The results of this test are presented in Figure IV.A.1-12.

To continue the study of attenuation characteristics, shot 5 was conducted using explosive nuts rather than explosive bolts. The 5.7 lb/ft^3 honeycomb absorbers were again used.

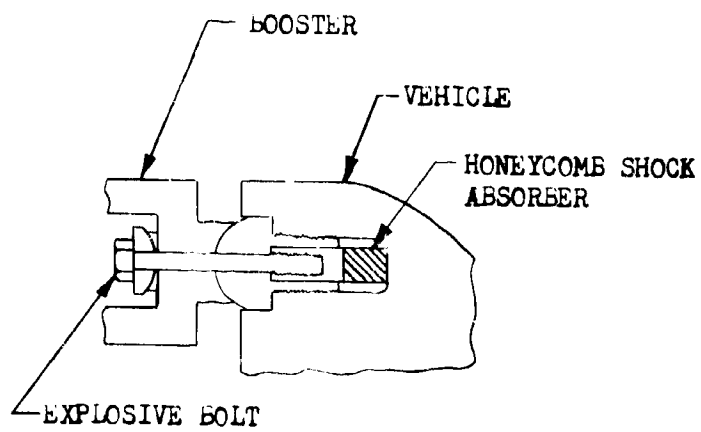
The results of shots 1 and 5 are compared in figures IV.A.1-2 through IV.A.1-11.

DESCRIPTION OF DATA

Figures IV.A.1-2 through IV.A.1-12 present 27 shock spectra for the three tests described above as itemized in Table IV.A.1-1.

TABLE IV.A.1
INDEX OF DATA LOCATIONS

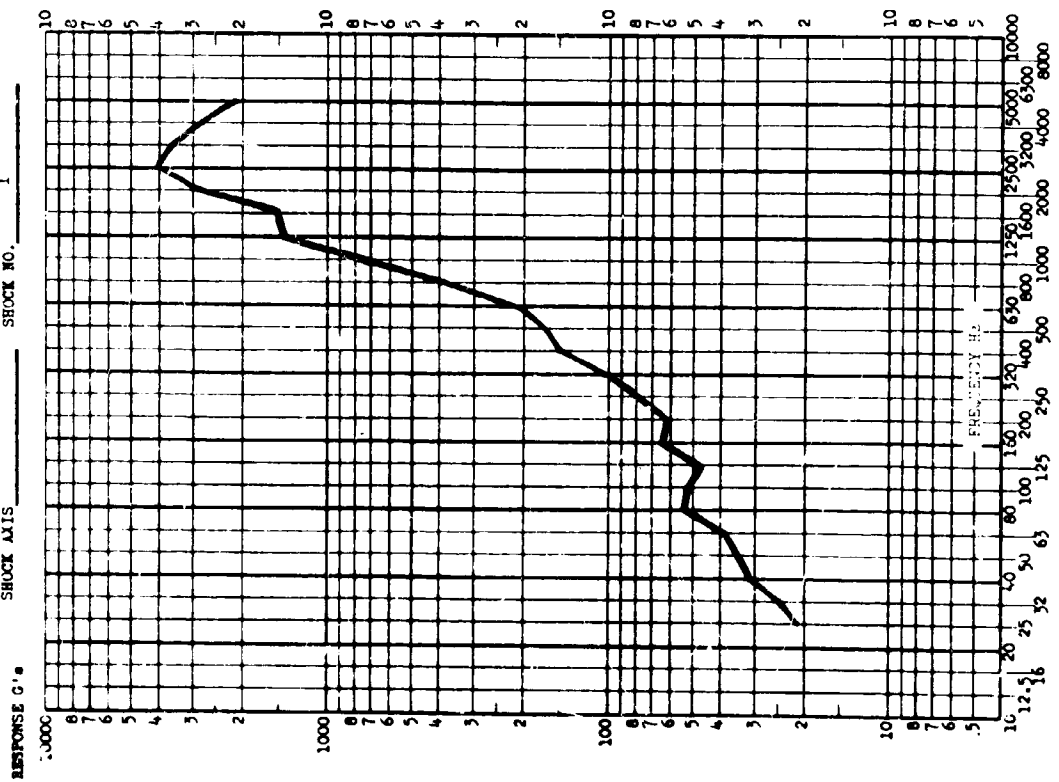
<u>Shock No.</u>	<u>Accelerometer No.s</u>	<u>Figure No.</u>
1 and 5	1A, 1A roll	IV.A.1-2
1 and 5	2 ptich, 2 roll	IV.A.1-3
1 and 5	2 yaw, 3 roll	IV.A.1-4
1 and 5	3 pitch, 3 yaw	IV.A.1-5
5	1X pitch, 1X yaw	IV.A.1-6
5	1B pitch, 3B yaw	IV.A.1-7
5,1	5B ptich, 6 yaw	IV.A.1-8
1	6 roll, 7 pitch	IV.A.1-9
1	7 roll, 7 yaw	IV.A.1-10
1	9 roll, 9 yaw	IV.A.1-11
Booster Bolt Test	1A, 2 pitch	IV.A.1-12



EXPLOSIVE BOLT (BOOSTER SEPARATION)

FIGURE IV.A.1-1 EXPLOSIVE BOLT/SHOCK ABSORBER CONFIGURATION

TEST ITEM PRIME BOOSTER SEPARATION
 ACCEL. NO. 1A TEST DATE March 29, 1966
 SHOCK AXIS Roll SHOCK NO. 1



TEST ITEM PRIME BOOSTER SEPARATION
 ACCEL. NO. 1A TEST DATE May 24, 1966
 SHOCK AXIS Roll SHOCK NO. 5

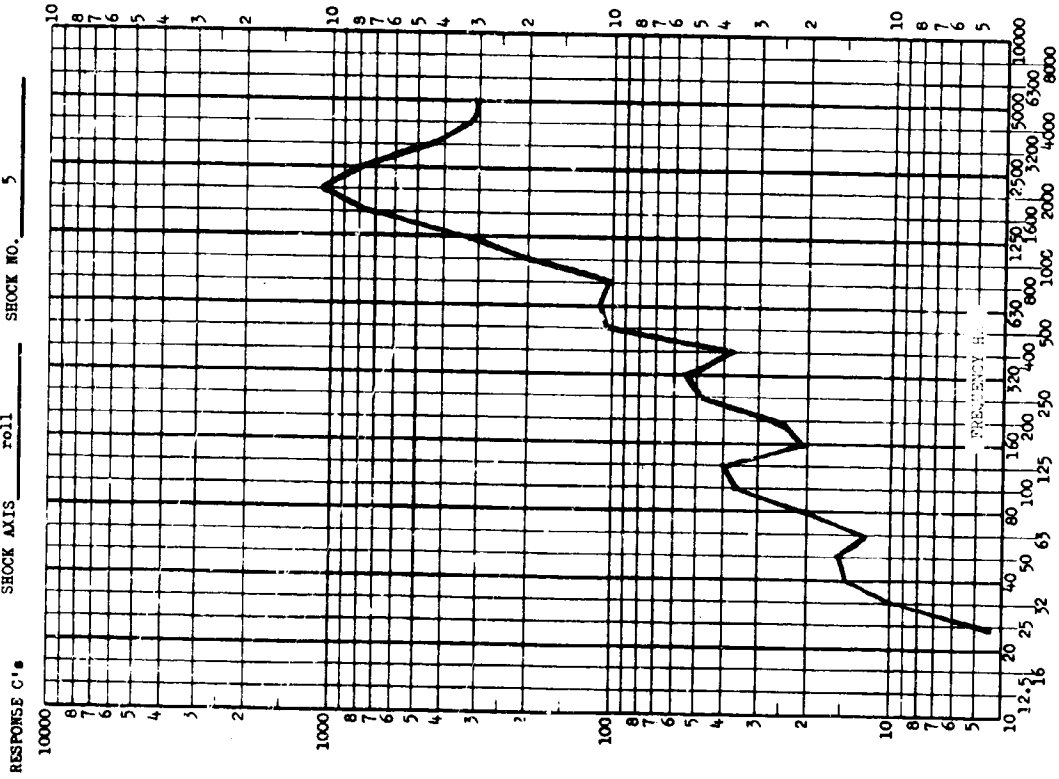
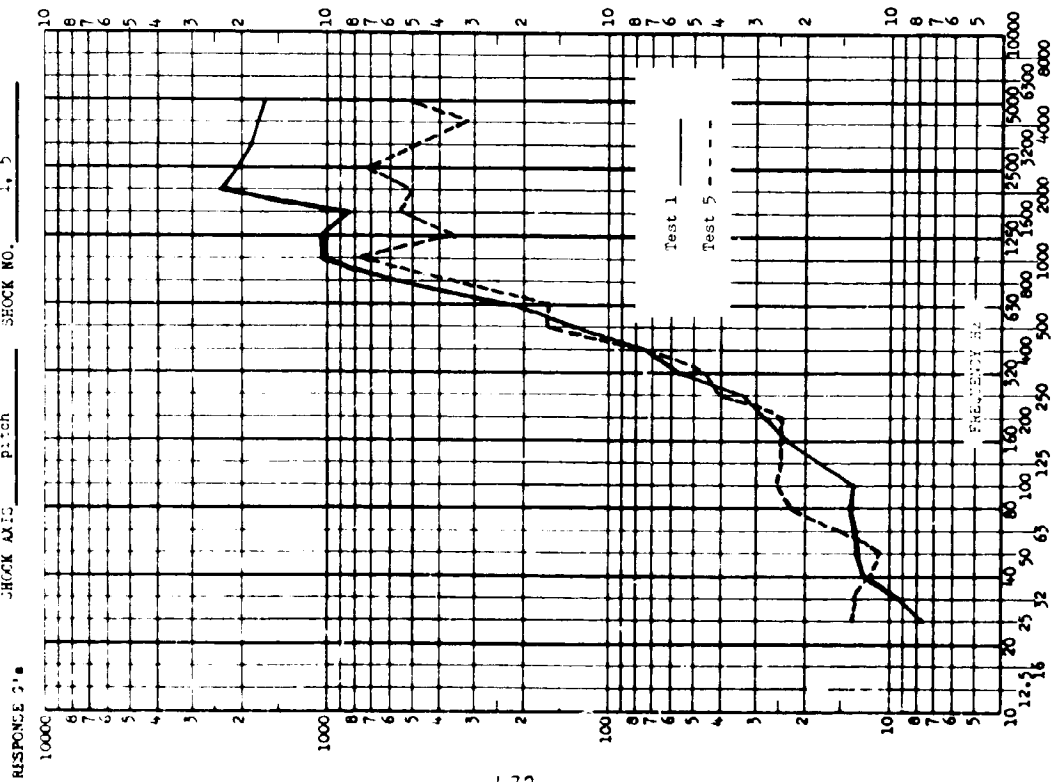


FIGURE IV.A.1-2

TEST ITEM: BOOSTER SEPARATION
 COLL. NO.: 1
 TEST DATE: 3/29/66, 5/24/66
 SHOCK AXIS: pitch
 SHOCK NO.: 1, 5



TEST ITEM: BOOSTER SEPARATION
 COLL. NO.: 2
 TEST DATE: 3/29/66, 5/24/66
 SHOCK AXIS: Roll
 SHOCK NO.: 1, 5

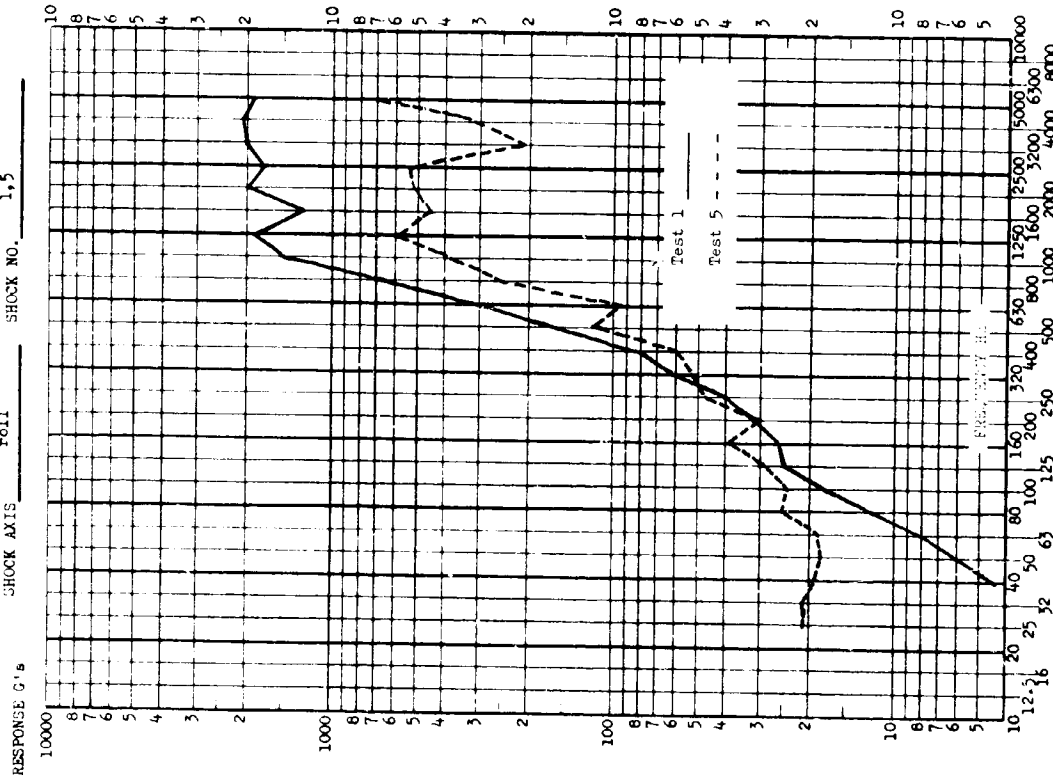
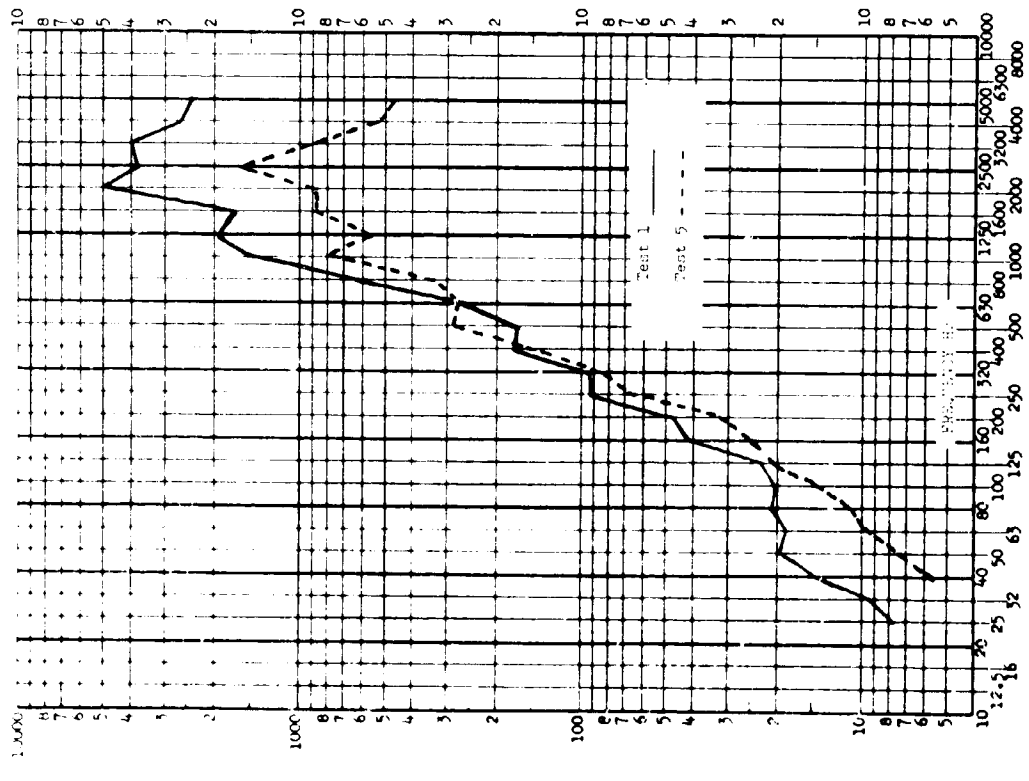


FIGURE IV.A.1-3

TEST ITEM: BOASTER SEPARATION
 VIB. NO.: 2
 TEST DATE: 3/29/66, 5/4/66
 SHOCK AXIS: JAW
 SHOCK NO.: 1-5



TEST ITEM: BOASTER SEPARATION
 VIB. NO.: 3
 TEST DATE: 3/29/66, 5/24/66
 SHOCK AXIS: roll
 SHOCK NO.: 1-5

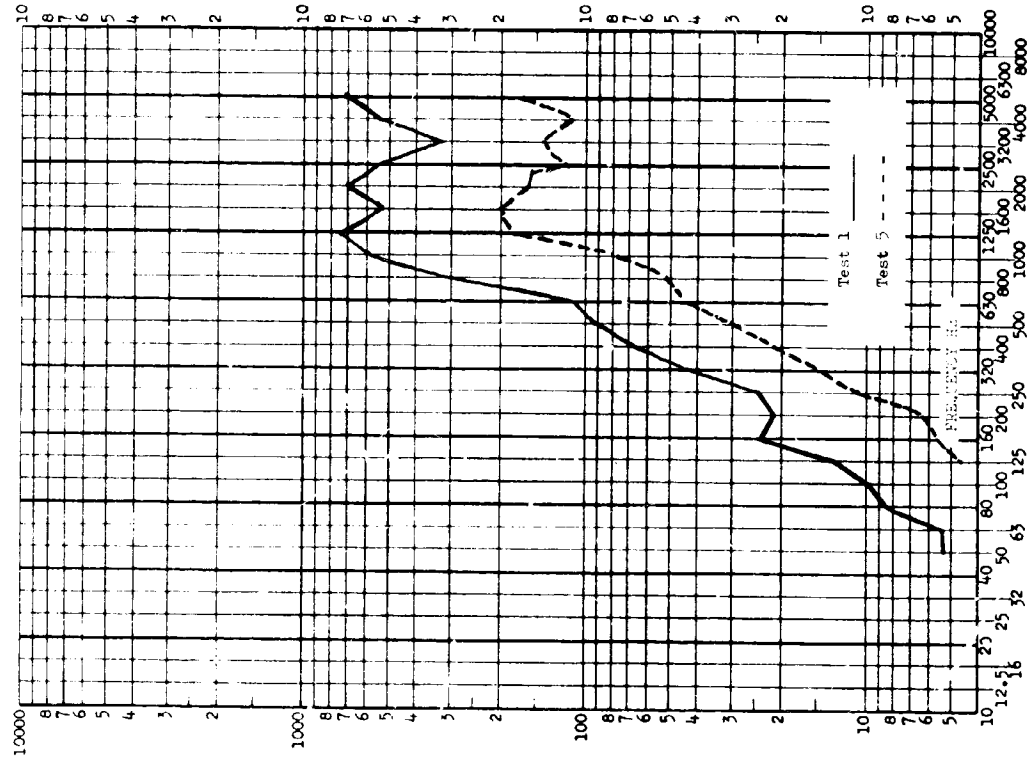
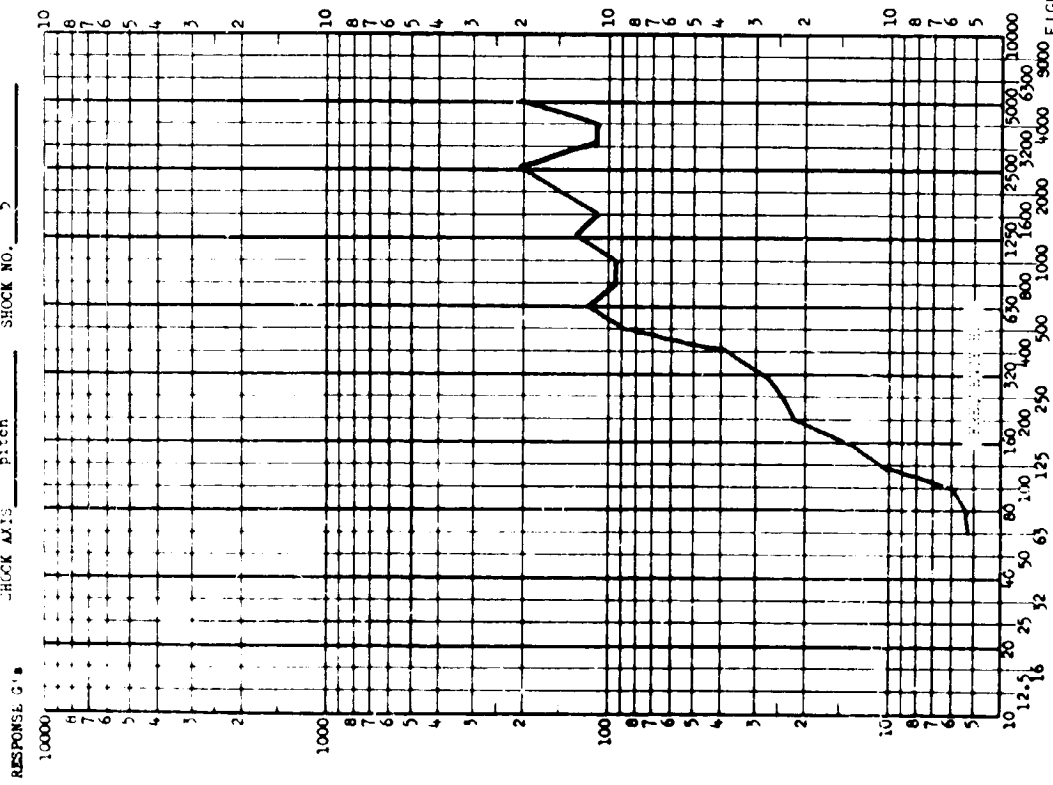


FIGURE IV.A.1-4

TEST ITEM: PRIMARY BOOSTER SEPARATION

TEST NO. 3 TEST DATE May 24, 1966
SHOCK AXIS pitch SHOCK NO. 5



TEST ITEM: PRIMARY BOOSTER SEPARATION

TEST NO. 3 TEST DATE 3/29/66, 5/24/66
SHOCK AXIS yaw SHOCK NO. 1, 5

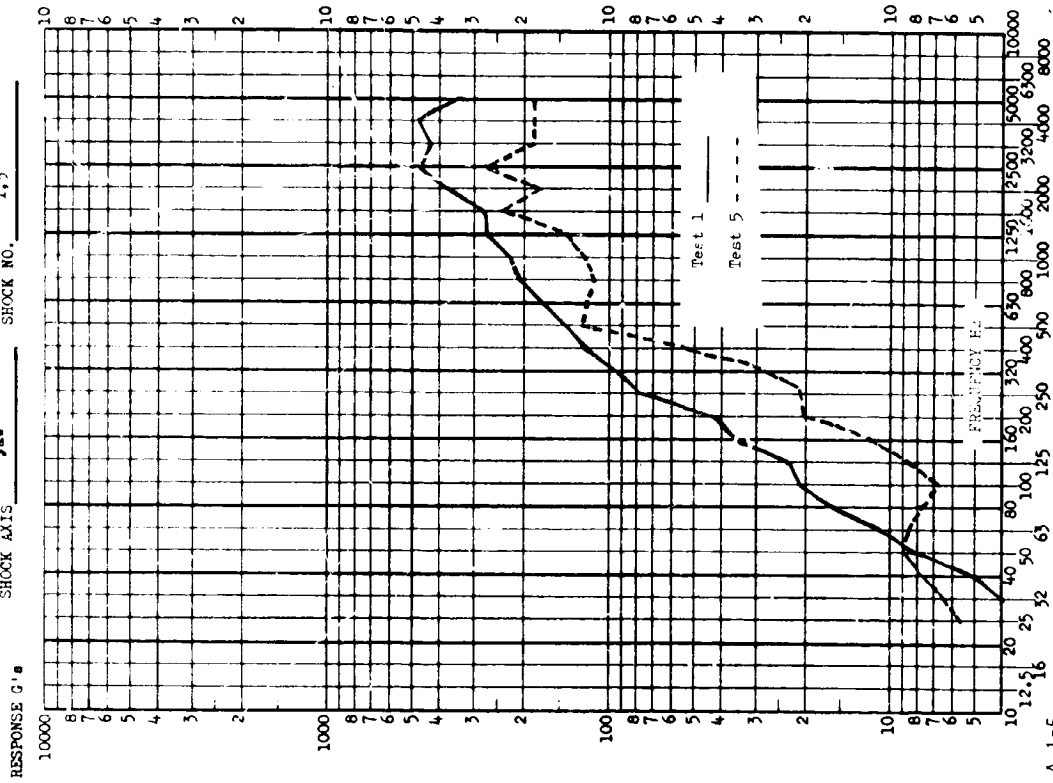
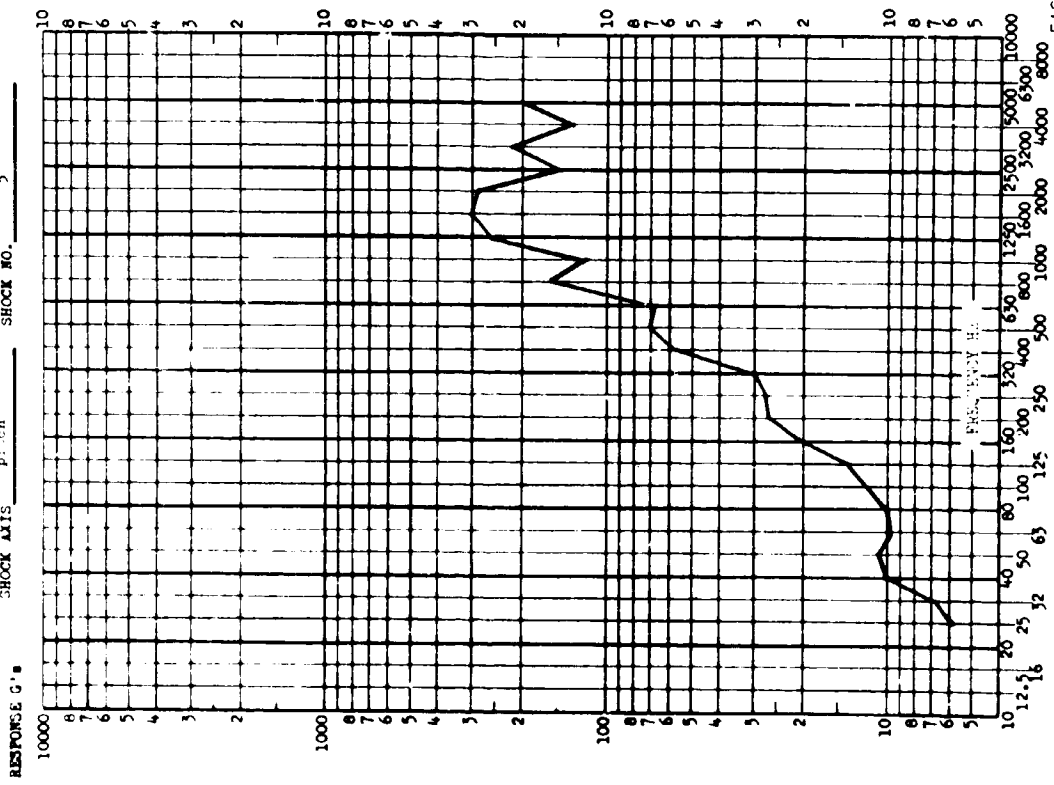


FIGURE IV.A.1-5

TEST ITEM 11111 BOOSTER SEPARATION
 A.I.L. NO. 11 TEST DATE May 24, 1966
 SHOCK AXIS pitch SHOCK NO. 5



TEST ITEM 11111 BOOSTER SEPARATION
 A.I.L. NO. 11 TEST DATE May 24, 1966
 SHOCK AXIS yaw SHOCK NO. 5

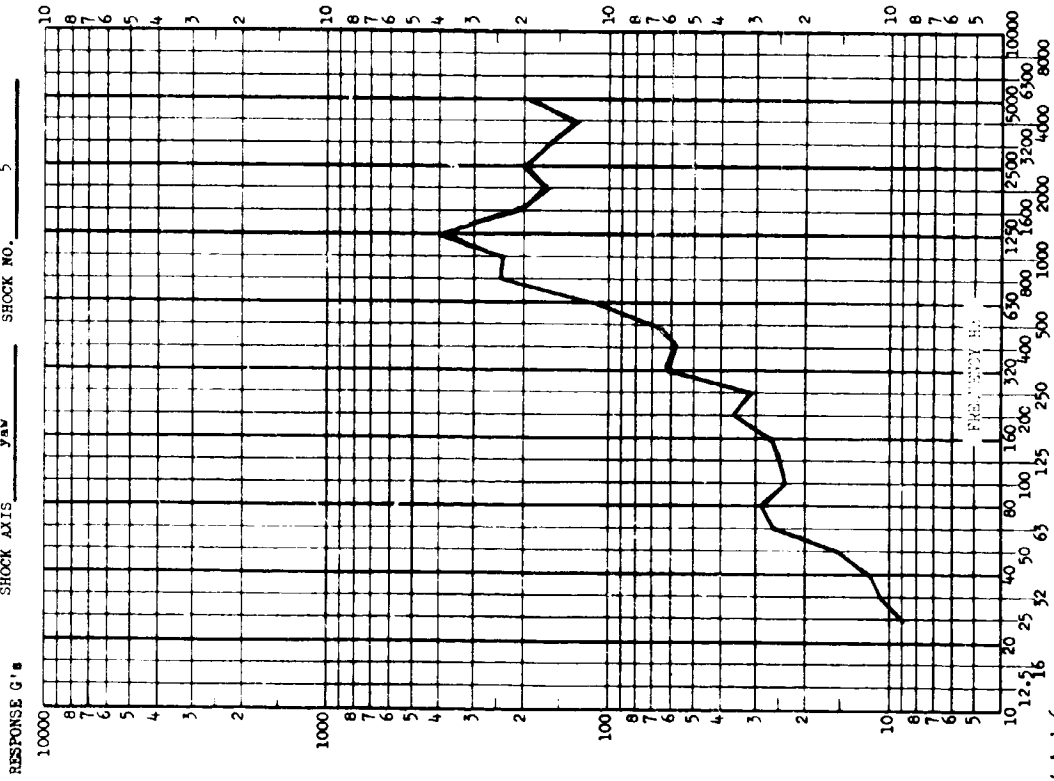
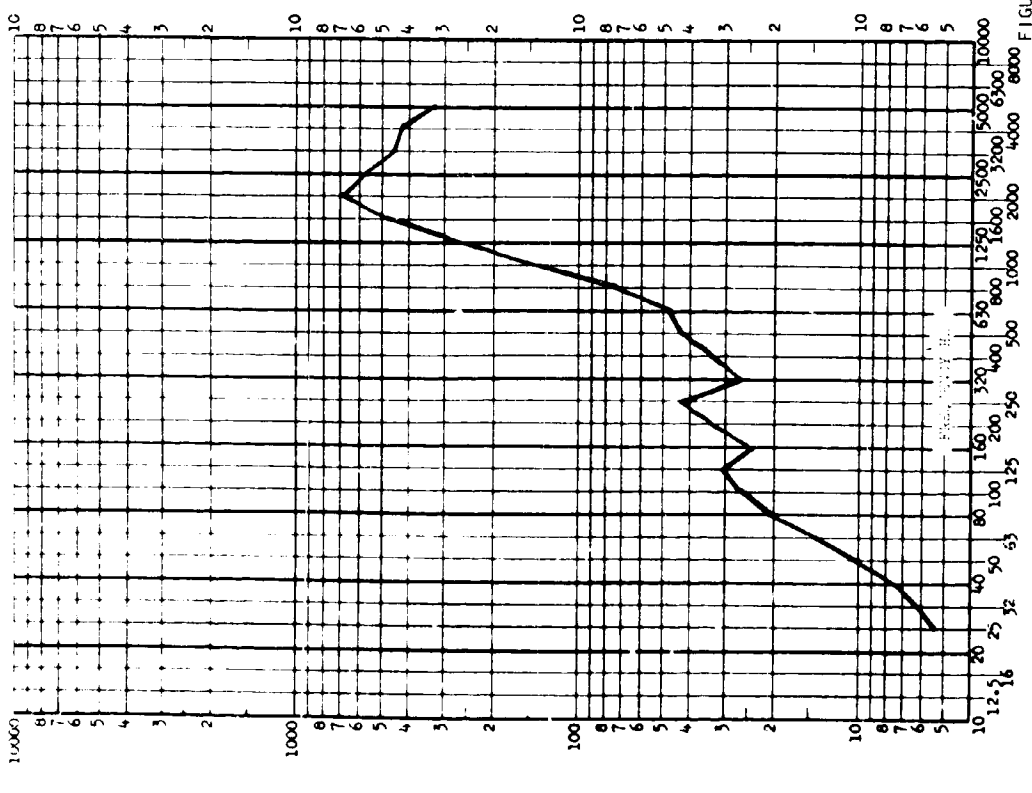


FIGURE IV.A.1-6

TEST ITEM: HEXA BOOSTER SEPARATION
 SERIAL NO.: 1B TEST DATE: May 24, 1966
 SHOCK AXIS: pitch SHOCK NO.: 5



TEST ITEM: HEXA BOOSTER SEPARATION
 SERIAL NO.: 1B TEST DATE: May 24, 1966
 SHOCK AXIS: yaw SHOCK NO.: 5

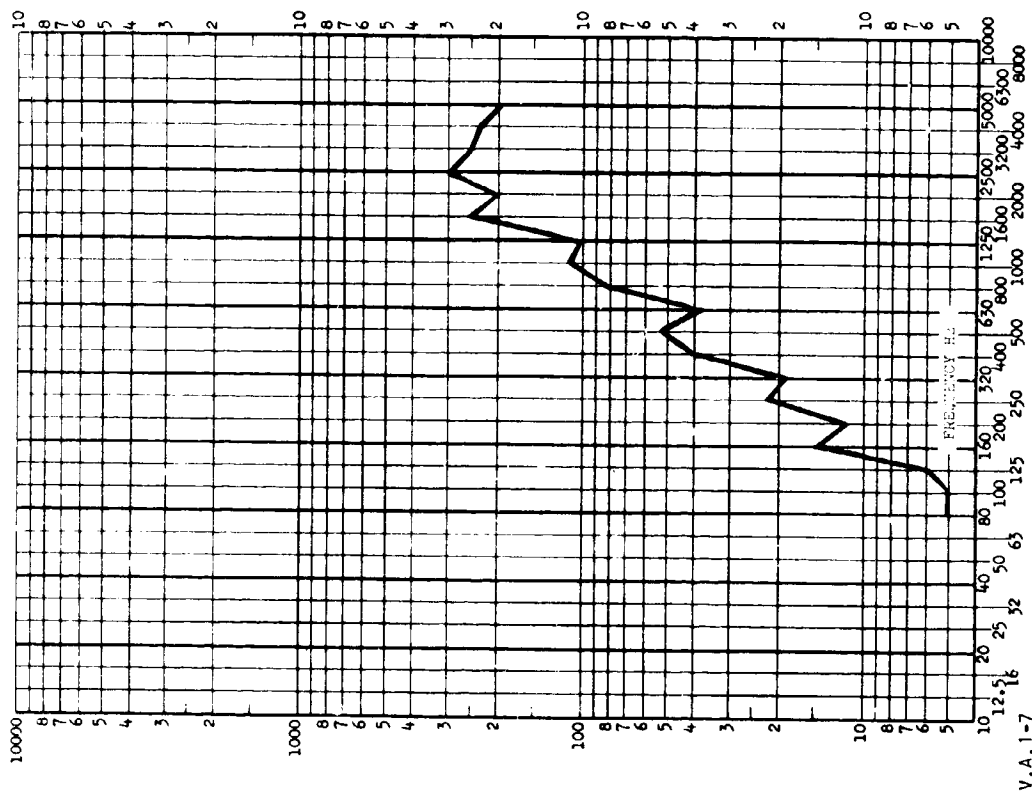
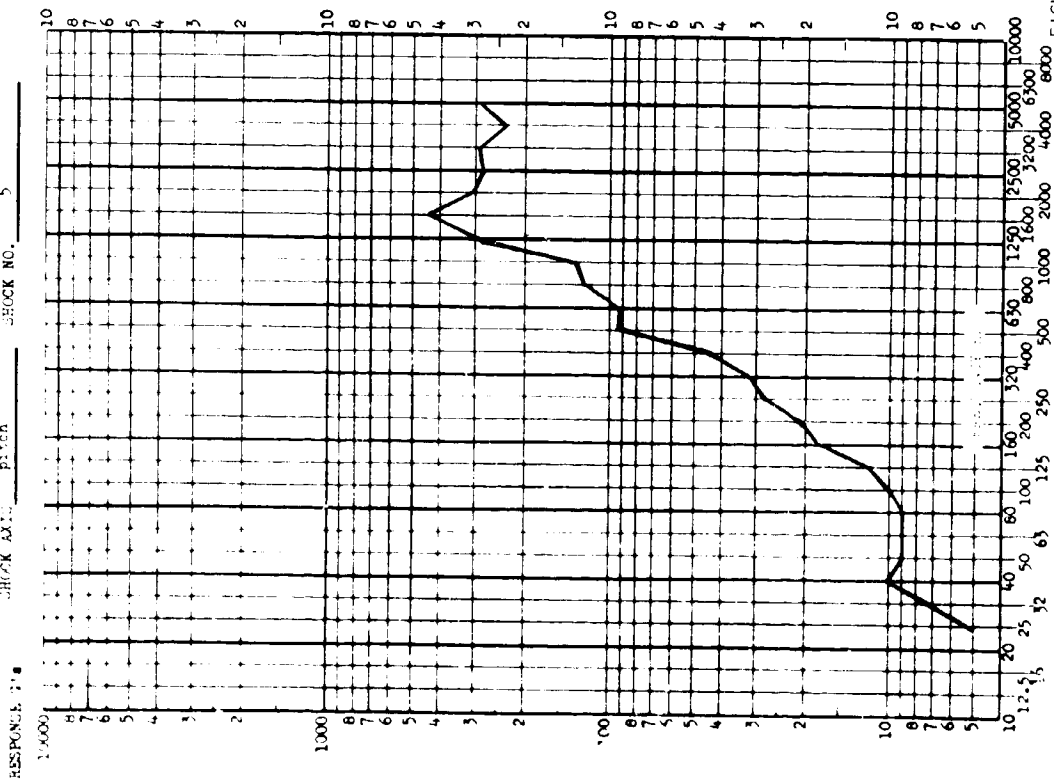


FIGURE IV.A.1-7

TEST ITEM: BOOSTER SEPARATION

TEST NO.: 58 TEST DATE: MAY 24, 1965
SHOCK AXIS: pitch SHOCK NO.: 5



TEST ITEM: BOOSTER SEPARATION

TEST NO.: 6 TEST DATE: March 29, 1966
SHOCK AXIS: yaw SHOCK NO.: 1

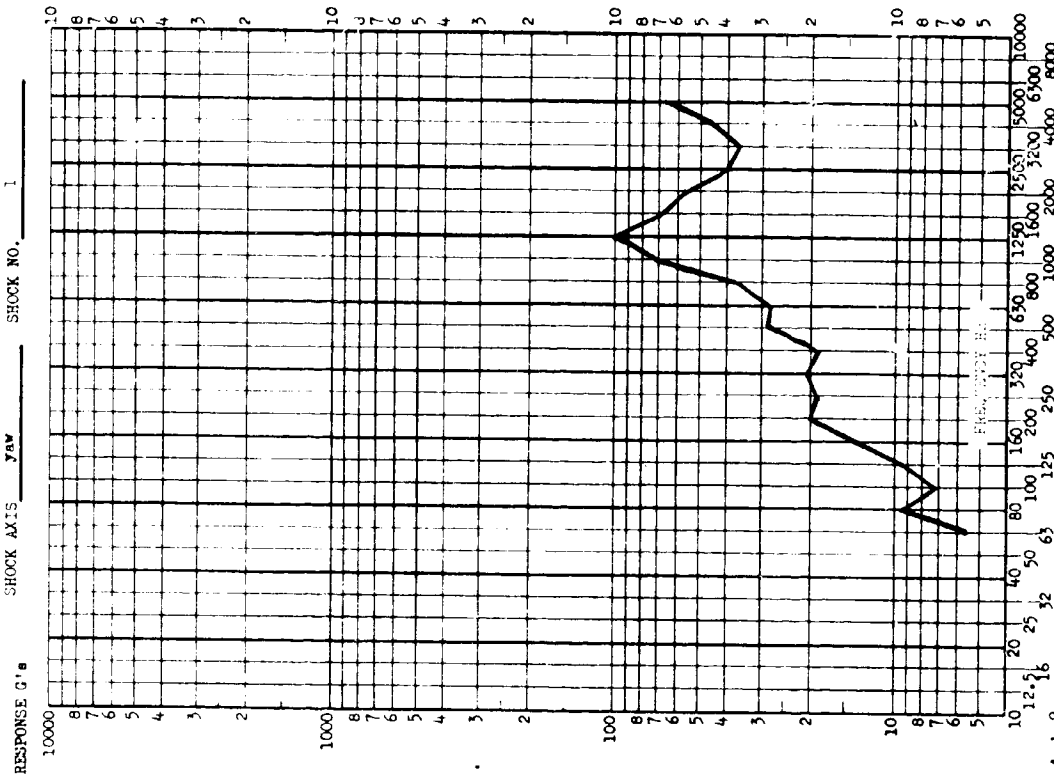
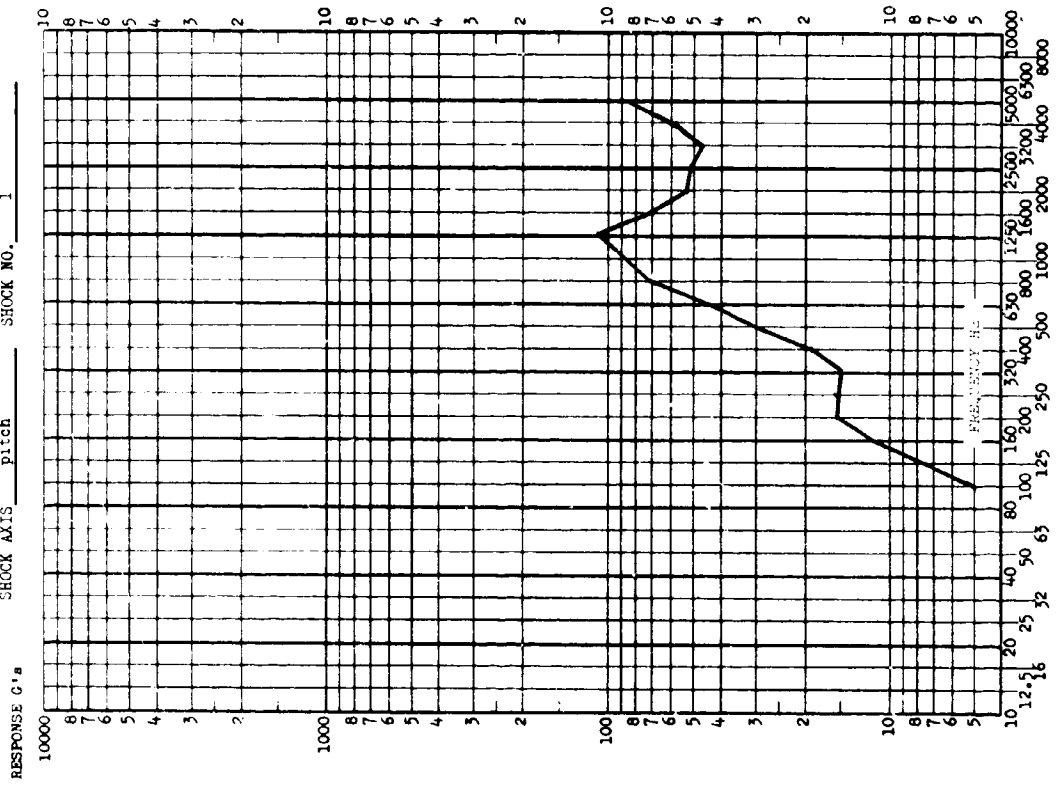


FIGURE IV.A.11-8

TEST ITEM BOOSTER SEPARATION
 No. 7 TEST DATE March 29, 1966
 SHOCK AXIS pitch SHOCK NO. 1



TEST ITEM BOOSTER SEPARATION
 No. 5 TEST DATE March 29, 1966
 SHOCK AXIS roll SHOCK NO. 1

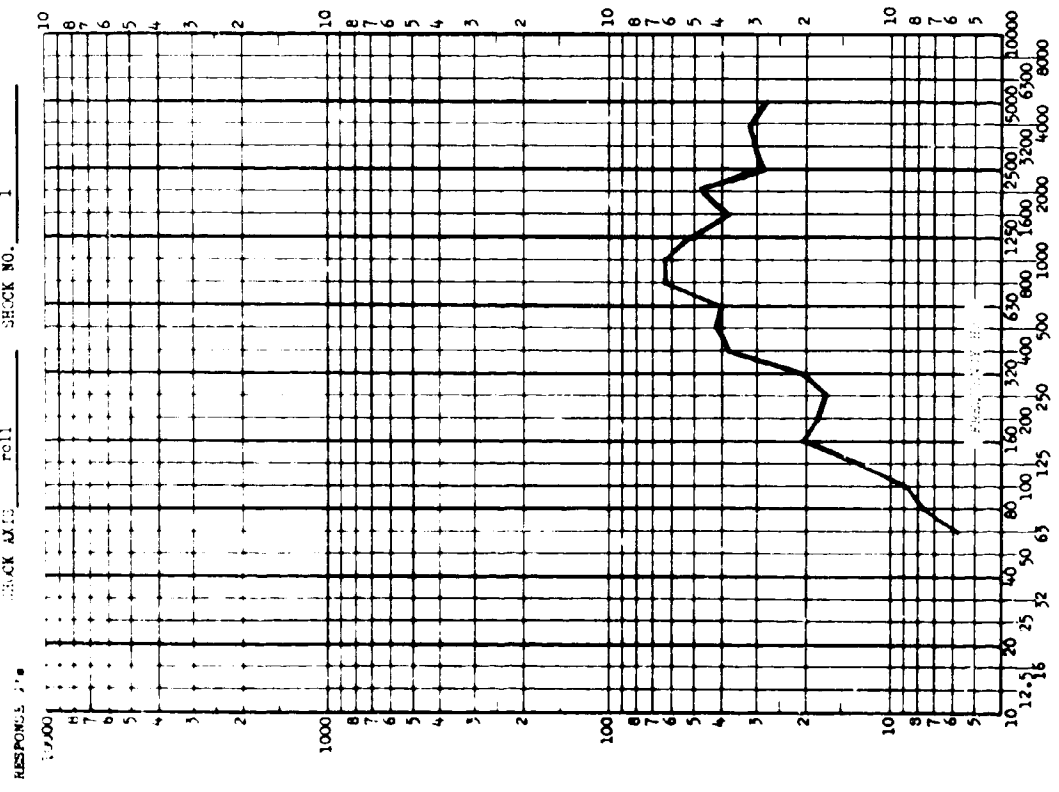
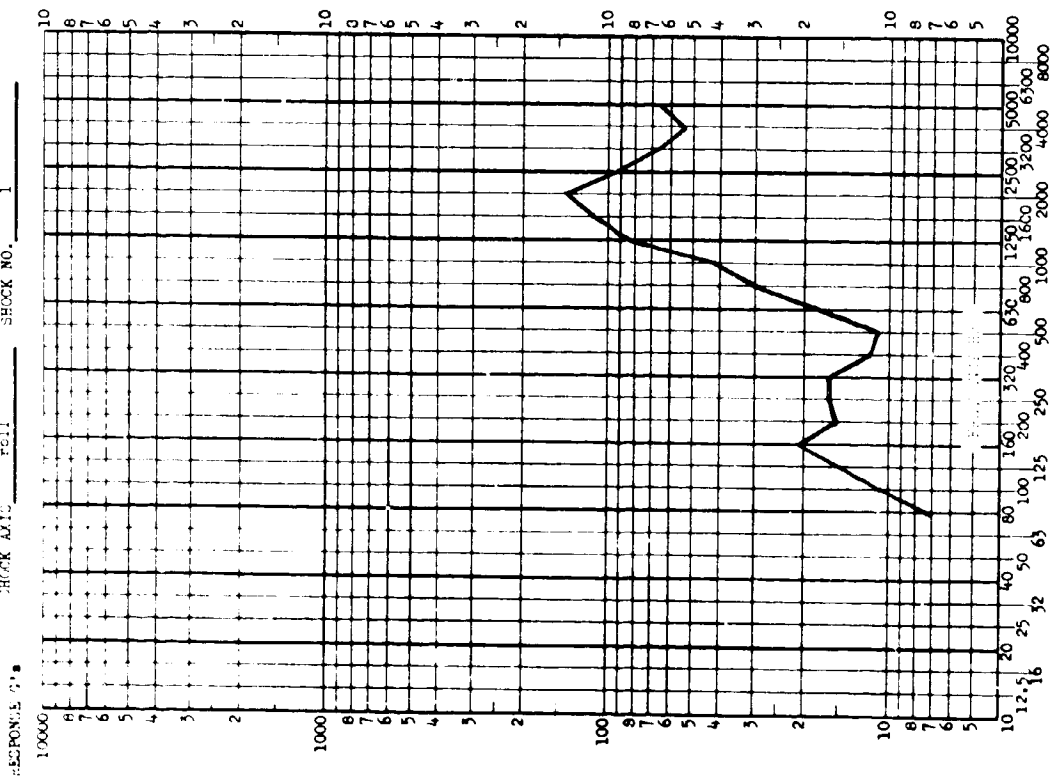


FIGURE IV.A.1-9

TEST ITEM 100% ROCKET SEPARATION
 TEST NO. 7 TEST DATE March 29, 1964
 SHOCK AXIS roll SHOCK NO. 1



TEST ITEM 100% ROCKET SEPARATION
 TEST NO. 7 TEST DATE March 29, 1964
 SHOCK AXIS yaw SHOCK NO. 1

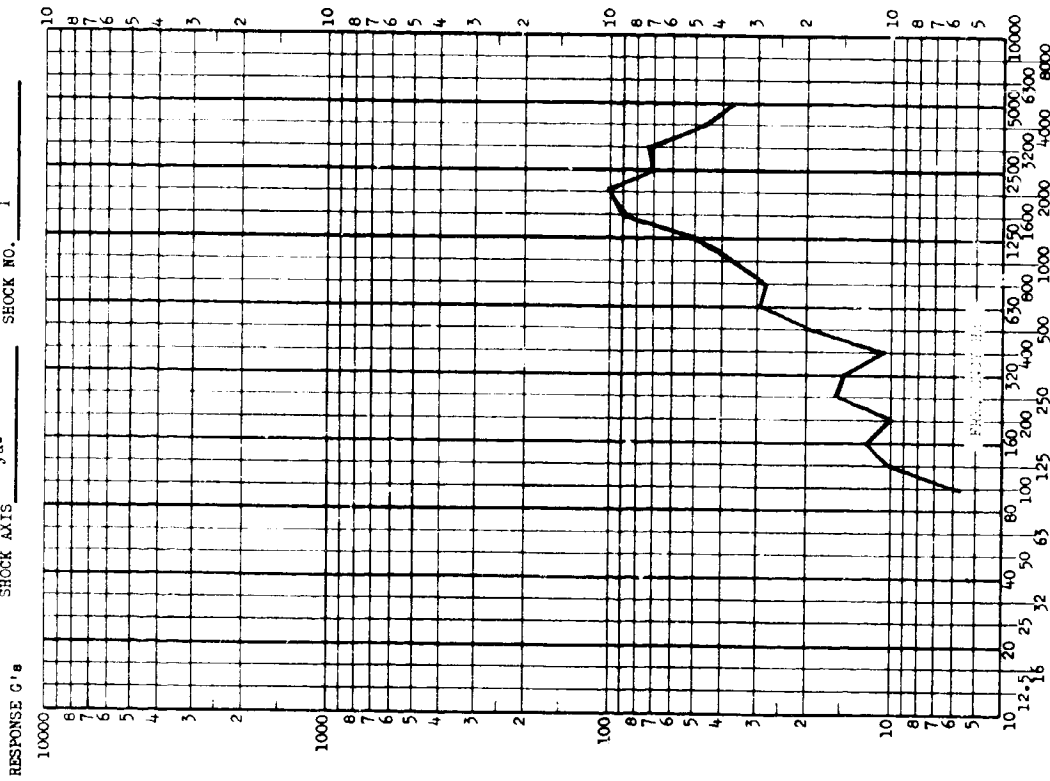
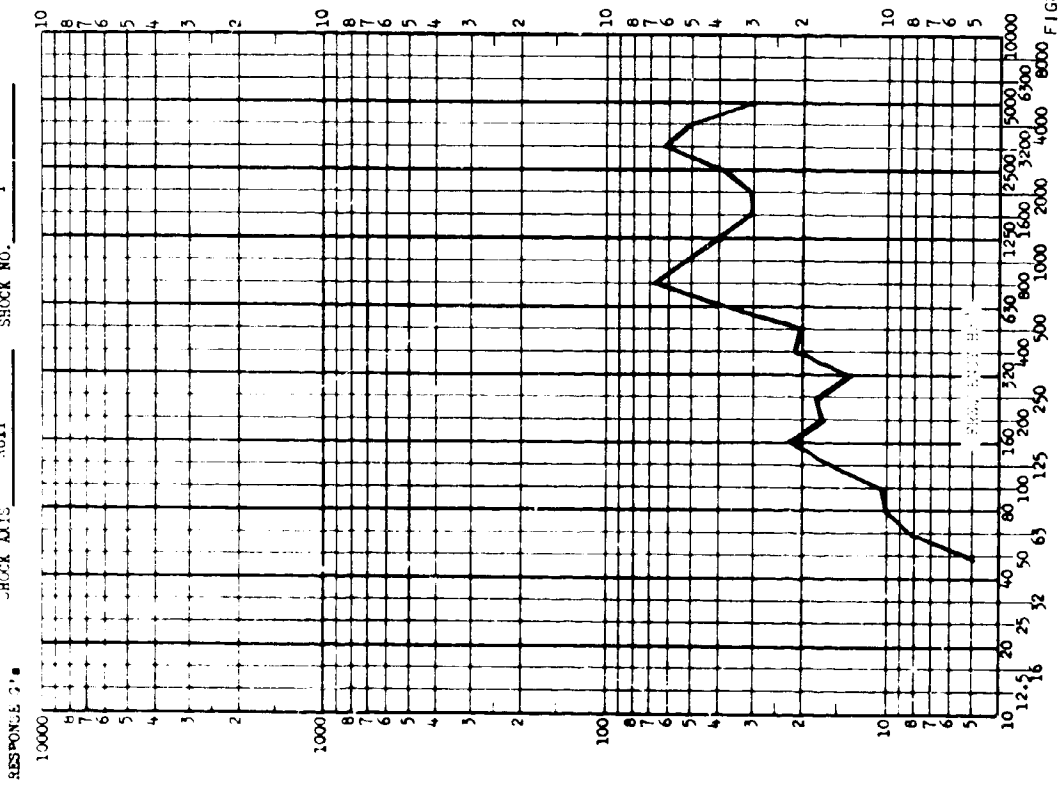


FIGURE IV.A.1-10

TEST ITEM ENGINE BOOSTER SEPARATION
 TEST NO. 9 TEST DATE March 29, 1966
 SHOCK AXIS Roll SHOCK NO. 1



TEST ITEM ENGINE BOOSTER SEPARATION
 TEST NO. 9 TEST DATE March 29, 1966
 SHOCK AXIS Yaw SHOCK NO. 1

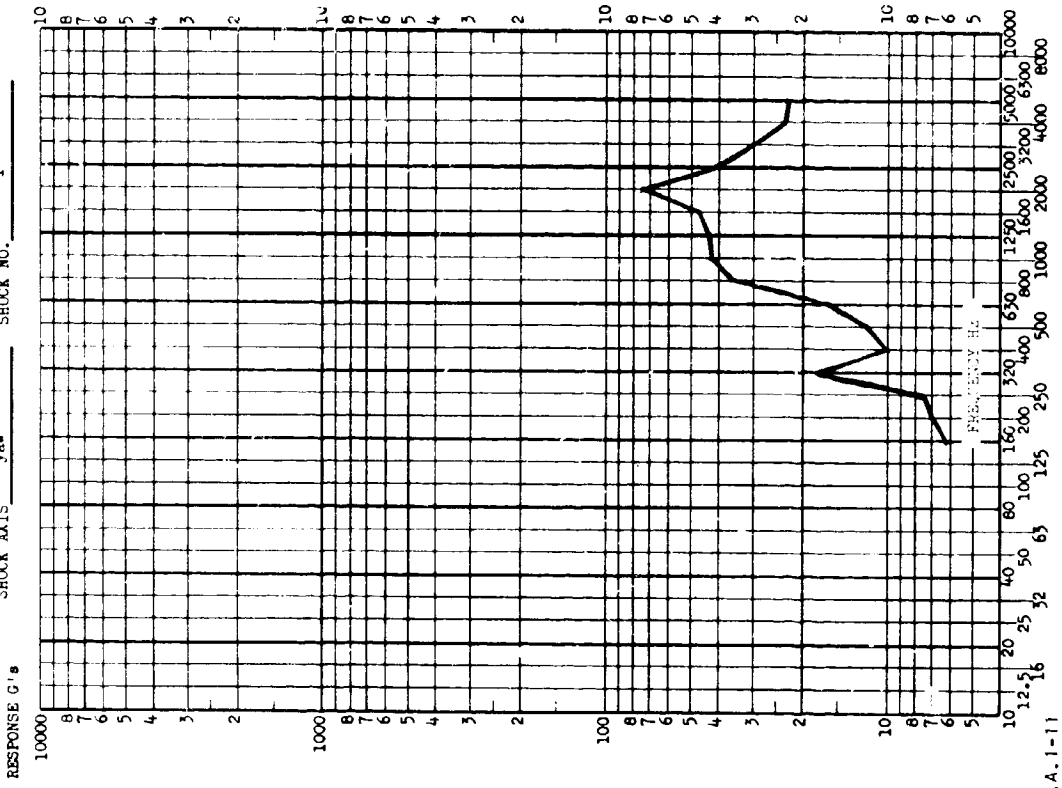
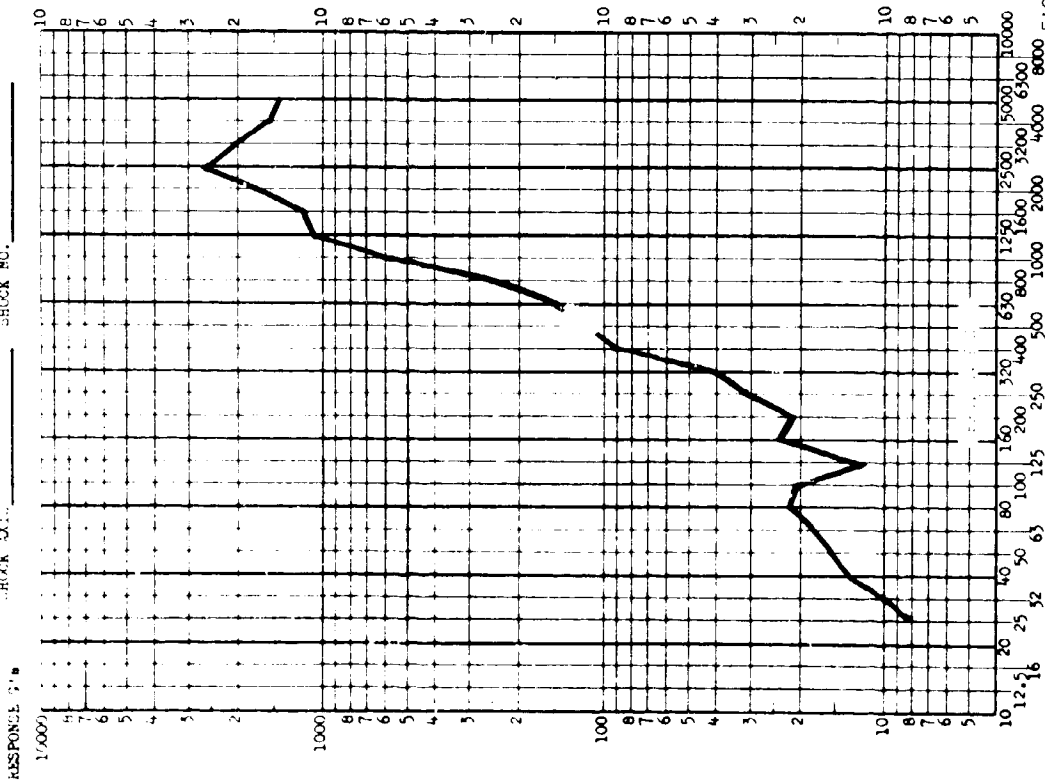


FIGURE IV.A.1-11

TEST ITEM _____ BOOSTER BOLT TEST

VIB. NO. _____ TEST DATE March 31, 1966

SHOCK AXIS _____ SHOCK NO. _____



TEST ITEM _____ BOOSTER BOLT TEST

VIB. NO. _____ TEST DATE March 31, 1966

SHOCK AXIS _____ SHOCK NO. _____

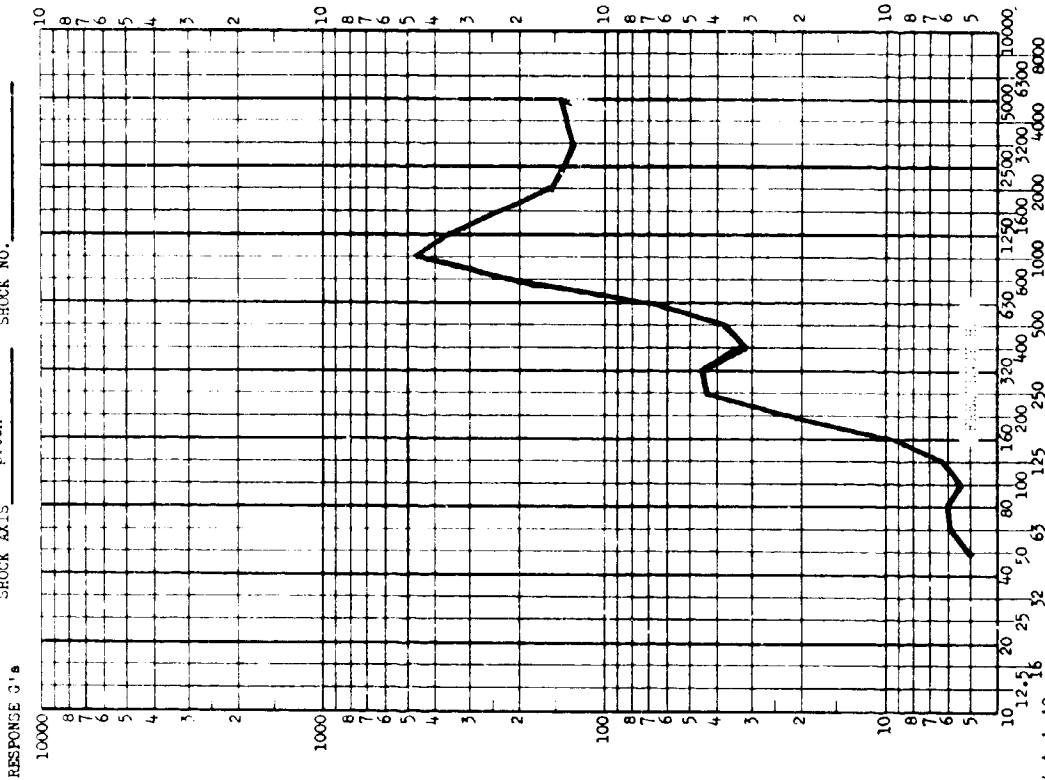


FIGURE IV.A.11-12

SECTION IV.A.2

PRIME PARACHUTE HATCH SEPARATION TESTS

DESCRIPTION OF EVENTS

Six hatch separation tests were conducted, and some of the resulting shock spectra for shots 2 through 6 are presented. The important differences among the attenuation devices employed from test to test are cited in Table IV.A.2-1.

DESCRIPTION OF DATA

Fifty-nine shock spectra are presented in Figures IV.A.2-1 through IV.A.2-19 as itemized in Table IV.A.2-2.

DESCRIPTION OF PYROTECHNIC

Type: FLSC
Size: 5 grains per foot

TABLE IV.A.2-1
 VARIATIONS IN ATTENUATION DEVICES

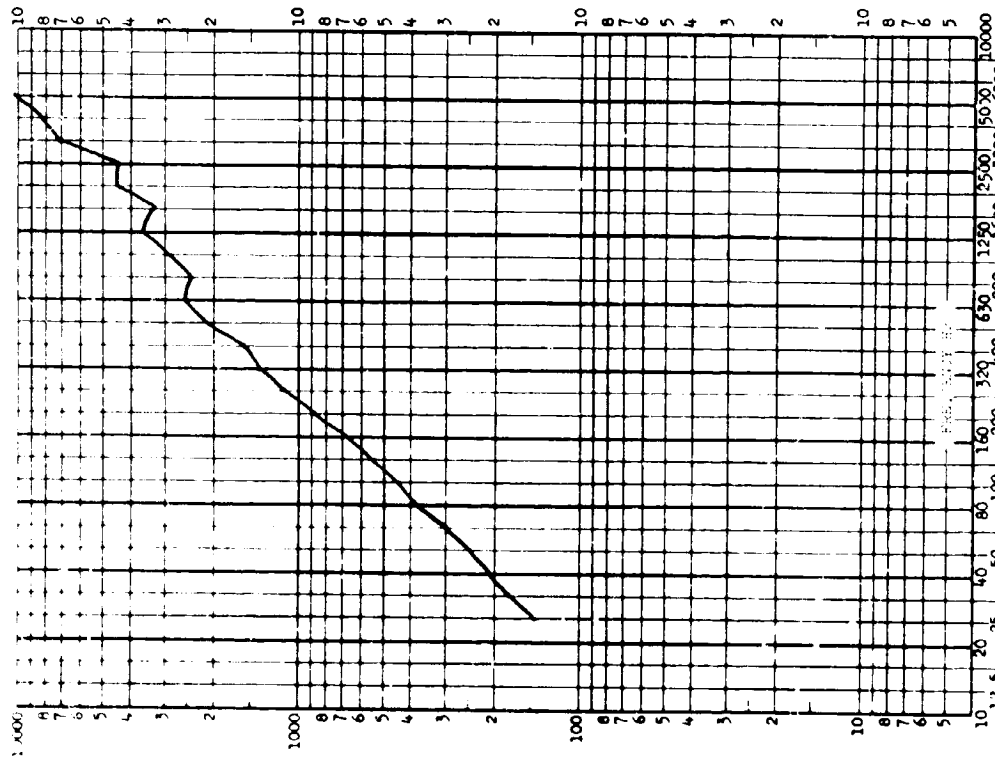
<u>Shock Number</u>	<u>Attenuation Devices</u>	<u>Effected Accelerometer Locations</u>
2	standard	
3	rubber washers at recovery can	5
	0.07 inch Pyrotex inserts for equipment beam mounting points	7,9
4	LORD Mounts and Pyrotex inserts at recovery can	5
	2-0.07 inch Pyrotex inserts for equipment beam mounting points	7,9
5	Lower attach points of recovery can were riveted and LORD mounts were again used at the upper attach points	5
	Layers of fairprene at equipment beam's primary mounting points	7,7B 9A,9B
6	Pyrotex inserts at equip- ment beam's primarily attach points and rubber inserts at other attach- ment points.	7,7,B

TABLE IV.A.2-2

INDEX OF DATA LOCATIONS

<u>Figure No.</u>	<u>Graph 1</u>		<u>Graph 2</u>	
	<u>Shock No.s</u>	<u>Accel. No.s</u>	<u>Shock No.s</u>	<u>Accel. No.s</u>
IV.A.2-1	4	1C	5, 6	1C2
IV.A.2-2	2,3	2 roll	2, 3	2 pitch
IV.A.2-3	2,3	2 yaw	2, 3	3 roll
IV.A.2-4	3	3 yaw	4	3B yaw
IV.A.2-5	2,3	5 roll	4, 5	5 roll
IV.A.2-6	2,3	5 pitch	5	5 pitch
IV.A.2-7	4	5 yaw	2, 3	6 roll
IV.A.2-8	2	6 yaw	2, 3	7 roll
IV.A.2-9	4,5,6	7 roll	2, 3	7 pitch
IV.A.2-10	5,6	7 pitch	2, 3	7 yaw
IV.A.2-11	6	7 yaw	5, 6	7B roll
IV.A.2-12	5,6	7B pitch	5, 6	7B yaw
IV.A.2-13	2,3	9 roll	4	9 roll
IV.A.2-14	2,3	9 pitch	3	9 yaw
IV.A.2-15	4,5	9A roll	4, 5	9A pitch
IV.A.2-16	5	9B roll	4	9A yaw
IV.A.2-17	5	9B pitch	5	9B yaw
IV.A.2-18	6	11 roll	6	11 pitch
IV.A.2-19	6	11 yaw	---	---

TEST ITEM: HATCH SEPARATION
 TEST DATE: APRIL 21, 1966
 SHOCK AXIS: 4



TEST ITEM: HATCH SEPARATION
 TEST DATE: 5/19/66
 SHOCK AXIS: 5, 6

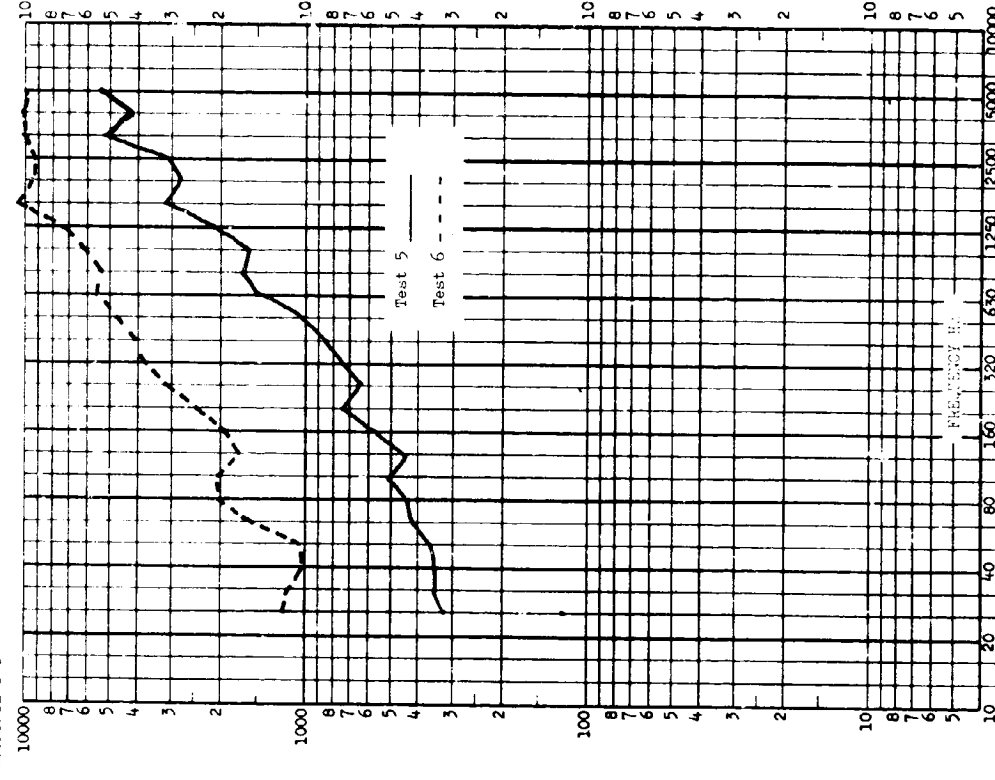
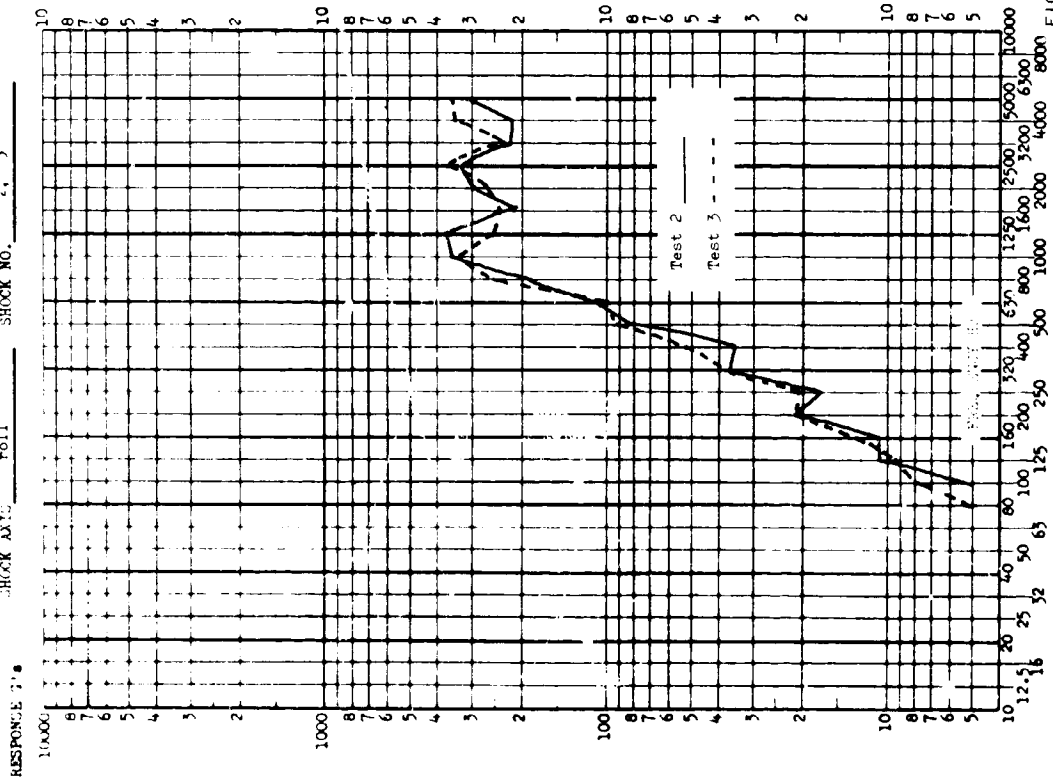


FIGURE IV.A.2-1

TEST ITEM: PRIME HATCH SEPARATION
 A.I. NO.: 2 TEST DATE: 4/6/66, 4/18/66
 SHOCK AXIS: roll SHOCK NO.: 2, 3



TEST ITEM: PRIME HATCH SEPARATION
 A.I. NO.: 2 TEST DATE: 4/6/66, 4/18/66
 SHOCK AXIS: pitch SHOCK NO.: 2, 3

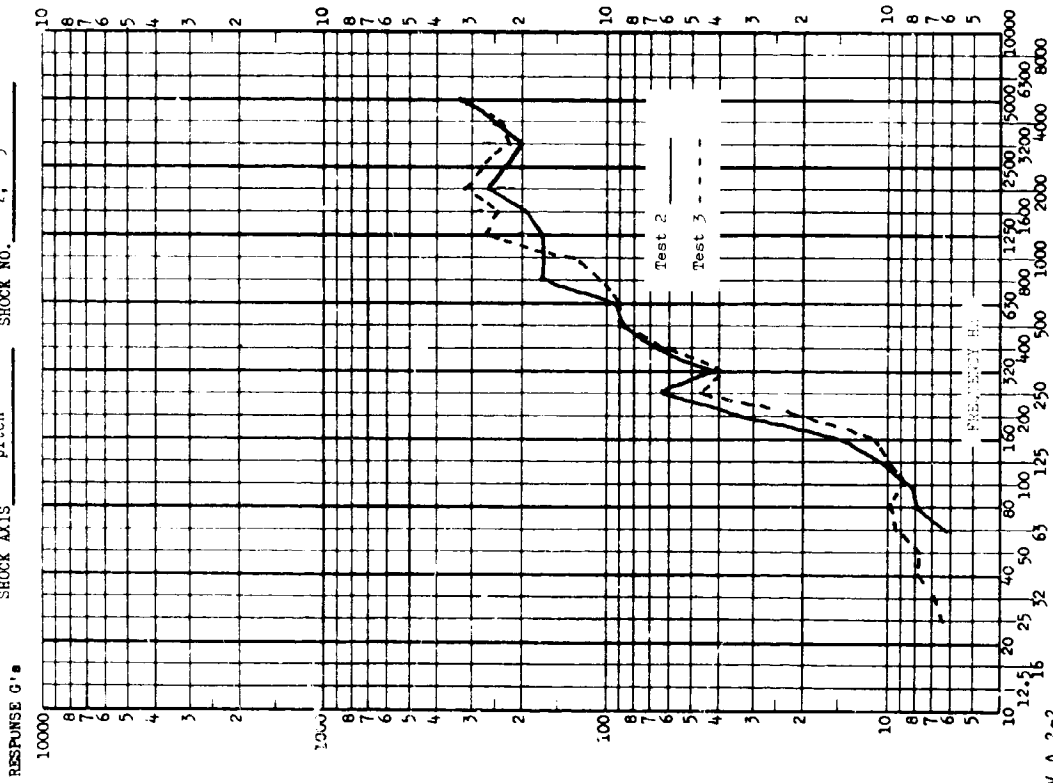
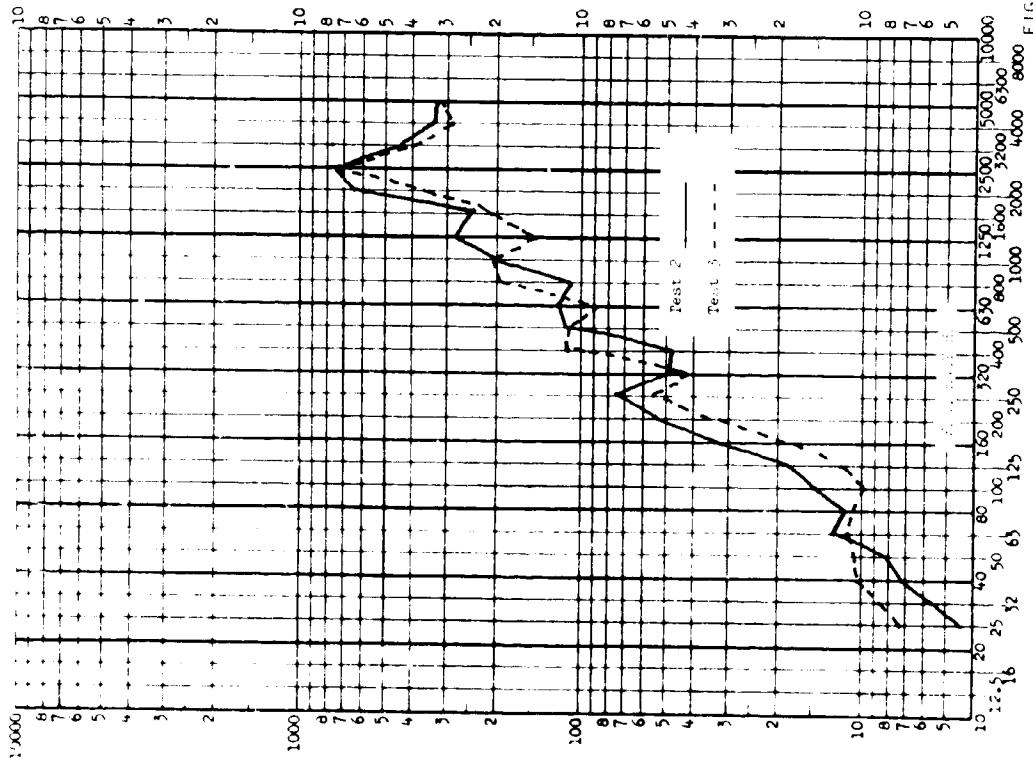


FIGURE IV.A.2-2

TEST ITEM: ROLL HATCH SEPARATION

TEST NO.: 3 TEST DATE: 4/18/66
SHOCK AXIS: yaw SHOCK NO.: 7, 3



TEST ITEM: ROLL HATCH SEPARATION

TEST NO.: 3 TEST DATE: 4/18/66
SHOCK AXIS: roll SHOCK NO.: 7, 3

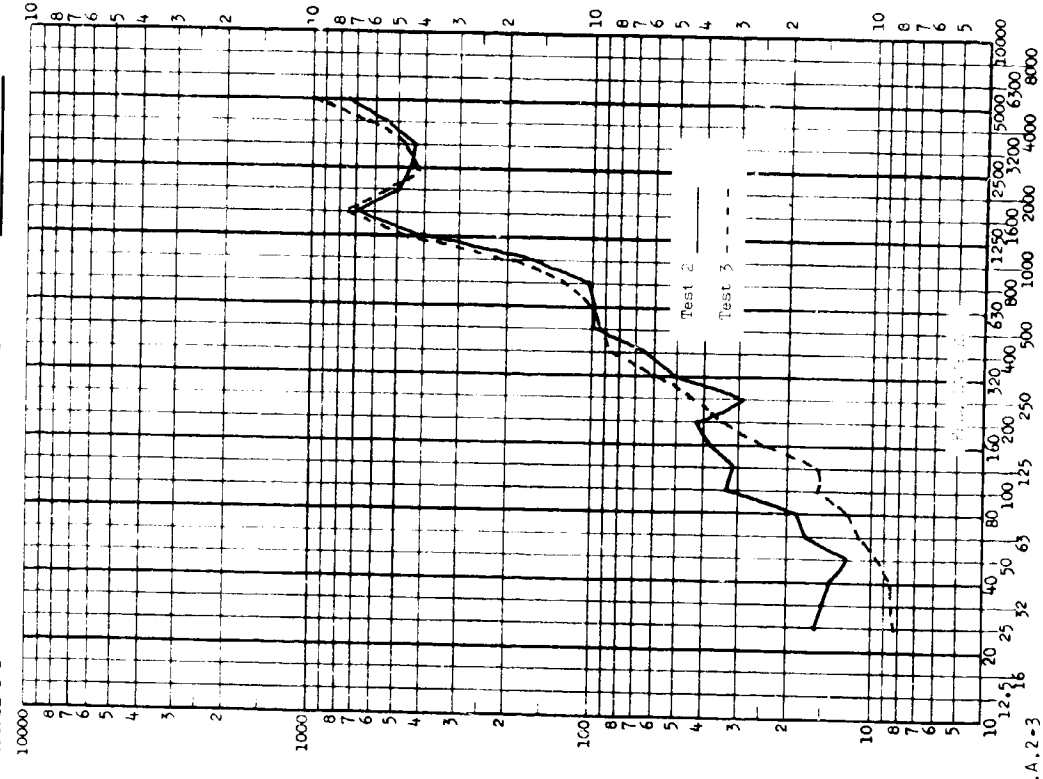
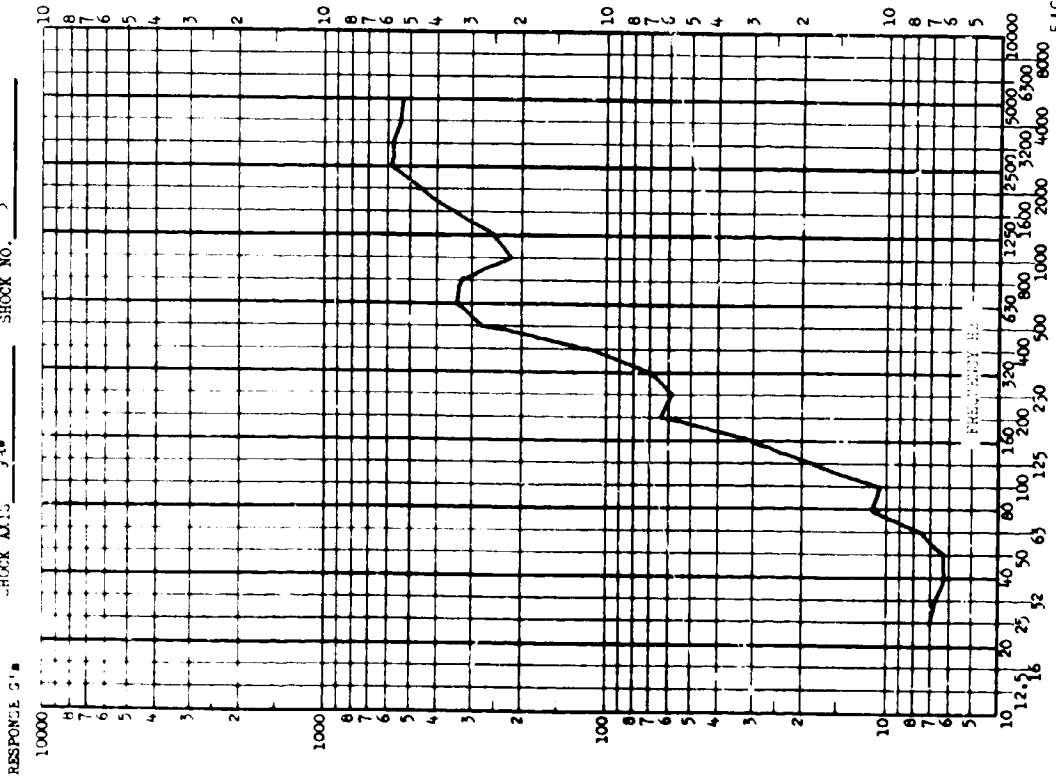


FIGURE IV.A.2-3

TEST ITEM ENGINE HATCH SEPARATION
 A.C.E.L. NO. 3 TEST DATE APRIL 18, 1966
 SHOCK AXIS YAW SHOCK NO. 3



TEST ITEM ENGINE HATCH SEPARATION
 A.C.E.L. NO. 38 TEST DATE APRIL 21, 1966
 SHOCK AXIS YAW SHOCK NO. 4

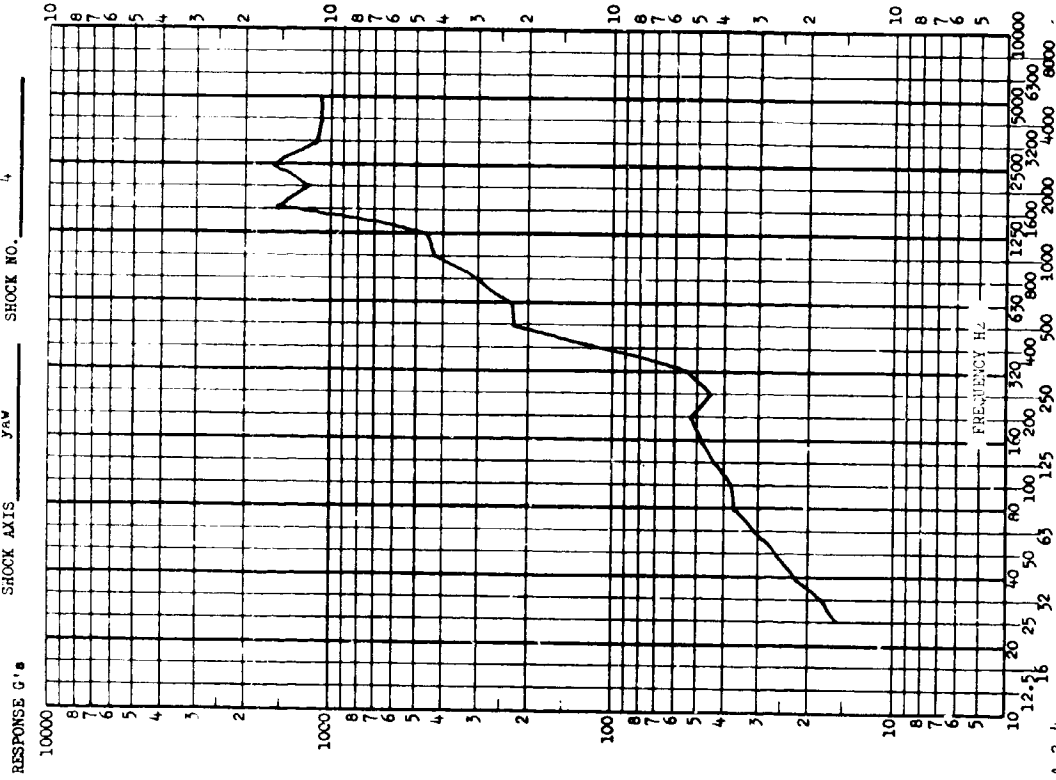
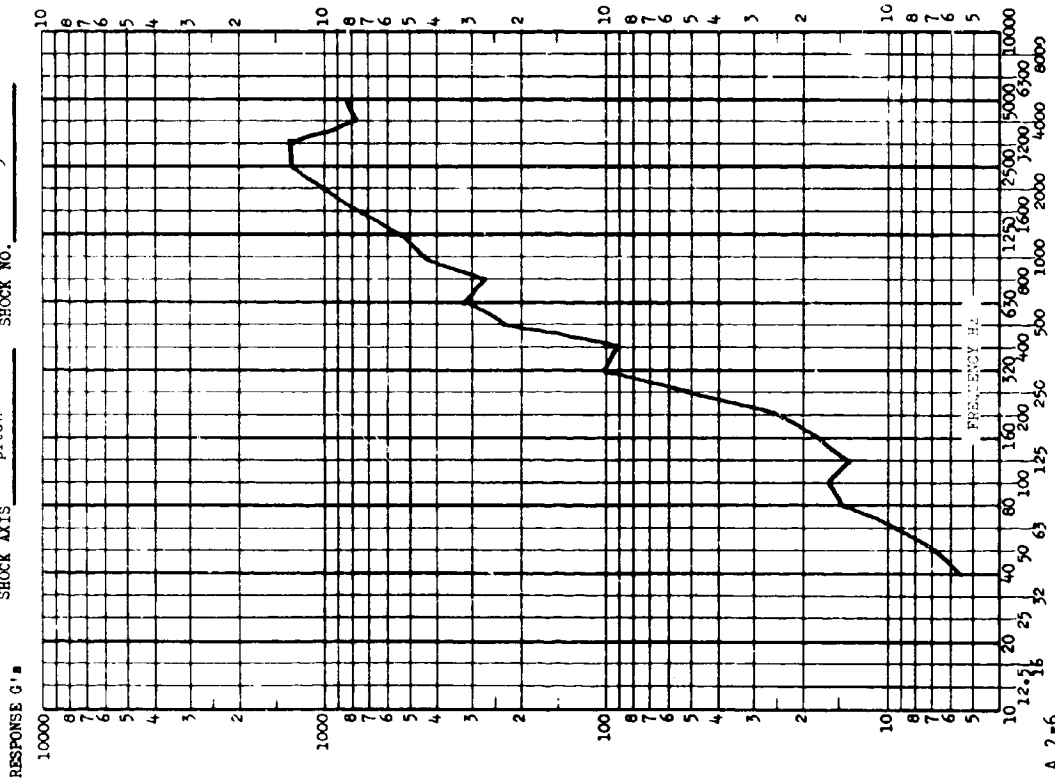


FIGURE IV.A.2-4

TEST ITEM PRIMA HATCH SEPARATION
 ASSM. NO. 5 TEST DATE May 19, 1966
 SHOCK AXIS pitch SHOCK NO. 5



TEST ITEM PRIMA HATCH SEPARATION
 ASSM. NO. 5 TEST DATE 4/19/66
 SHOCK AXIS pitch SHOCK NO. 5

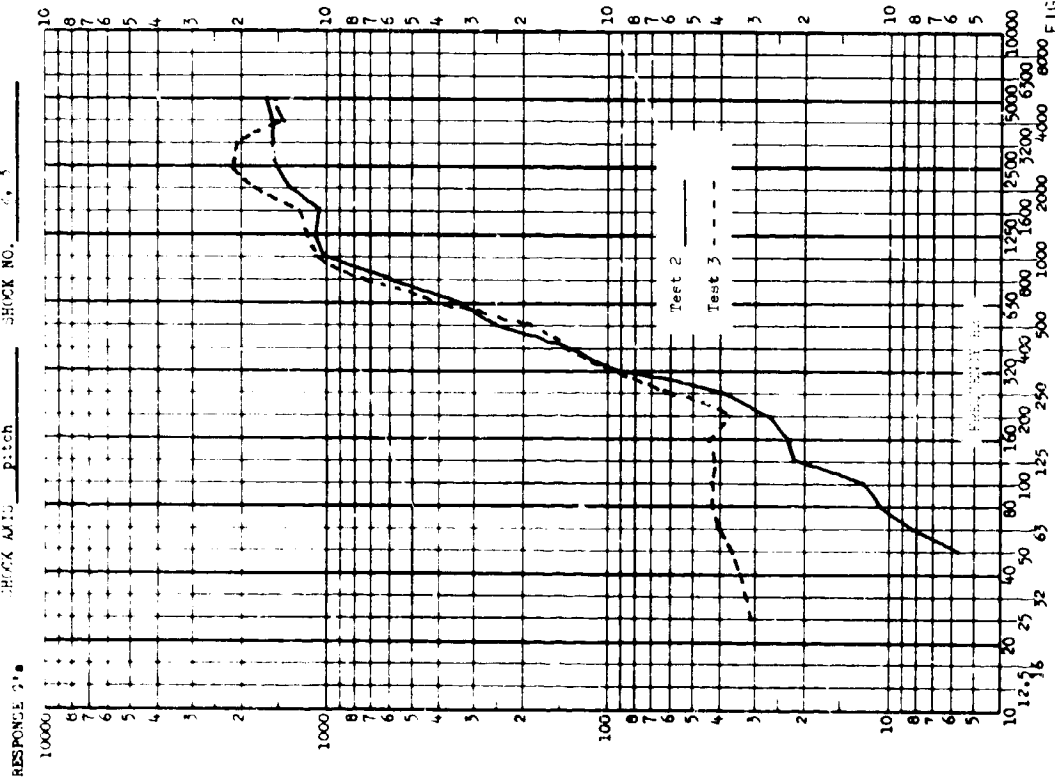


FIGURE IV.A.2-6

TEST ITEM: WHEEL SEPARATION
 TEST NO.: 5 TEST DATE: April 21, 1966
 SHOCK AXIS: vw SHOCK NO.: 4

TEST ITEM: WHEEL SEPARATION
 TEST NO.: 6 TEST DATE: 4/6/66, 4/18/66
 SHOCK AXIS: Roll SHOCK NO.: 2,3

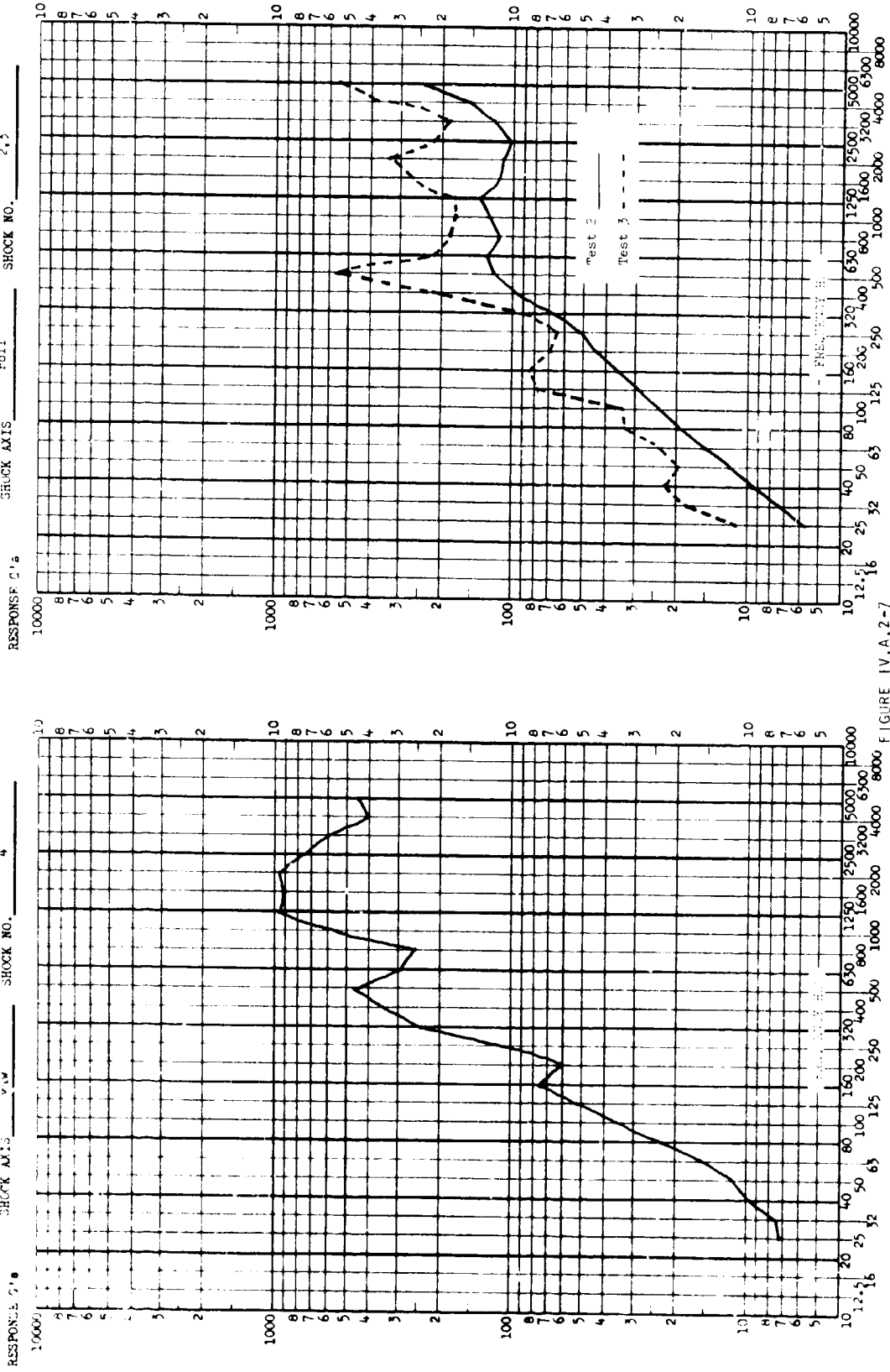
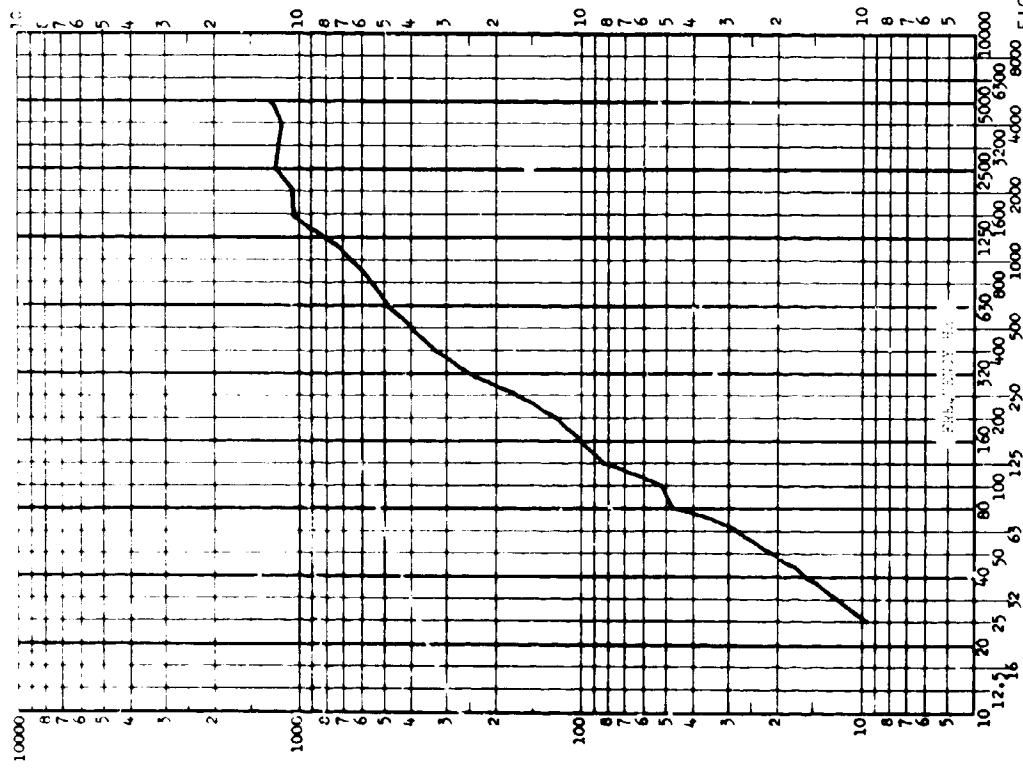


FIGURE IV.A.2-7

TEST ITEM: I.V. HATCH SEPARATION
 NO.: 5
 TEST DATE: APRIL 6, 1966
 SHOCK AXIS: Y*W
 SHOCK NO.: 2



TEST ITEM: I.V. HATCH SEPARATION
 NO.: 7
 TEST DATE: 4/6/66, 4/18/66
 SHOCK AXIS: Roll
 SHOCK NO.: 2, 3

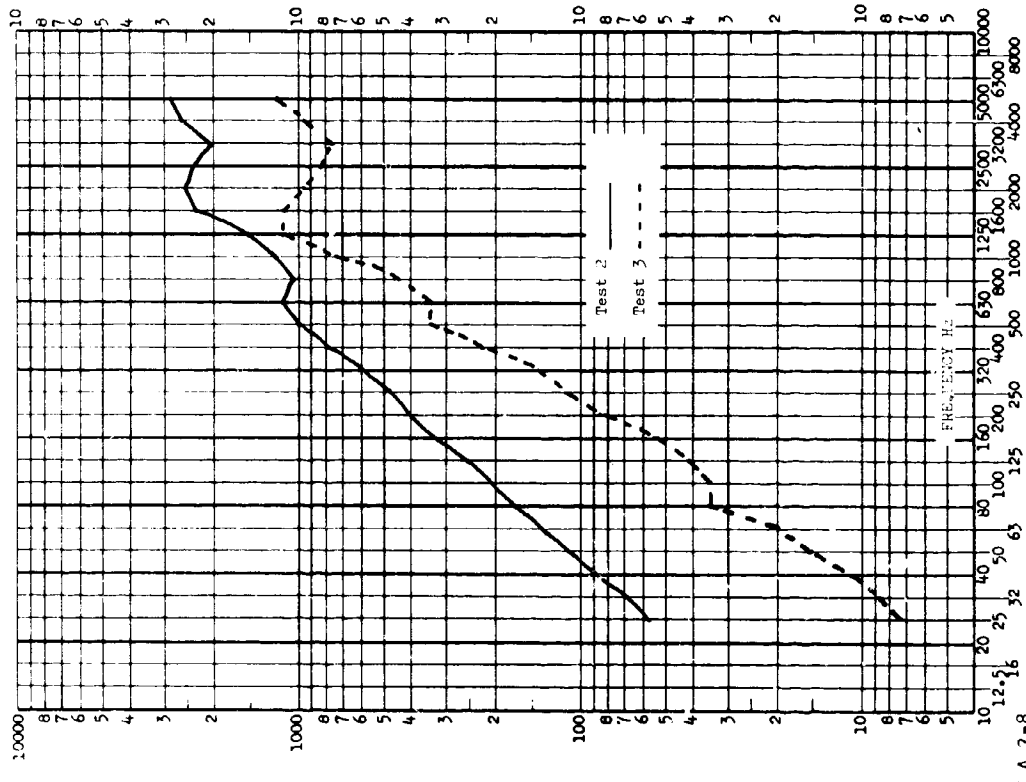
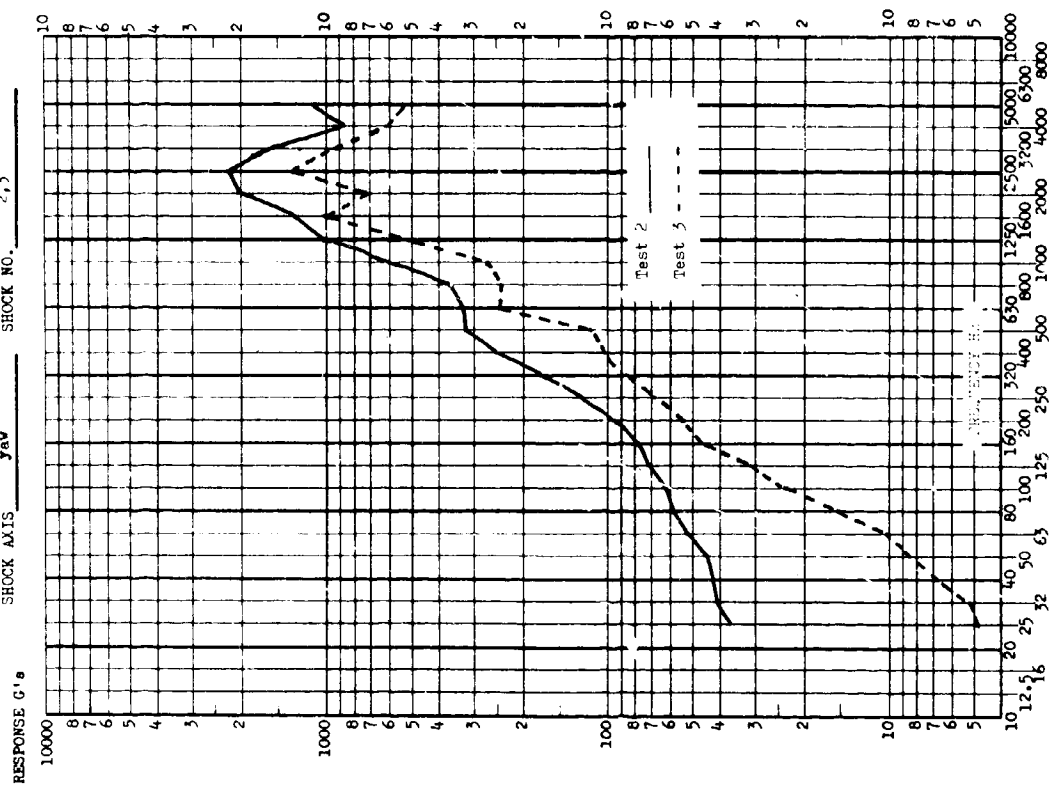


FIGURE IV.A.2-8

TEST ITEM PRIME HATCH SEPARATION
 ALLEN. NO. 7 TEST DATE 4/6/66, 4/18/66
 SHOCK AXIS Yaw SHOCK NO. 2, 3



TEST ITEM PRIME HATCH SEPARATION
 ALLEN. NO. 7 TEST DATE 5/9/66, 5/31/66
 SHOCK AXIS pitch SHOCK NO. 5, 6

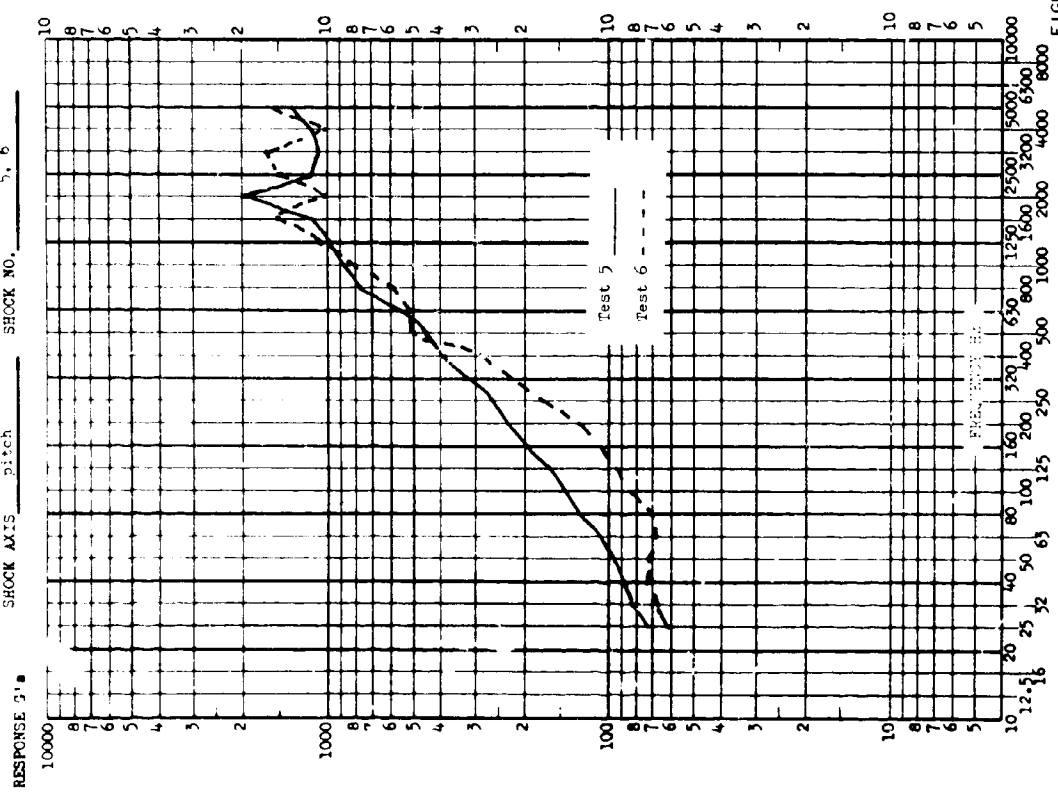
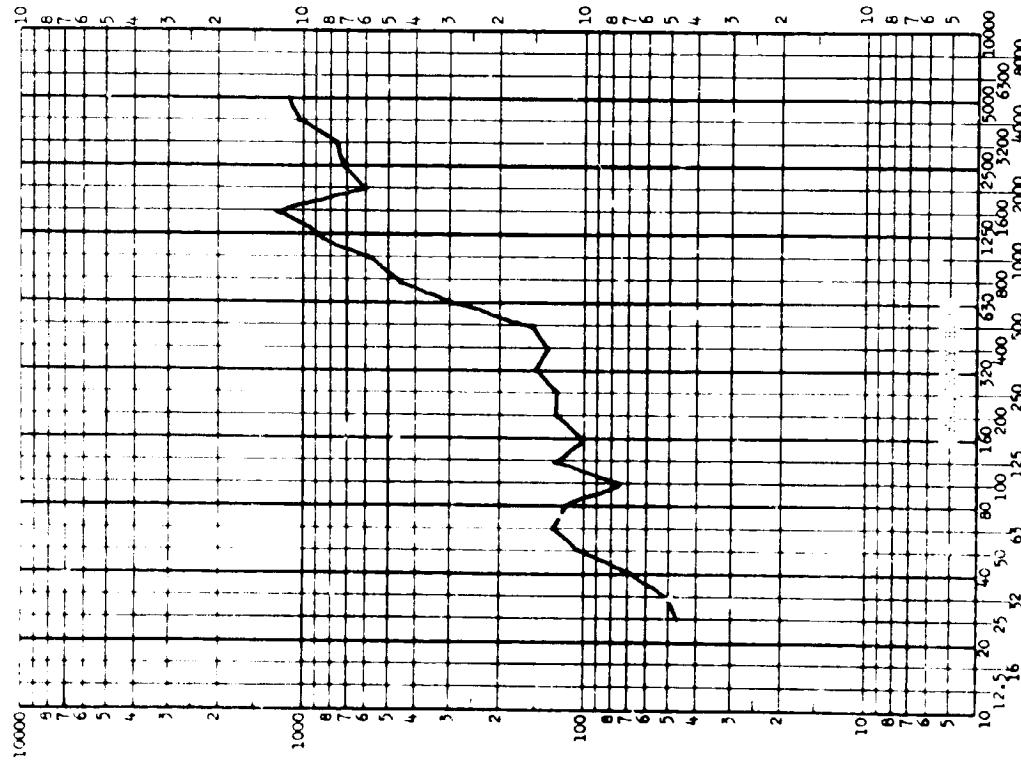


FIGURE IV.A.2-10

TEST ITEM: _____ BATCH SEPARATION
 TEST NO.: 7 TEST DATE: May 23, 1966
 SHOCK AXIS: YAW SHOCK NO.: 6



TEST ITEM: _____ BATCH SEPARATION
 TEST NO.: 7R TEST DATE: 19/66, 5/31/66
 SHOCK AXIS: Roll SHOCK NO.: 5, 6

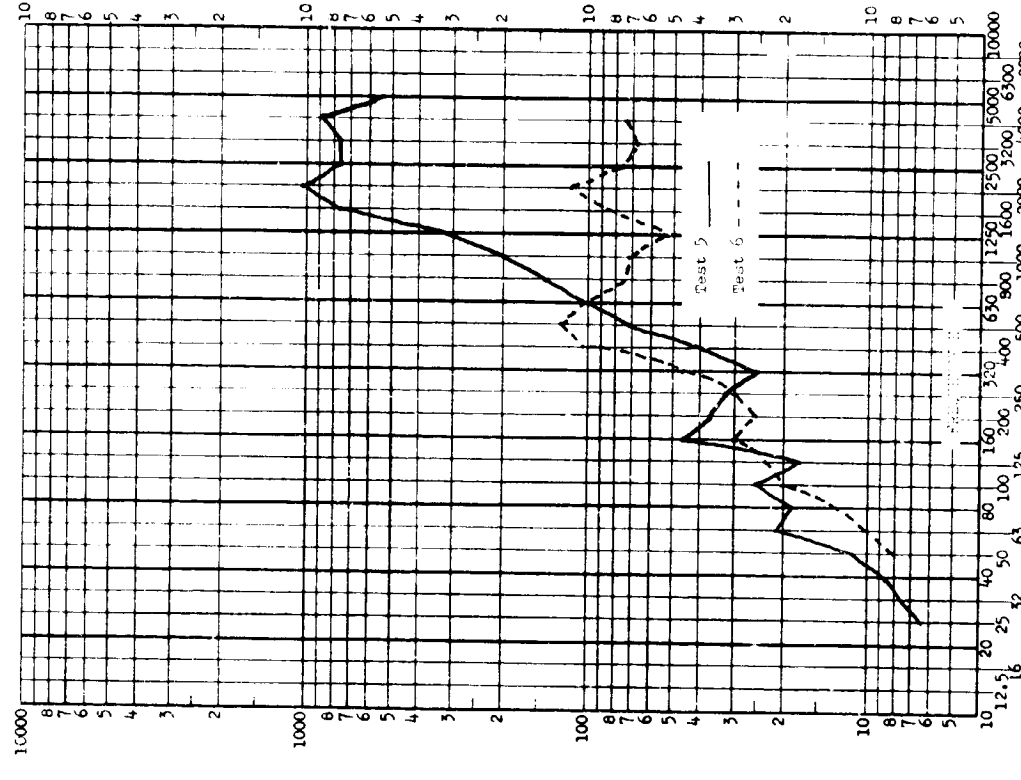
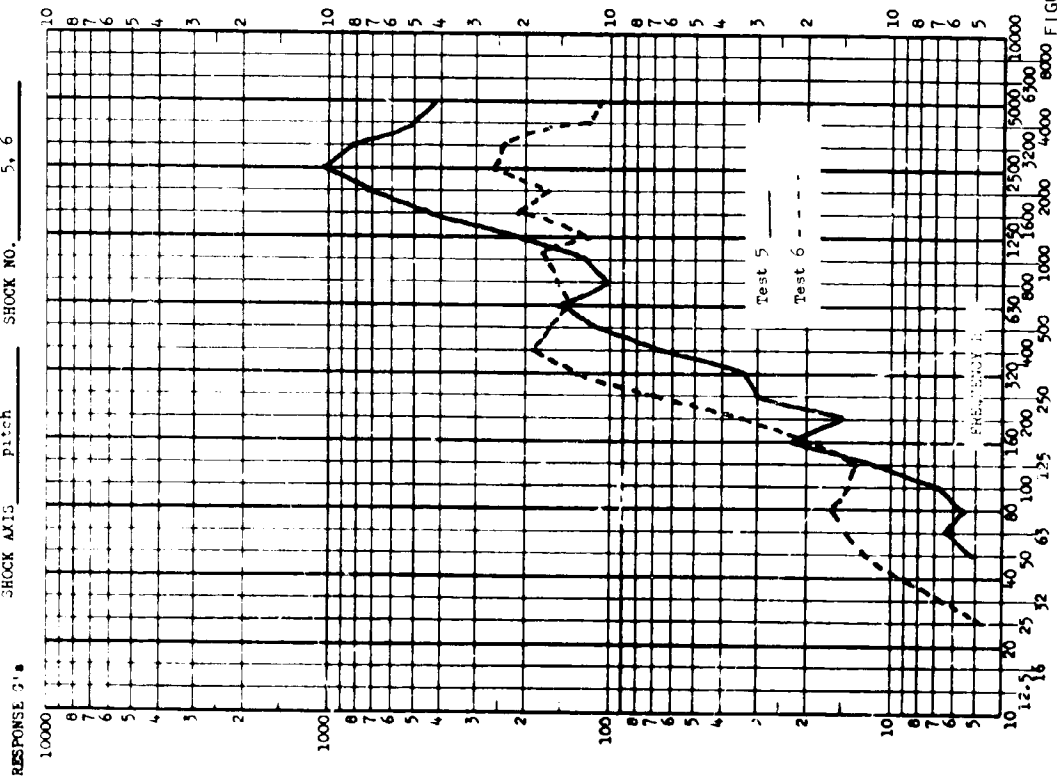
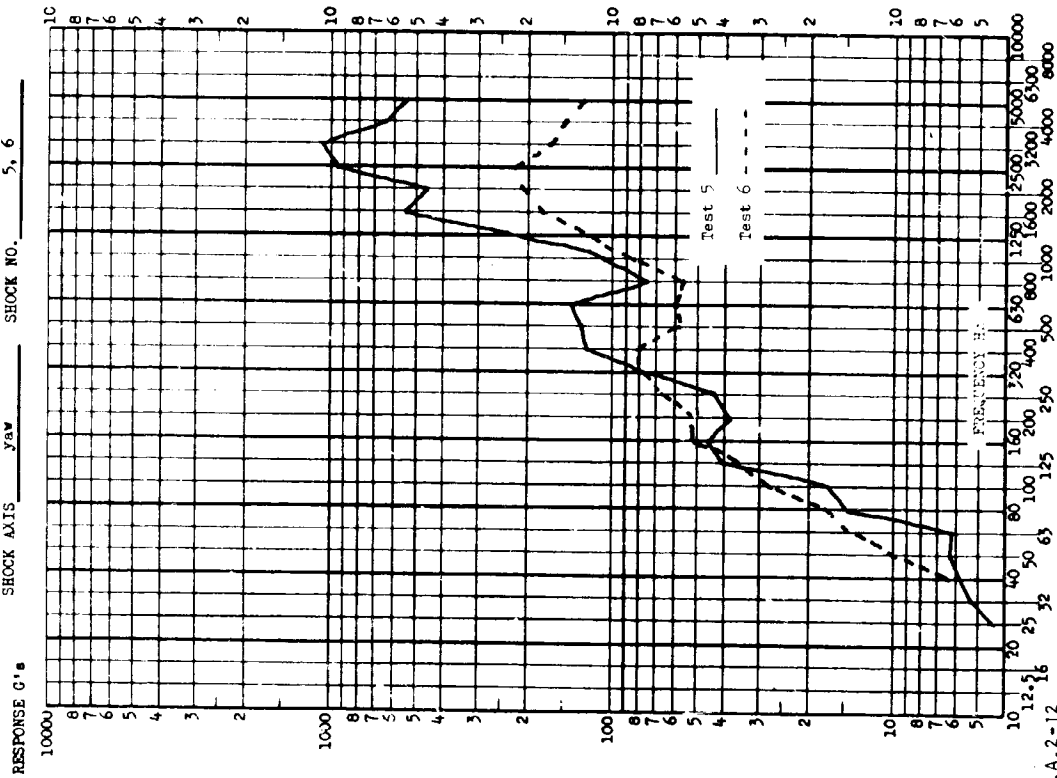


FIGURE IV.A.2-11

TEST ITEM 7B HATCH SEPARATION
 ADDEL. NO. 7B TEST DATE 5/19/66, 5/31/66
 SHOCK AXIS Pitch SHOCK NO. 5, 6

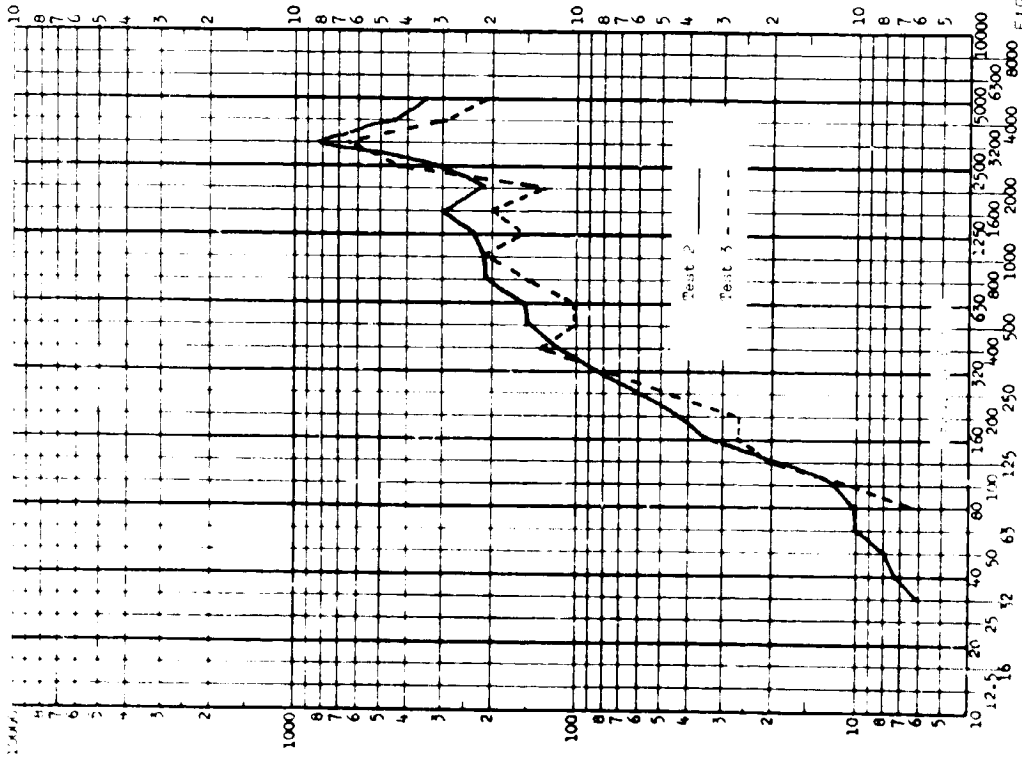


TEST ITEM 7B HATCH SEPARATION
 ADDEL. NO. 7B TEST DATE 5/19/66, 5/31/66
 SHOCK AXIS Yaw SHOCK NO. 5, 6



8000 FIGURE IV.A.2-12

TEST ITEM: HATCH DEFORMATION
 M.I. NO.: 9
 TEST DATE: 4/16/66, 4/18/66
 SHOCK AXIS: roll
 SHOCK NO.: 2, 3



TEST ITEM: HATCH DEFORMATION
 M.I. NO.: 9
 TEST DATE: April 21, 1966
 SHOCK AXIS: roll
 SHOCK NO.: 4

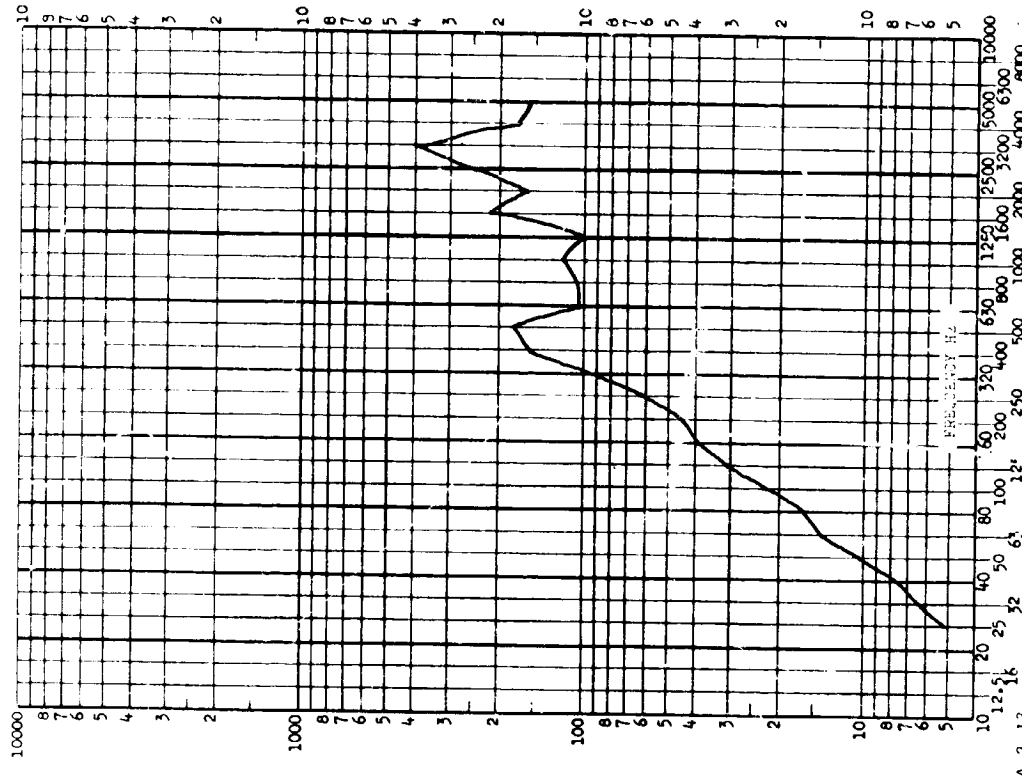
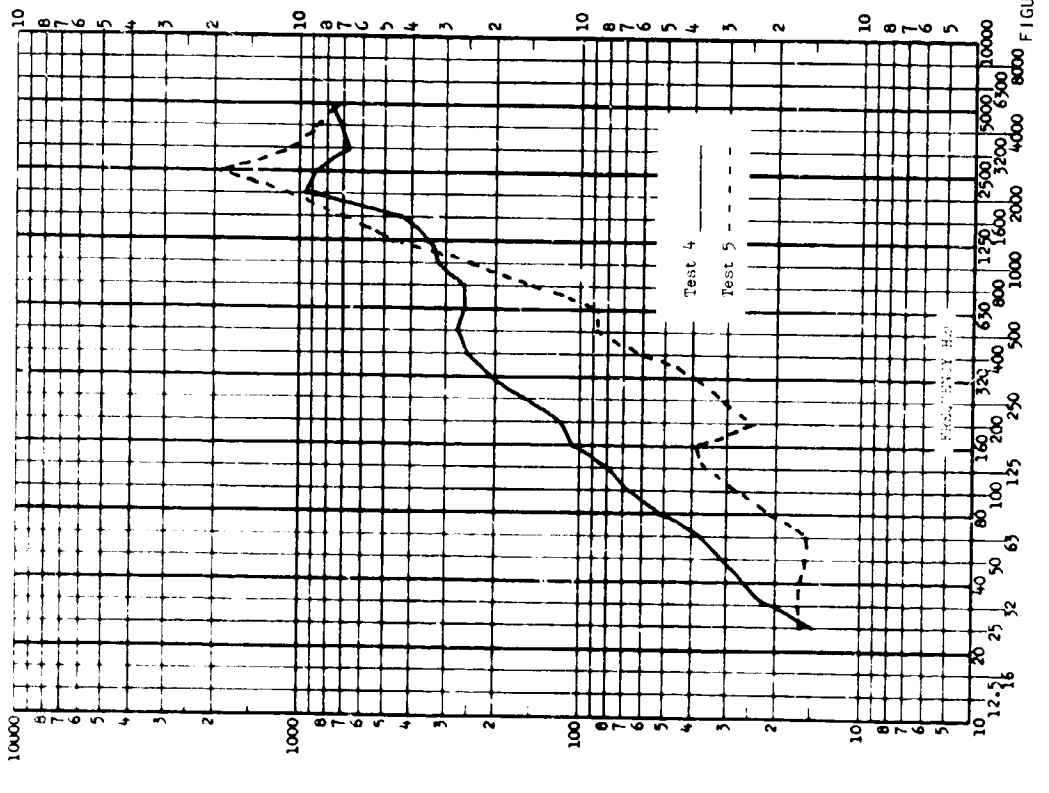


FIGURE IV.A.2-13

TEST ITEM _____ BATCH SEPARATION _____
 ACCEL. NO. 9A TEST DATE 4/21/66, 5/19/66
 SHOCK AXIS pitch SHOCK NO. 4, 5



TEST ITEM _____ BATCH SEPARATION _____
 ACCEL. NO. 9A TEST DATE 4/21/66, 5/19/66
 SHOCK AXIS pitch SHOCK NO. 4, 5

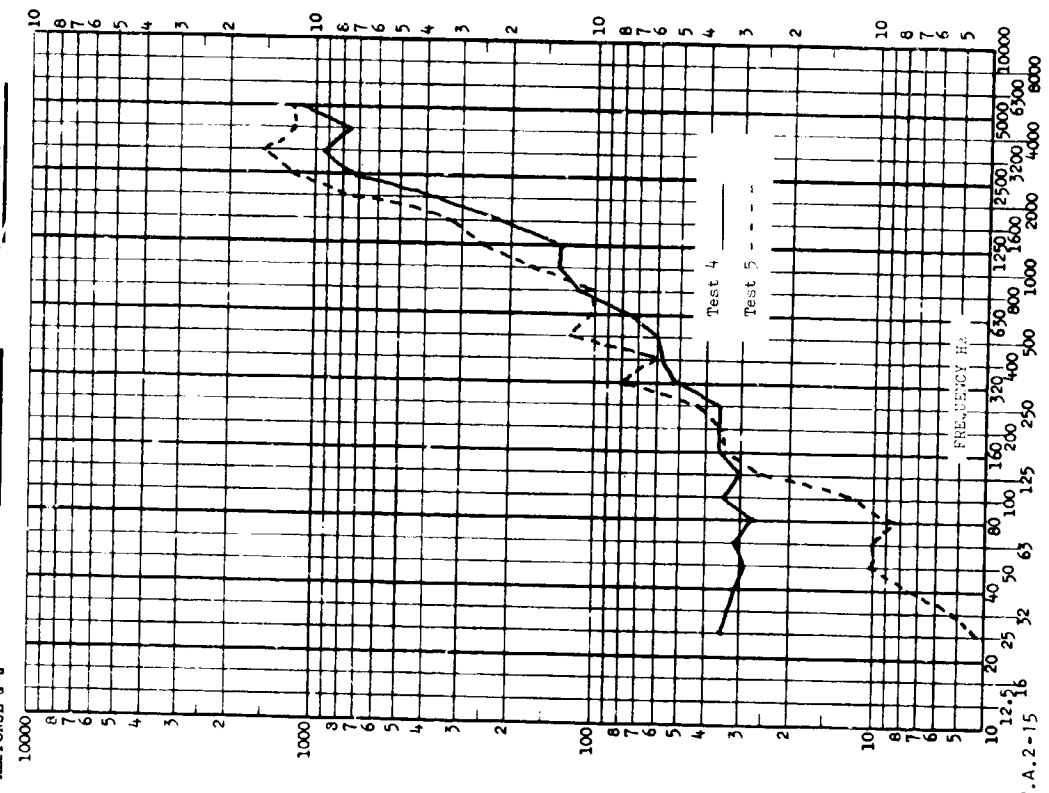
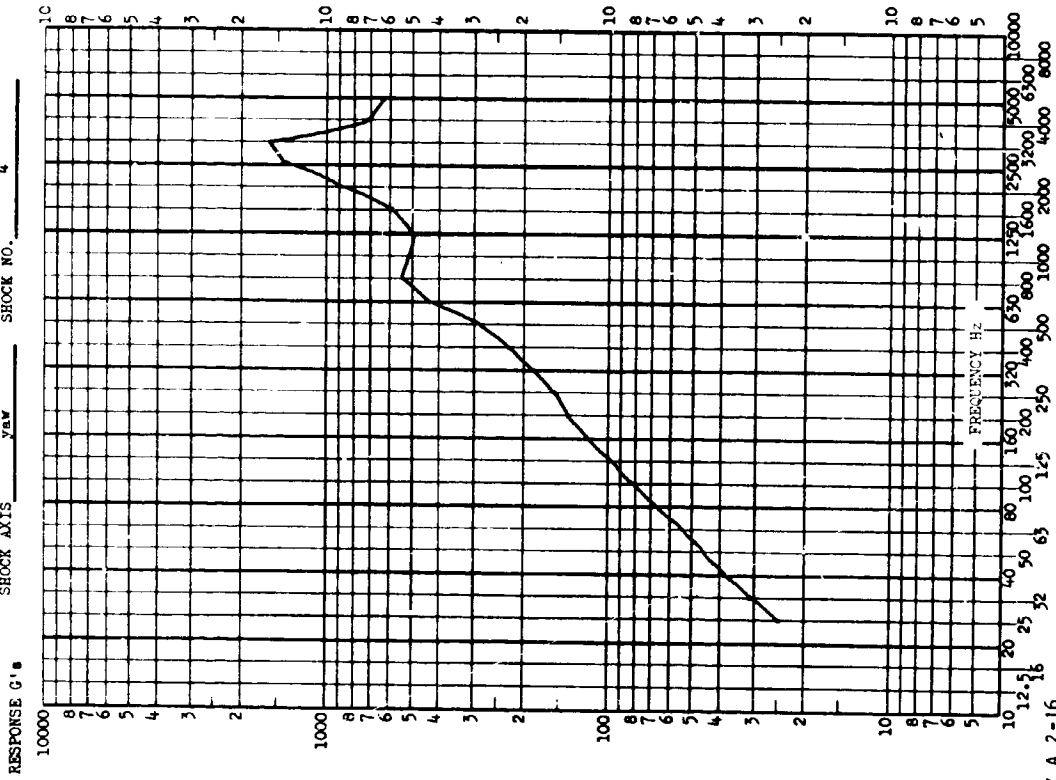


FIGURE IV.A.2-15

TEST ITEM PRIME BATCH SEPARATION
 ADJ. NO. 9A TEST DATE April 21, 1966
 SHOCK AXIS Yaw SHOCK NO. 4



TEST ITEM PRIME BATCH SEPARATION
 ADJ. NO. 9B TEST DATE MAY 19, 1966
 SHOCK AXIS roll SHOCK NO. 5

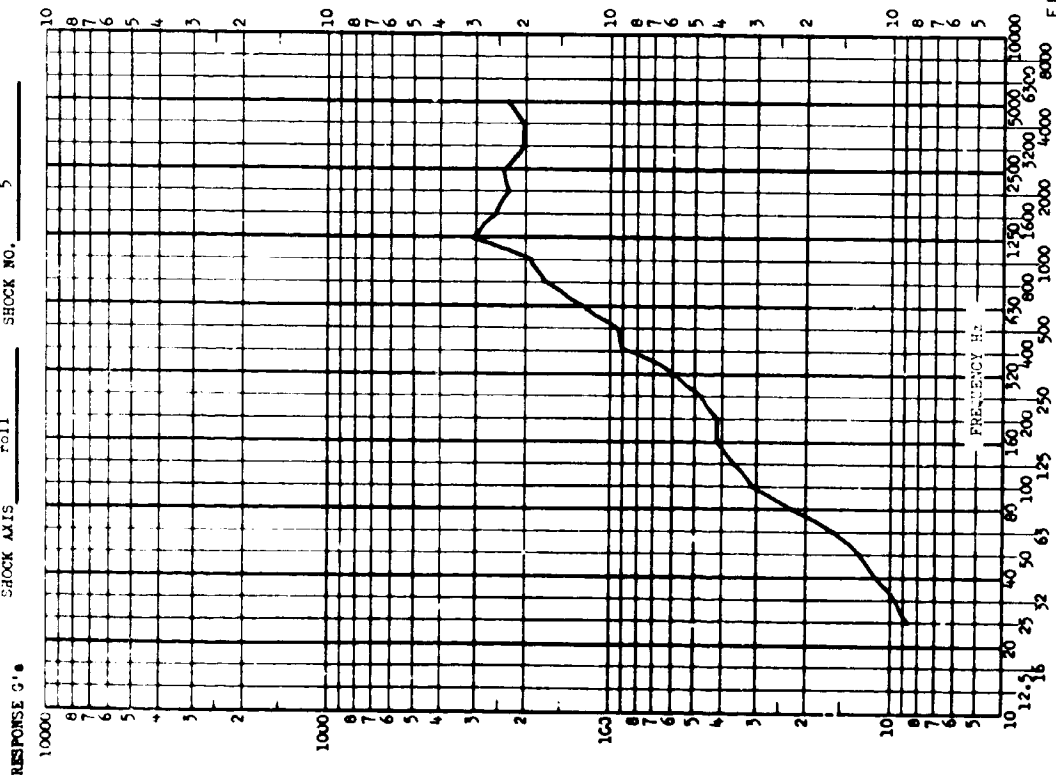
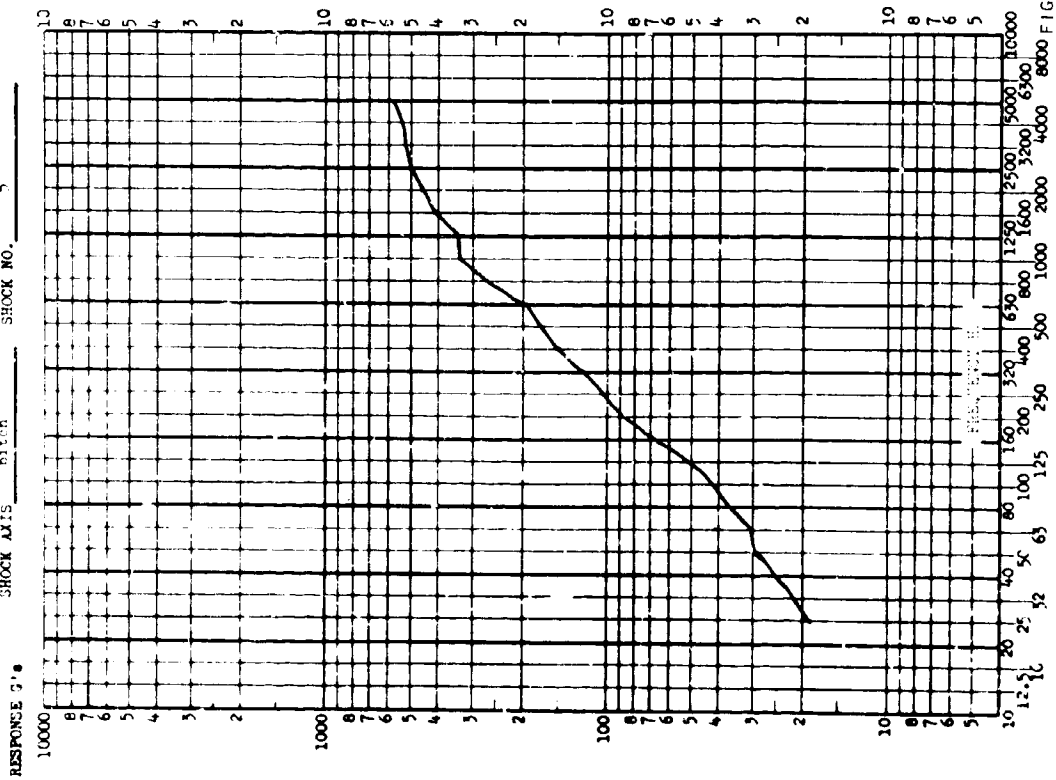
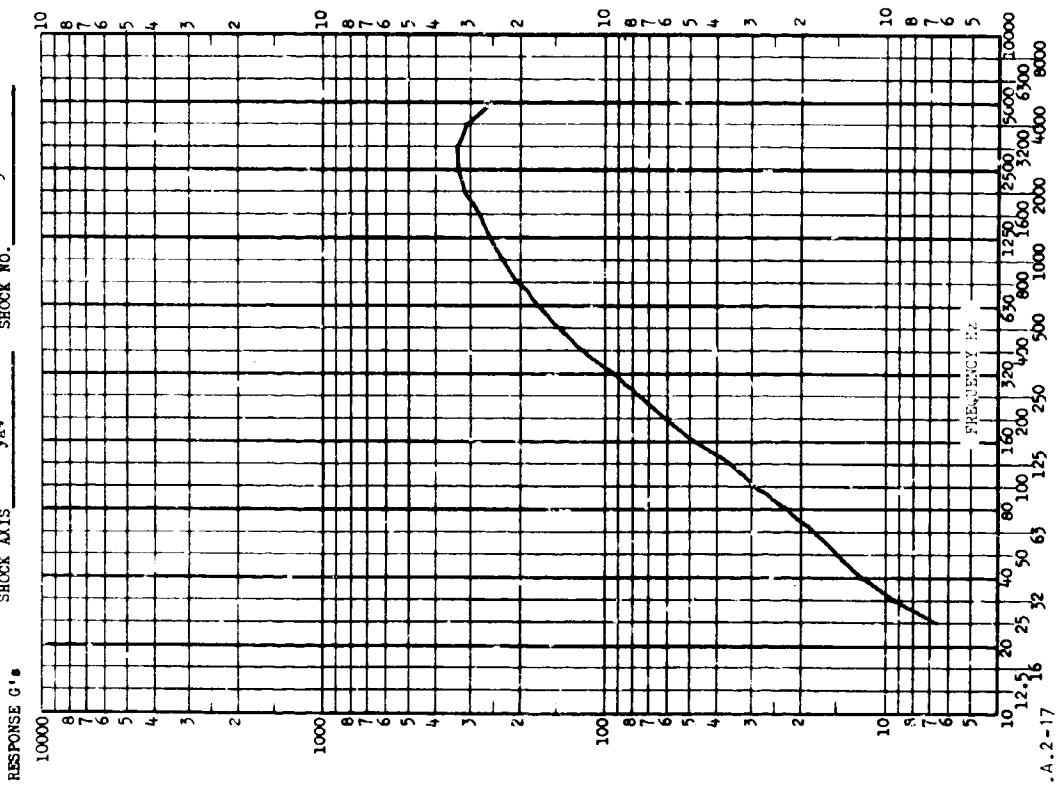


FIGURE IV.A.2-16

TEST ITEM PRIME HATCH SEPARATION
 ACCEL. NO. 9B TEST DATE May 19, 1966
 SHOCK AXIS pitch SHOCK NO. 5

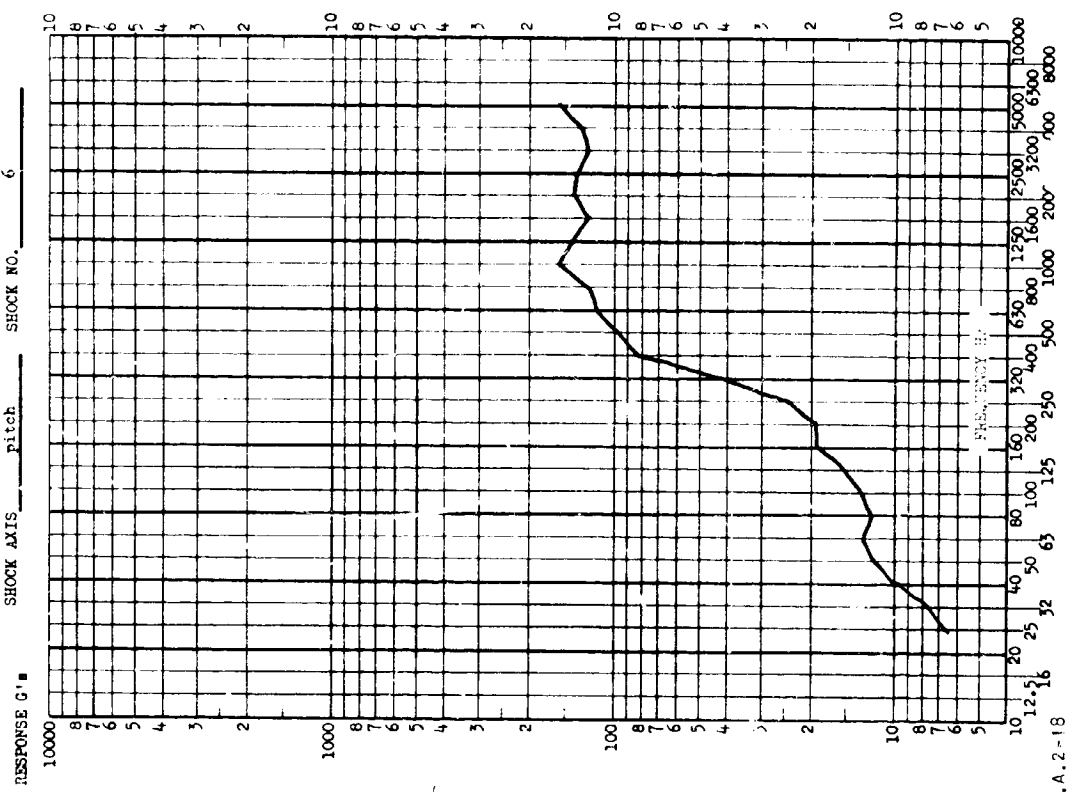


TEST ITEM PRIME HATCH SEPARATION
 ACCEL. NO. 9B TEST DATE May 19, 1966
 SHOCK AXIS yaw SHOCK NO. 5



IV.A.2-17 8000 FIGURE

TEST ITEM PRIME HATCH SEPARATION
 ACCEL. NO. 11 TEST DATE May 31, 1966
 SHOCK AXIS pitch SHOCK NO. 6



TEST ITEM PRIME HATCH SEPARATION
 ACCEL. NO. 11 TEST DATE May 31, 1966
 SHOCK AXIS roll SHOCK NO. 6

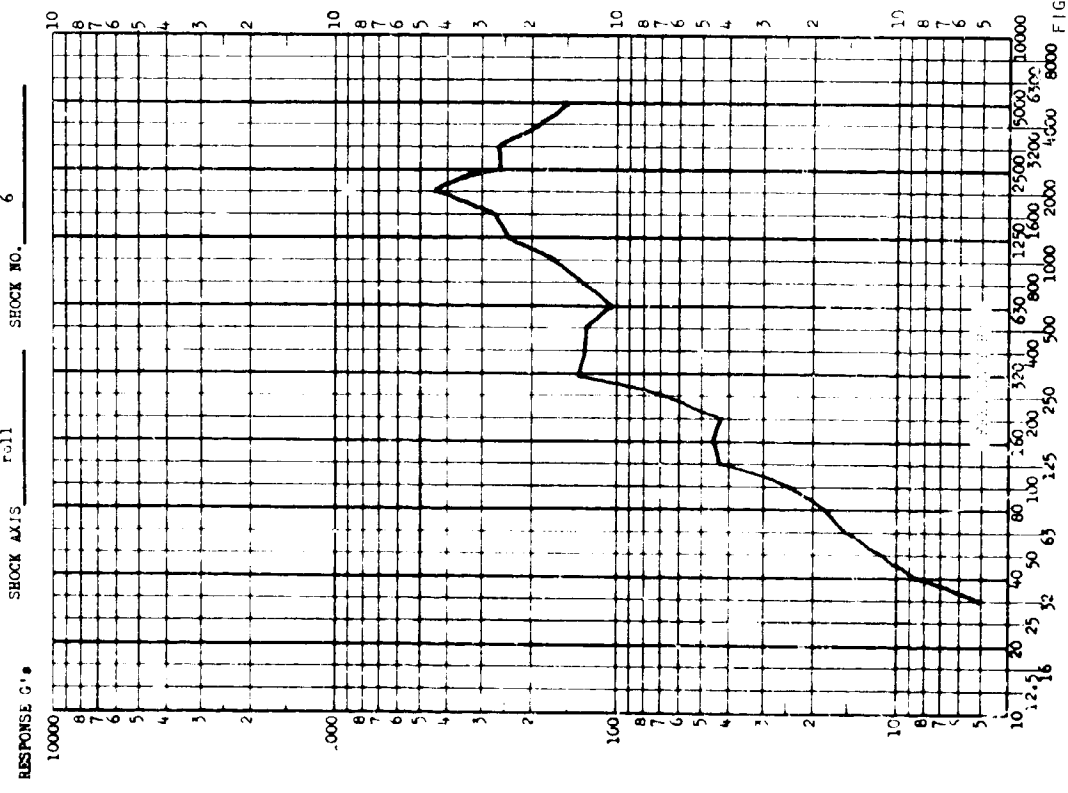


FIGURE IV.A.2-18

TEST ITEM 1410A HATCH SEPARATION
 SERIAL NO. 11 TEST DATE May 31, 1966
 SHOCK AXIS Yaw SHOCK NO. 6

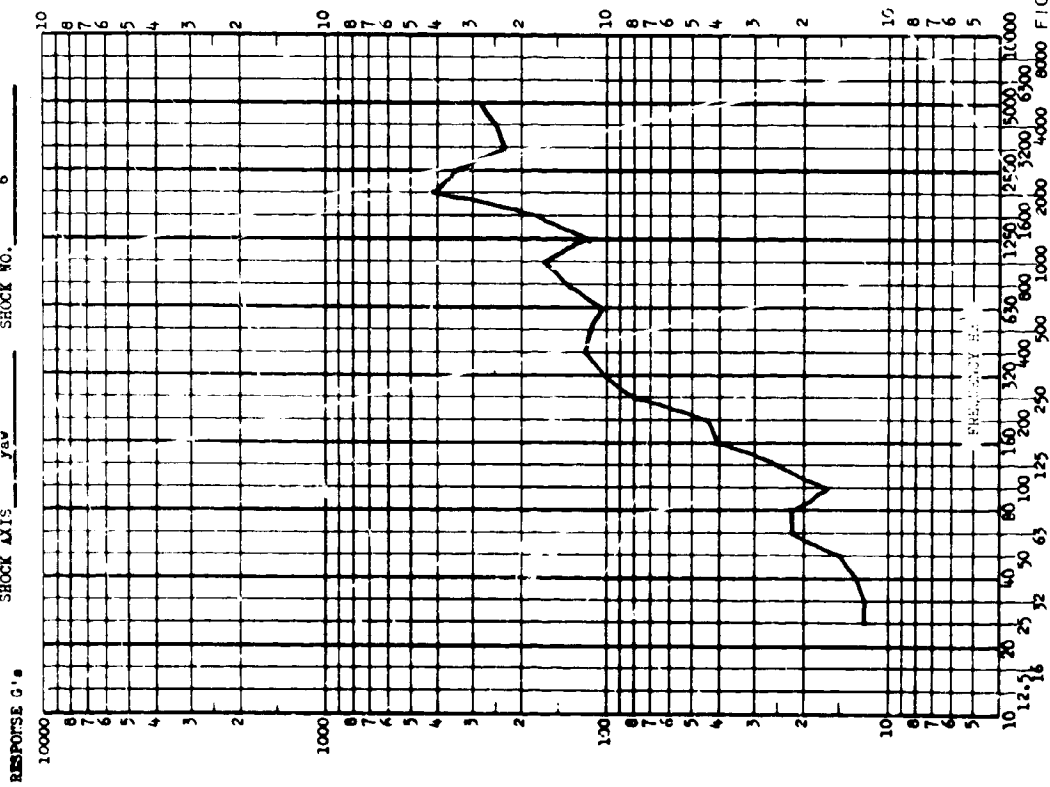


FIGURE IV.A.2-19

SECTION IV.A.3

PRIME DROGUE CHUTE EJECTION MORTAR TESTS

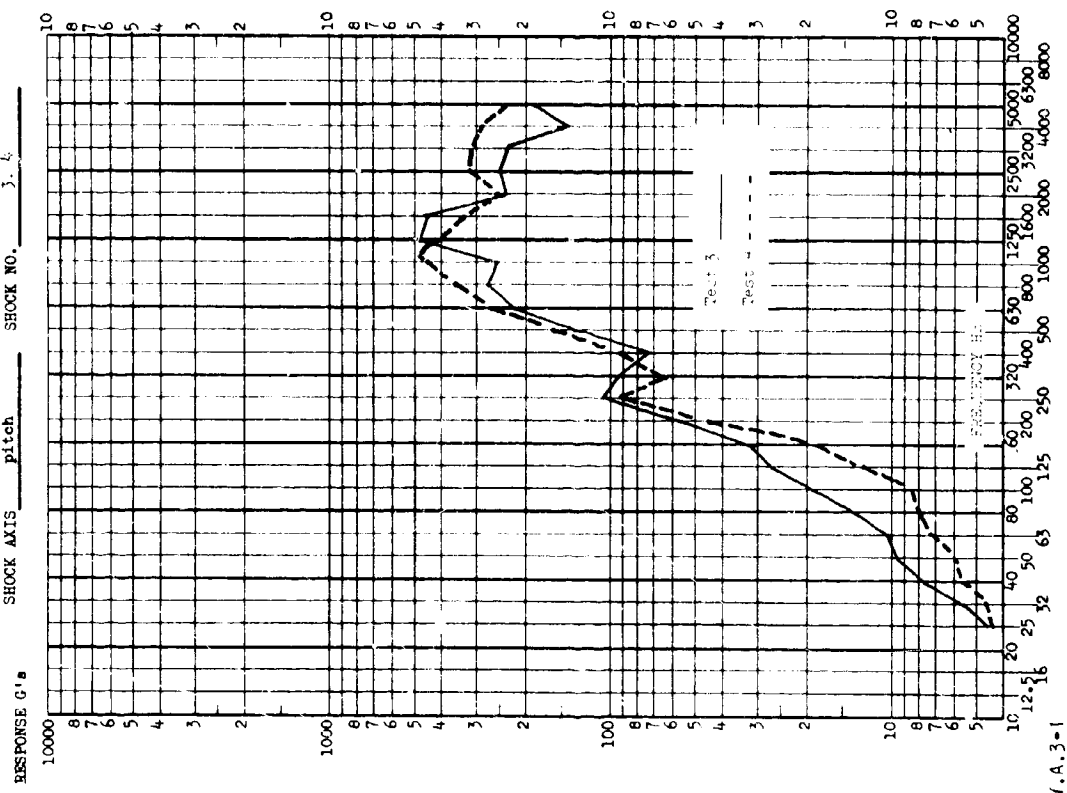
Four firings of the drogue mortar were performed. No data were obtained from the first firing, and only partial data were obtained from the second firing due to accelerometer sensitivity settings. The 25 shock spectra obtained for shots 2, 3, and 4 are presented in Figures IV.A.3-1 through IV.A.3-8 as indexed in Table IV.A.3-1.

TABLE IV.A.3-1

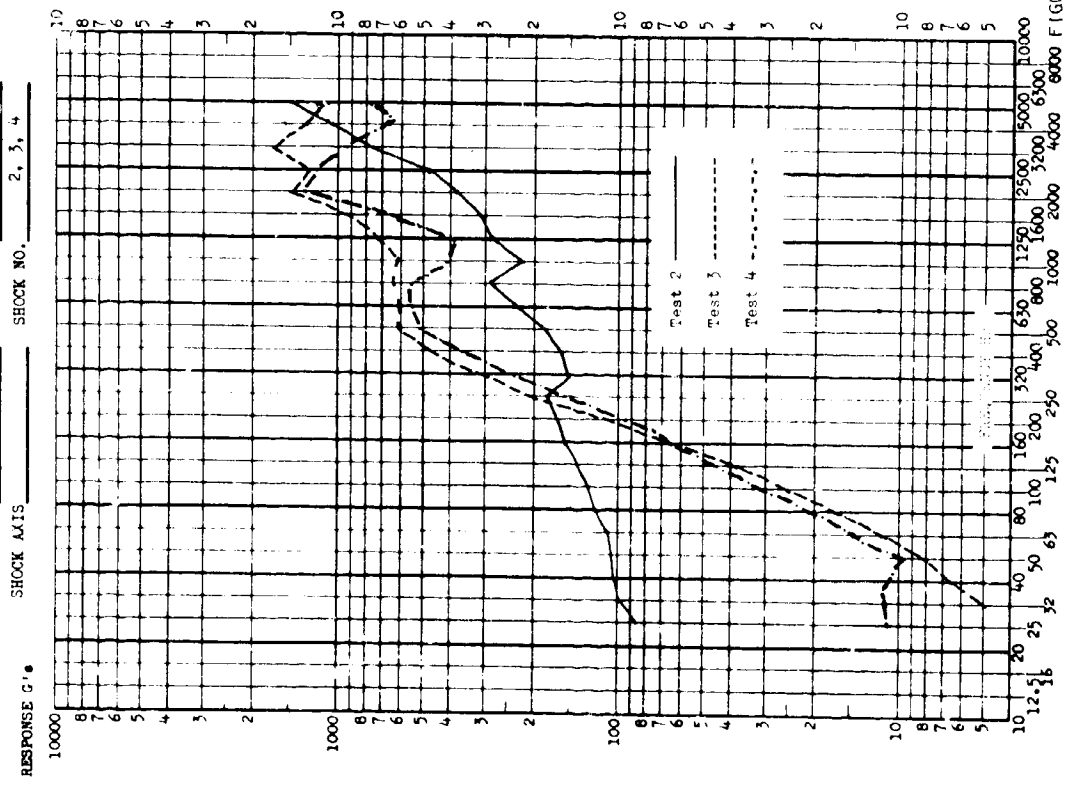
INDEX OF DATA LOCATIONS

<u>Figure</u>	<u>Graph 1</u>		<u>Graph 2</u>	
	<u>Shot No.s</u>	<u>Accel. No.s</u>	<u>Shot No.s</u>	<u>Accel. No.s</u>
IV.A.3-1	2,3,4	1B	3,4	2 pitch
IV.A.3-2	3,4	2 roll	2,3,4	3 roll
IV.A.3-3	2,3,4	3 yaw	4	5 pitch
IV.A.3-4	2,3	5 roll	3	5 yaw
IV.A.3-5	4	6 pitch	3	6 roll
IV.A.3-6	4	7 pitch	4	7 yaw
IV.A.3-7	4	9 pitch	3	9 yaw
IV.A.3-8	3,4	10 roll	---	---

TEST ITEM PRIME DROGHT MORTAR
 MODEL NO. 2 TEST DATE 3/25/66, 4/12/66
 SHOCK AXIS pitch SHOCK NO. 3, 4

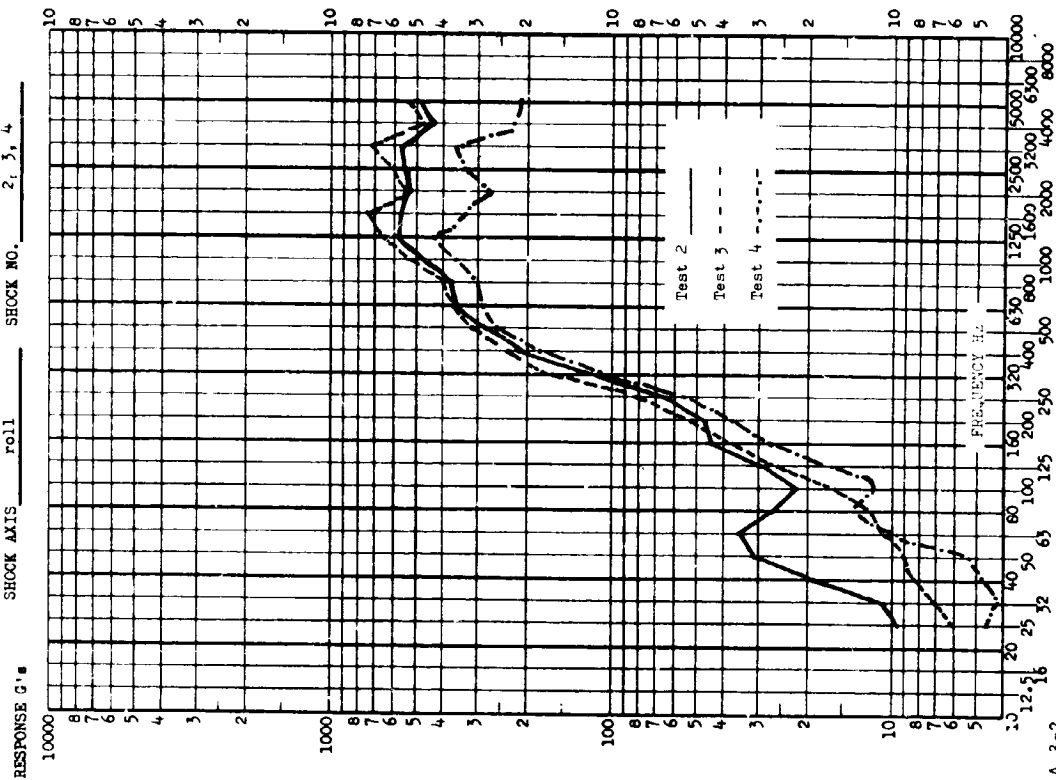


TEST ITEM PRIME DROGHT MORTAR
 MODEL NO. 1B TEST DATE 3/24, 25/66, 4/12/66
 SHOCK AXIS 2, 3, 4 SHOCK NO. 2, 3, 4



IV.A.3-1

TEST ITEM PRIME BROQUE MORTAR
 MODEL NO. 3 TEST DATE 3/24, 25/66, 4/12/66
 SHOCK AXIS Roll SHOCK NO. 2, 3, 4



TEST ITEM PRIME BROQUE MORTAR
 MODEL NO. 2 TEST DATE 3/25/66, 4/12/66
 SHOCK AXIS Roll SHOCK NO. 3, 4

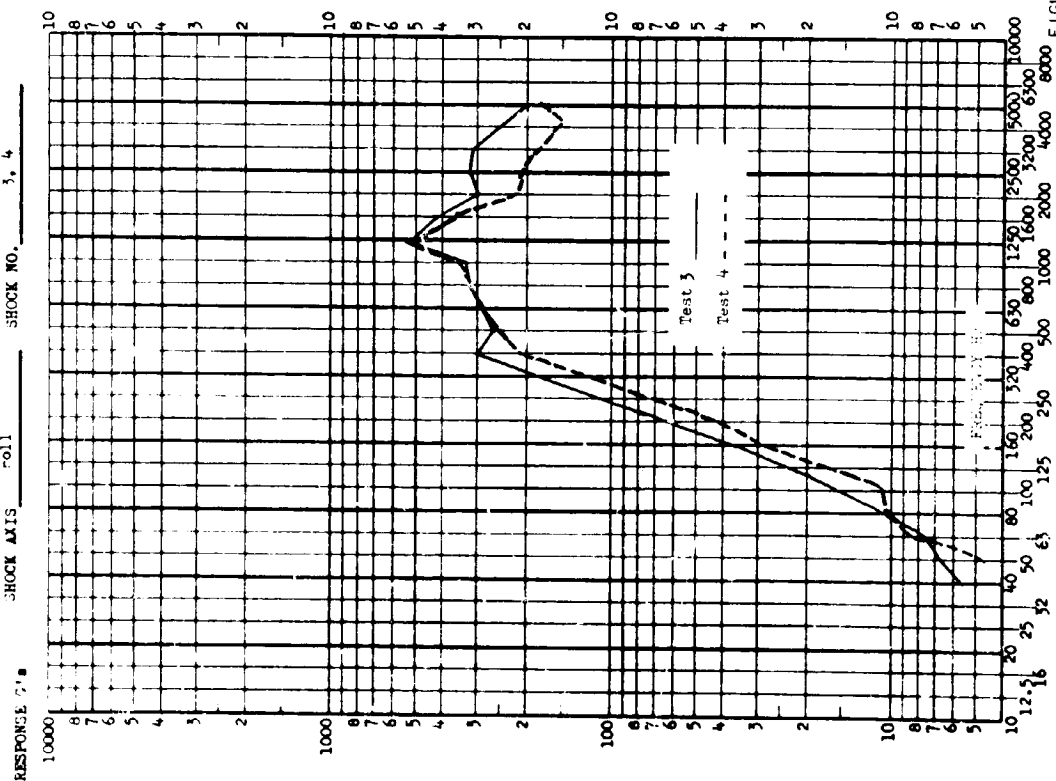


FIGURE IV.A.3-2

TEST ITEM PIVING DROUPE MORTAR
 SER. NO. 3 TEST DATE 3/24, 25/66, 4/10/66
 SHOCK AXIS Y-Z SHOCK NO. 2, 3, 4

TEST ITEM PIVING DROUPE MORTAR
 SER. NO. 5 TEST DATE 4/12/66
 SHOCK AXIS pitch SHOCK NO. 4

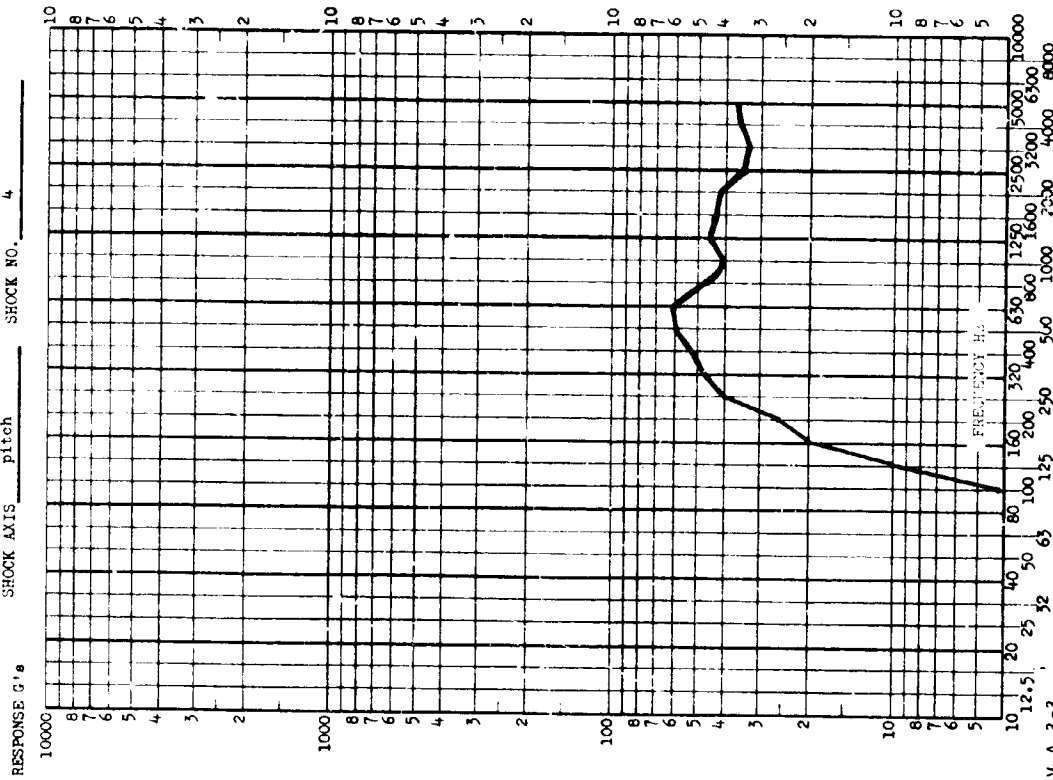
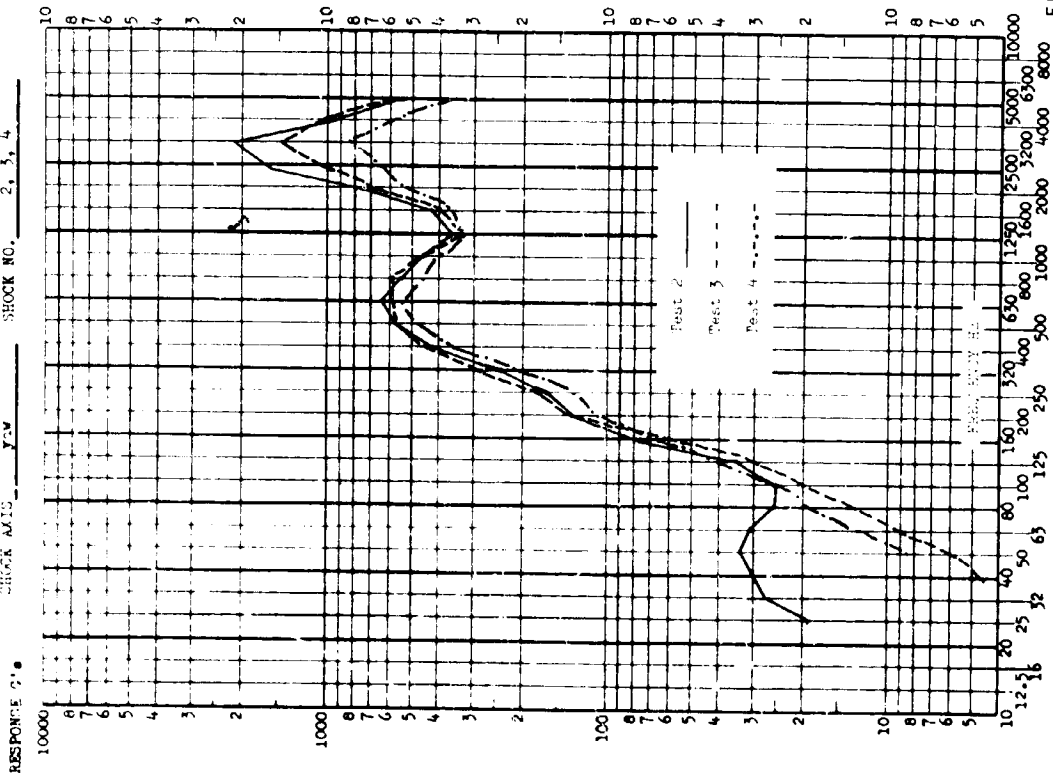


FIGURE IV.A.3-3

TEST ITEM ITEM DROPER MORTAR
 ADJEL. NO. 5 TEST DATE 3/25/66
 SHOCK AXIS YAW SHOCK NO. 3

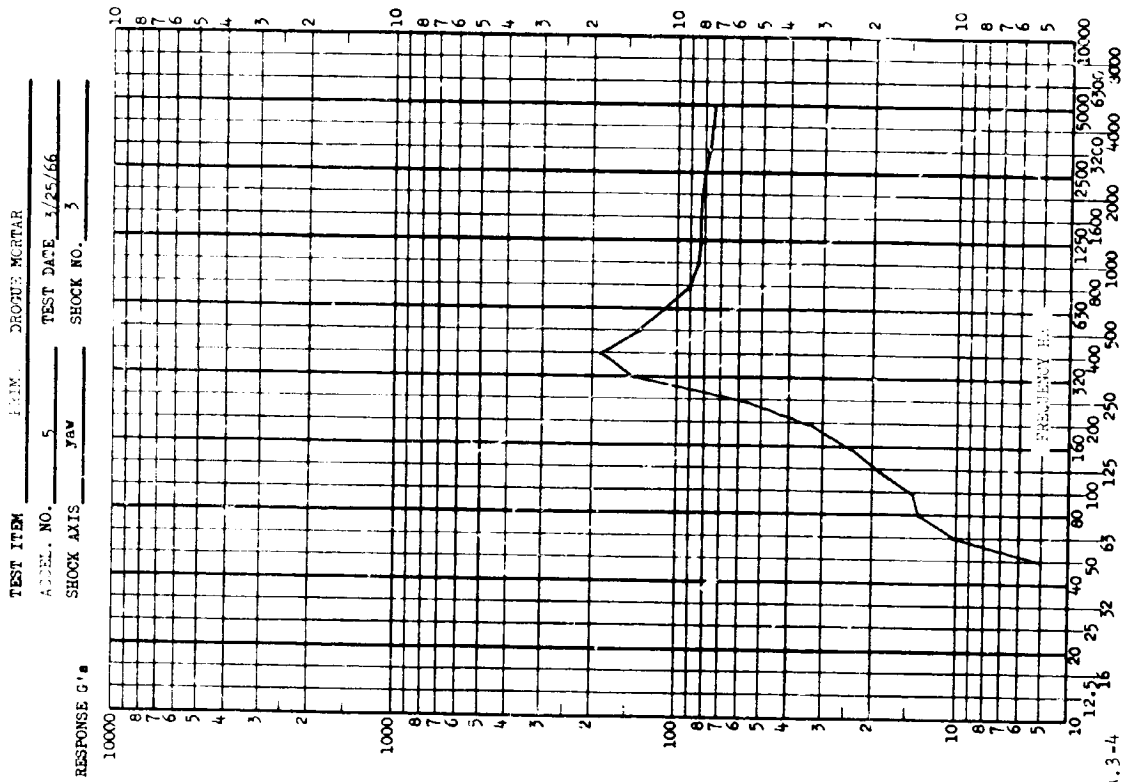
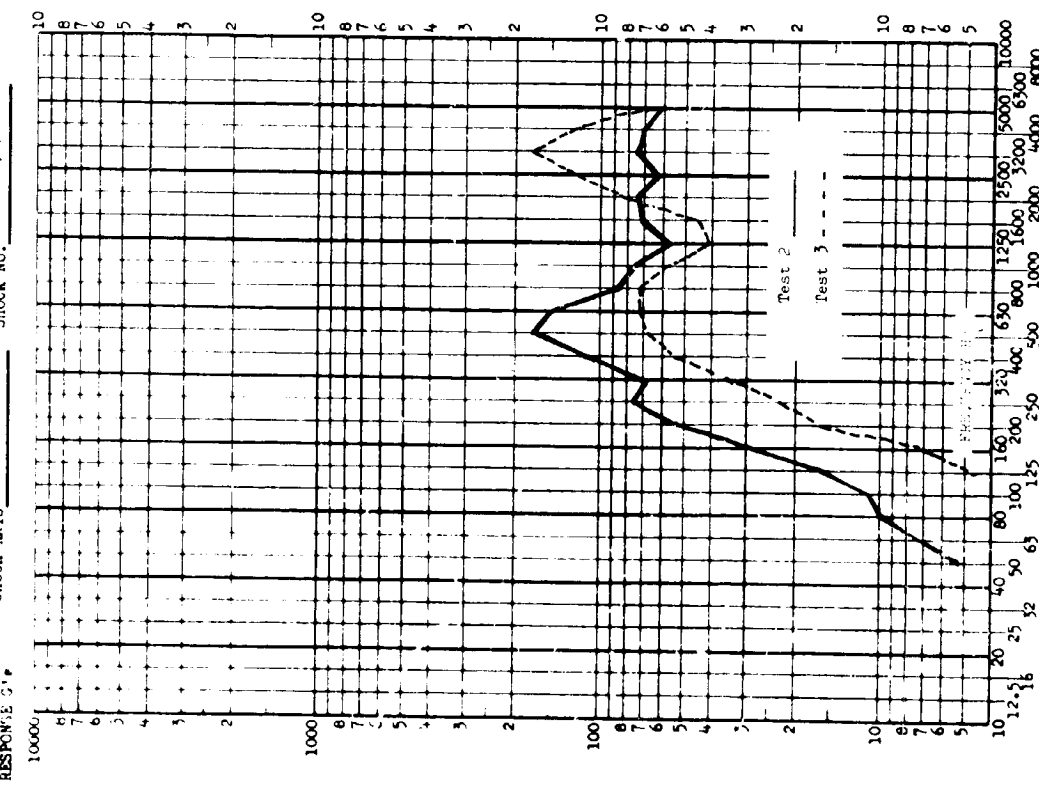
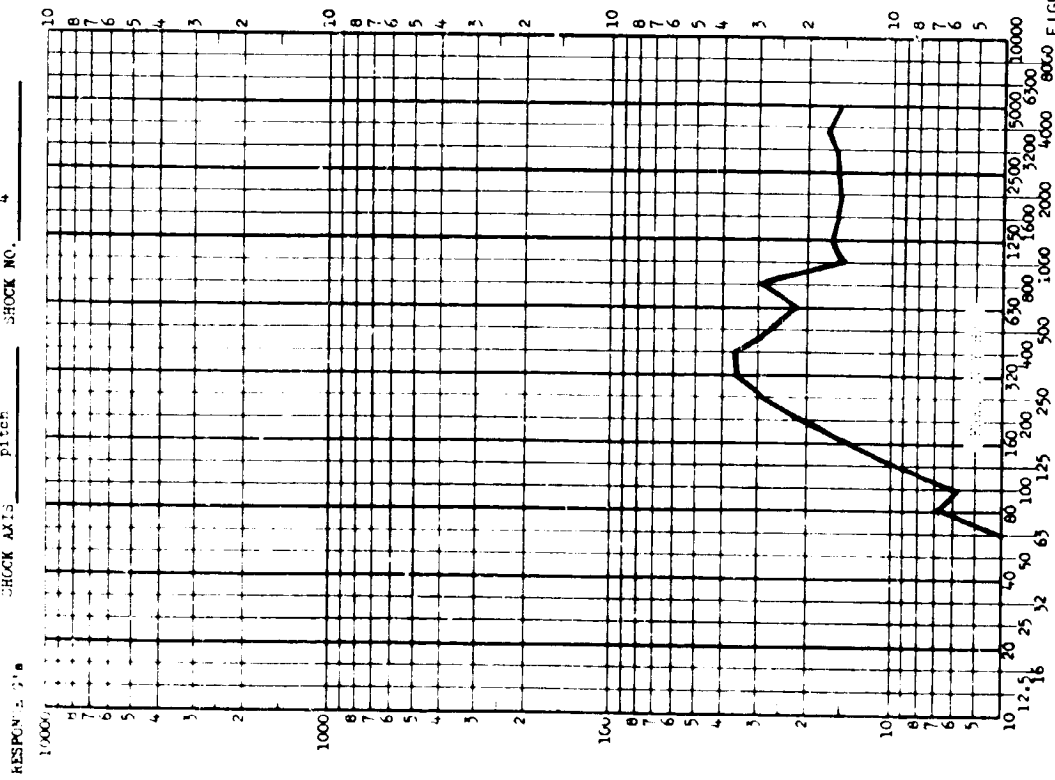


FIGURE IV.A.3-4

TEST ITEM ENGINE DRUMS MORTAR

APP. NO. 6 TEST DATE 4/12/66

SHOCK AXIS pitch SHOCK NO. 4



TEST ITEM ENGINE DRUMS MORTAR

APP. NO. 6 TEST DATE 3/27/66

SHOCK AXIS roll SHOCK NO. 3

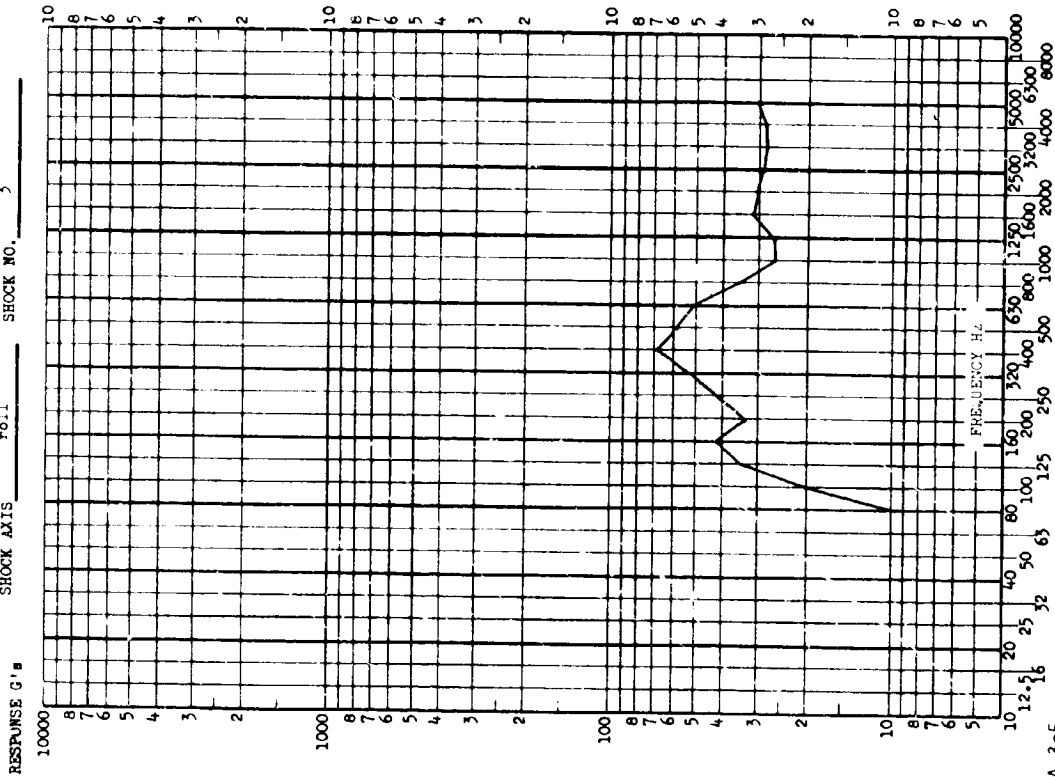
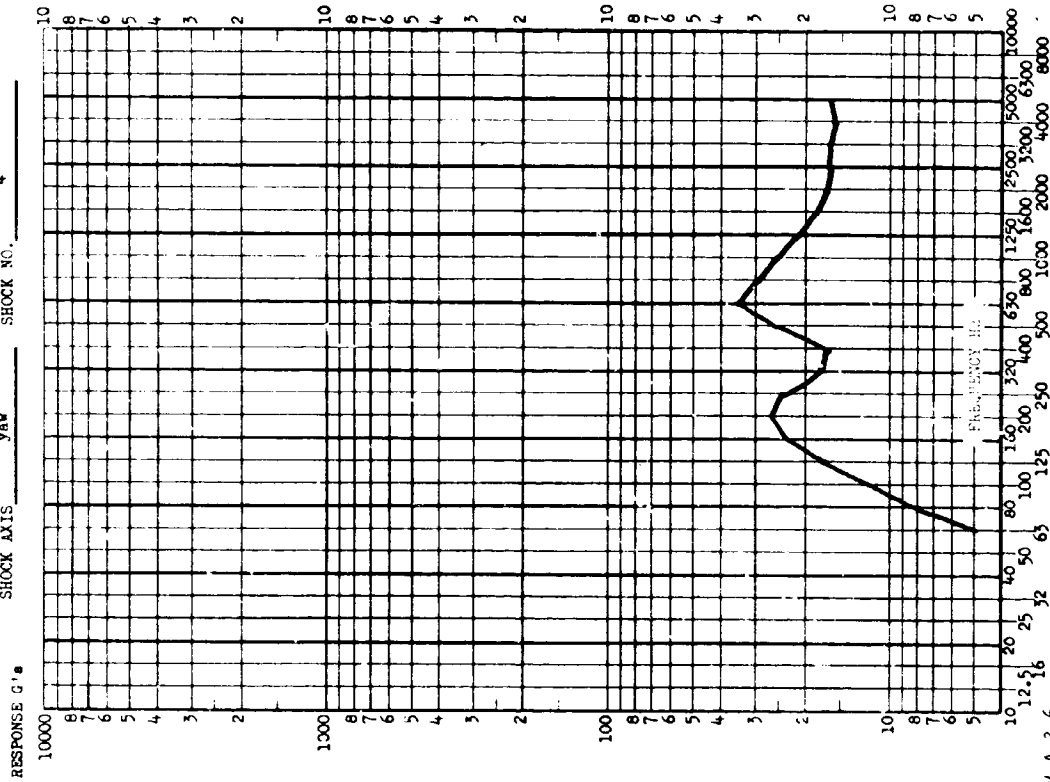
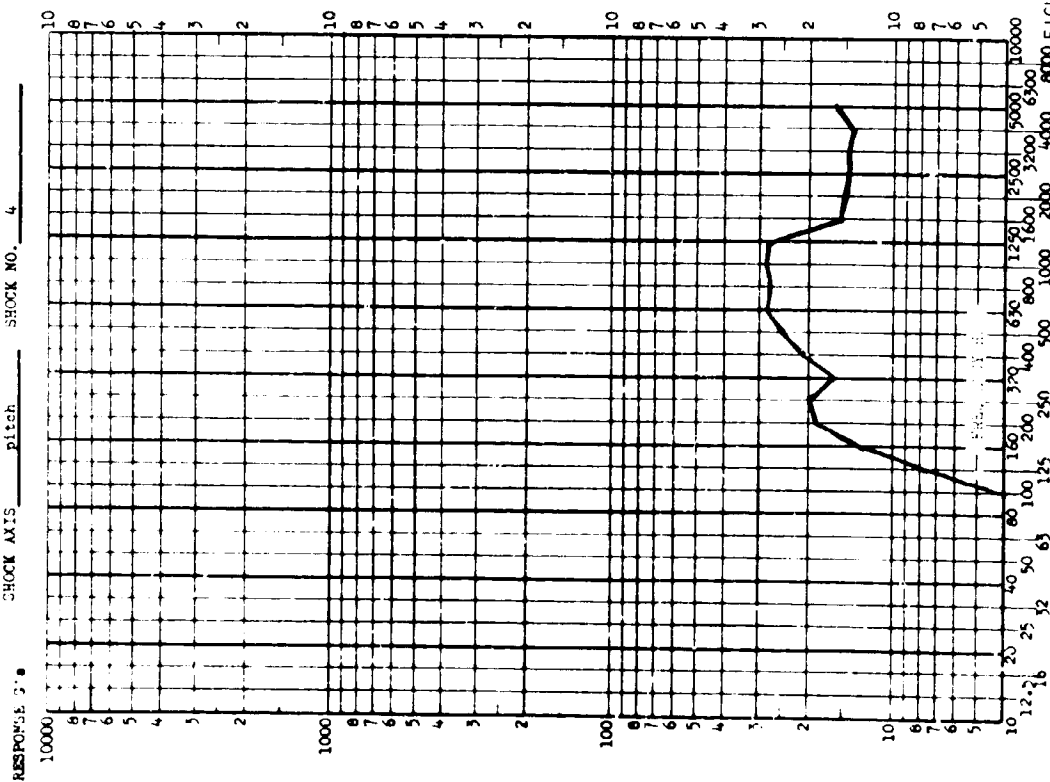


FIGURE IV.A.3-5

TEST ITEM FRONT DROGUE MORTAR
 ACCEL. NO. 7 TEST DATE 4/12/66
 SHOCK AXIS yaw SHOCK NO. 4

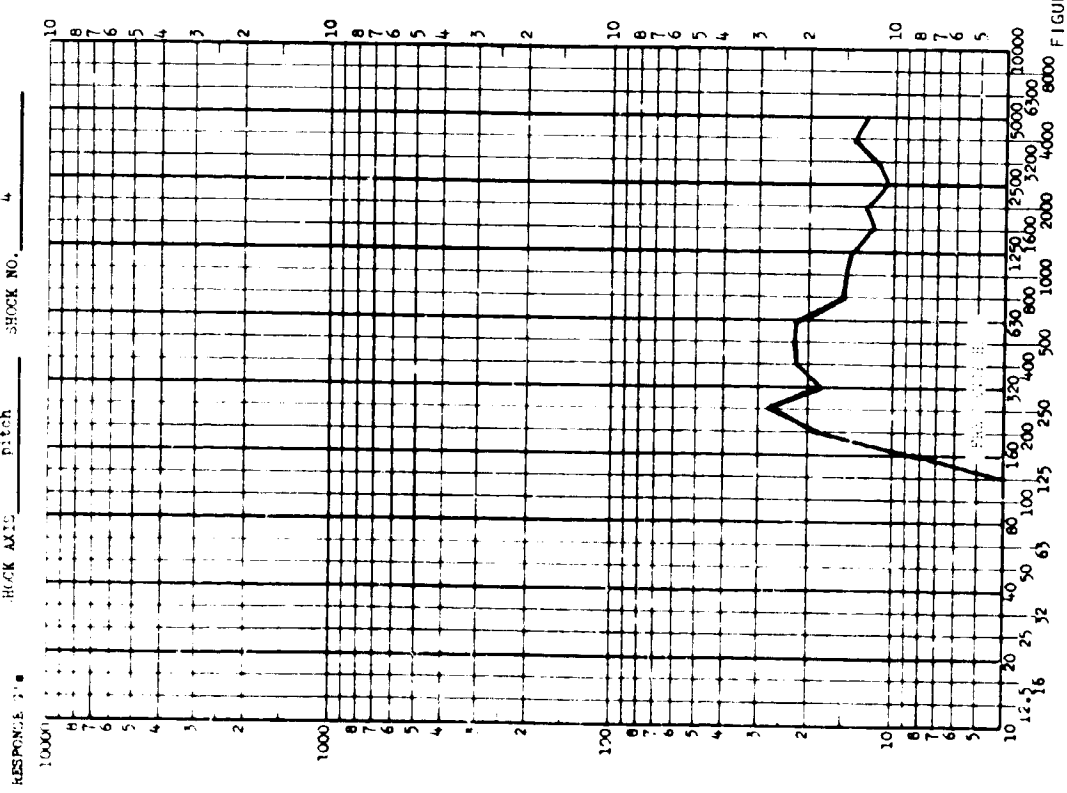


TEST ITEM REAR DROGUE MORTAR
 ACCEL. NO. 7 TEST DATE 4/12/66
 SHOCK AXIS pitch SHOCK NO. 4



8000 F I G U R E I V . A . 3 - 6

TEST ITEM DROGUE MORTAR
 SER. NO. 9 TEST DATE 4/12/66
 SHOCK AXIS PAN SHOCK NO. 4



TEST ITEM DROGUE MORTAR
 SER. NO. 9 TEST DATE 4/25/66
 SHOCK AXIS PAN SHOCK NO. 3

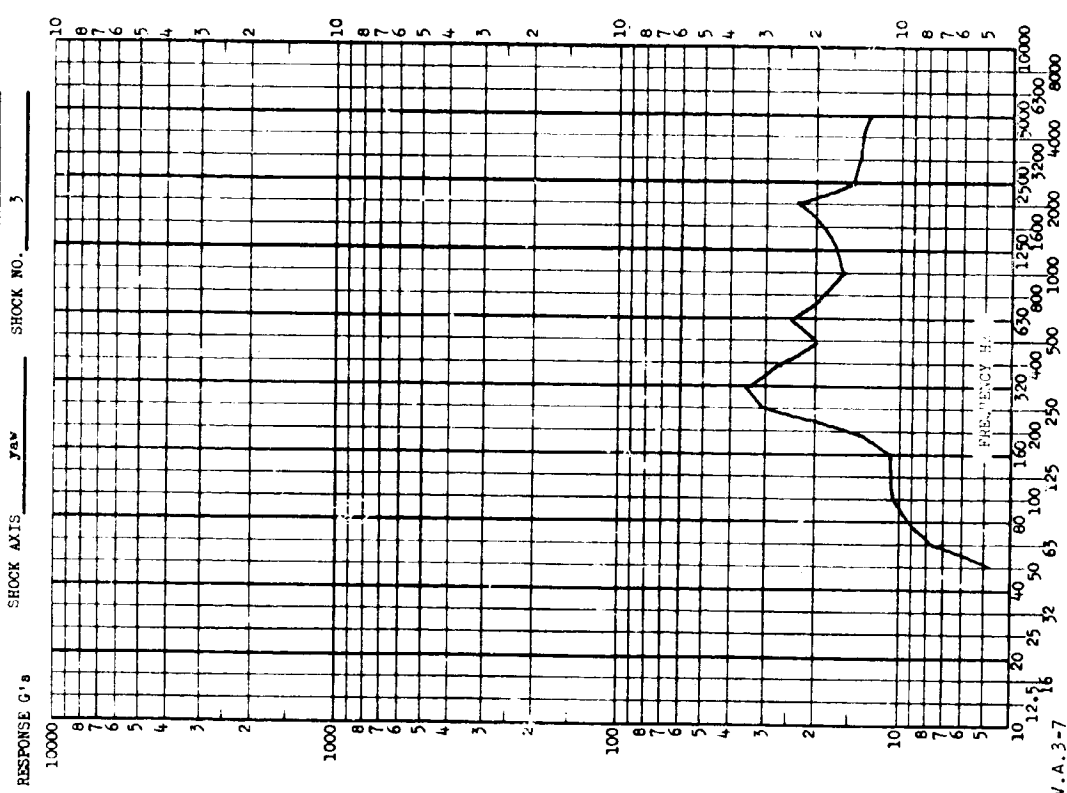


FIGURE IV.A.3-7

TEST ITEM: DROTD. MORTAR
 TEST NO.:
 TEST DATE: 3/25/66, 4/12/66
 SHOCK AXIS: P-11
 SHOCK NO.: 3, 4

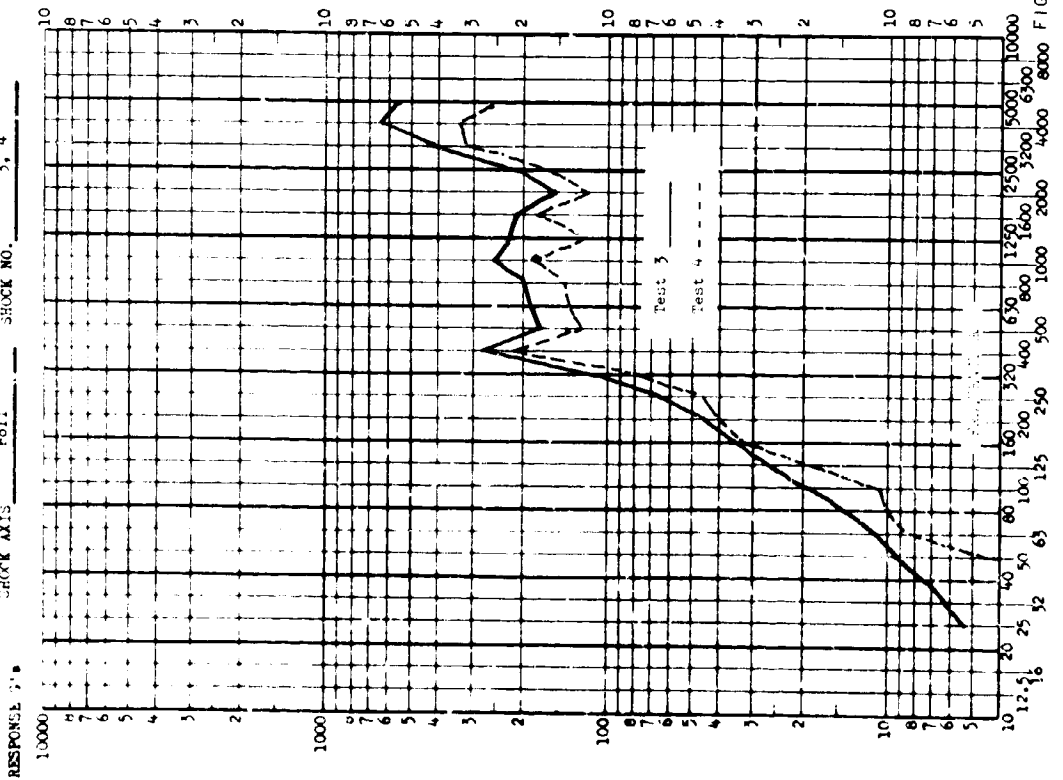


FIGURE IV.A.3-8

SECTION IV.A.4

PRIME DROGUE CHUTE SEPARATION TESTS

Shock data are presented for four firings of the drogue disconnect hardware and for one functional disconnect test. In all tests the separation nut configuration shown in Figure IV.A.4-1 produced the pyrotechnic shock activity. Shots 1, 2 and 3 and the functional test were performed on the standard configuration; however, shot 6 made use of a Pyrotex washer as a shock absorber to reduce the shock levels at locations 1B and 2.

Figures IV.A.4-2 through IV.A.4-15 present the shock spectra for these five tests in the order indicated by Table IV.A.4-1.

TABLE IV.A.4-1
INDEX OF DATA LOCATIONS

<u>Figure Number</u>	<u>Graph 1</u>		<u>Graph 2</u>	
	<u>Shot No.s</u>	<u>Accel. No.s</u>	<u>Shot No.s</u>	<u>Accel. No.s</u>
IV.A.4-2	1,2,5	1B	6	1B
IV.A.4-3	5	2 pitch	6	2 pitch
IV.A.4-4	1,2,5	2 roll	6	2 roll
IV.A.4-5	1,2,5	3 roll	6	3 roll
IV.A.4-6	1,5	3 yaw	6	3 yaw
IV.A.4-7	5	5 pitch	5	5 roll
IV.A.4-8	5	5 yaw	5	6 roll
IV.A.4-9	5	6 yaw	5	7 roll
IV.A.4-10	5	7 yaw	5	9 roll
IV.A.4-11	5	9 yaw	5	10 roll
IV.A.4-12	6	10 roll	---	---
Functional test				
IV.A.4-13		1B		2 roll
IV.A.4-14		3 roll		3 yaw
IV.A.4-15		10 roll		-----

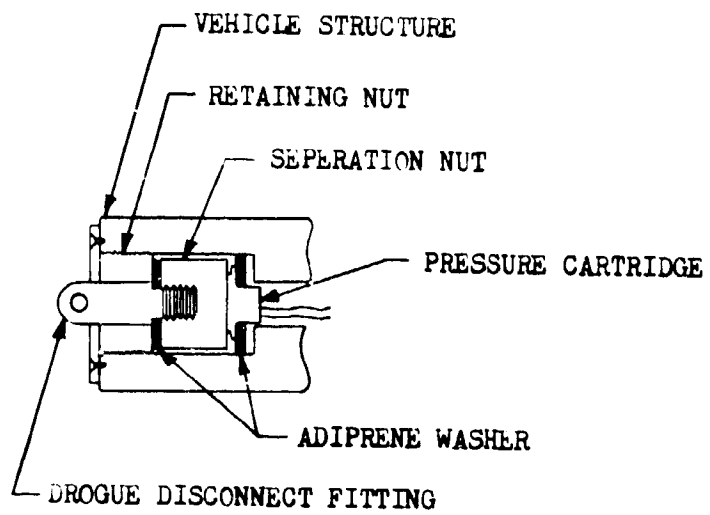
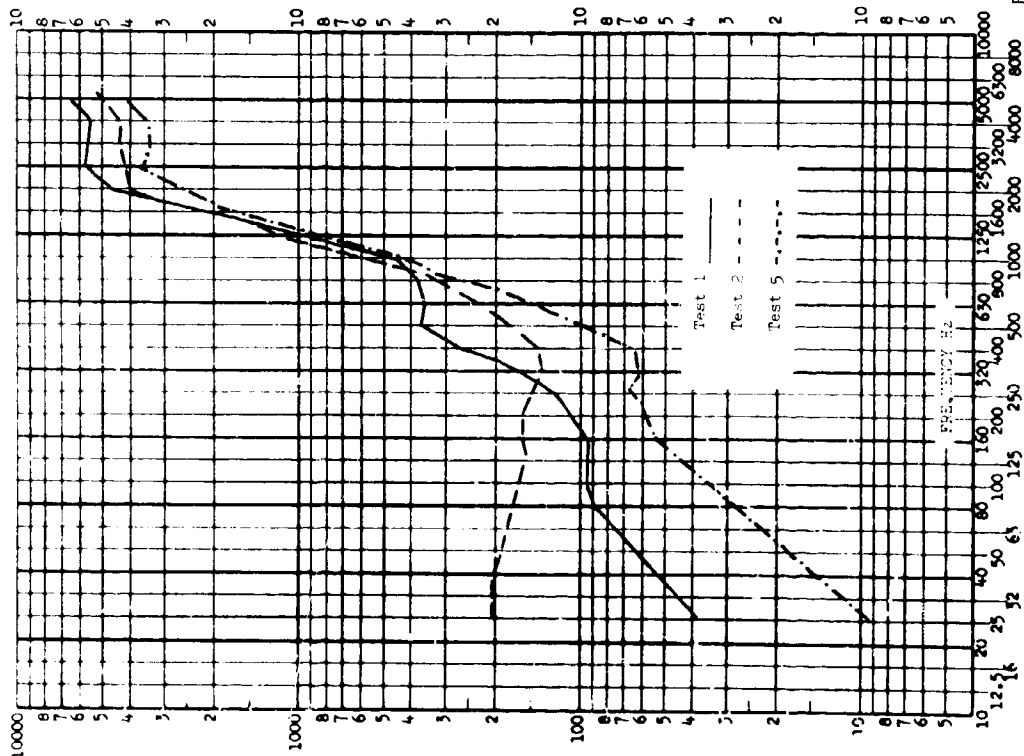


FIGURE IV.A.4-1 SEPERATION NUT CONFIGURATION FOR DROGUE DISCONNECT

TEST ITEM DRUM DROUPE DISCONNECT TEST

APP. NO. 1B TEST DATE 4/18, 23, 25/ 66
SHOCK AXIS 1, 2, 5

RESPONSE G's



TEST ITEM DRUM DROUPE DISCONNECT TEST

APP. NO. 1B TEST DATE April 12, 1966
SHOCK AXIS 6

RESPONSE G's

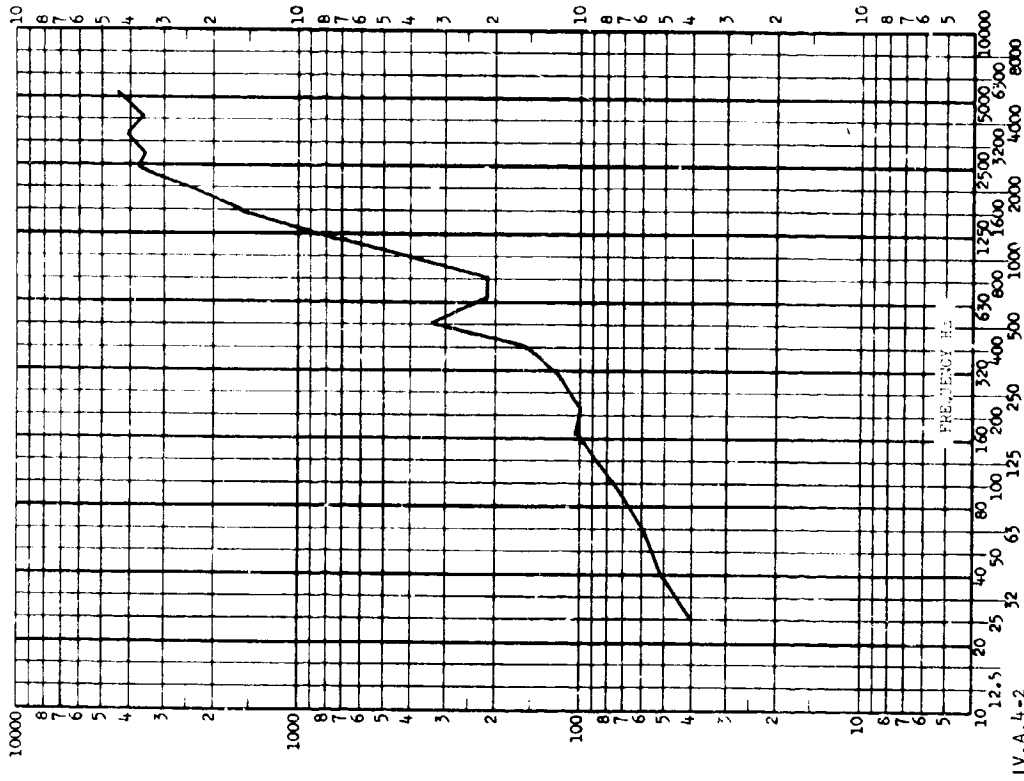
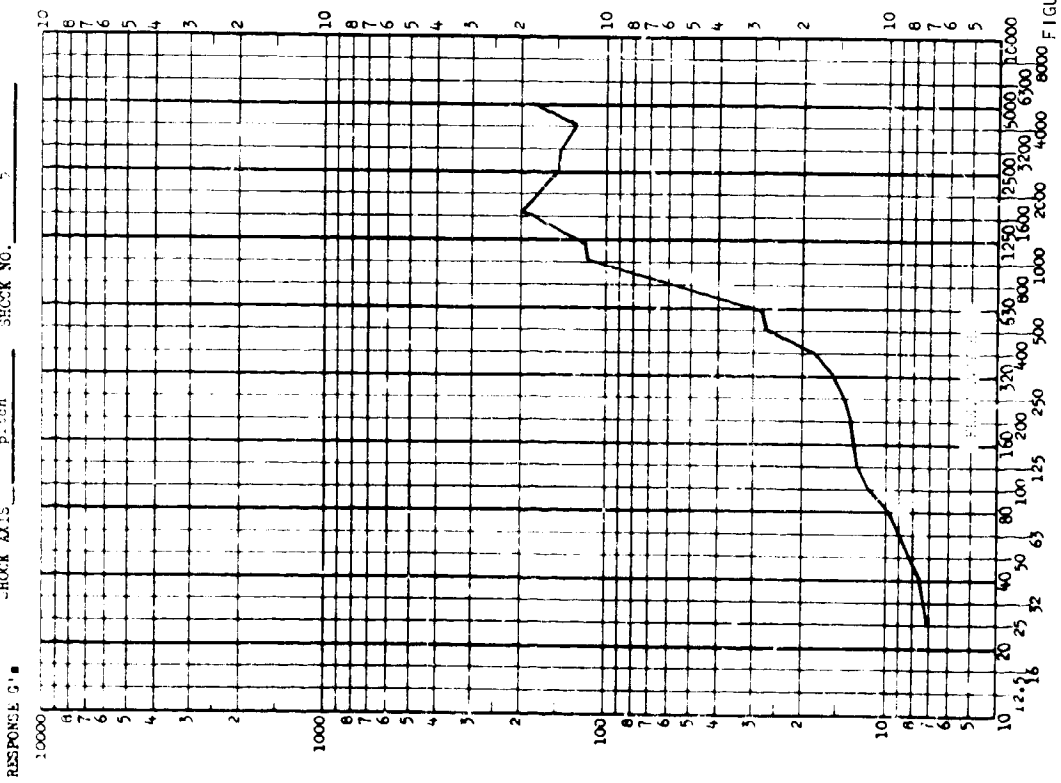


FIGURE IV.A.4-2

TEST ITEM PRIME DROGU DISCONNECT TEST
A/C No. 2 TEST DATE March 25, 1966
SHOCK AXIS pitch SHOCK NO. 5



TEST ITEM PRIME DROGU DISCONNECT TEST
A/C No. 2 TEST DATE April 12, 1966
SHOCK AXIS pitch SHOCK NO. 6

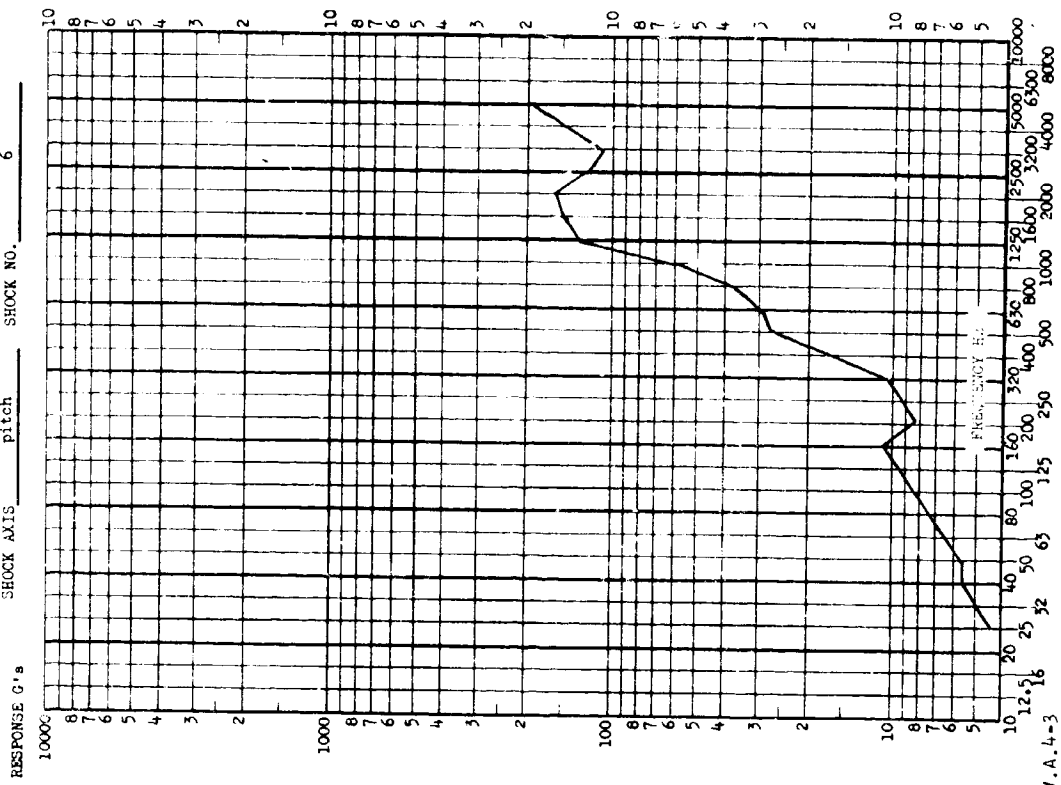
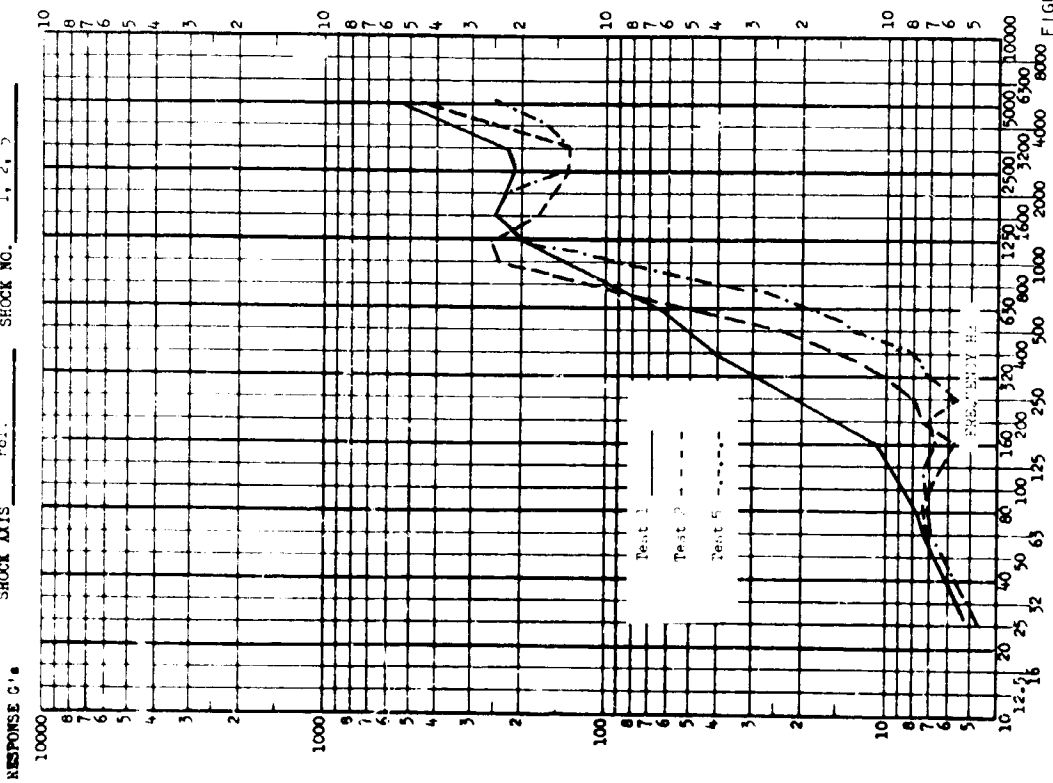


FIGURE IV.A.4-3

X

TEST ITEM PRIME BROUPE DISCONNECT TEST
 A.C.E.L. NO. 2 TEST DATE 4/18, 23, 25/66
 SHOCK AXIS Roll SHOCK NO. 1, 2, 3



TEST ITEM PRIME BROUPE DISCONNECT TEST
 A.C.E.L. NO. 2 TEST DATE April 12, 1966
 SHOCK AXIS Roll SHOCK NO. 6

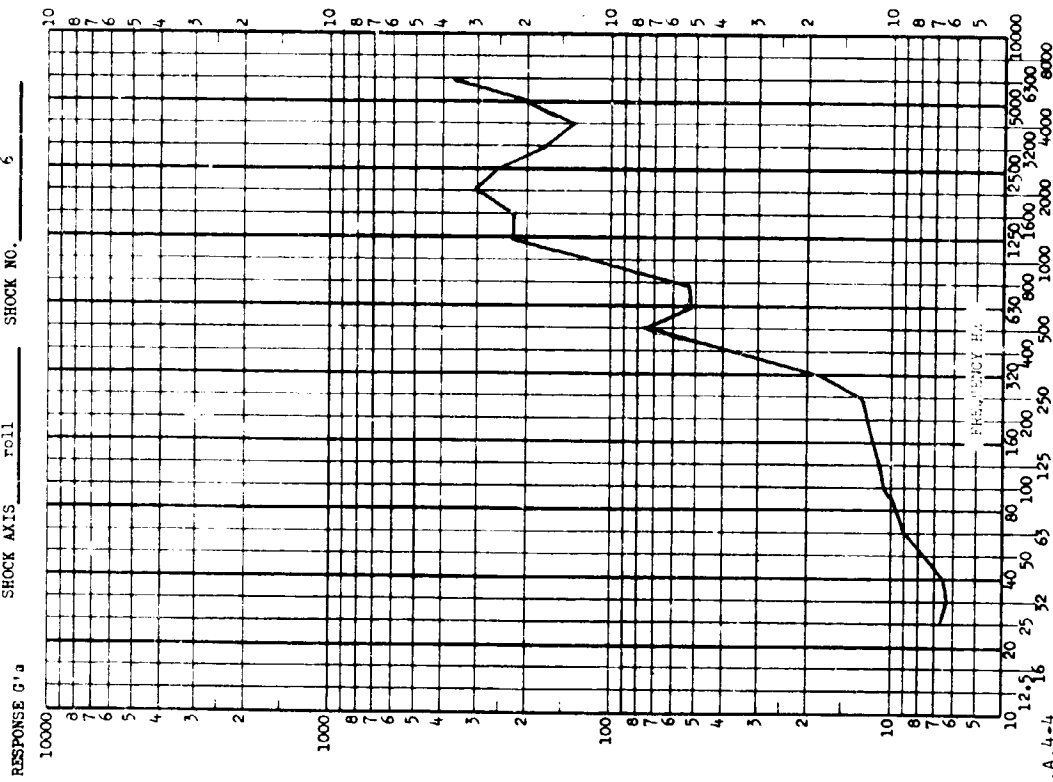
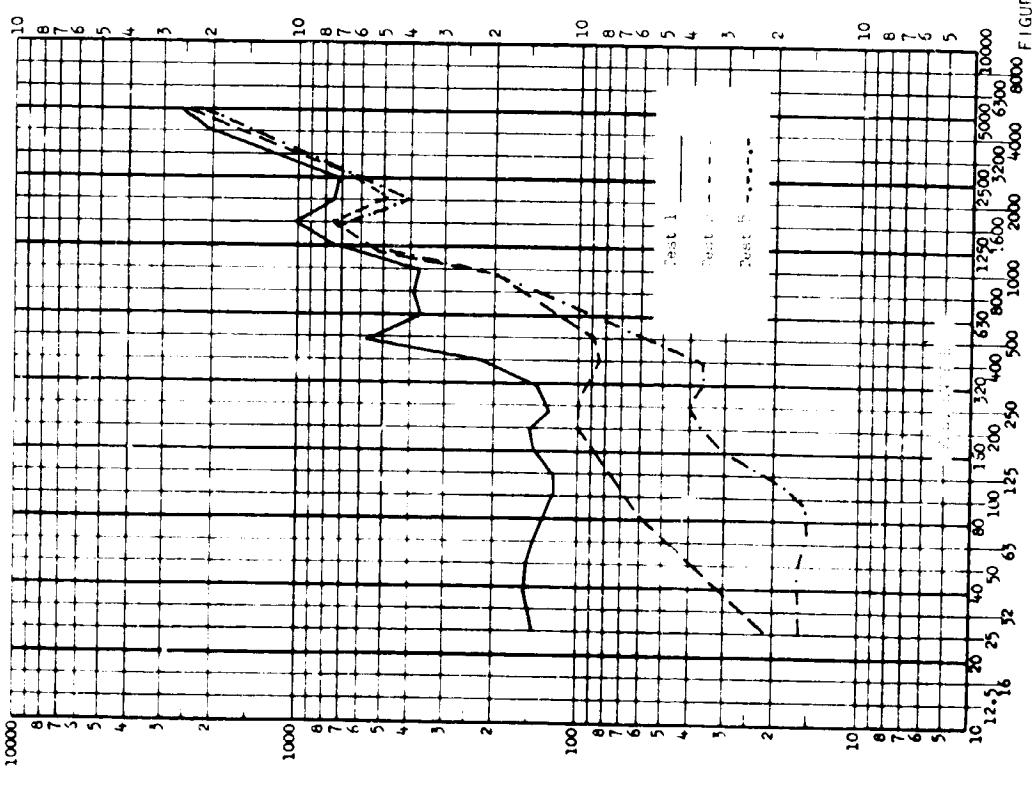


FIGURE IV.A.4-4

TEST ITEM BRIMS BROCHE DISCONNECT TEST
 ACCEL. NO. 3 TEST DATE 4/18, 23, 25/66
 SHOCK AXIS Roll SHOCK NO. 1, 2, 5



TEST ITEM BRIMS BROCHE DISCONNECT TEST
 ACCEL. NO. 3 TEST DATE April 12, 1966
 SHOCK AXIS roll SHOCK NO. 6

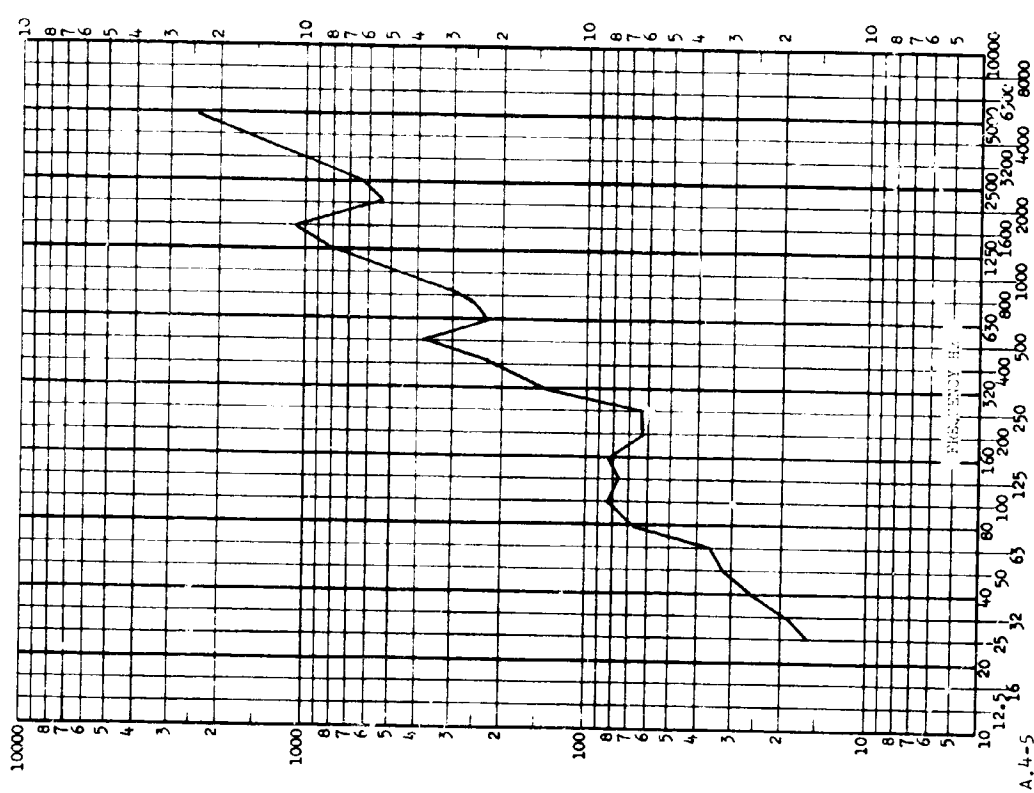
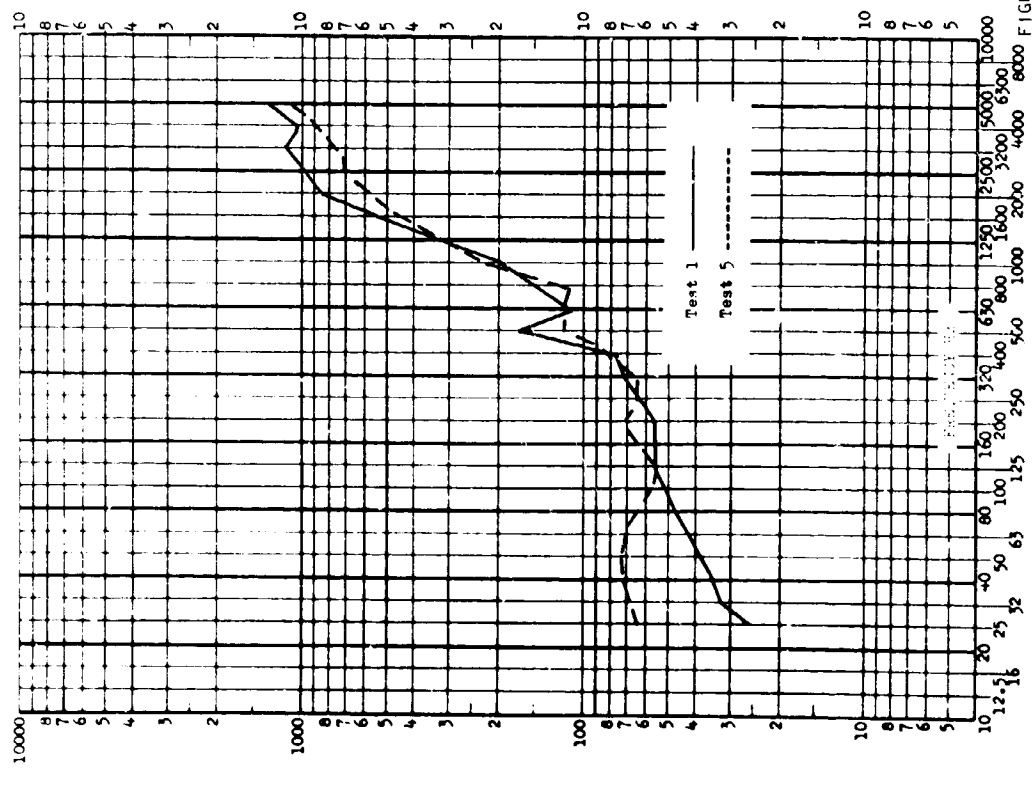


FIGURE IV.A.4-5

TEST ITEM: FRAME BROCHES DISCONNECT TEST
 APPL. NO.: 7 TEST DATE: 4/18, 25/66
 SHOCK AXIS: YAW SHOCK NO.: 1, 5



TEST ITEM: FRAME BROCHES DISCONNECT TEST
 APPL. NO.: 3 TEST DATE: April 12, 1966
 SHOCK AXIS: YAW SHOCK NO.: 6

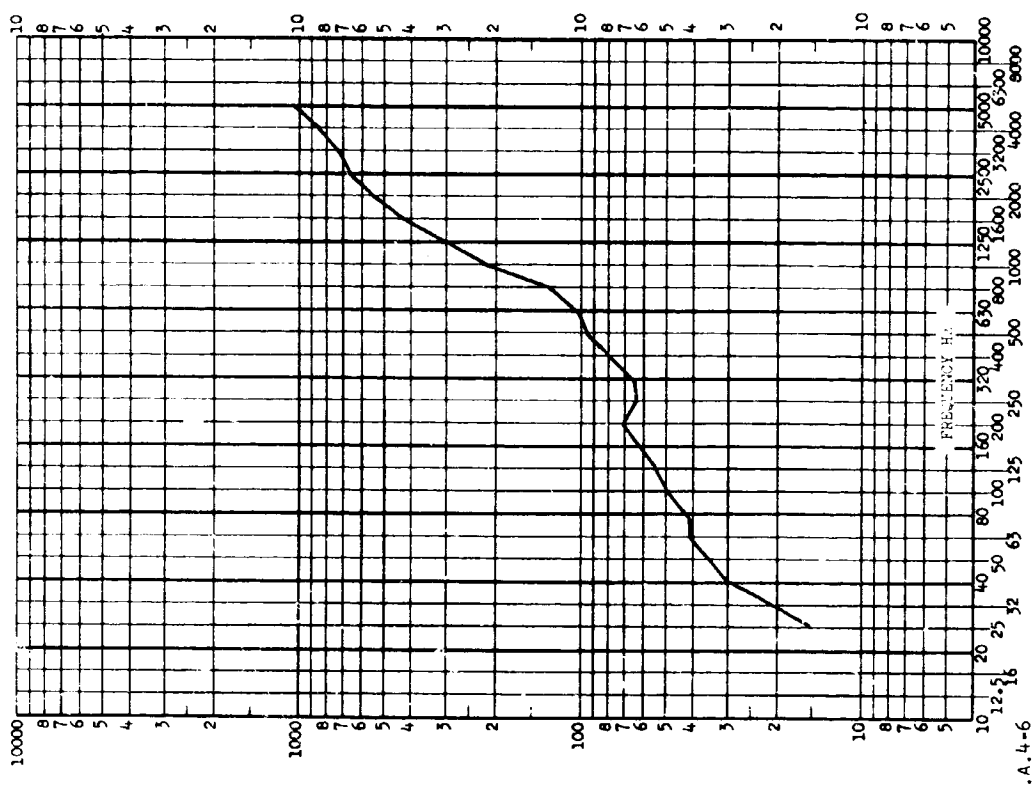
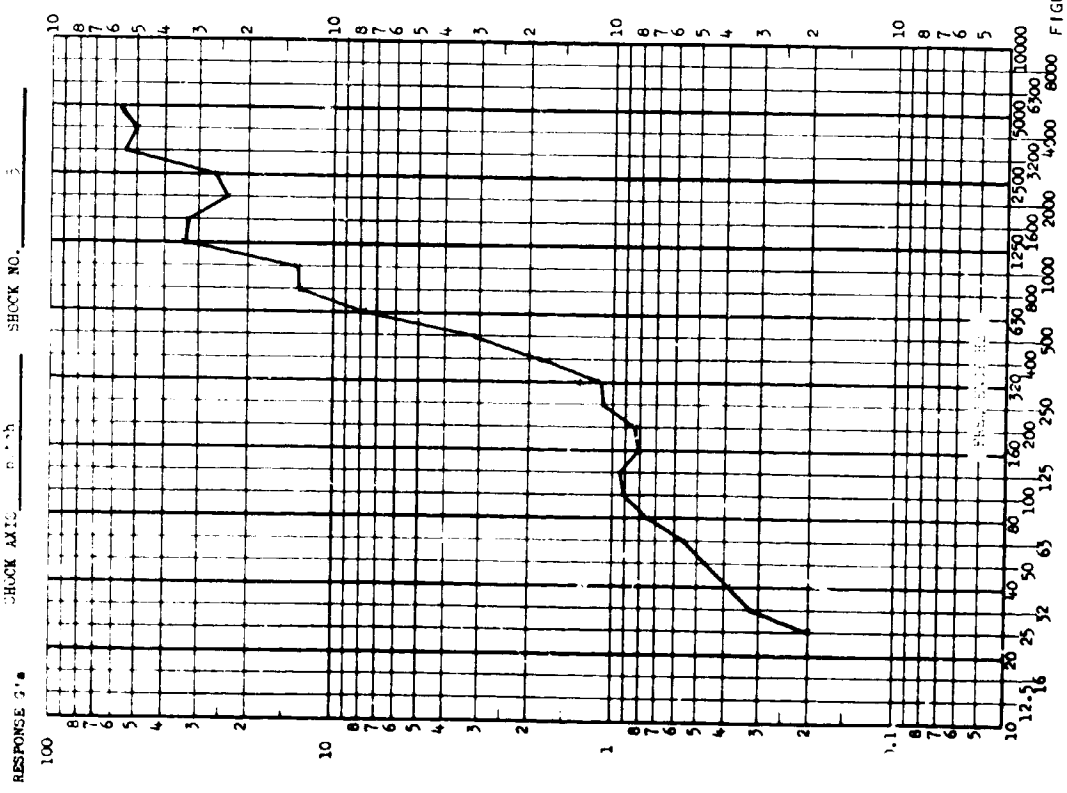


FIGURE IV.A.4-6

TEST ITEM 1. P.M. DROPPED DISCONNECT TEST
 APP. NO. 5 TEST DATE March 25, 1966
 SHOCK AXIS roll SHOCK NO. 5



TEST ITEM 1. P.M. DROPPED DISCONNECT TEST
 APP. NO. 5 TEST DATE March 25, 1966
 SHOCK AXIS roll SHOCK NO. 5

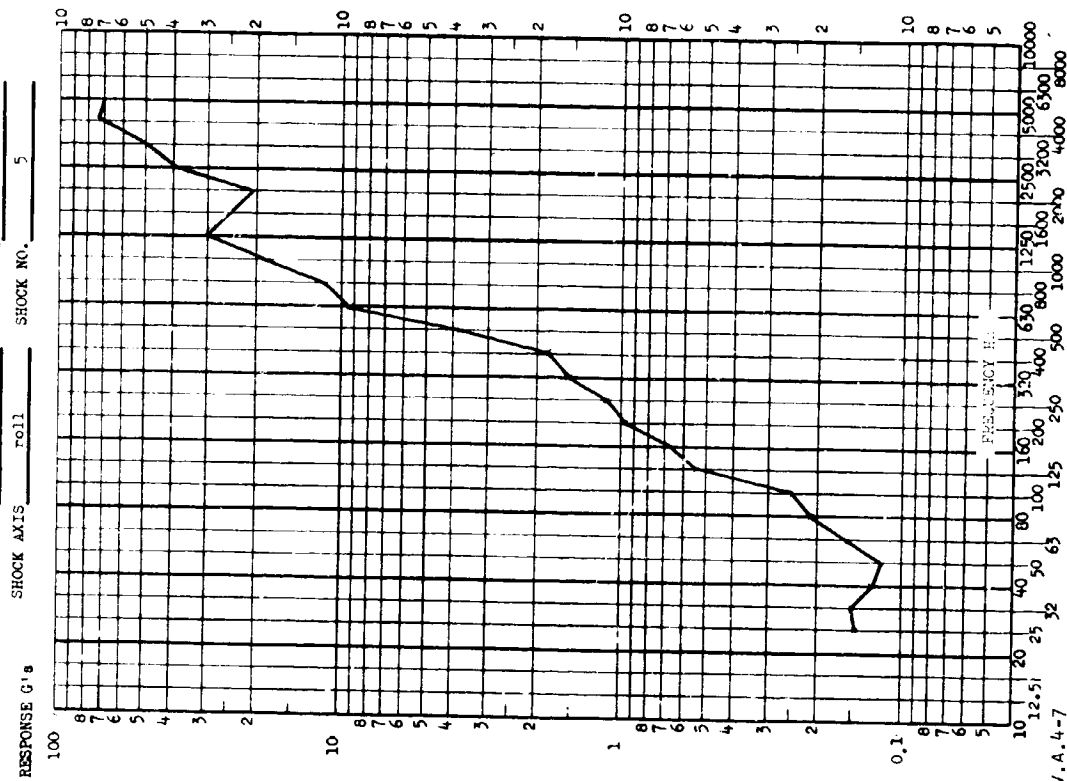
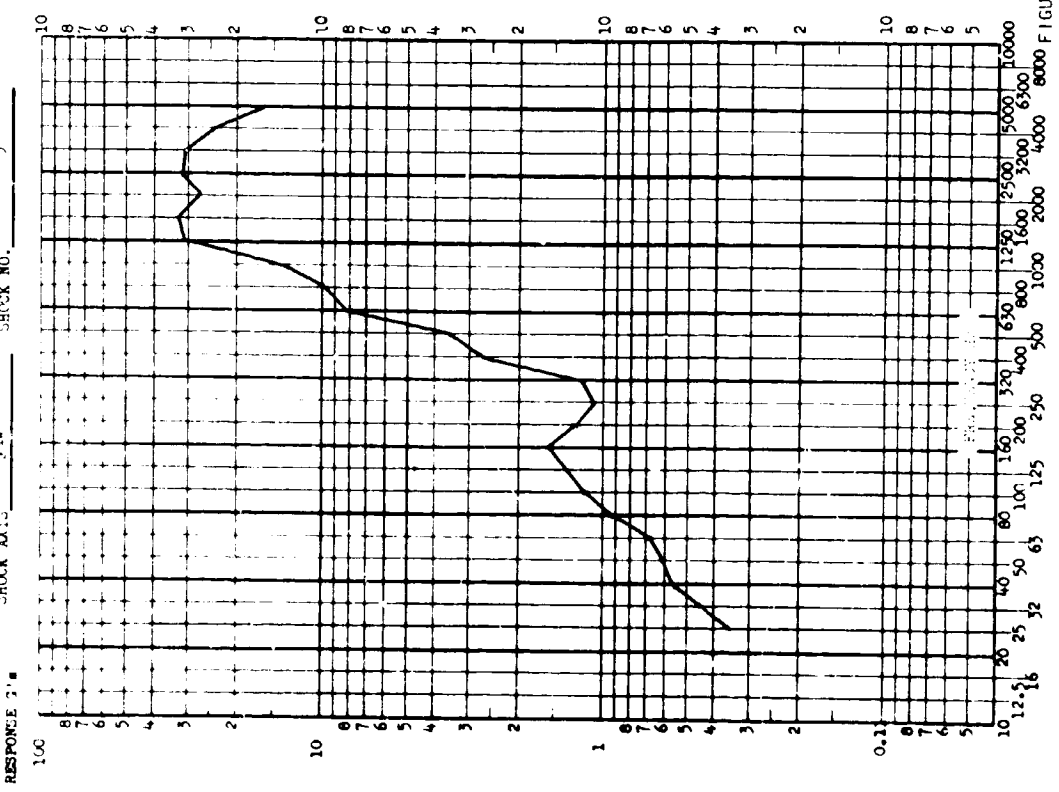


FIGURE IV.A.4-7

TEST ITEM: PRIME DROGUE DISCONNECT TEST
 SERIAL NO.: 5 TEST DATE: March 25, 1966
 SHOCK AXIS: Yaw SHOCK NO.: 5



TEST ITEM: PRIME DROGUE DISCONNECT TEST
 SERIAL NO.: 6 TEST DATE: March 25, 1966
 SHOCK AXIS: Roll SHOCK NO.: 5

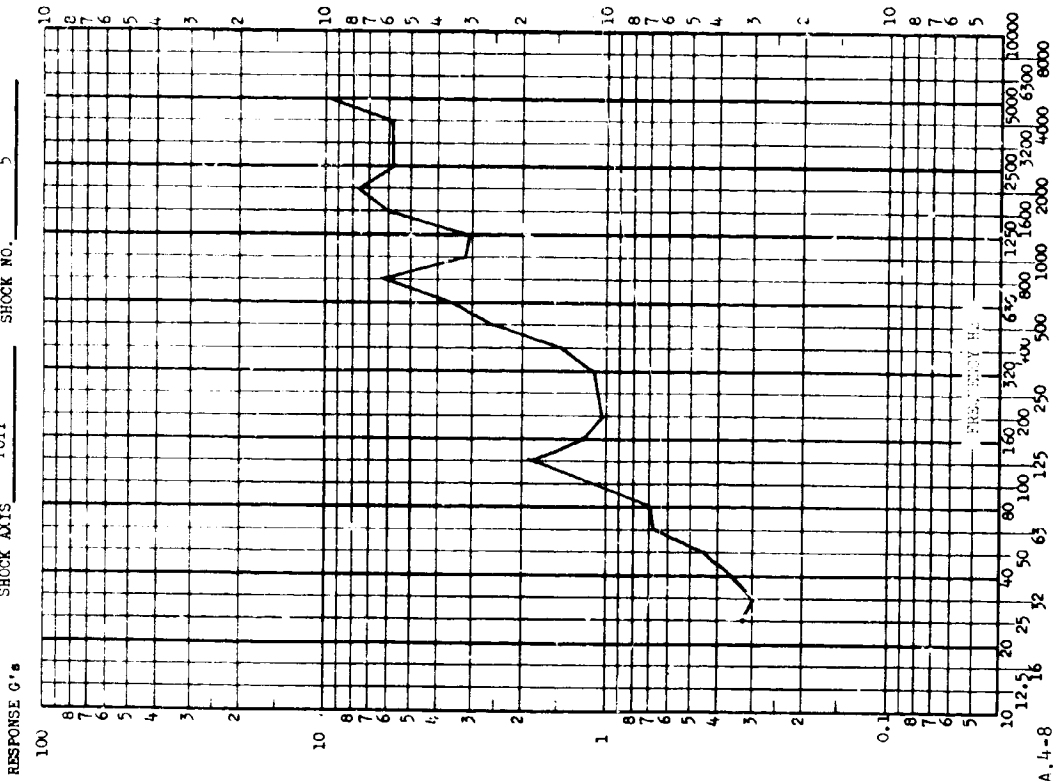
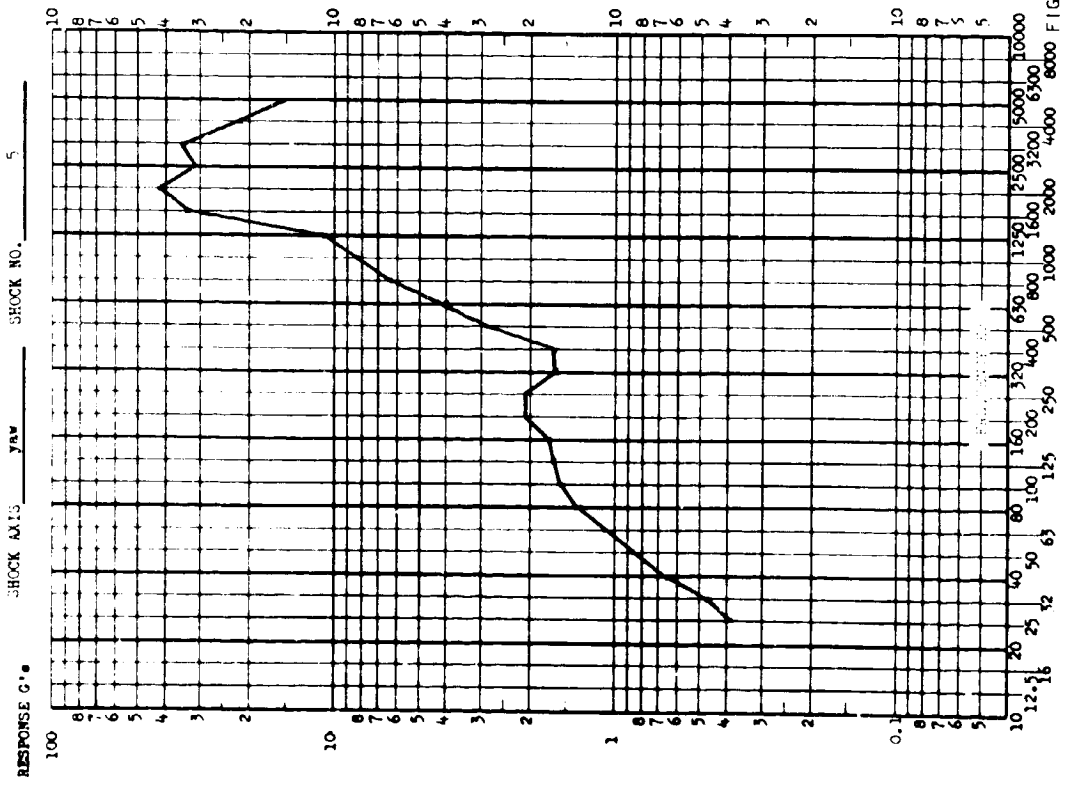
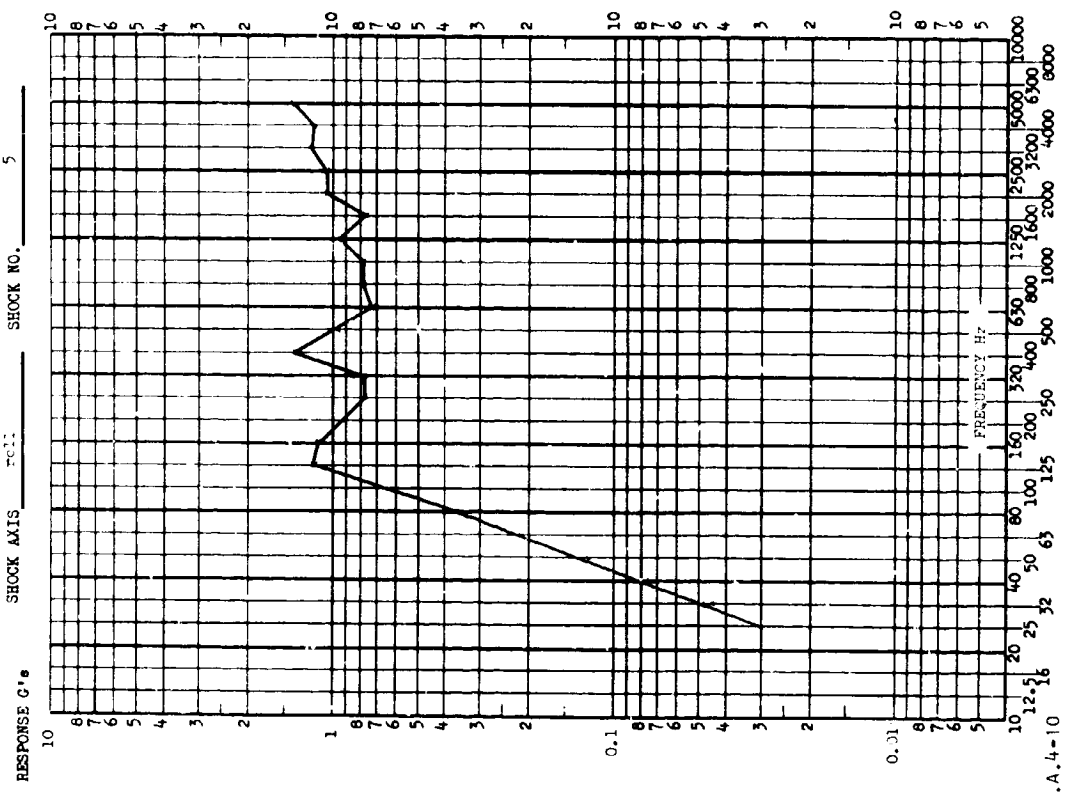


FIGURE IV.A.4-8

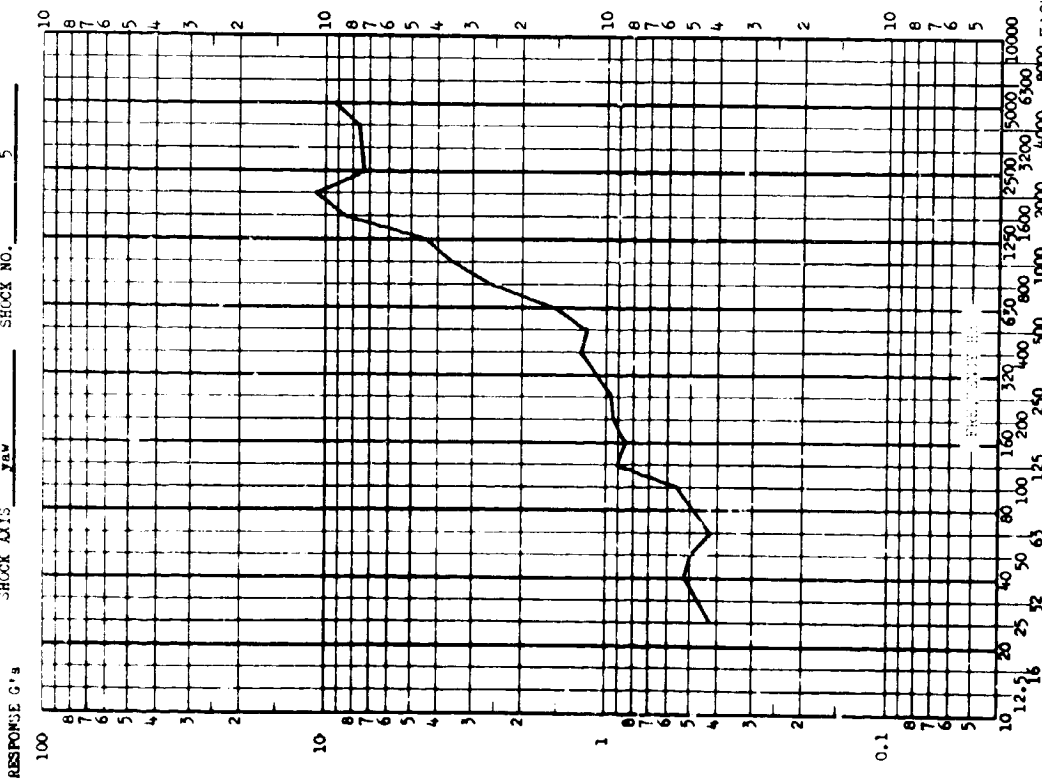
TEST ITEM FRAME SHOCK DISCONNECT TEST
 ACCL. NO. 7 TEST DATE March 25, 1966
 SHOCK AXIS YAW SHOCK NO. 5



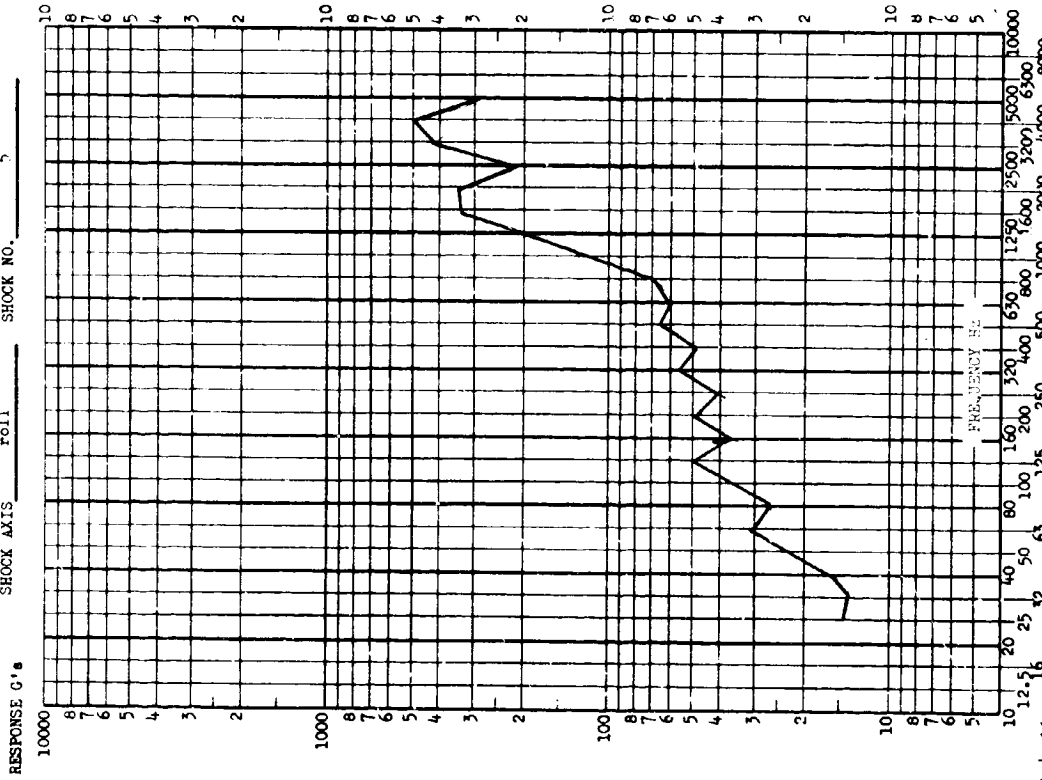
TEST ITEM FRAME SHOCK DISCONNECT TEST
 ACCL. NO. 9 TEST DATE March 25, 1966
 SHOCK AXIS Roll SHOCK NO. 5



TEST ITEM: PRIMA BROGUE DISCONNECT TEST
 APP. NO.: 9
 TEST DATE: March 25, 1966
 SHOCK AXIS: YAW
 SHOCK NO.: 5



TEST ITEM: PRIMA BROGUE DISCONNECT TEST
 APP. NO.: 10
 TEST DATE: March 25, 1966
 SHOCK AXIS: Roll
 SHOCK NO.: 5



8000 FIGURE I.V.A.4-11

TEST ITEM: ENGINE HOUSING DISCONNECT TEST
 PART NO.: 10 TEST DATE: April 12, 1966
 SHOCK AXIS: roll SHOCK NO.: 6

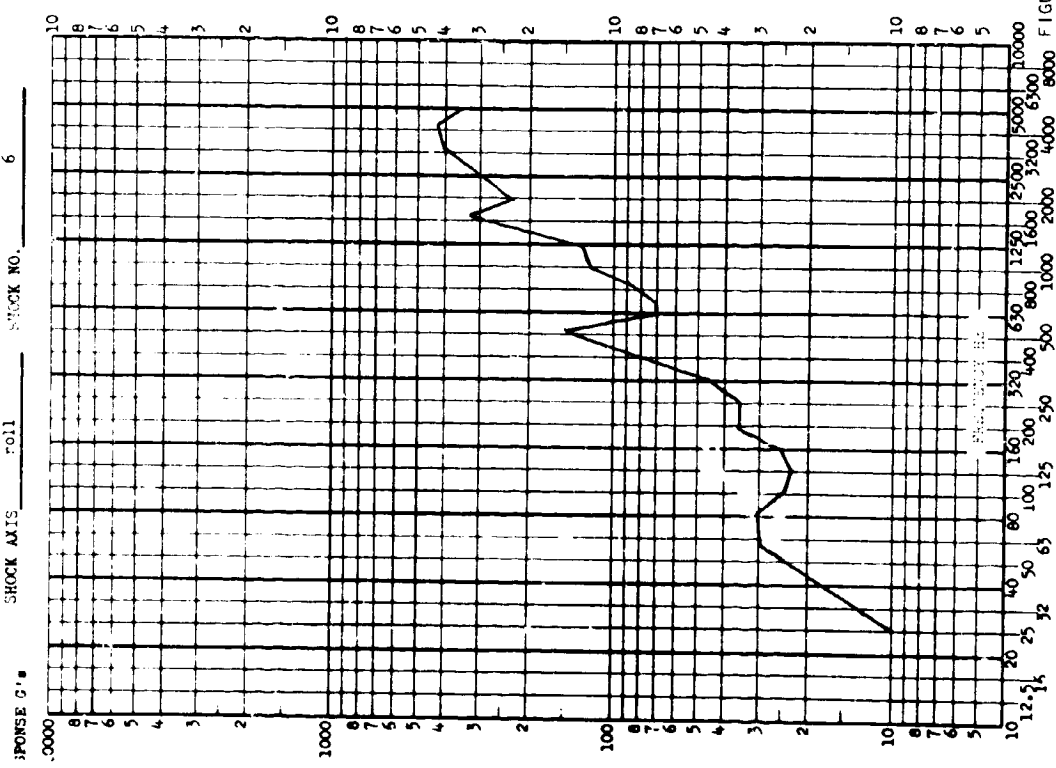
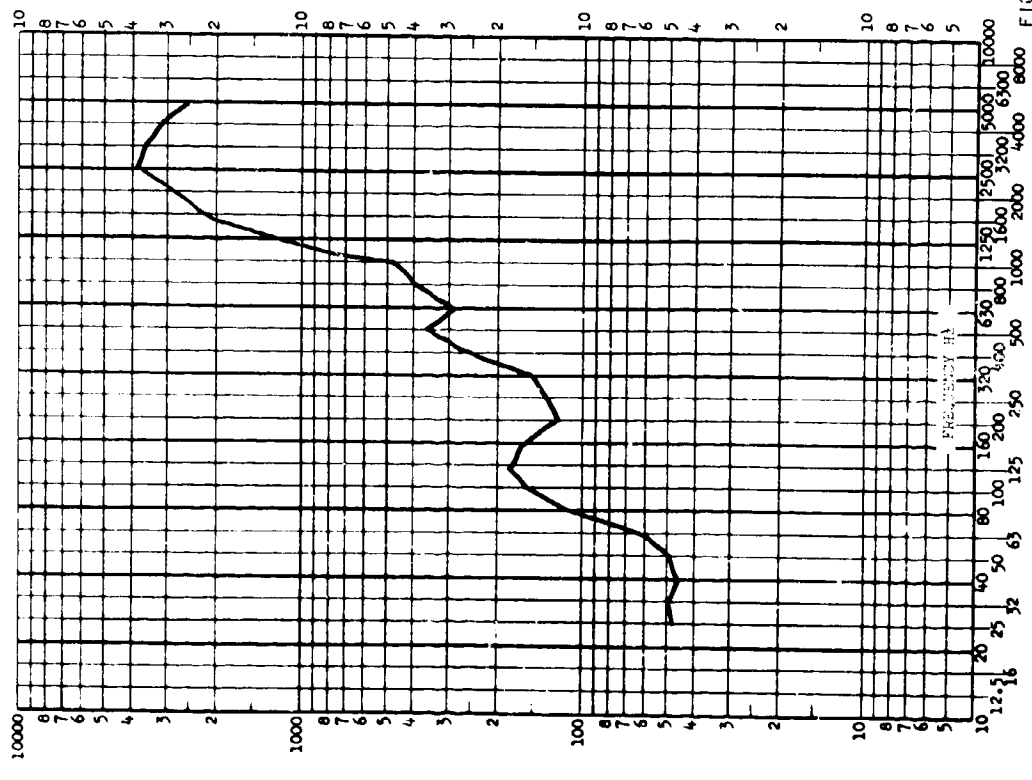


FIGURE IV.A.4-12

TEST ITEM PRIME DROGUE DISCONNECT FUNCTIONAL TEST
 ACCEL. NO. 1 TEST DATE April 26, 1966
 SHOCK AXIS roll SHOCK NO. 1



TEST ITEM PRIME DROGUE DISCONNECT FUNCTIONAL TEST
 ACCEL. NO. 2 TEST DATE April 26, 1966
 SHOCK AXIS roll SHOCK NO. 1

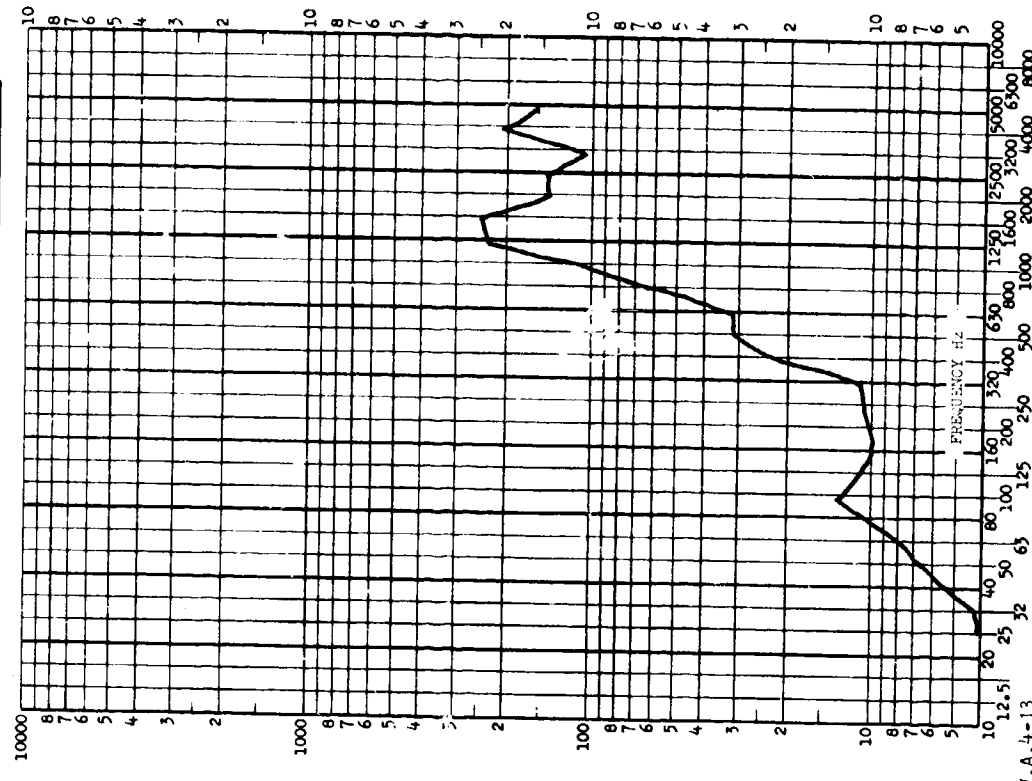
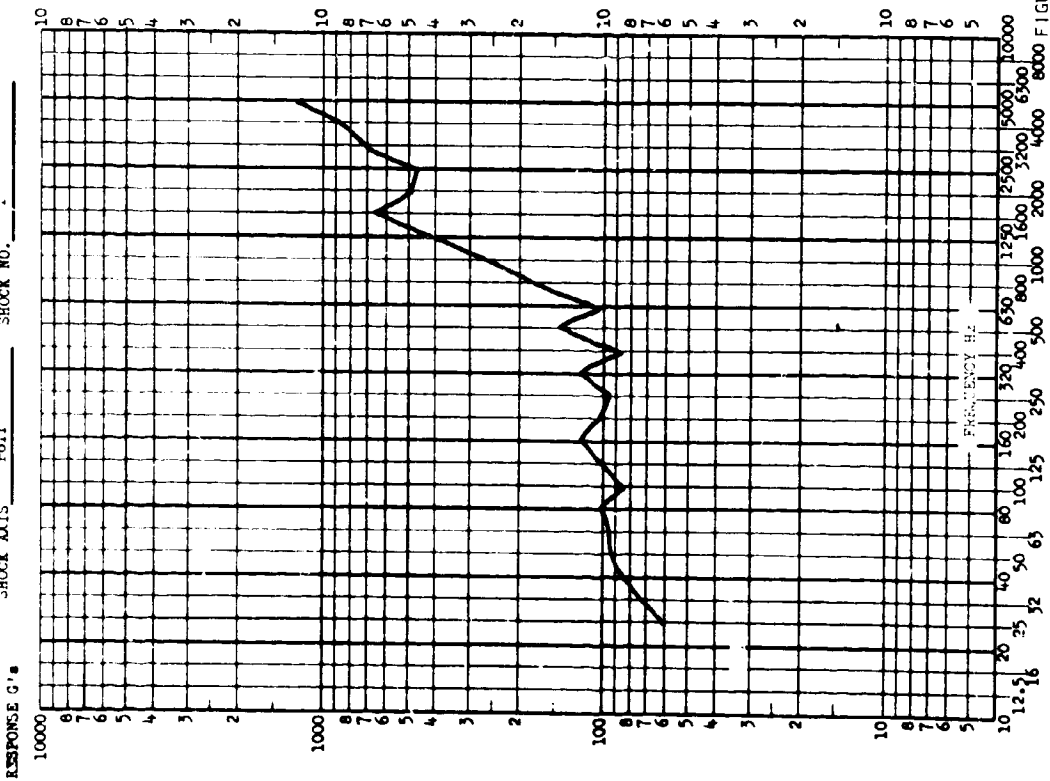


FIGURE IV.A.4-13

TEST ITEM PRIME BROUHE DISCONNECT FUNCTIONAL TEST
 ACCEL. NO. 3 TEST DATE April 26, 1966
 SHOCK AXIS roll SHOCK NO. 1



TEST ITEM PRIME BROUHE DISCONNECT FUNCTIONAL TEST
 ACCEL. NO. 3 TEST DATE April 26, 1966
 SHOCK AXIS Yaw SHOCK NO. 1

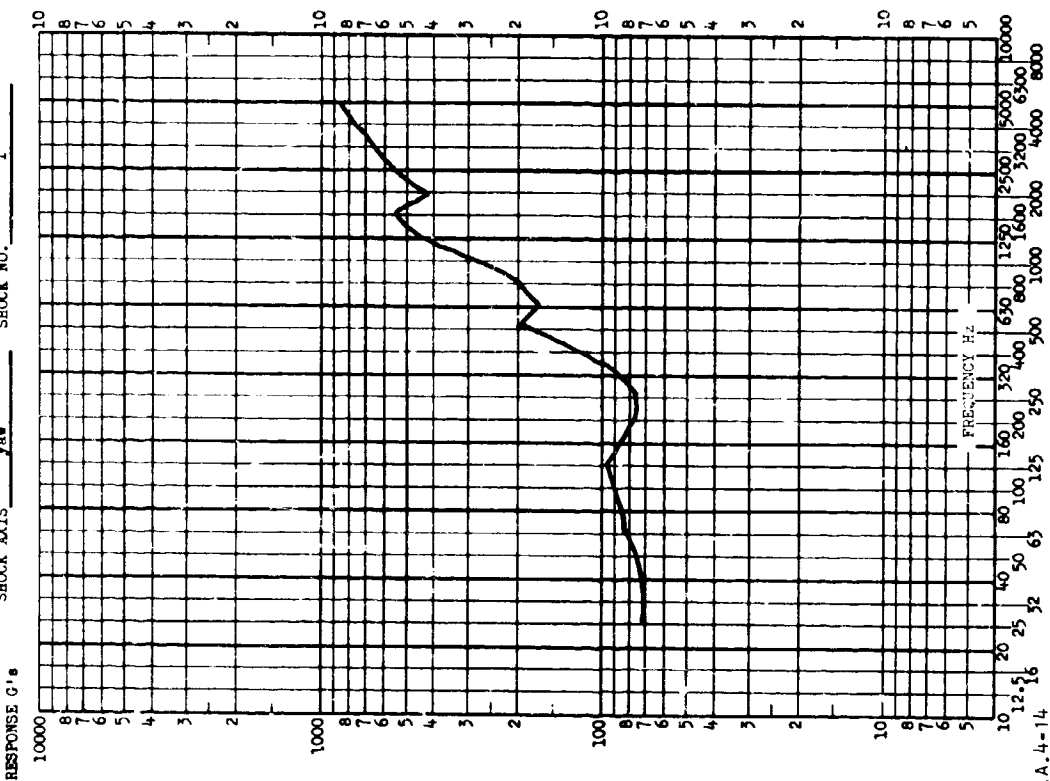


FIGURE IV.A.4-14

TEST ITEM: PRIMO DROGUE DISCONNECT FUNCTIONAL TEST
 S. N. NO.: 10 TEST DATE: April 26, 1966
 SHOCK AXIS: roll SHOCK NO.: 1

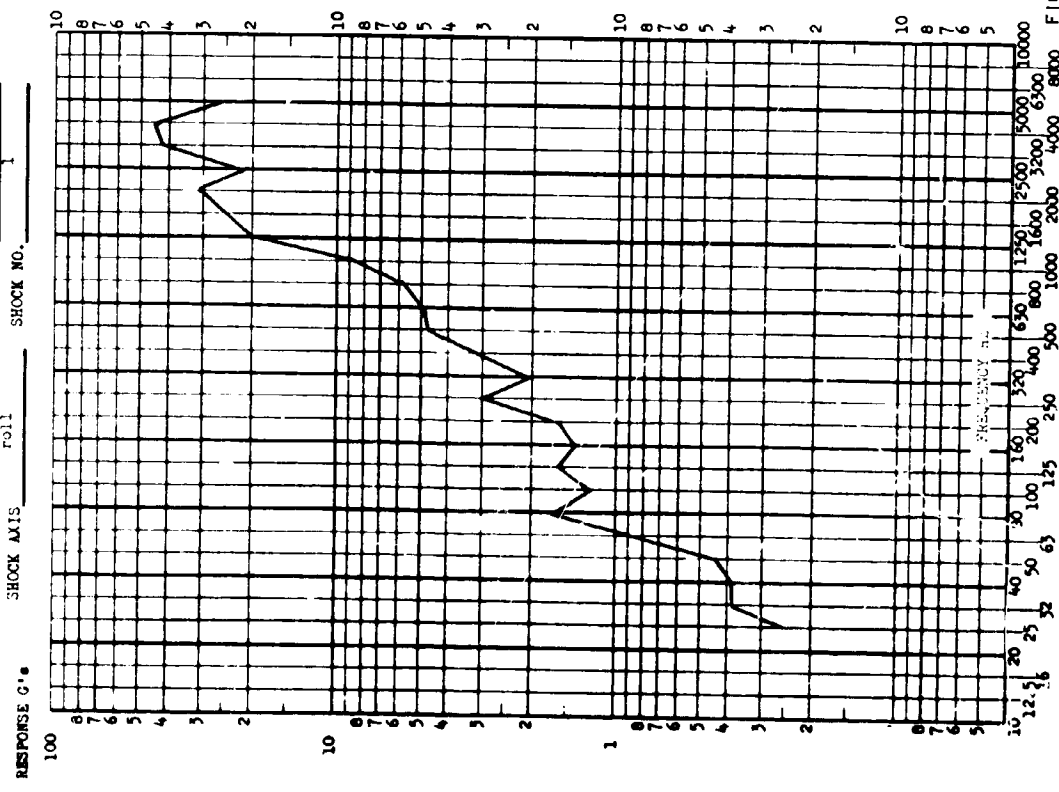


FIGURE IV.A.4-15

PART IV.B

PYROTECHNIC SHOCK DATA COMPILED FOR
MARINER (VENUS & MARS) '67 FLIGHT
ACCEPTANCE TESTS

PART IV.B

MARINER VENUS 67 FLIGHT ACCEPTANCE PYROTECHNIC TESTS

PURPOSE OF TESTS

The objectives of the pyrotechnic shock acceptance tests of the M67-1 (Mariner Venus) and M67-2 (Mariner V) are listed below:

1. To initiate all pyro devices on or near the spacecraft in the natural flight sequence in order to verify the operation of the pyrotechnics and their associated control systems.
2. To verify that the spacecraft operation was not adversely affected by the detonation of the pyrotechnics.
3. To measure, record, and analyze the shock transients at selected locations on the vehicle.

DESCRIPTION OF EVENTS

The test vehicles for these test programs were the M67-1 and M67-2 spacecraft. The M67-1 flight acceptance pyro test was conducted with the spacecraft in its flight configuration secured atop the LMSC adapter and on the Agena forward equipment rack. The rack, in turn, was bolted to a 2-inch-thick steel plate. Prior to shroud V-band pyro release, the test configuration was as shown in Figure IV.B-1. The

shroud was secured to the adapter by a tensioned shroud V-band. The spacecraft was also secured to the adapter with another V-band, which secured the eight feet of the spacecraft to eight mating surfaces on the adapter. Figure IV.B.2 shows the adapter interfaces with both the shroud and the spacecraft.

The M67-1 test consisted of firing all six of the pyro devices on or near the spacecraft in the sequence they would be fired during an actual mission. In addition, the spring loaded umbilical door in the LMSC shroud was opened fully and allowed to slam shut. Hence, the test program included the following events:

1. Shroud V-band pyro release (initiates shroud separation from Agena booster) - Section IV.B.1.
2. Spacecraft V-band pyro release (initiates spacecraft separation from Agena) - Section IV.B.2.
3. Solar panel deployment - Section IV.B.3.
4. Post injection propulsion system pyro 1 (PIPS1) - Section IV.B.4.
5. Post injection propulsion system pyro 2 (PIPS2) - Section IV.B.5.
6. High-gain antenna pointing angle change (APAC) pyrotechnic - Section IV.B.6.
7. Umbilical door slam (non-pyrotechnic event - two runs) Section IV.B.7.

The test configuration for the M67-2 was identical to the M67-1, except for the shroud, which was omitted in M67-2 because there was no shroud V-band pyro event specified. In addition, the M67-2 spacecraft adapter was not mounted on the Agena forward equipment rack but was secured to a handling fixture.

The M67-2 test sequence consisted of firing only those pyros that would produce the maximum shock levels throughout the spacecraft. From the experience gained in the M67-1 tests, the events selected were:

1. Spacecraft V-band pyro release.
2. Solar panel deployment
3. APAC

All events and their associated pyrotechnic devices are discussed in greater detail along with the data presentation in Sections IV.B.1 through IV.B.7.

DESCRIPTION OF DATA

The following information is characteristic of the data presented for each test event:

Type of shock spectra analyses	digital
Duration of time history analyzed	30 milliseconds
Sample rate	160,000/sec
Valid frequency range	Table IV.B-1
Frequency increment	10 points per decade
Damping	$Q = 20$
Aliasing filter	none

DESCRIPTION OF STRUCTURE

Figures IV.B-1 through IV.B-5.

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225 and other Endevco models
having the frequency ranges indicated in Table
IV.B-1.

Location: Table IV.B-1 and Figures IV.B-3 through
IV.B-5.

Axis of sensitivity: Table IV.B-1 and Figures
IV.B-3 through IV.B-5

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorders: Ampex 1300 with Ampex ES100 FM electronics
(flat to 20 K Hz.)

Amplifiers: Dynamics 6443 charge amplifiers (flat to
30 K Hz.)

TABLE IV.B-1
ACCELEROMETER DESCRIPTIONS

<u>Accelerometer Number</u>	<u>General Location</u>	<u>Sensitive Axis</u>	<u>Maximum Useful Frequency (Hz)</u>
B3*	Upper bus leg B	Z	8000
F4*	Adapter bay II	Z	8000
F1*	Adapter foot G	Radial	20,000
F3*	Adapter foot C	Tangential	20,000
F4A*	Adapter near F4	Z	20,000
B1A	Bus top leg B	X	20,000
B2A	" " " "	Y	20,000
B3A	" " " "	Z	20,000
B4	Bus top leg F	X	9000
B5	" " " "	Y	9000
B6	" " " "	Z	9000
BB1	Bus bottom leg B	X	20,000
BB2	" " " "	Y	20,000
BB3	" " " "	Z	20,000
SS4A	Secondary Structure (near bay IV)	Z	7500
SS5A	" " " " "	XY bays IV-VIII	7500
SS6A	" " " " "	XY bays II-VI	7500
AS1	Antenna superstructure	I antenna axis	15,000
AS2	" "	II antenna axis	15,000
IC4	Solar panel 1 (lower center)	X	15,000
3T3	Solar panel 3 (Rt. tip)	Y	15,000
MCV1	PIPS nitrogen valve	XY bays II-VI	20,000
MCV4	PIPS fuel valve	XY bays II-VI	20,000
MC4	PIPS frame	XY bays II-VI	20,000

* These measurements were the only ones used on M67-2

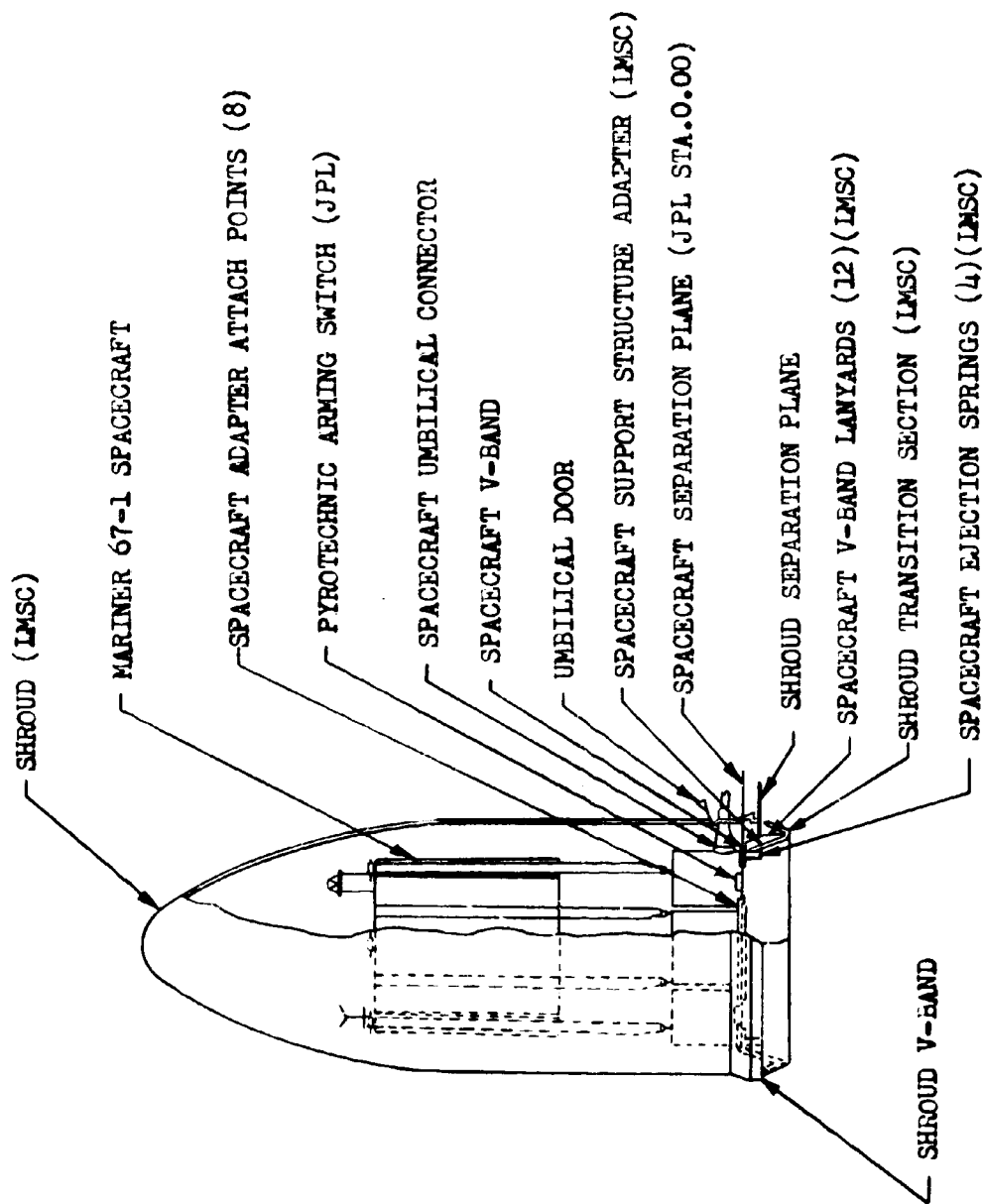


FIGURE IV.B-1. M67-1 SPACECRAFT PYRO TEST CONFIGURATION SHOWING SHROUD, SPACECRAFT AND ADAPTER

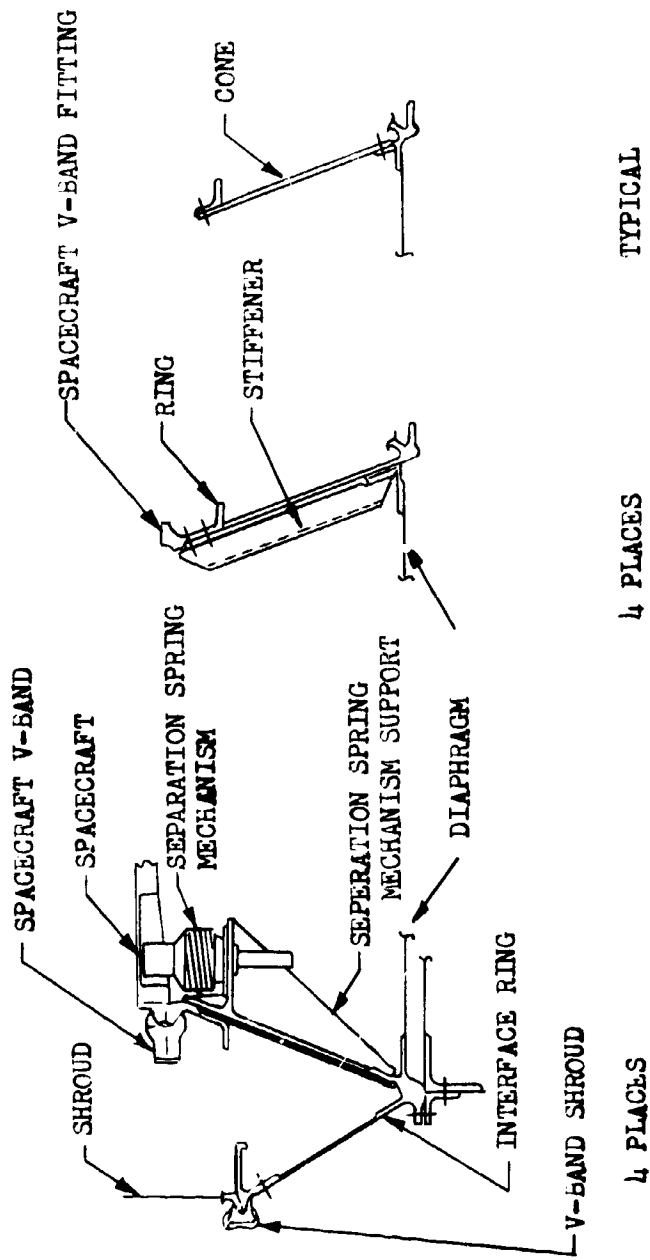


FIGURE IV.B-2. SPACECRAFT ADAPTER INTERFACING WITH SHROUD AND SPACECRAFT

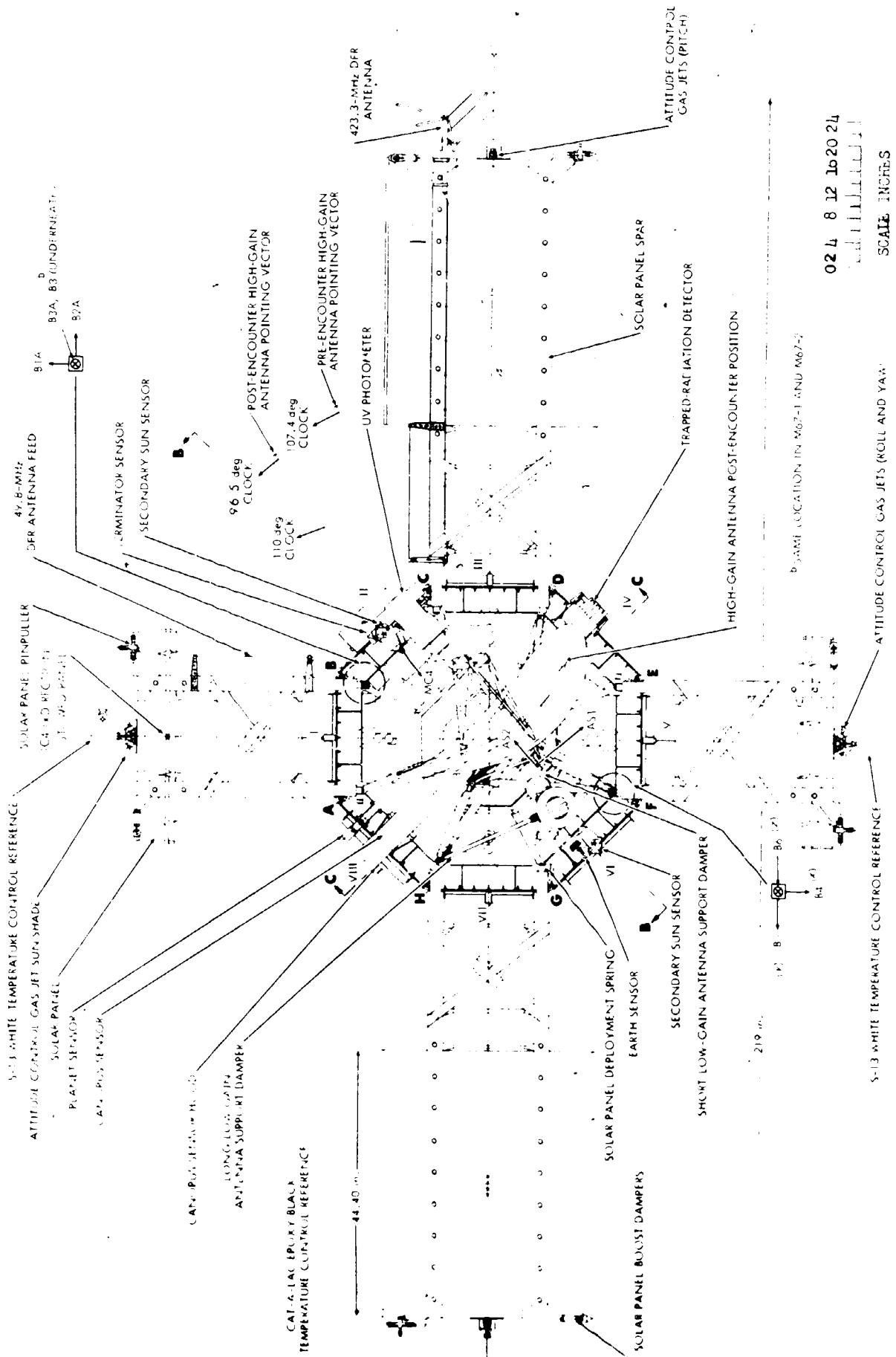


FIGURE IV.B.3. ACCELEROMETER LOCATIONS FOR MARINER VENUS 67 FLIGHT ACCEPTANCE TEST

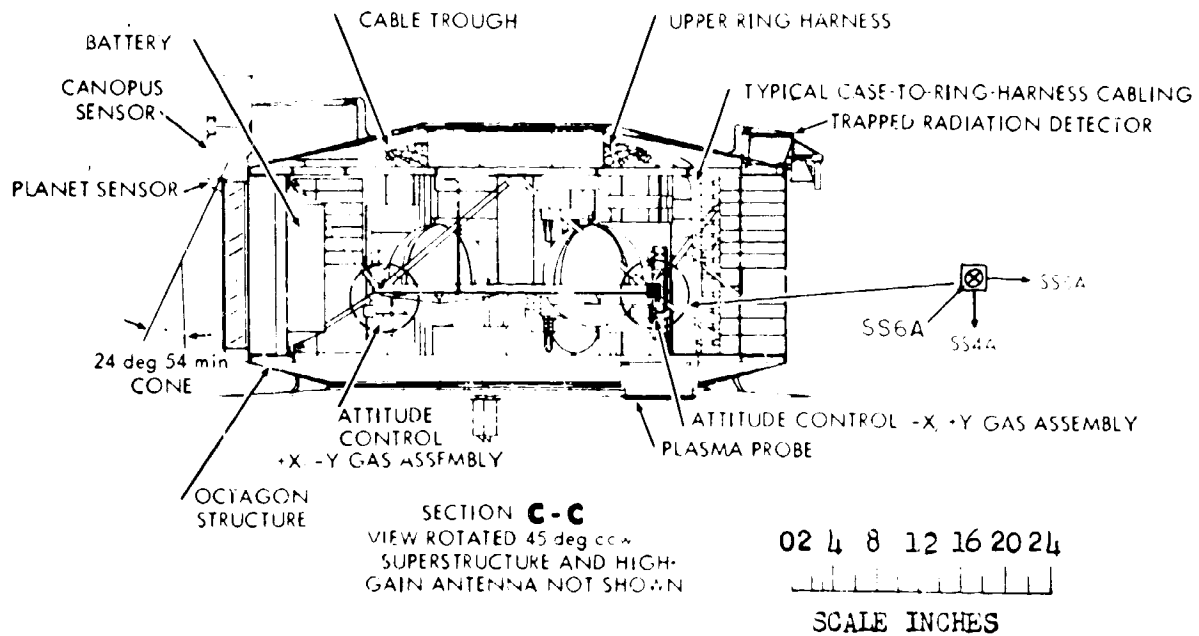
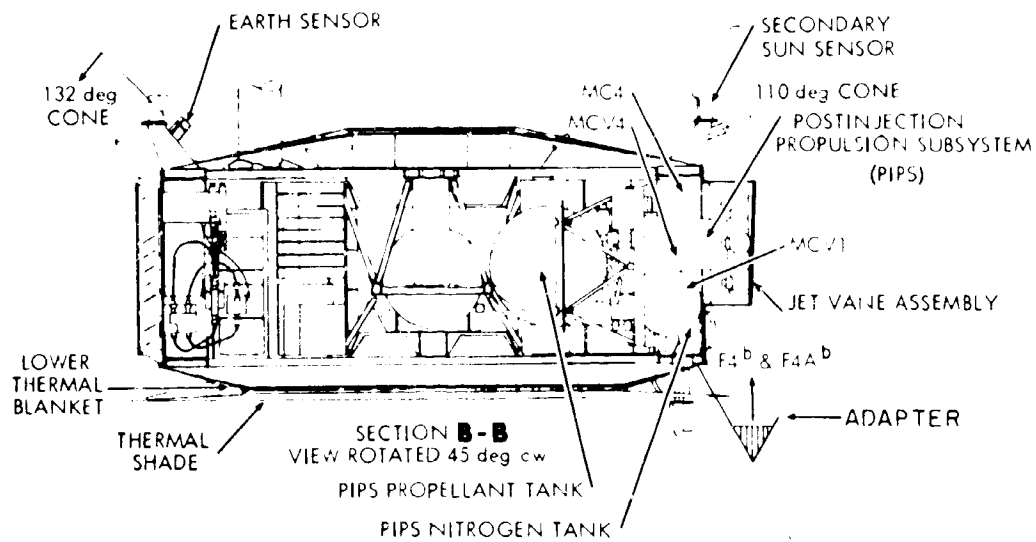


FIGURE IV.B.4. ACCELEROMETER LOCATIONS FOR MARINER VENUS 67 FLIGHT ACCEPTANCE TEST

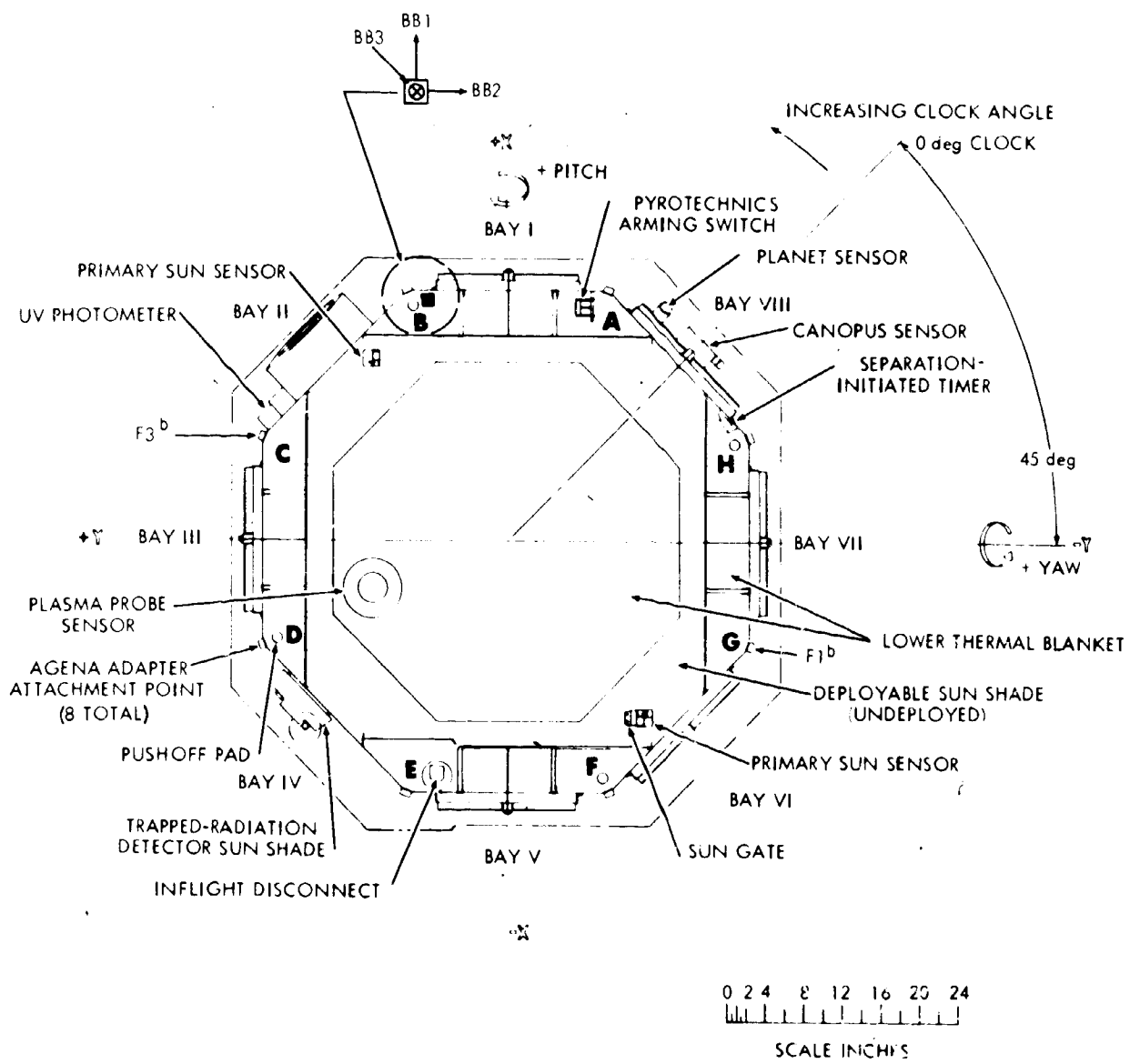


FIGURE IV.B.5. ACCELEROMETER LOCATIONS FOR MARINER VENUS 67
FLIGHT ACCEPTANCE TEST

SECTION IV.B.1

M67-1 SHROUD V-BAND RELEASE

One test of the shroud V-band release was conducted for the M67-1 configuration. The V-band pyrotechnic release mechanism employed is illustrated in Figure IV.B.1-1. Nineteen shock spectra for this event are presented along with their corresponding time histories in Figures IV.B.1-2 through IV.B.1-11 as indexed in Table IV.B.1-1.

TABLE IV.B.1-1
INDEX OF DATA LOCATIONS

<u>Accelerometer No.s</u>	<u>Figure No.</u>
B3, F4	IV.B.1-2
F1, F3	IV.B.1-3
F4A, B1A	IV.B.1-4
B2A, B3A	IV.B.1-5
B4, B5	IV.B.1-6
B6, BB1	IV.B.1-7
BB2, BB3	IV.B.1-8
AS1	IV.B.1-9
IC4, 3T3	IV.B.1-10
MC4	IV.B.1-11

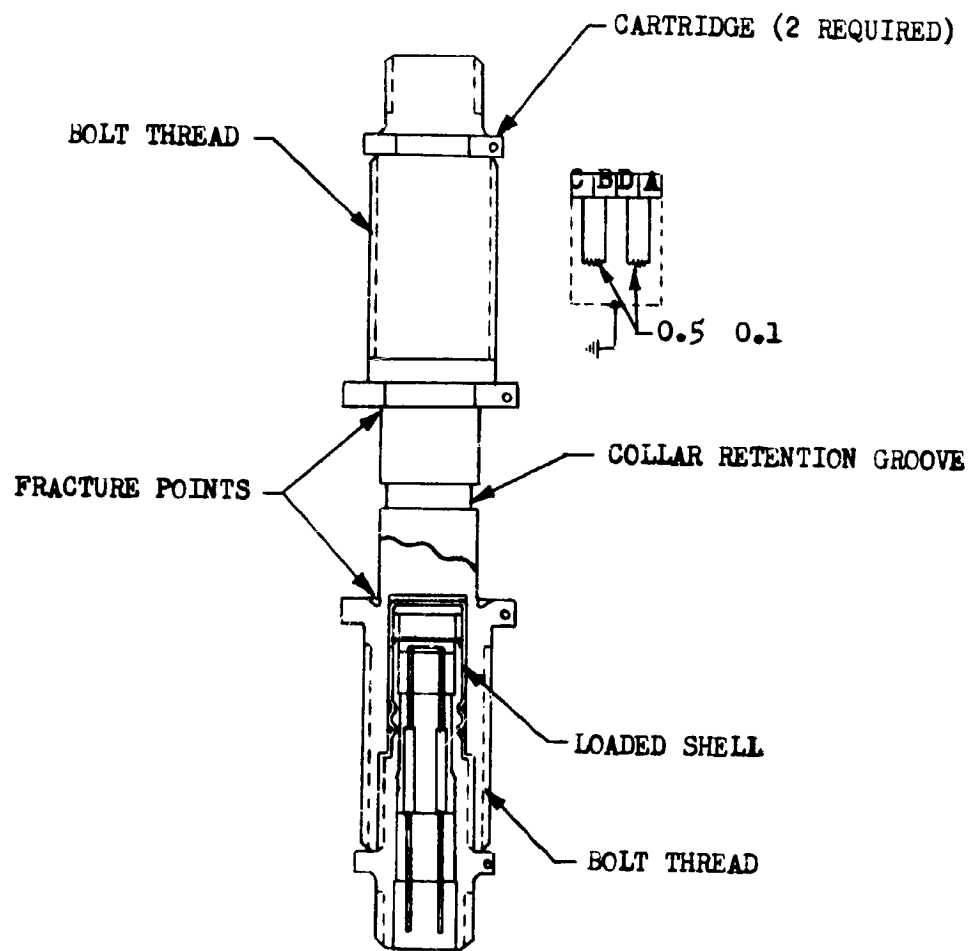
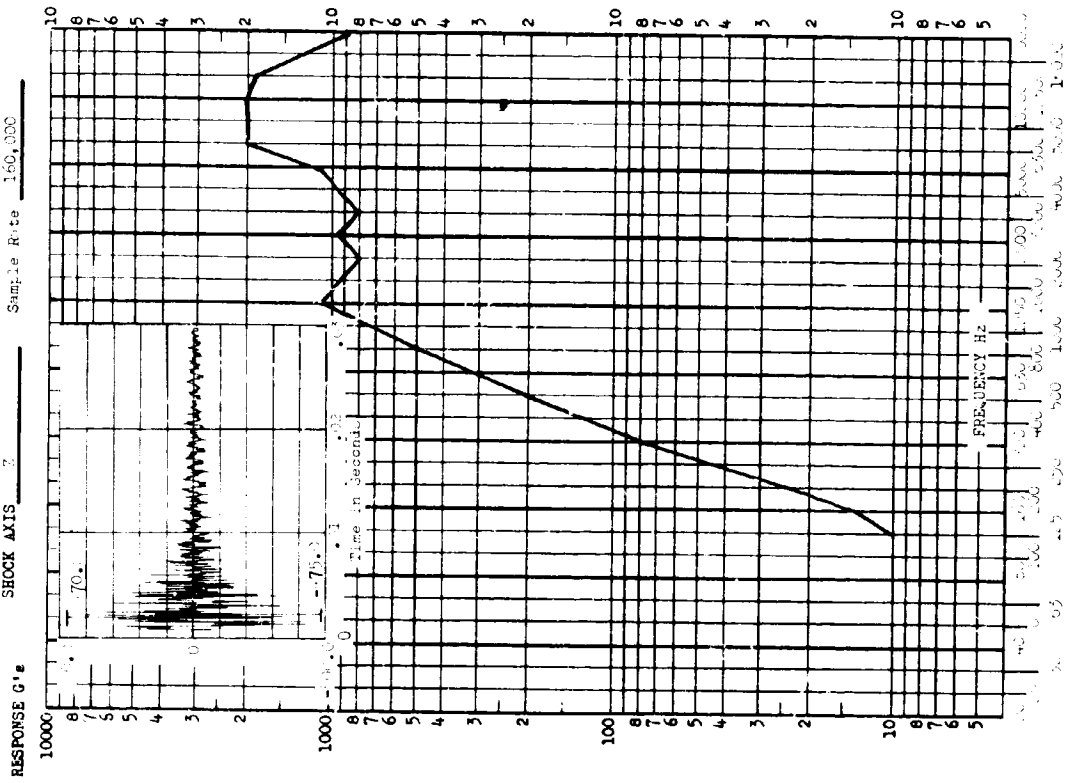


FIGURE IV.B.1-1

SHROUD V-BAND EXPLOSIVE BOLT RELEASE ASSEMBLY

TEST ITEM: M67-1 ** Shroud V-belt: Pyro Release
 ACCEL. NO.: PL TEST DATE: _____
 SHOCK AXIS: Z Sample Rate: 160,000



TEST ITEM: M67-1 ** Shroud V-belt: Pyro Release
 ACCEL. NO.: PL TEST DATE: _____
 SHOCK AXIS: Z Sample Rate: 160,000

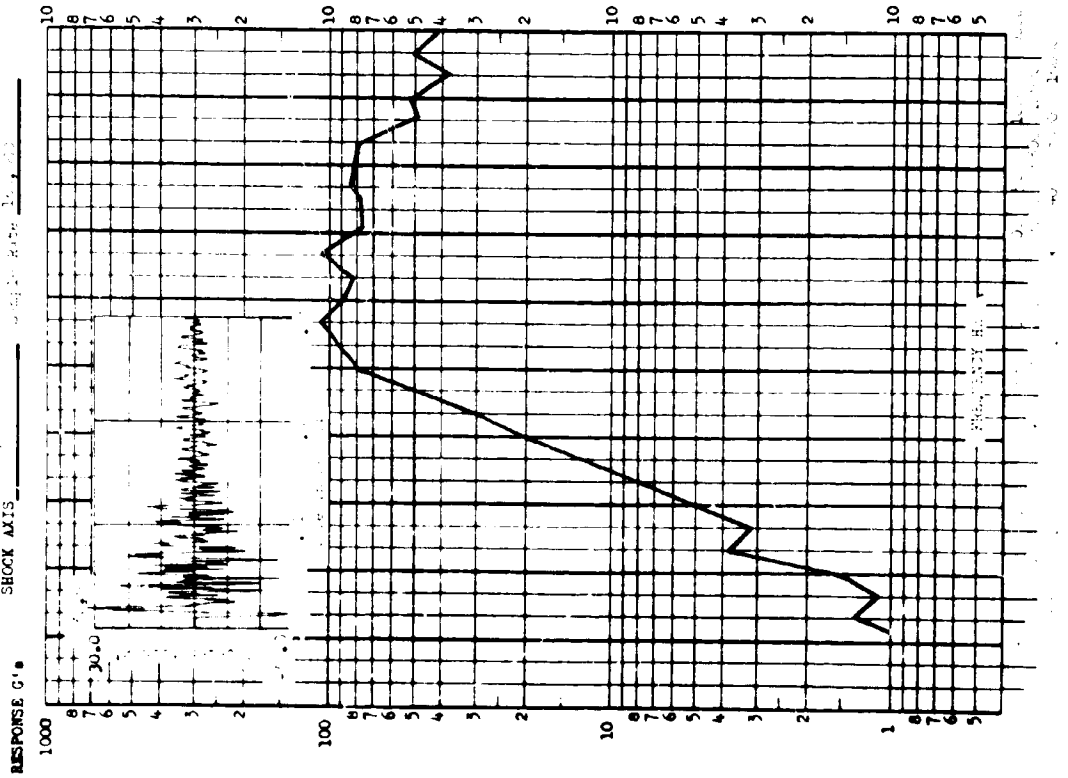
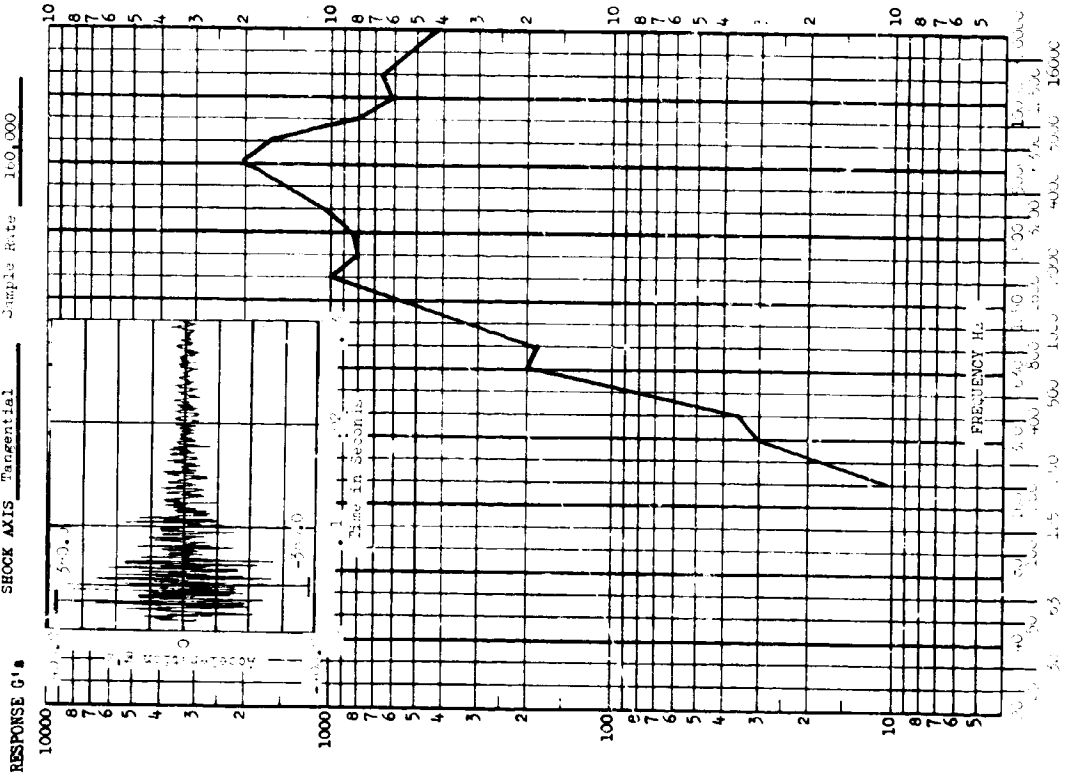


FIGURE IV.B.1-2

TEST ITEM M67-1 ** Ground V-band gyro Release
 ACCEL. NO. F3 TEST DATE
 SHOCK AXIS Tangential Sample Rate 100,000



TEST ITEM M67-1 ** Ground V-band gyro Release
 ACCEL. NO. F3 TEST DATE
 SHOCK AXIS Tangential Sample Rate 100,000

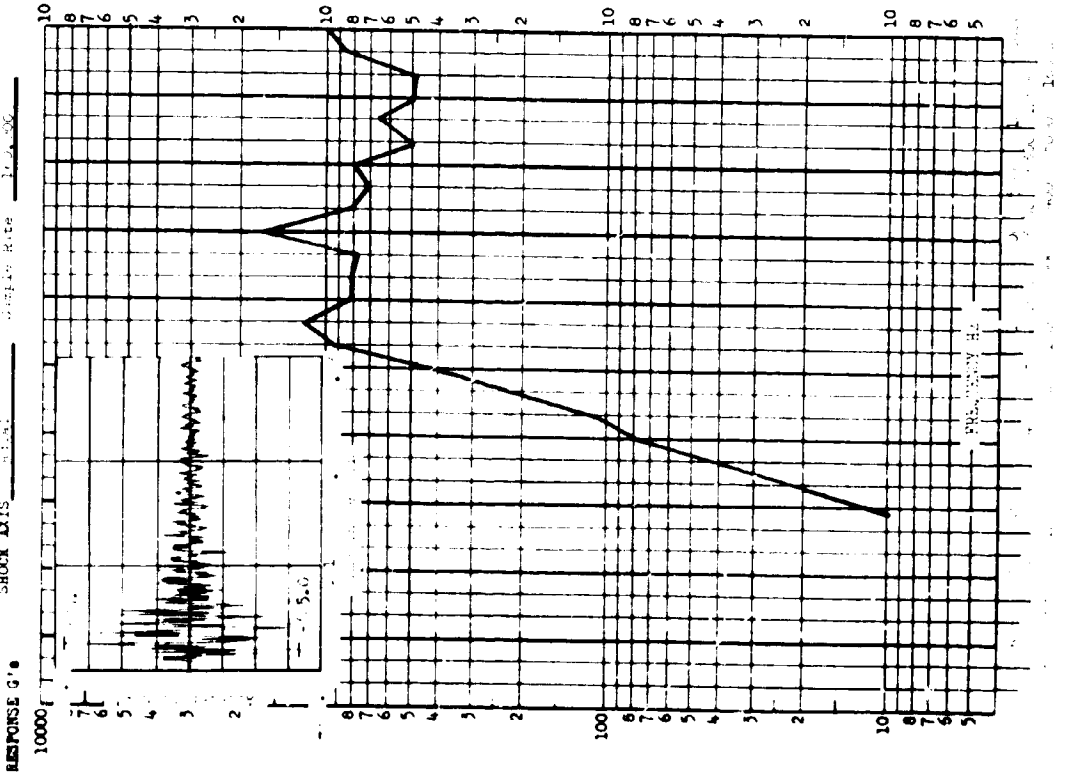
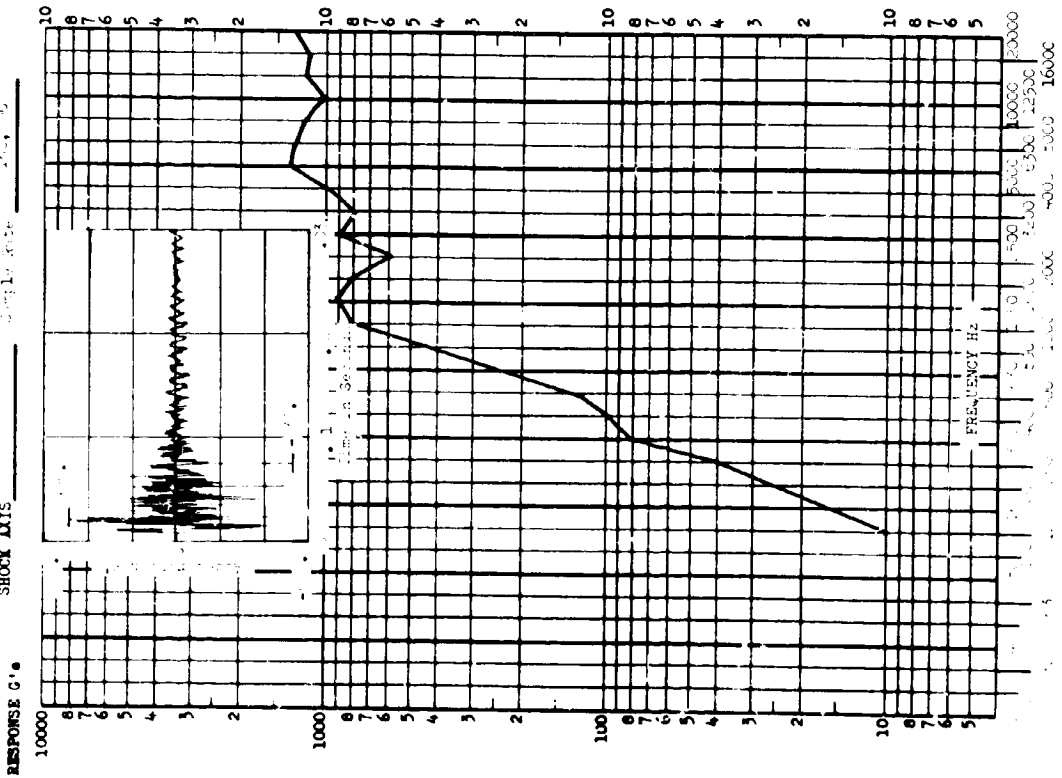


FIGURE IV.B.1-3

TEST ITEM 167-1 ** Shroud 7-bard Pyro Release
 ACCEL. NO. 21A TEST DATE _____
 SHOCK AXIS X Sample Rate 150,000



TEST ITEM 167-1 ** Shroud 7-bard Pyro Release
 ACCEL. NO. 21A TEST DATE _____
 SHOCK AXIS X Sample Rate 150,000

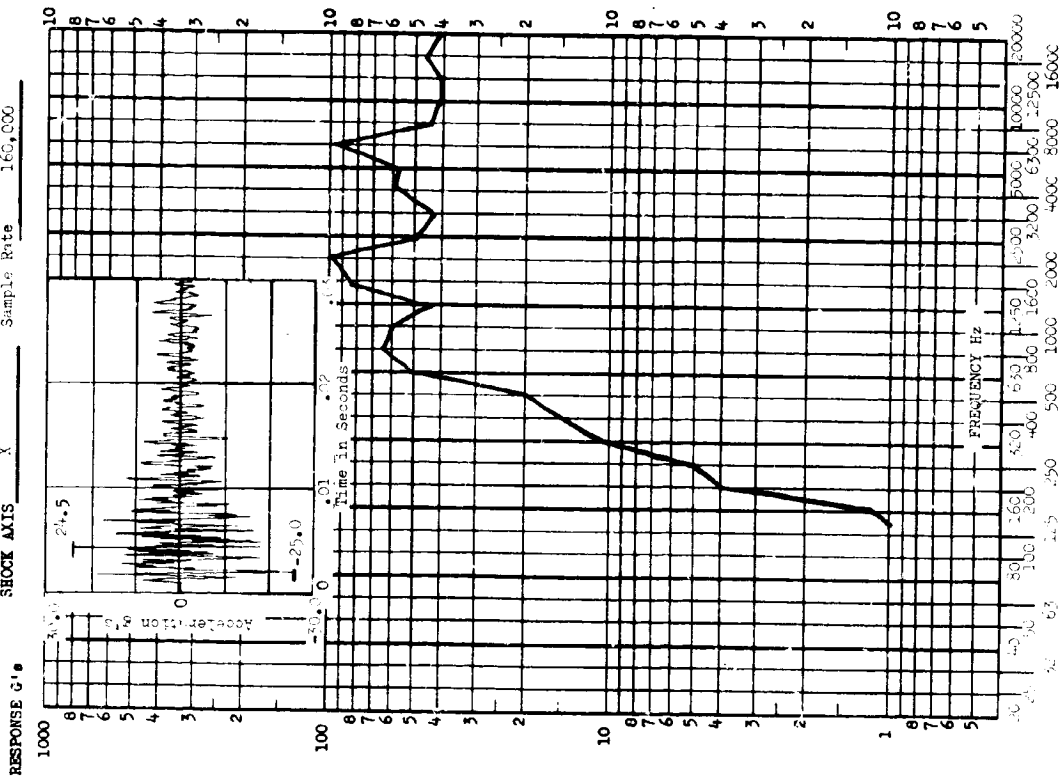
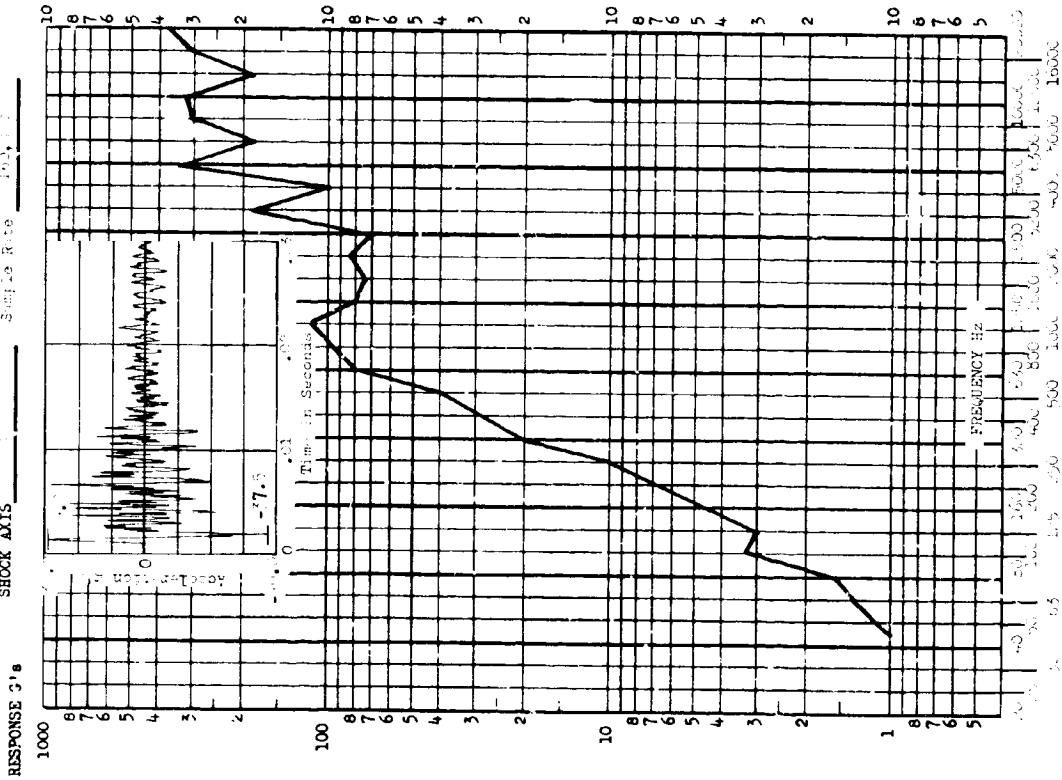


FIGURE IV.B.1-4

TEST ITEM Model 111 Shock Head Spindle
 ACCEL. NO. 111 TEST DATE _____
 SHOCK AXIS Vertical Strike Rate 100/100



TEST ITEM Model 111 Shock Head Spindle
 ACCEL. NO. 111 TEST DATE _____
 SHOCK AXIS Vertical Strike Rate 100/100

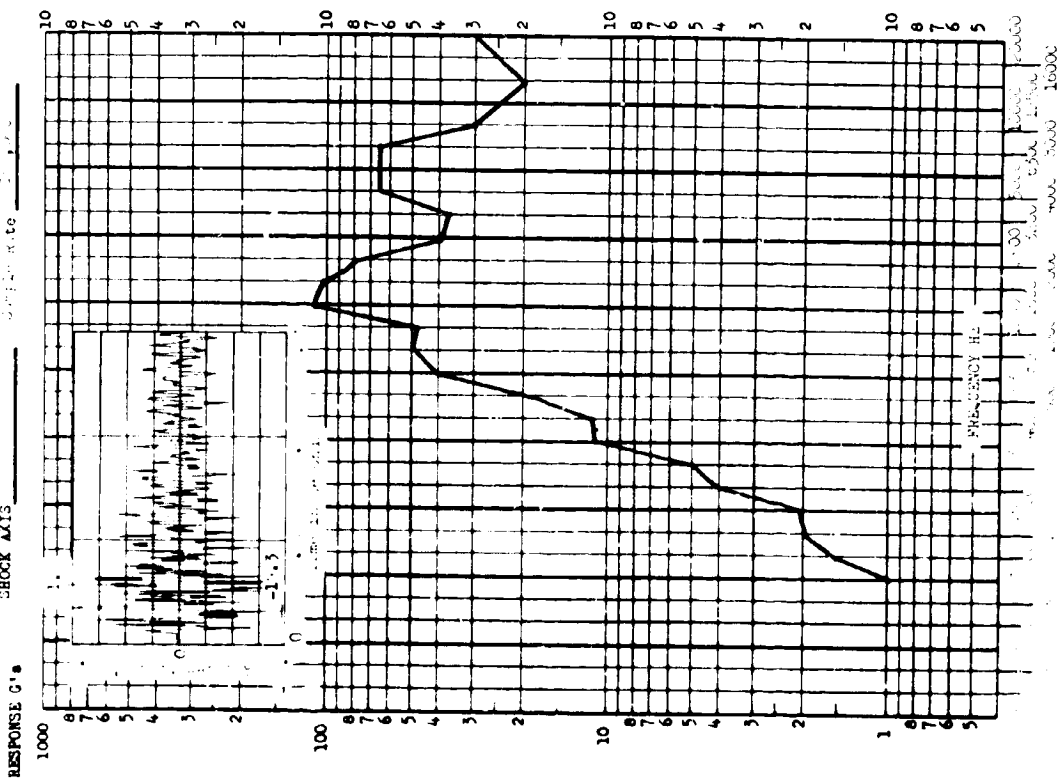
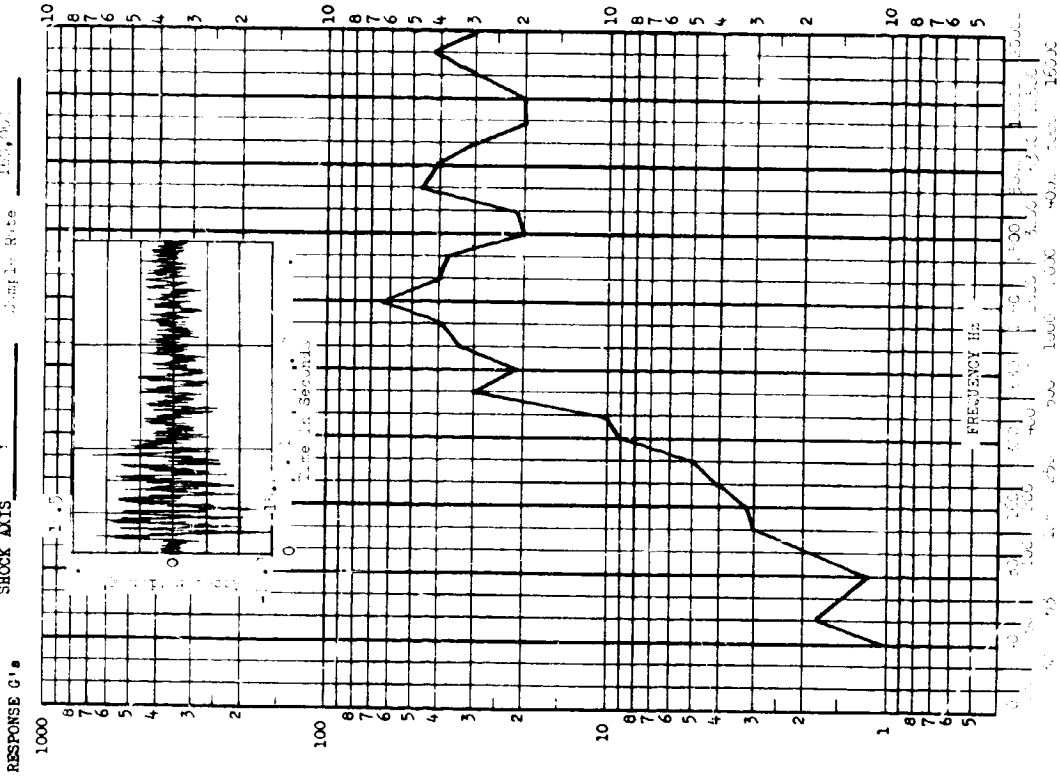


FIGURE IV.B.1-5

TEST ITEM: ME-1 ** Through V-belt Pyro Release
 ACCEL. NO.: BK
 SHOCK AXIS: Y
 TEST DATE: 10/27/54
 Amp. Rate: 1000 G's



TEST ITEM: ME-1 ** Through V-belt Pyro Release
 ACCEL. NO.: BK
 SHOCK AXIS: Y
 TEST DATE: 10/27/54
 Amp. Rate: 1000 G's

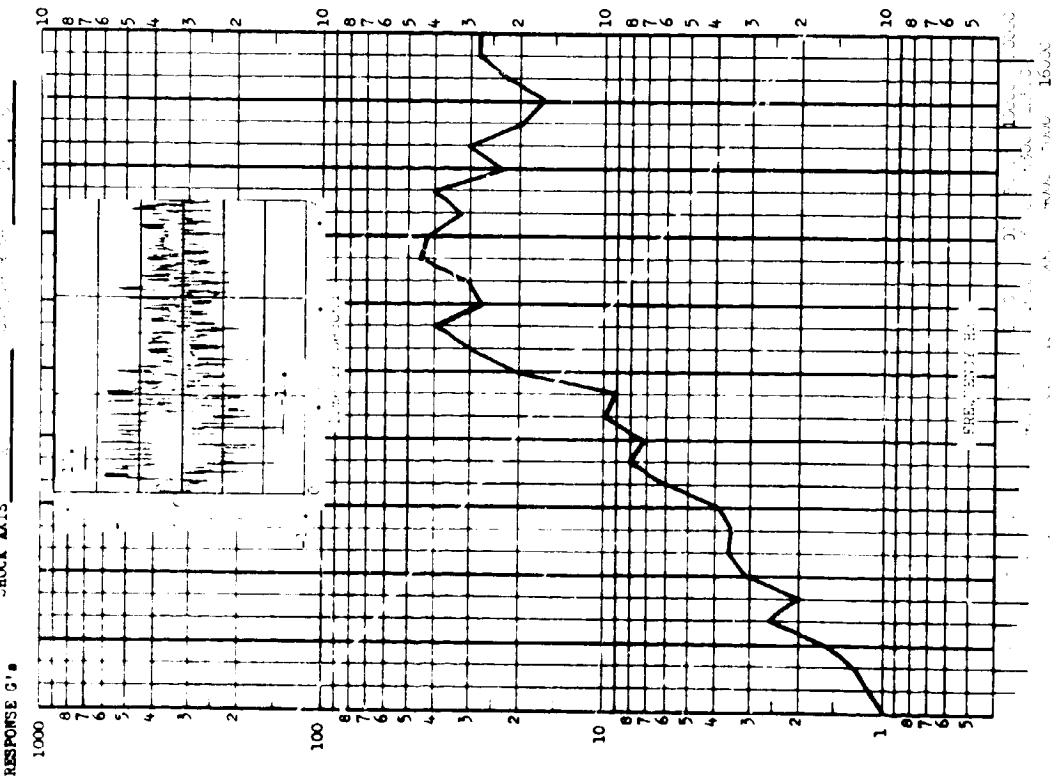
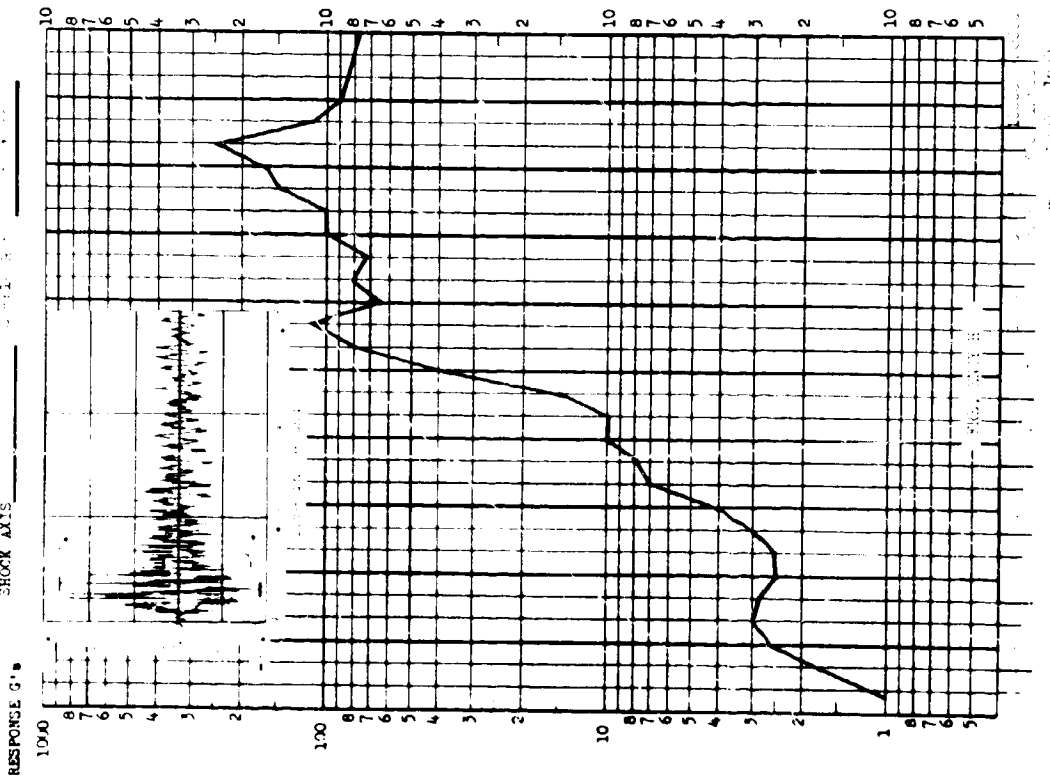


FIGURE IV.B.1-6

TEST ITEM _____
 ADJ. NO. _____ TEST DATE _____
 SHOCK AXIS _____



TEST ITEM _____
 ADJ. NO. _____ TEST DATE _____
 SHOCK AXIS _____

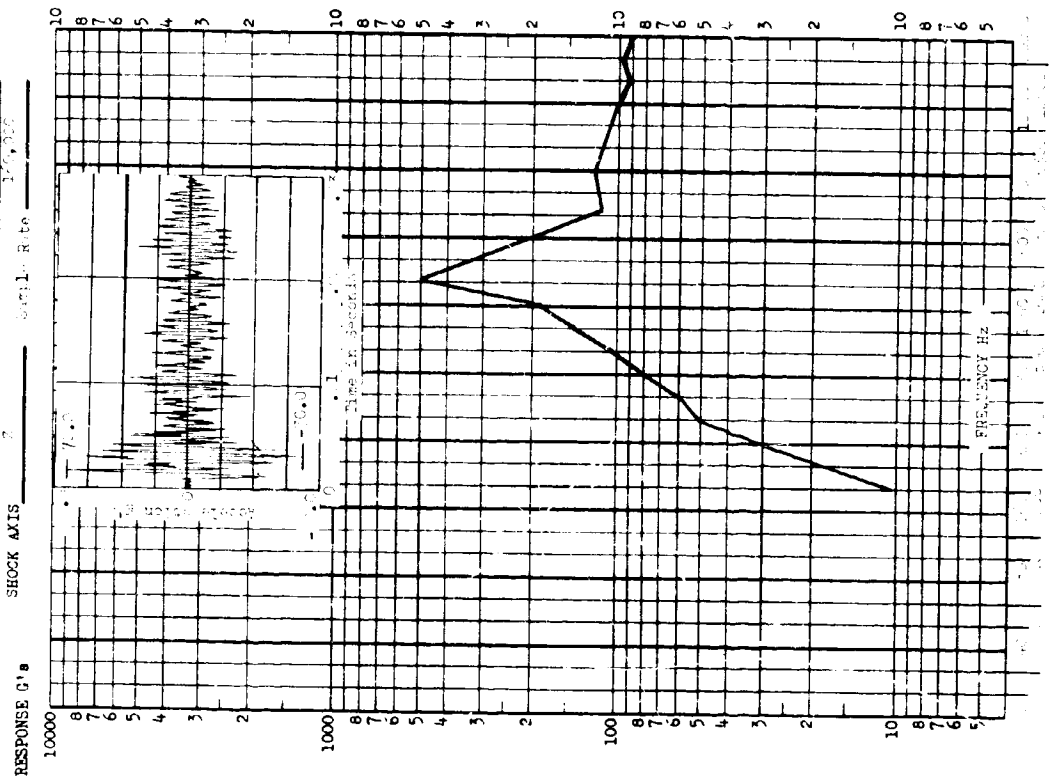
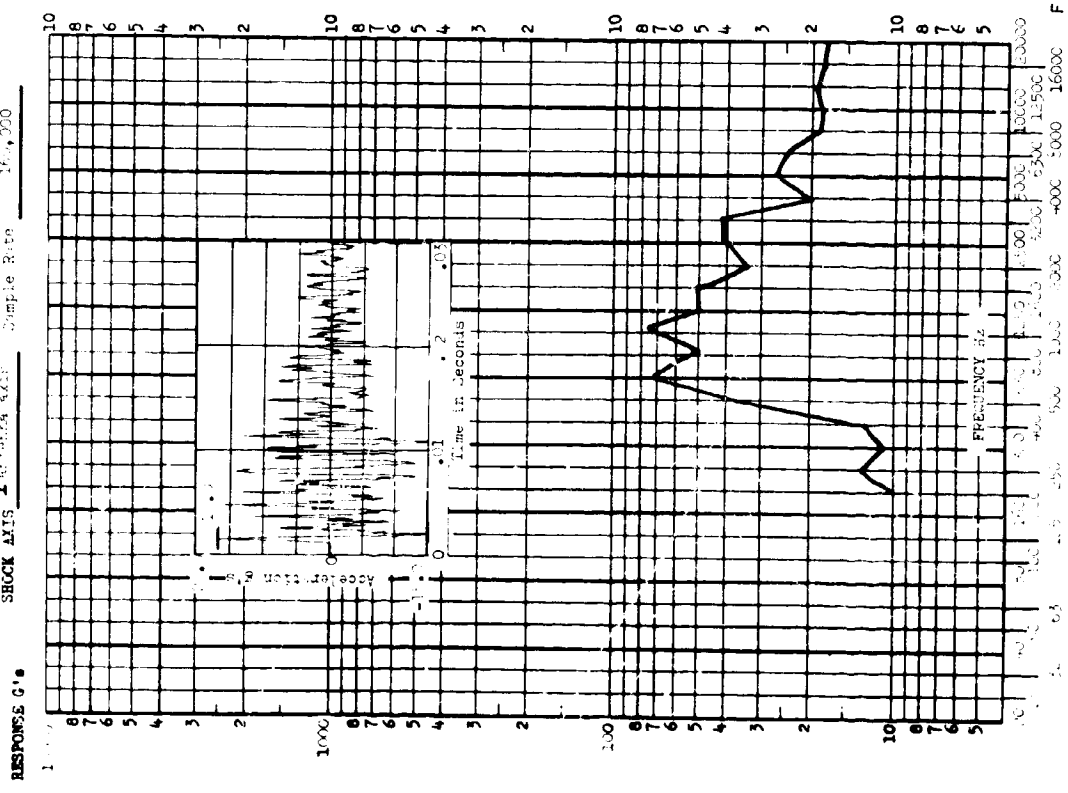
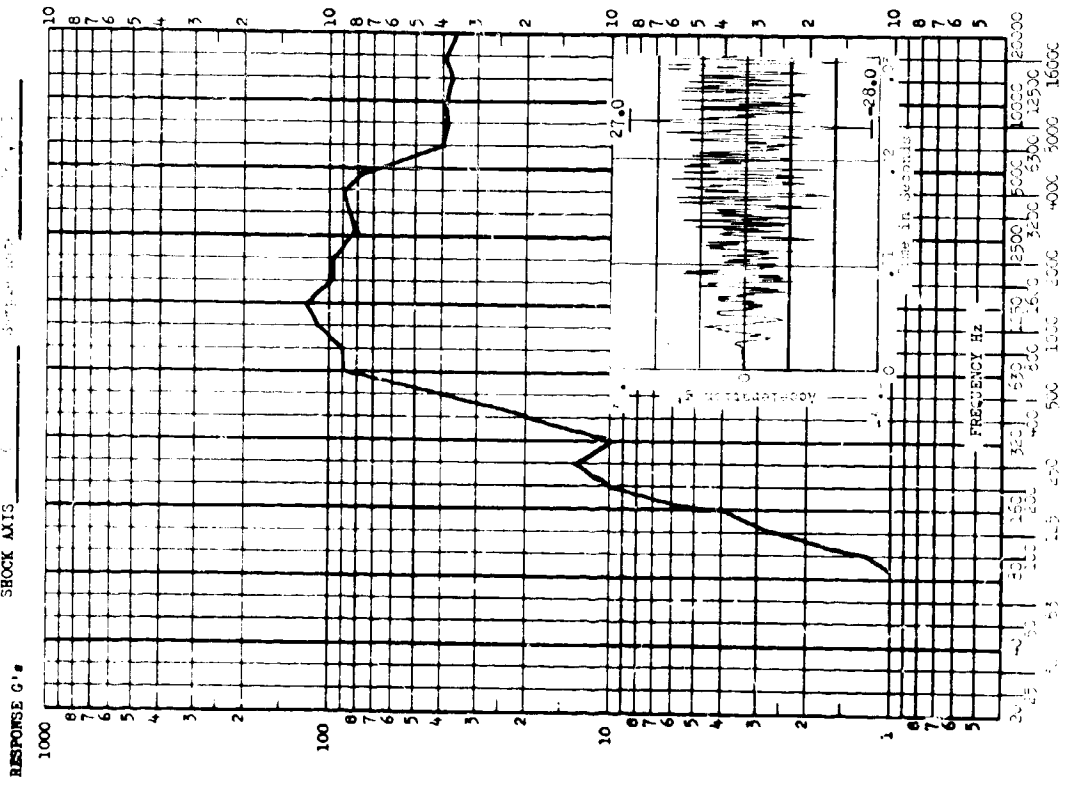


FIGURE IV.8.1-8

TEST ITEM: ...
 APPR. NO.: ... TEST DATE: ...
 SHOCK AXIS: ... Sample Rate: 16,000



TEST ITEM _____
 ADJ. NO. _____ TEST DATE _____
 SHOCK AXIS _____



TEST ITEM _____
 ADJ. NO. _____ TEST DATE _____
 SHOCK AXIS _____

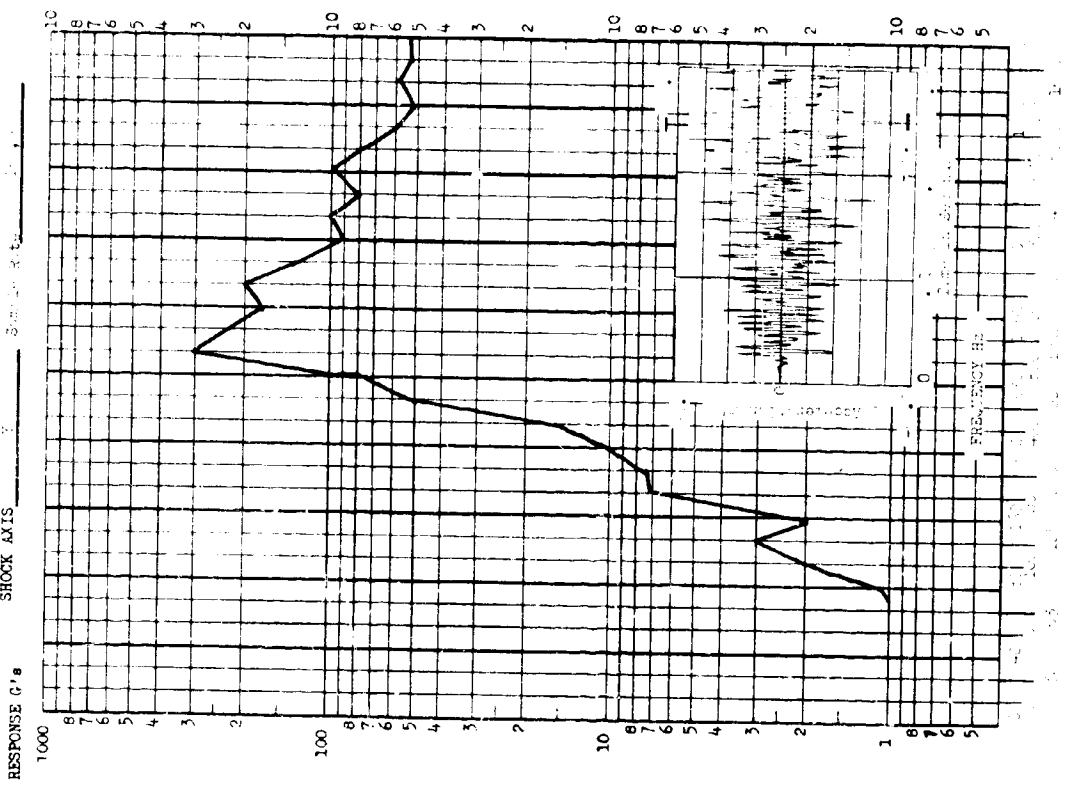


FIGURE IV.5.1-10

TEST ITEM: Model 11 - General Purpose Release
 ADEL. NO.: 204 TEST DATE: _____
 SHOCK AXIS: Ray Sample Rate: 200,000

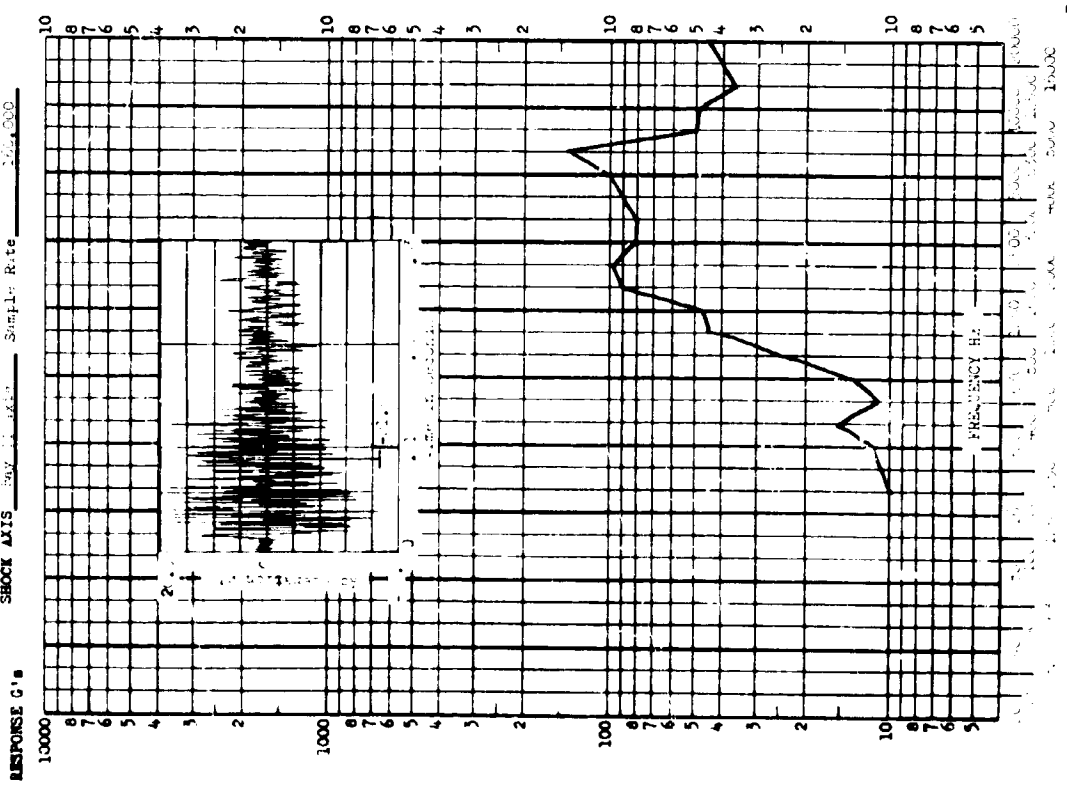


FIGURE IV.B.1-11

SECTION IV.B.2

M67 SPACECRAFT V-BAND RELEASE

One test of the spacecraft V-band release was conducted for both the M67-1 and M67-2 configurations. The V-band pyrotechnic release mechanism employed is illustrated in Figure IV.B.2-1. Twenty-five shock spectra for this event are presented along with their corresponding time histories in Figures IV.B.2-2 through IV.B.2-14 as indexed in Table IV.B.2-1.

TABLE IV.B.2-1
INDEX OF DATA LOCATIONS

<u>Accelerometer No.s</u>	<u>Configuration</u>	<u>Figure Number</u>
B3	M67-1, -2	IV.B.2-2
F4	M67-1, -2	IV.B.2-3
F1	M67-1, -2	IV.B.2-4
F3	M67-1, -2	IV.B.2-5
F4A	M67-1, -2	IV.B.2-6
B1A, B2A	M67-1	IV.B.2-7
B3A, B4	M67-1	IV.B.2-8
B5, B6	M67-1	IV.B.2-9
BB1, BB2	M67-1	IV.B.2-10
BB3, SS5A	M67-1	IV.B.2-11
SS6A, AS1	M67-1	IV.B.2-12
IC4, 3T3	M67-1	IV.3.2-13
MC, SS4A	M67-1	IV.B.2-14

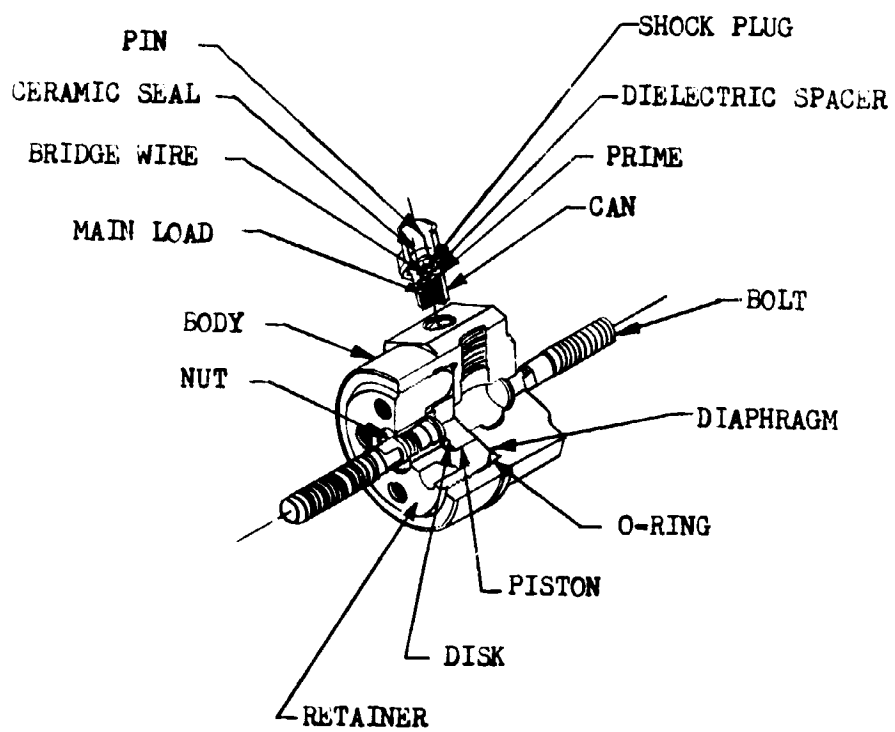


FIGURE IV.B.2-1

SPACECRAFT V-BAND RELEASE ASSEMBLY

TEST ITEM INTEGRATED SHOCK FOR RELEASE
 MODEL NO. 87 TEST DATE _____
 SHOCK AXIS Z Sample Rate 10,000

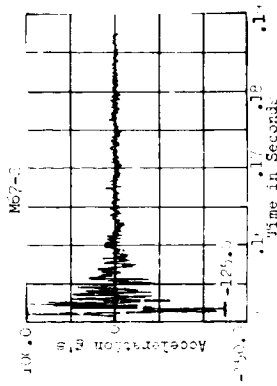
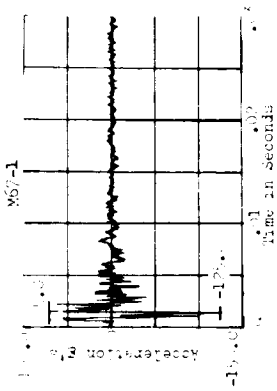
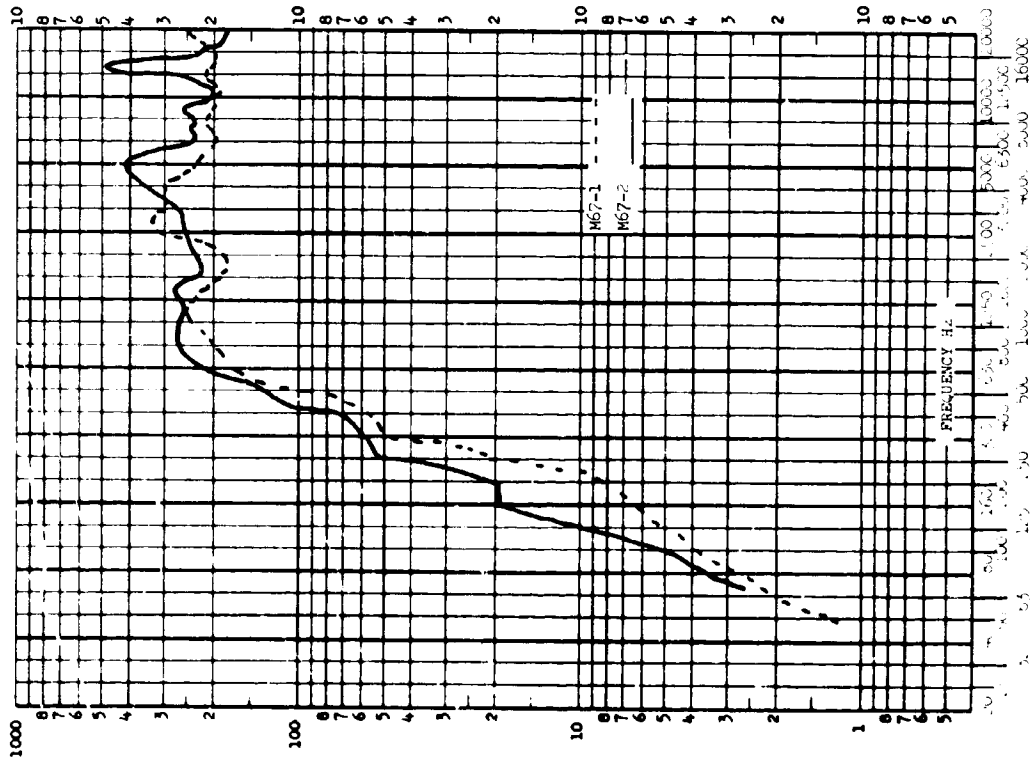


FIGURE IV.B.2-2

TEST ITEM _____
 TEST NO. _____ TEST DATE _____
 SHOCK AXIS _____

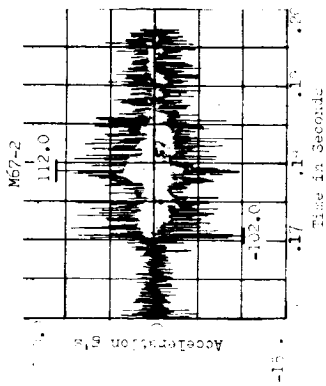
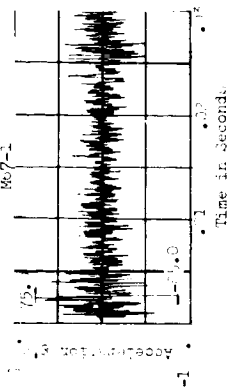
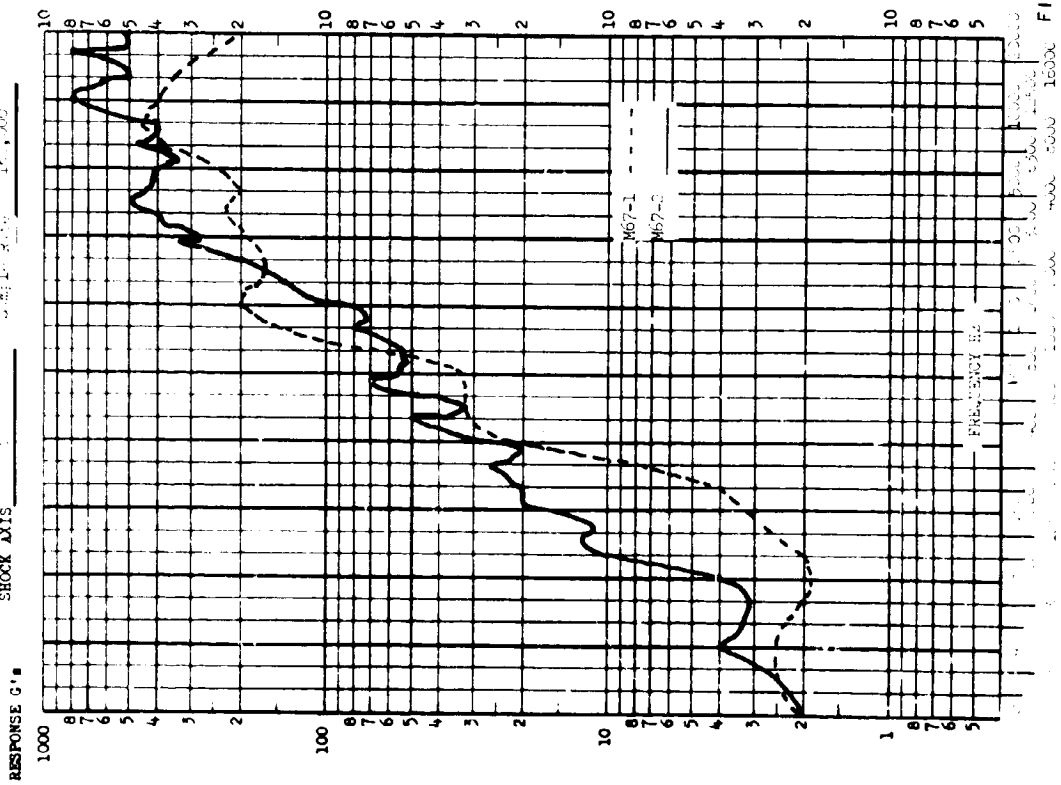


FIGURE IV.B.2-3

TEST ITEM _____
 Order No. _____ TEST DATE _____
 SHOCK AXIS Radial

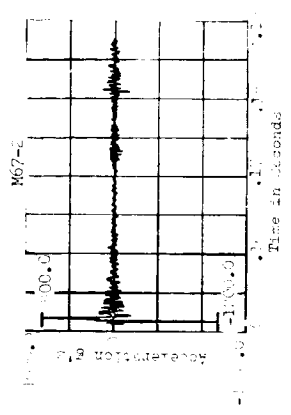
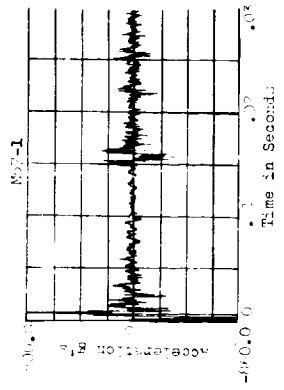
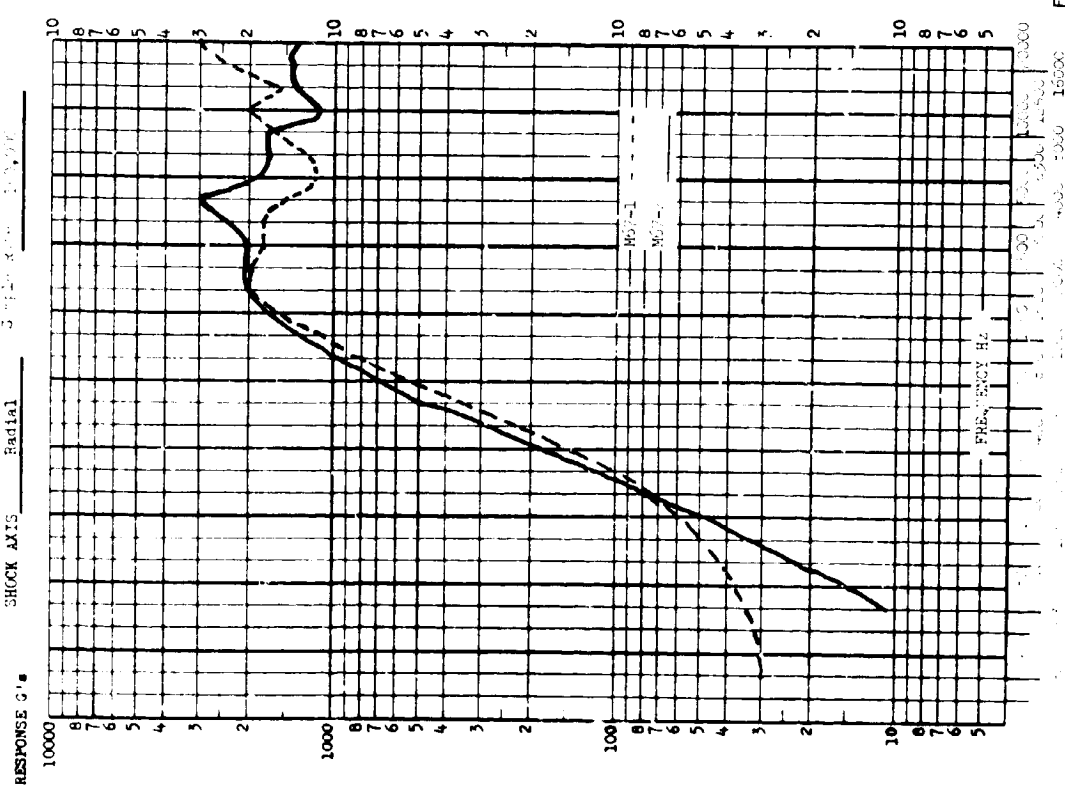


FIGURE IV.B.2-4

TEST ITEM _____
 TEST NO. _____ TEST DATE _____
 SHOCK AXIS _____

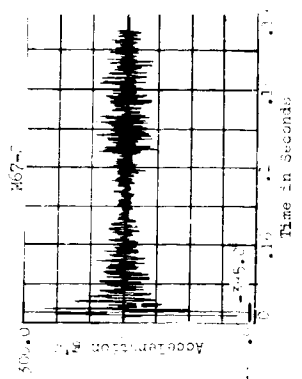
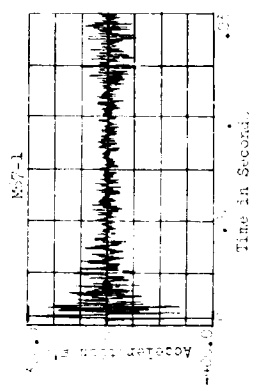
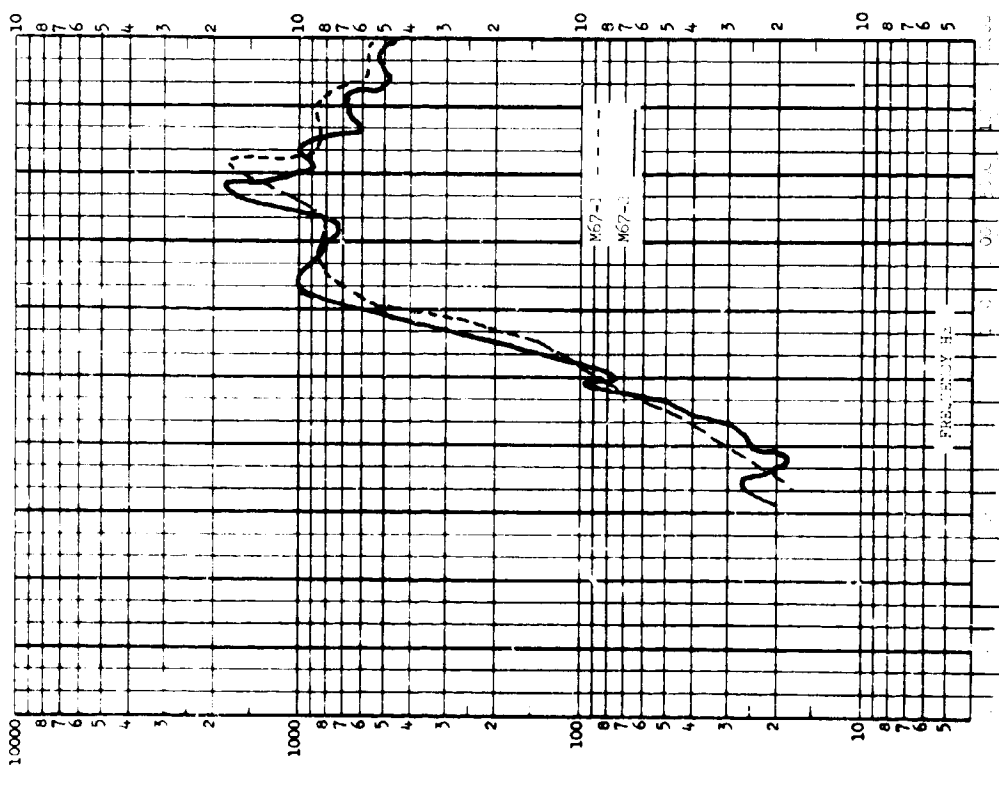


FIGURE IV.B.2-5

TEST ITEM General Electric Turbine Engine
 SERIAL NO. 100 TEST DATE 10/15/50
 SHOCK AXIS Vertical Sample rate 100,000

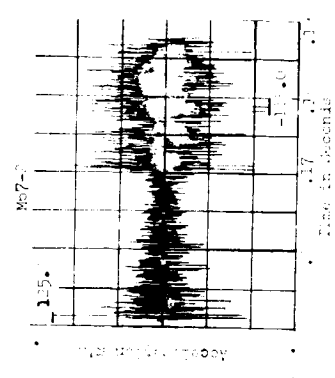
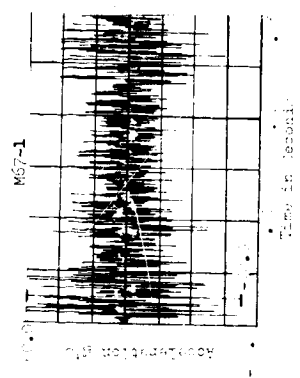
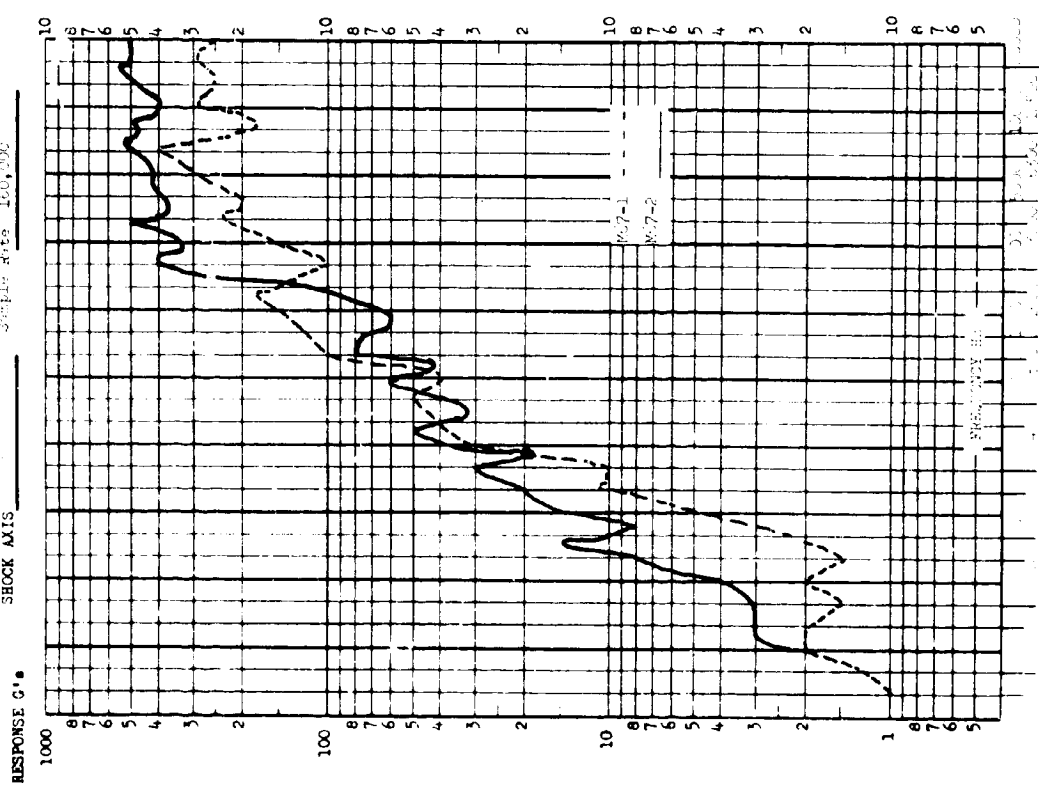
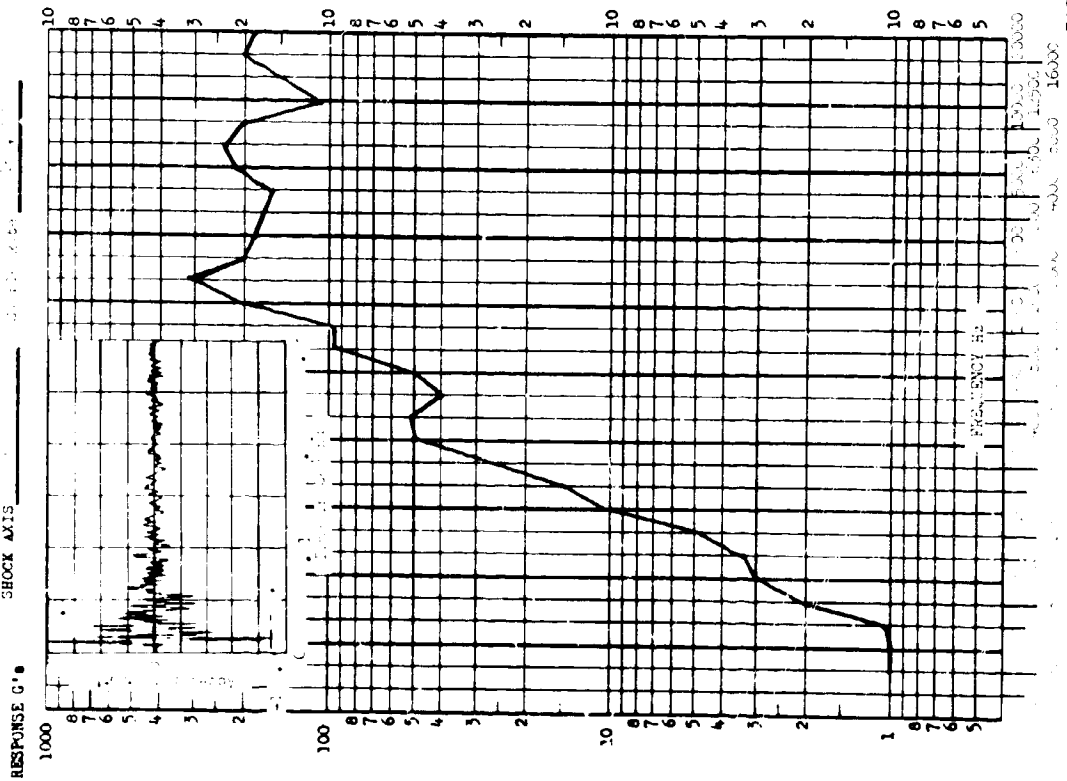


FIGURE IV.B.2-6

TEST ITEM _____
 MODEL NO. _____ TEST DATE _____
 SERIAL NO. _____
 SHOCK AXIS _____



TEST ITEM _____
 MODEL NO. _____ TEST DATE _____
 SERIAL NO. _____
 SHOCK AXIS _____

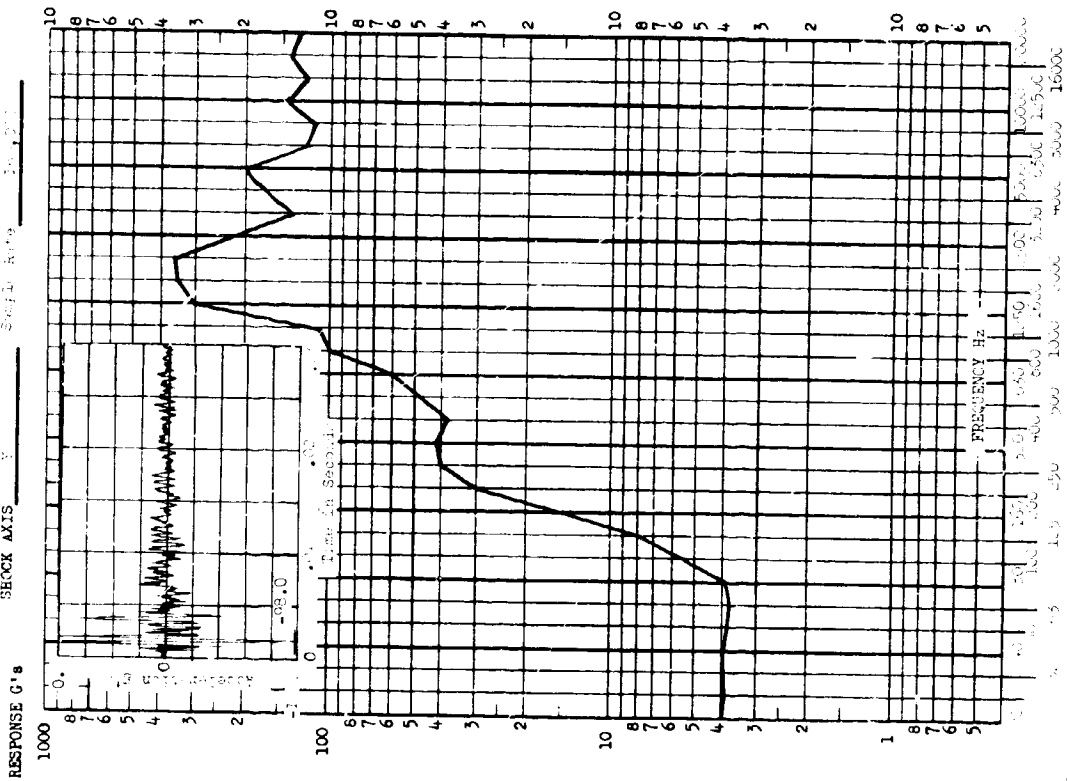
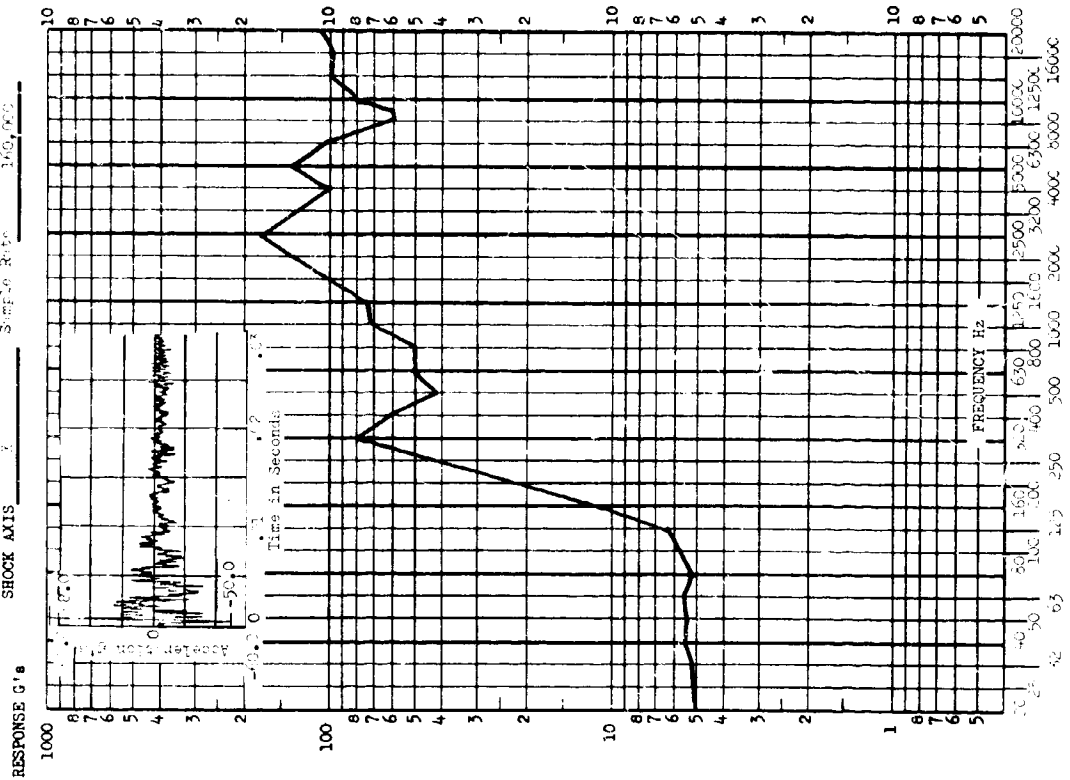


FIGURE IV.8.2-7

TEST ITEM No. 1 ... Aerospace 7-batt Pyro Release
 ACCEL. NO. 2 TEST DATE
 SHOCK AXIS 3 Sample Rate 160,000



TEST ITEM No. 1 ... Aerospace 7-batt Pyro Release
 ACCEL. NO. 2 TEST DATE
 SHOCK AXIS 3 Sample Rate 160,000

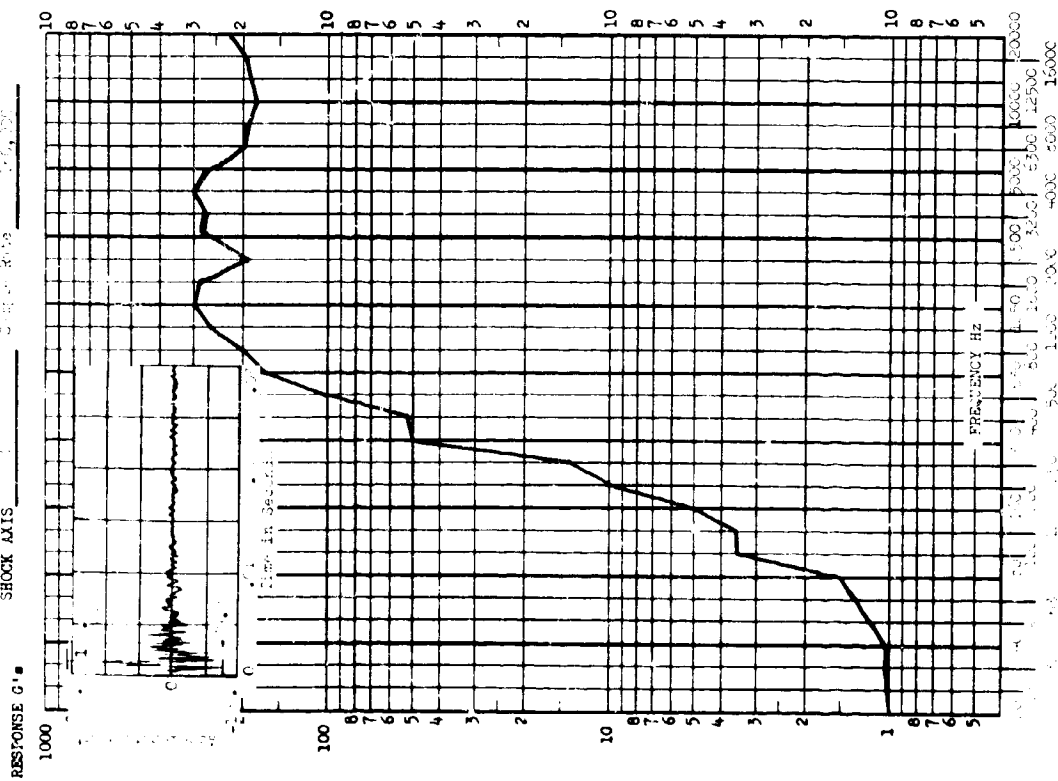
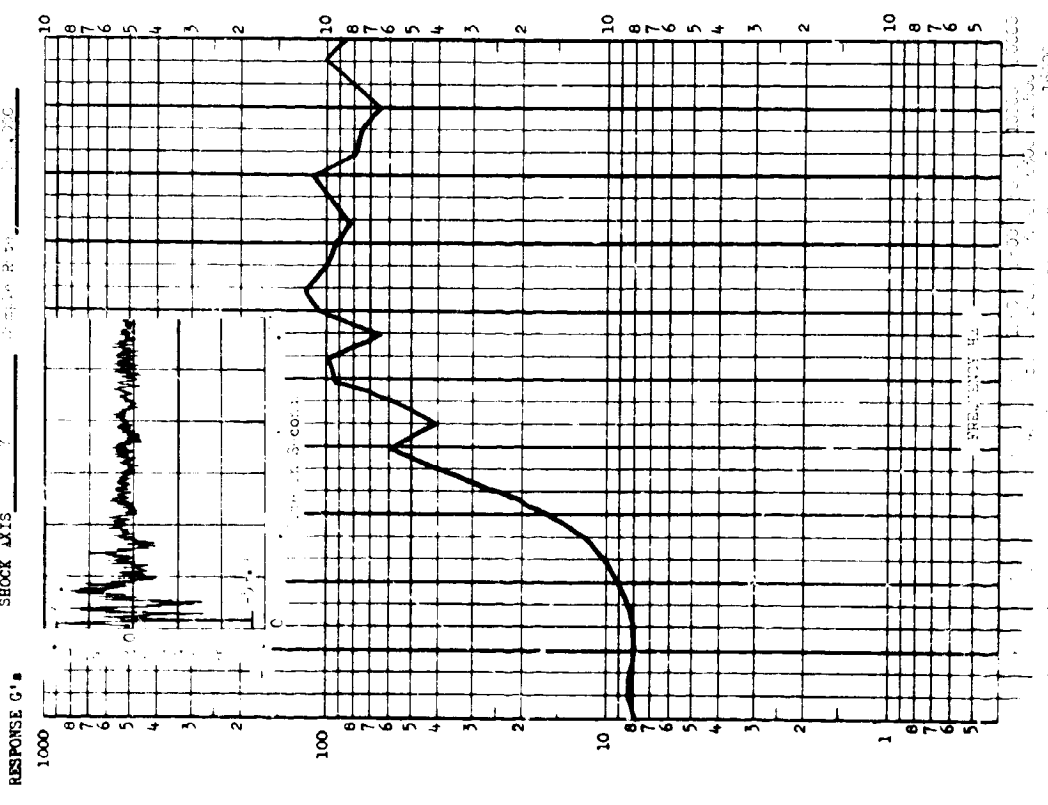


FIGURE IV.B.2-8

TEST ITEM: [unclear] ** [unclear] V-bari gyro release
 ACCEL. NO.: [unclear]
 SHOCK AXIS: [unclear] TEST DATE: [unclear]



TEST ITEM: [unclear] ** [unclear] V-bari gyro release
 ACCEL. NO.: [unclear]
 SHOCK AXIS: [unclear] TEST DATE: [unclear]

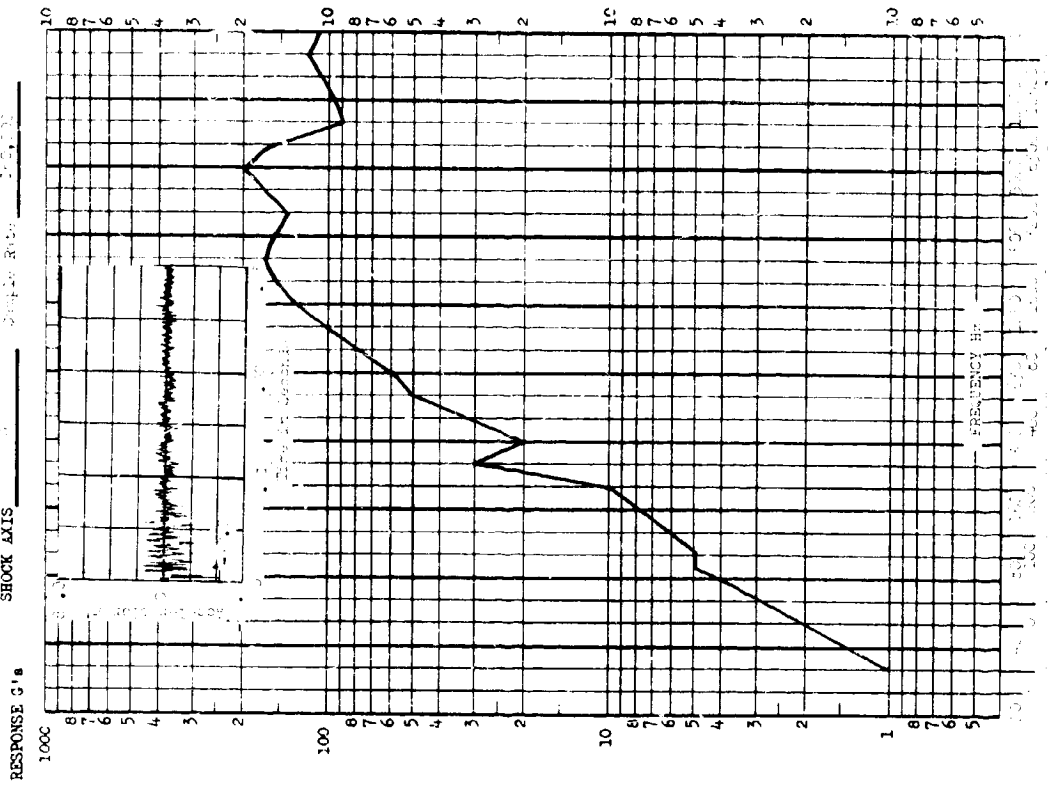
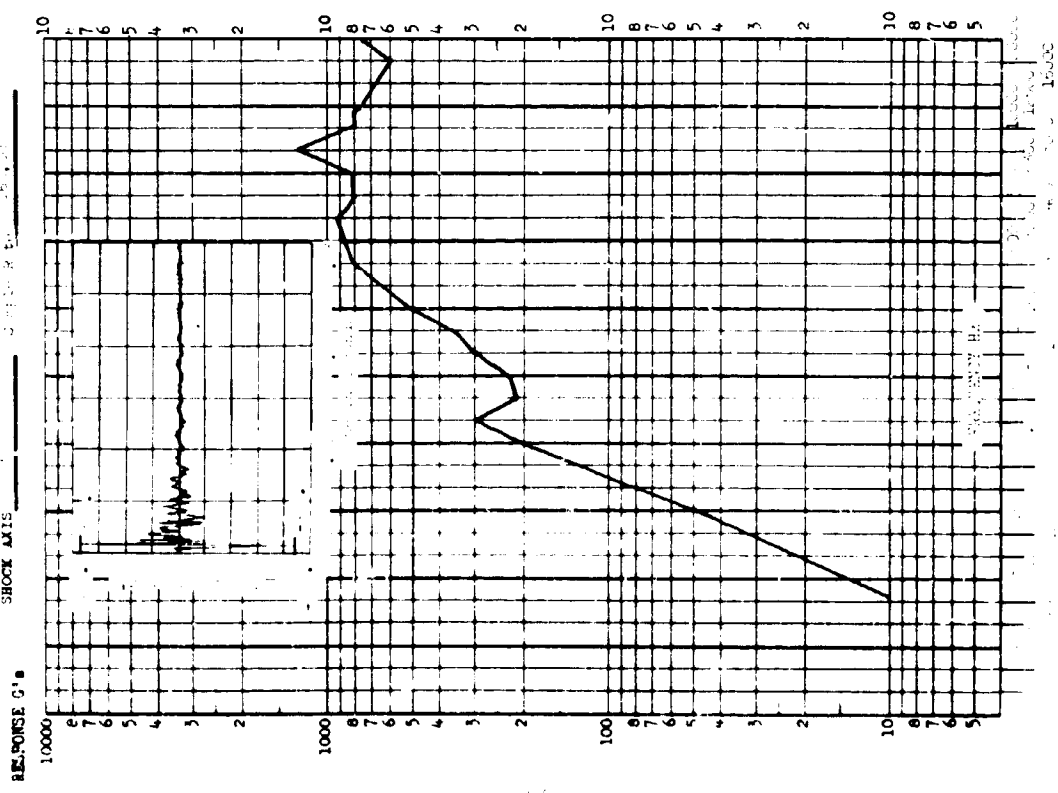


FIGURE IV.B.2-9

TEST ITEM Spacecraft P. No. Release
 ACCEL. NO. HP TEST DATE
 SHOCK AXIS Y Sample Rate 150,000



TEST ITEM M7-1 Spacecraft V-band Hydro Release
 ACCEL. NO. HP TEST DATE
 SHOCK AXIS Y Sample Rate 150,000

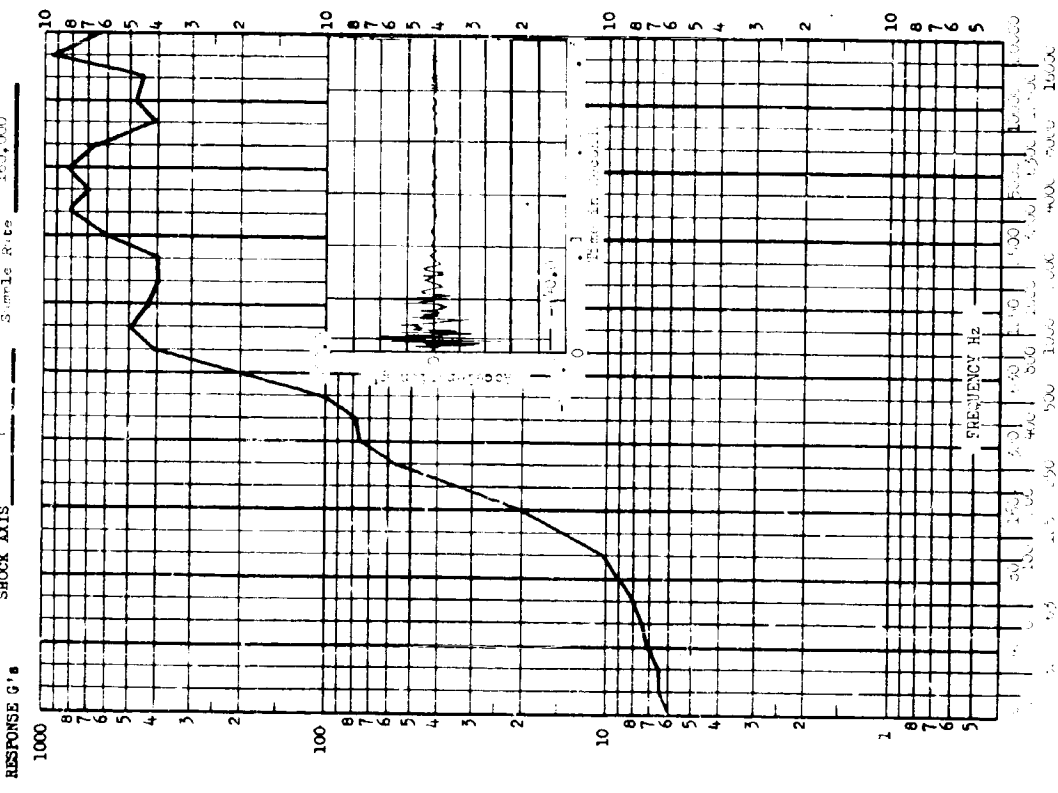
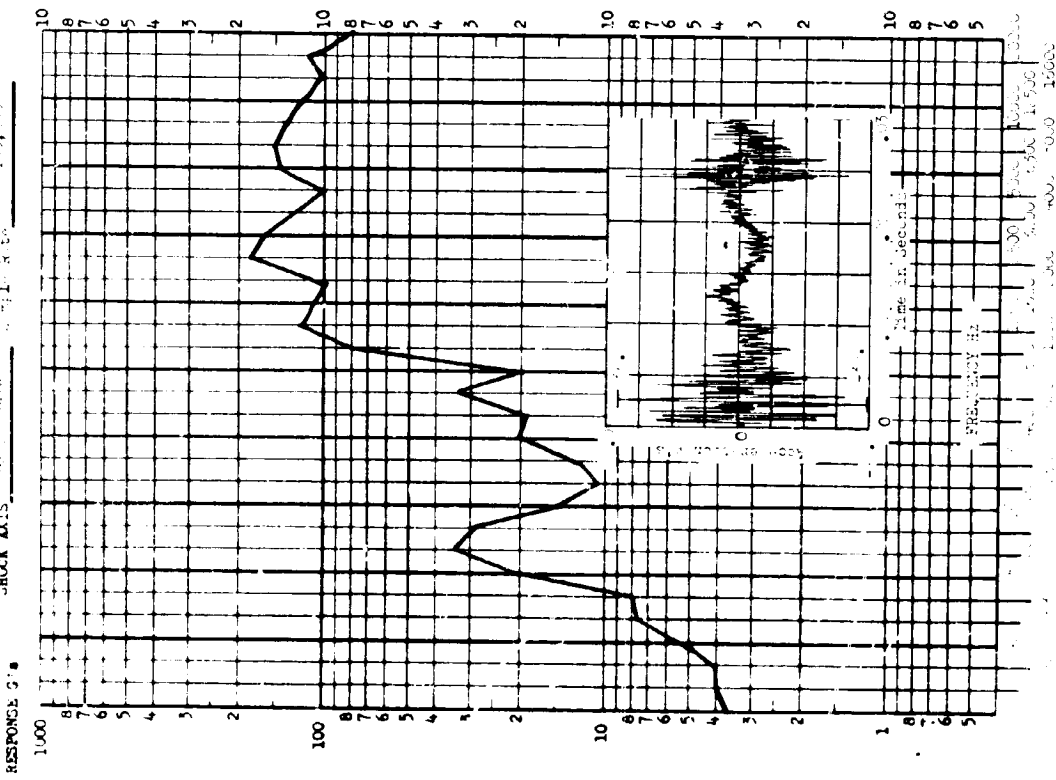


FIGURE IV.B.2-10

TEST ITEM: Spacecraft Cabin Pressure Release
 APPLIC. NO.: TEST DATE:
 SHOCK AXIS: Sample Rate:



TEST ITEM: Spacecraft Cabin Pressure Release
 APPLIC. NO.: TEST DATE:
 SHOCK AXIS: Sample Rate:

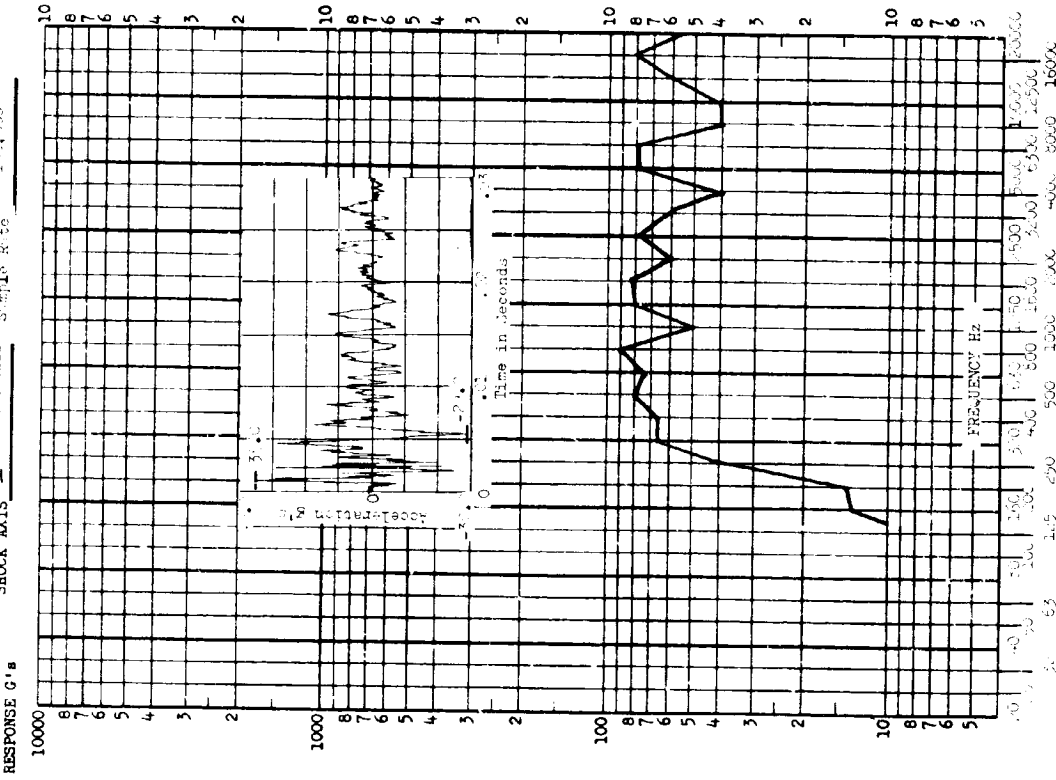
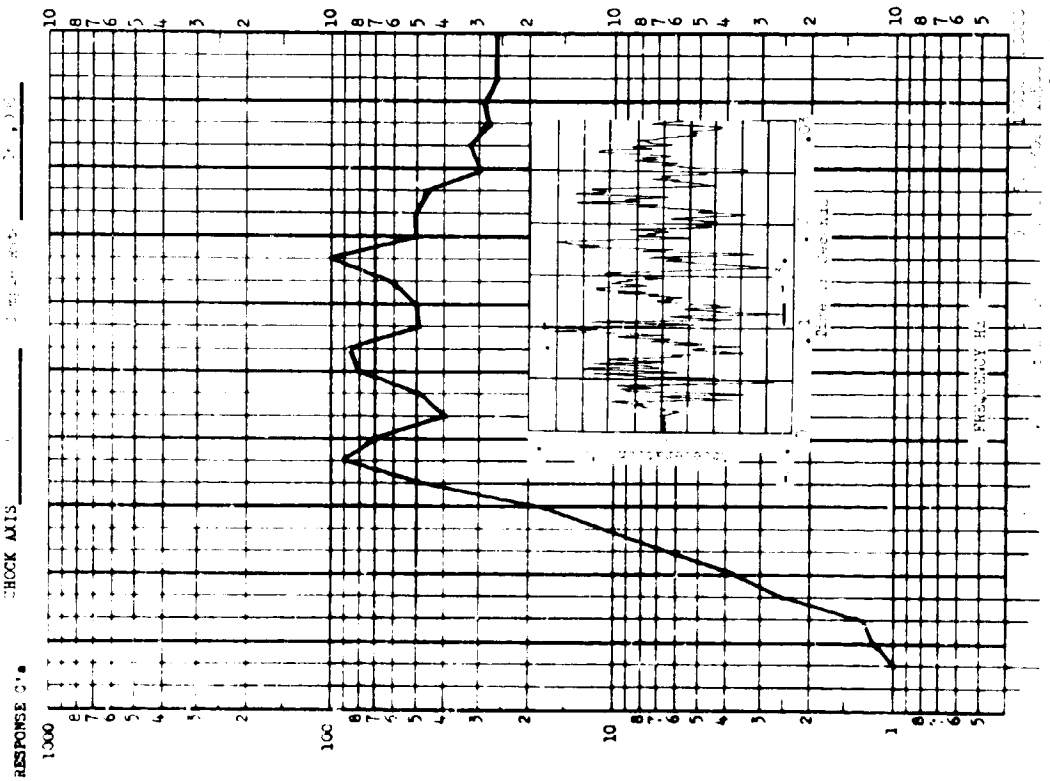


FIGURE IV.B.2-12

TEST ITEM Spacecraft V-band Pyro Release
 ACCEL. NO. 12 TEST DATE 3/1/60
 SHOCK AXIS Y Sample Rate 100,000



TEST ITEM Spacecraft V-band Pyro Release
 ACCEL. NO. 12 TEST DATE 3/1/60
 SHOCK AXIS Y Sample Rate 100,000

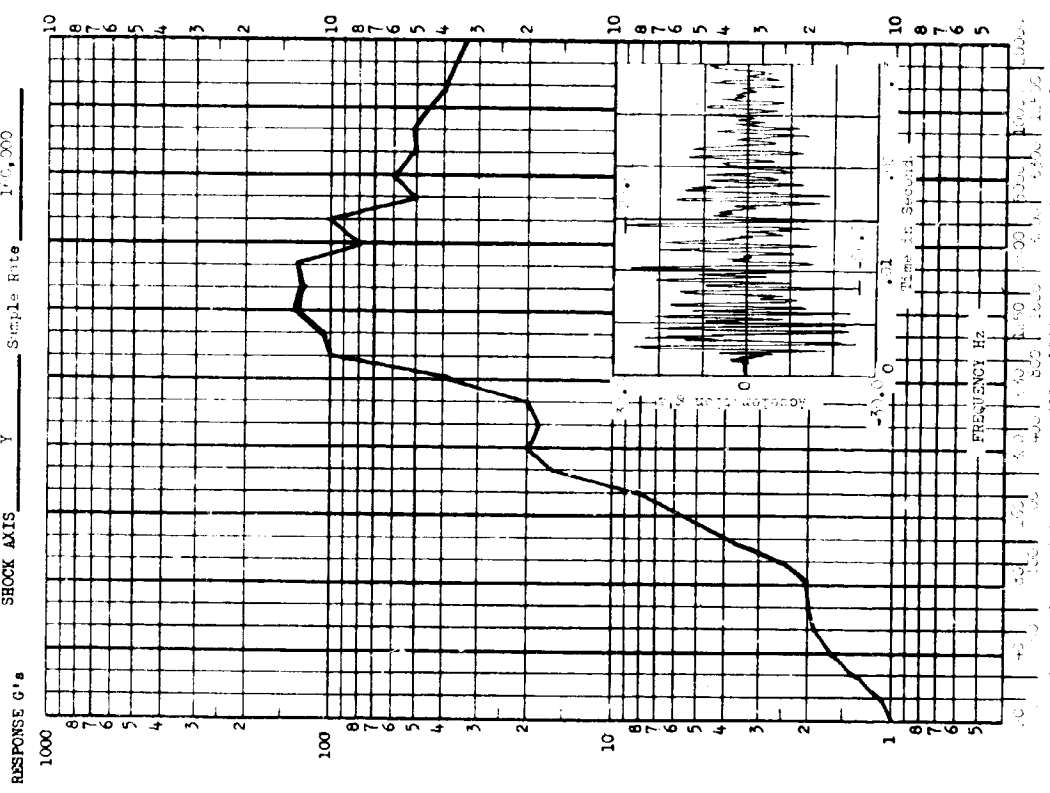
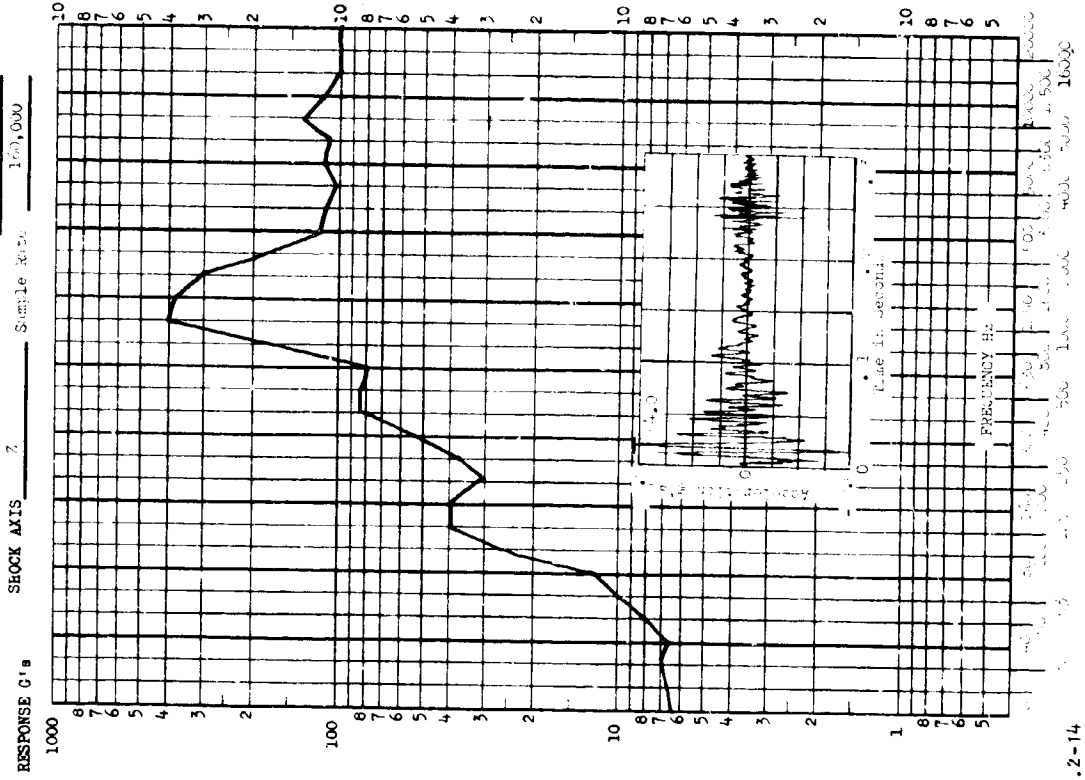


FIGURE IV.B.2-13

TEST ITEM Model 111 Spacraft V-band gyro release
 ACCEL. NO. 111A TEST DATE _____
 SHOCK AXIS Z Sample Rate 100,000



TEST ITEM Model 111 Spacraft V-band gyro release
 ACCEL. NO. 111A TEST DATE _____
 SHOCK AXIS Z Sample Rate 100,000

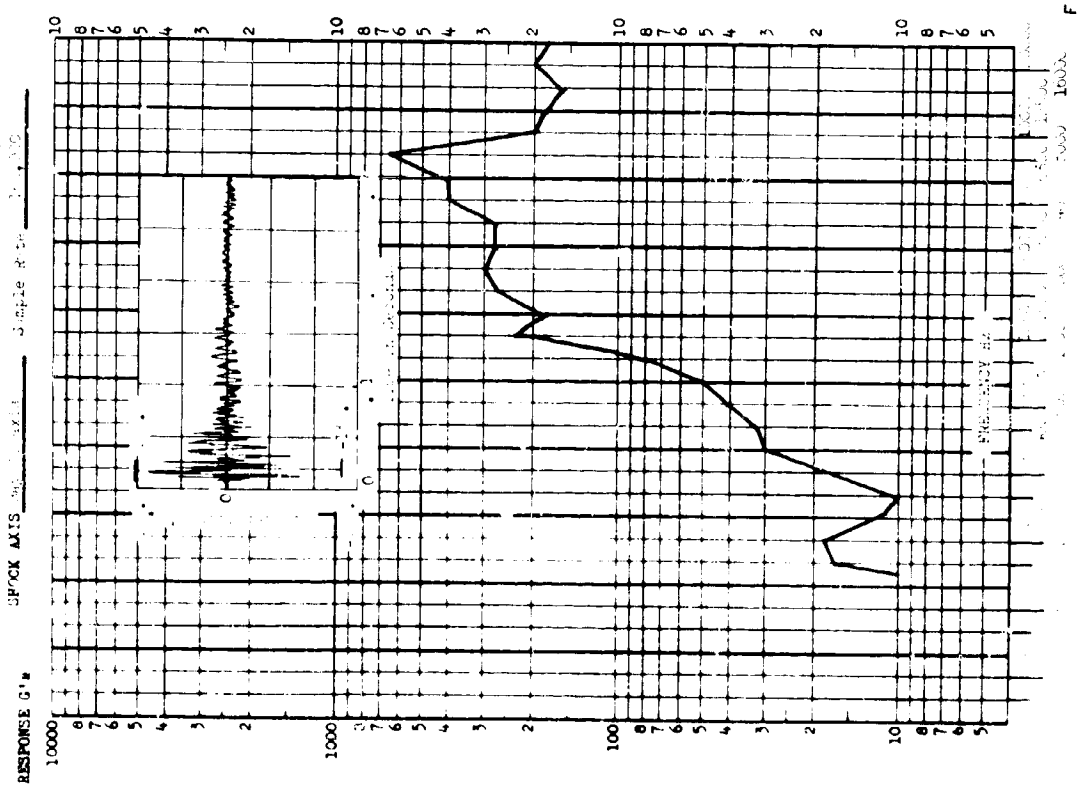


FIGURE IV.B.2-14

SECTION IV.B.3

M67 SOLAR PANEL DEPLOY EVENT

One test of the Solar Panel Deployment was conducted for both the M67-1 and M67-2. The deployment mechanism was a pin-pulling device. Twenty-two shock spectra for this event are presented along with their corresponding time histories in Figures IV.B.3-1 through IV.B.3-11 as indexed in Table IV.B.3-1.

TABLE IV.B.3-1
INDEX OF DATA LOCATIONS

<u>Accelerometer Number</u>	<u>Configuration</u>	<u>Figure No.</u>
B3	M67-1, -2	IV.B.3-1
F1	M67-1, -2	IV.B.3-2
F3	M67-1, -2	IV.B.3-3
F4A	M67-1, -2	IV.B.3-4
B2A, B3A	M67-1	IV.B.3-5
B4, B5	M67-1	IV.B.3-6
B6, BB2	M67-1	IV.B.3-7
BB3, SS4A	M67-1	IV.B.3-8
SS5A, SS6A	M67-1	IV.B.3-9
AS1, IC4	M67-1	IV.B.3-10
3T3, MC4	M67-1	IV.B.3-11

TEST ITEM _____
 TEST NO. _____ TEST DATE _____
 SHOCK AXIS _____

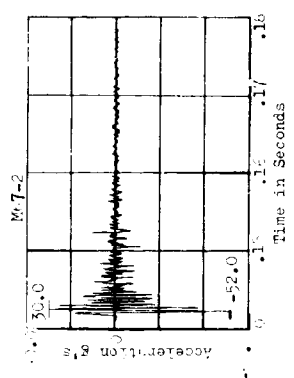
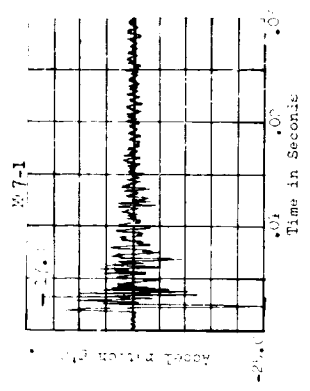
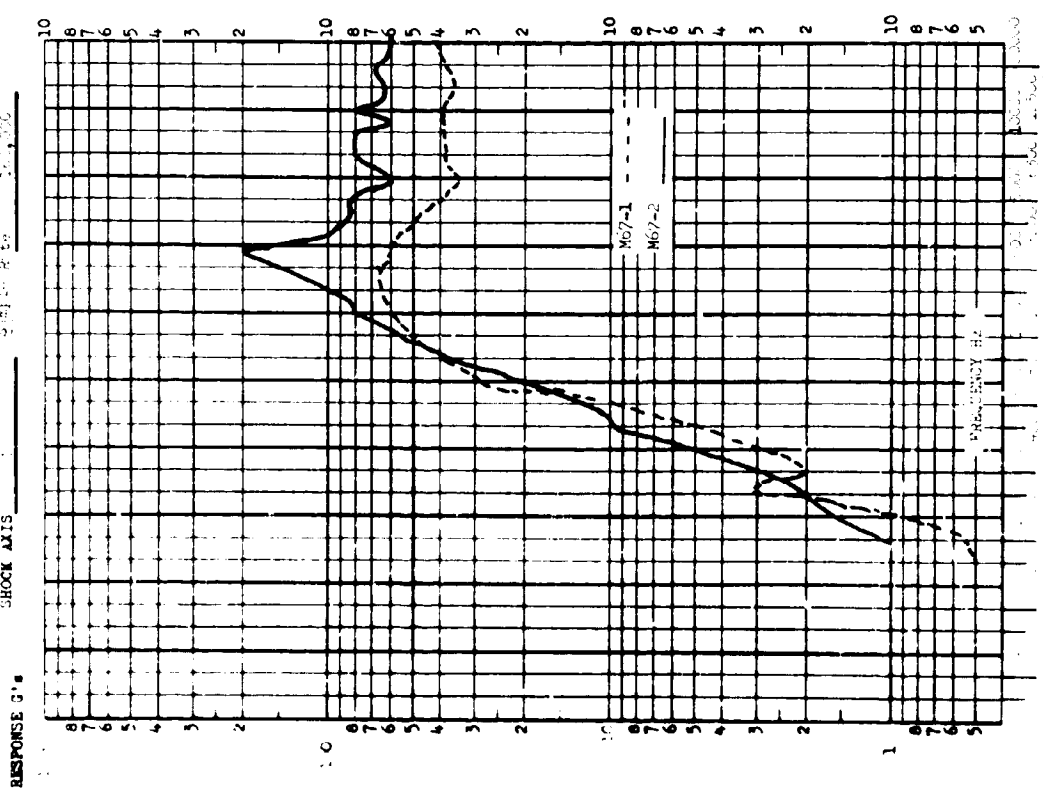


FIGURE IV.B.3-1

TEST ITEM: Shock Test - 1000 Hz, 1000 G, 1000 Cycles
 TEST NO.: 1000 TEST DATE: 10/10/50
 SHOCK AXIS: Vertical Shock Rate: 1600 G/C

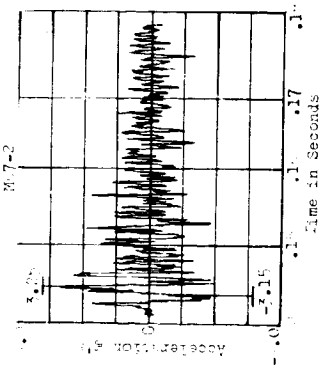
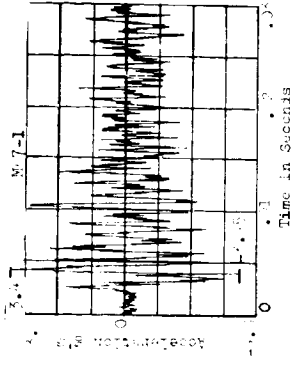
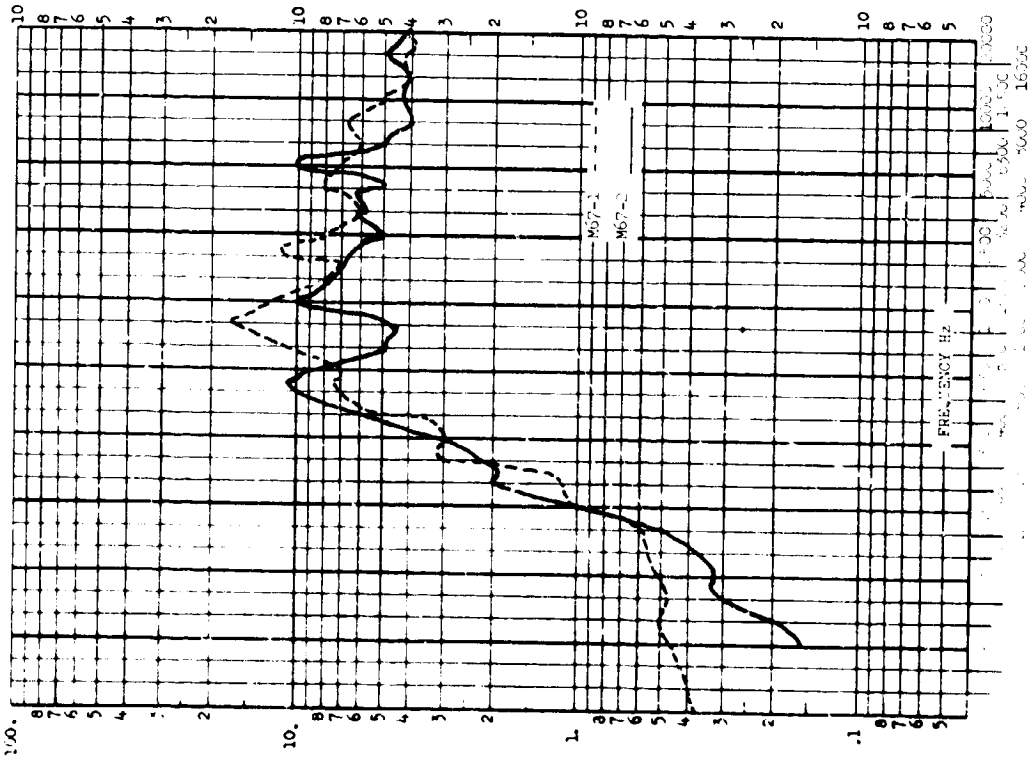


FIGURE IV.B.3-2

TEST ITEM _____
 TEST NO. _____ TEST DATE _____
 SHOCK AXIS _____

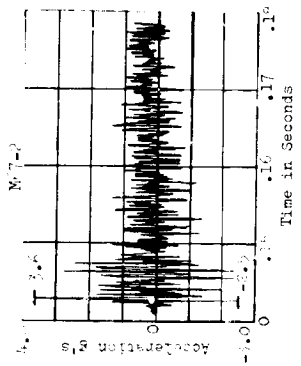
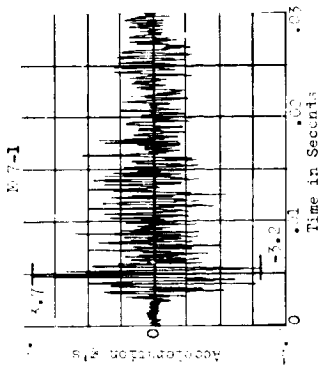
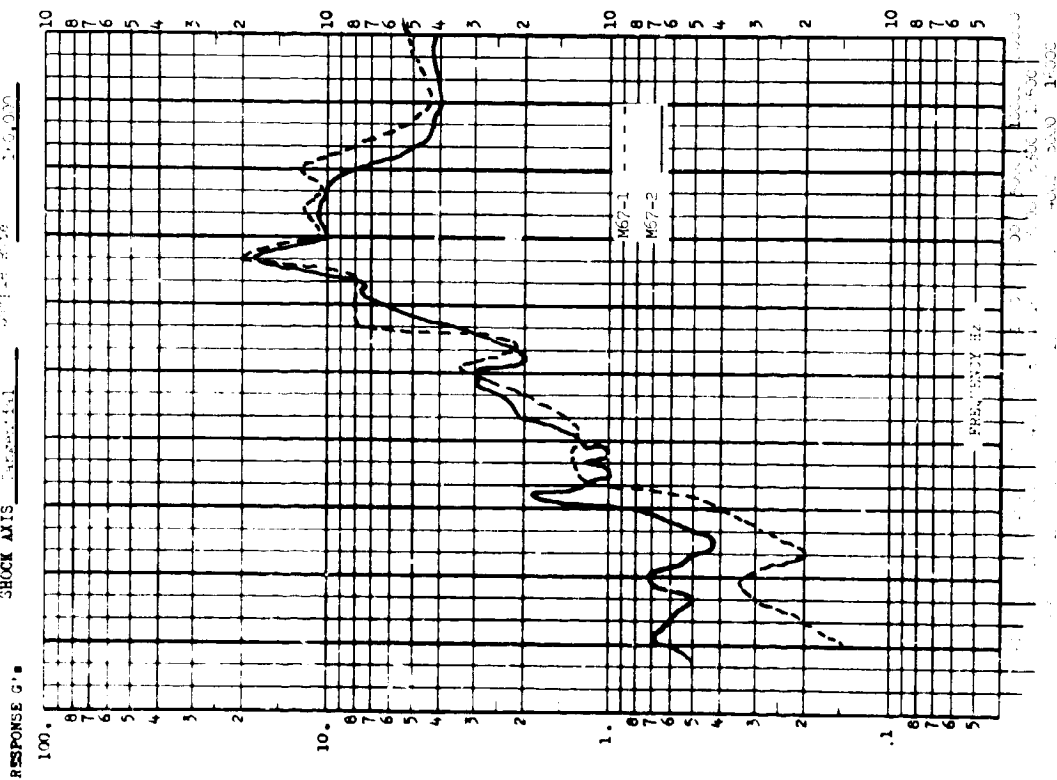


FIGURE IV.B.3-3

TEST ITEM _____
 SERIAL NO. _____ TEST DATE _____
 SHOCK AXIS _____ Sample Rate _____

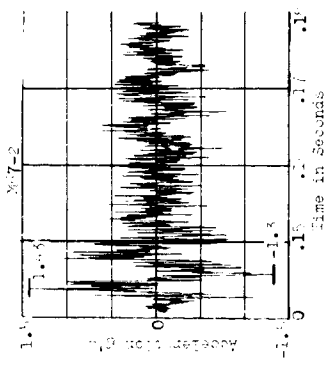
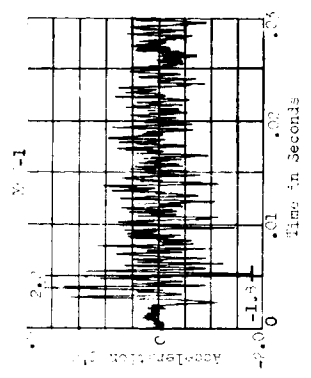
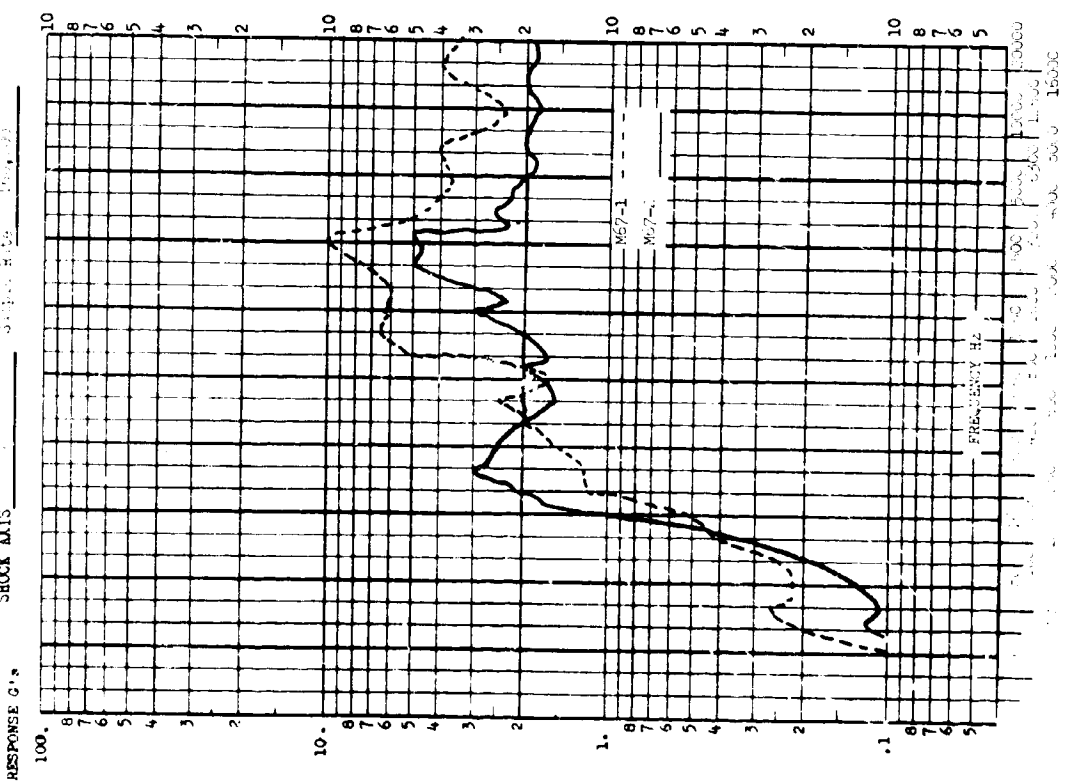
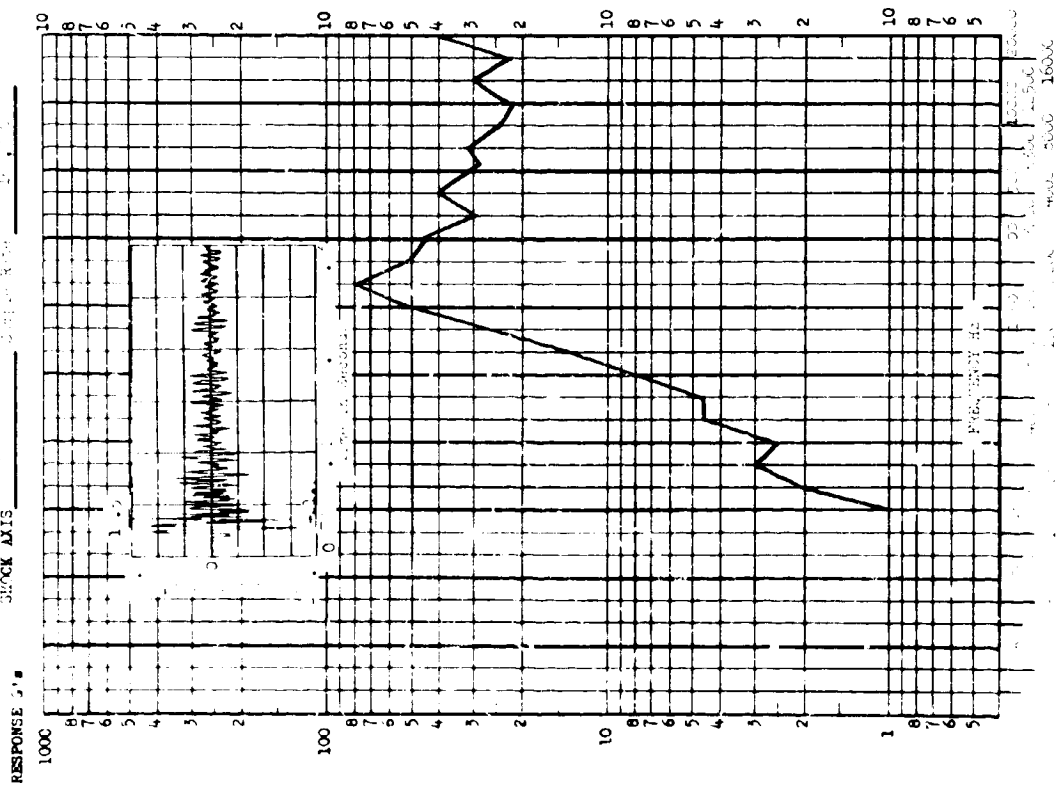


FIGURE IV.B.3-4

TEST ITEM: Solar Panel Deploy Rate
 A. EL. NO.: 73
 SHOCK AXIS: 7
 TEST DATE: 12/1/58
 Sample Rate: 1000 CPS



TEST ITEM: Solar Panel Deploy Rate
 A. EL. NO.: 73
 SHOCK AXIS: 7
 TEST DATE: 12/1/58
 Sample Rate: 1000 CPS

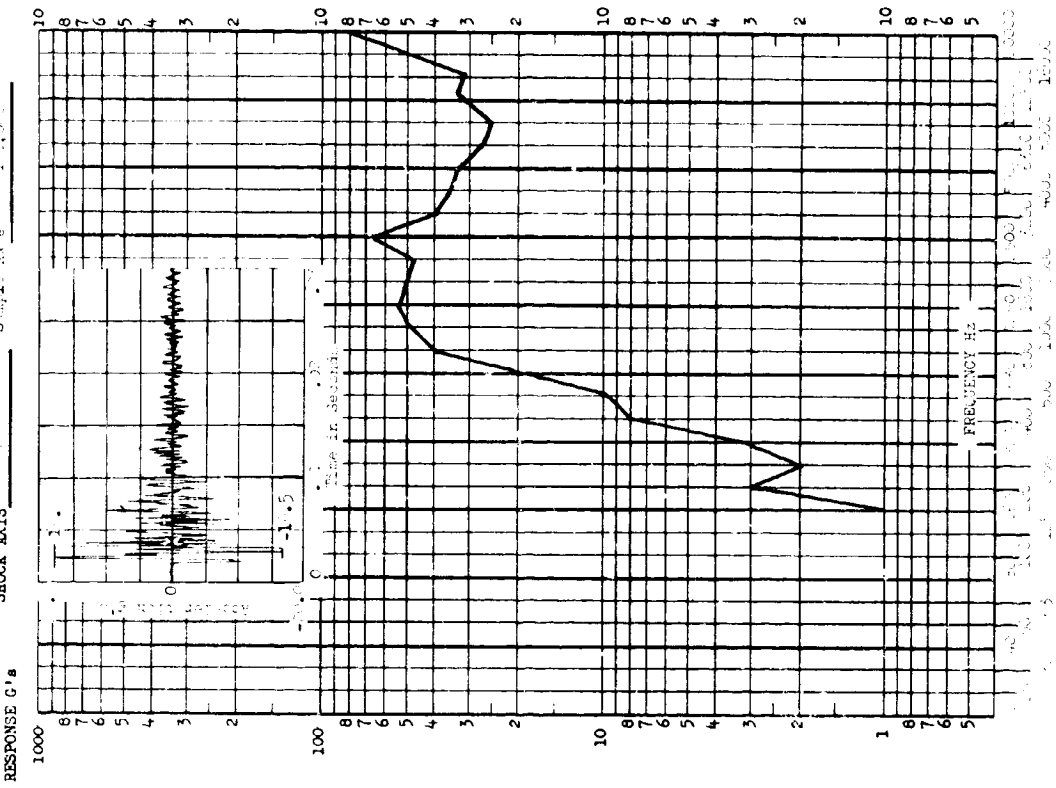
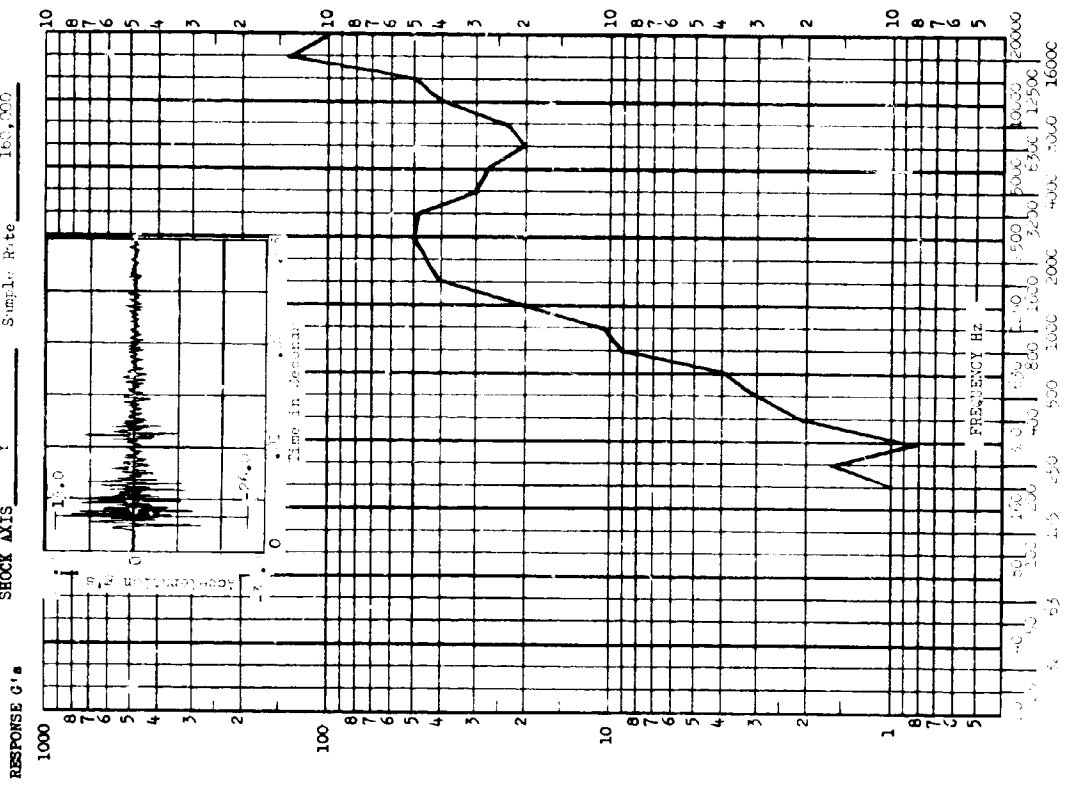


FIGURE IV.B.3-5

X

TEST ITEM: M67-1 ** Solar Panel Deploy Pyro Vent
 ACCEL. NO.: 95 TEST DATE:
 SHOCK AXIS: Y Sample Rate: 160,000



TEST ITEM: M67-1 ** Solar Panel Deploy Pyro Vent
 ACCEL. NO.: TEST DATE:
 SHOCK AXIS: Sample Rate: 160,000

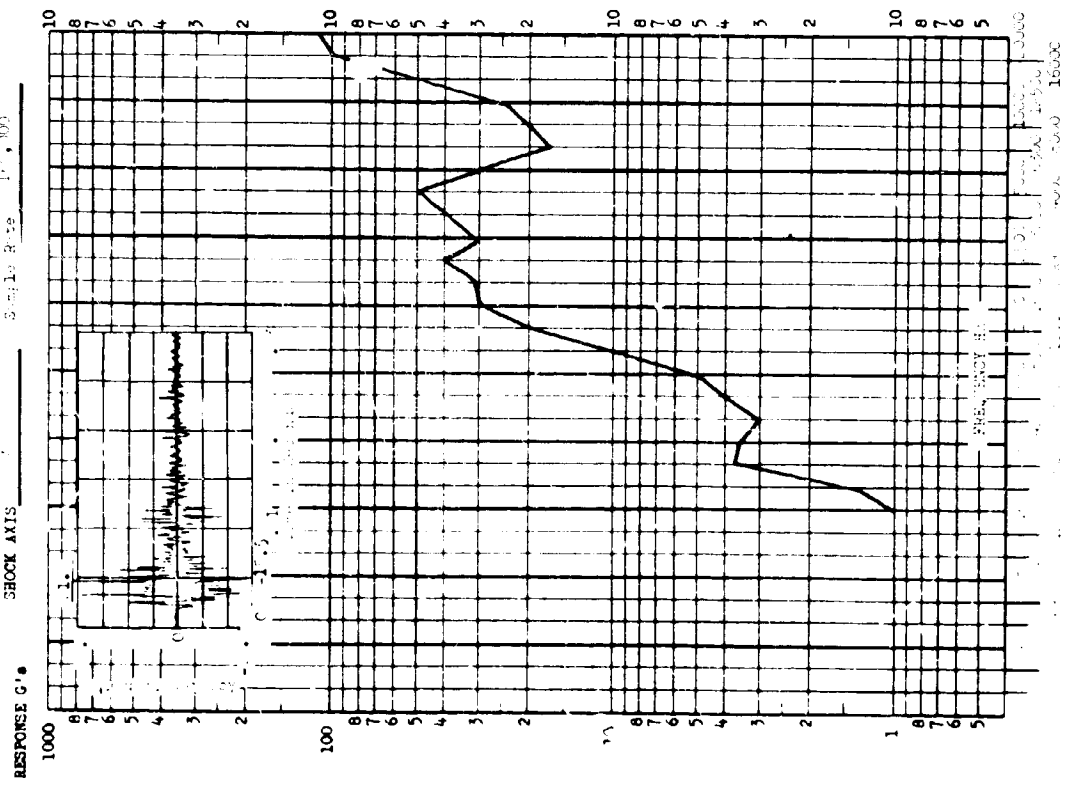
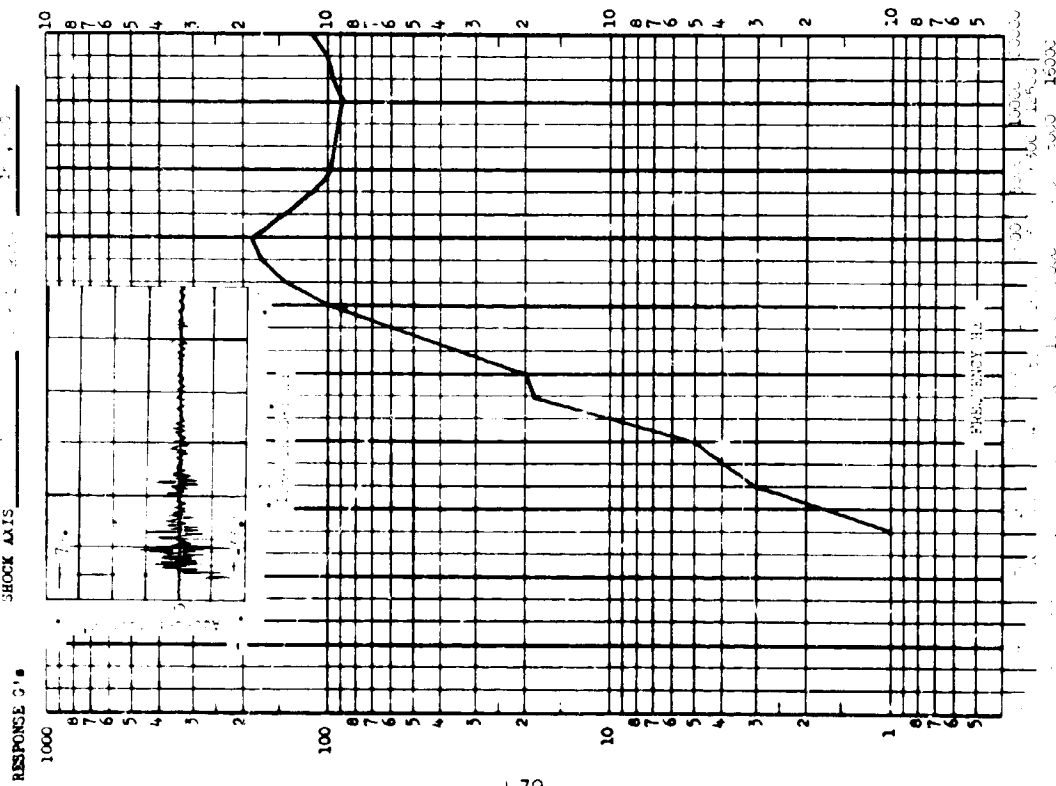


FIGURE IV.B.3-6

TEST ITEM _____
 ACCEL. NO. _____ TEST DATE _____
 SHOCK AXIS _____ SAMPLE RATE _____



TEST ITEM _____
 ACCEL. NO. _____ TEST DATE _____
 SHOCK AXIS _____ SAMPLE RATE _____

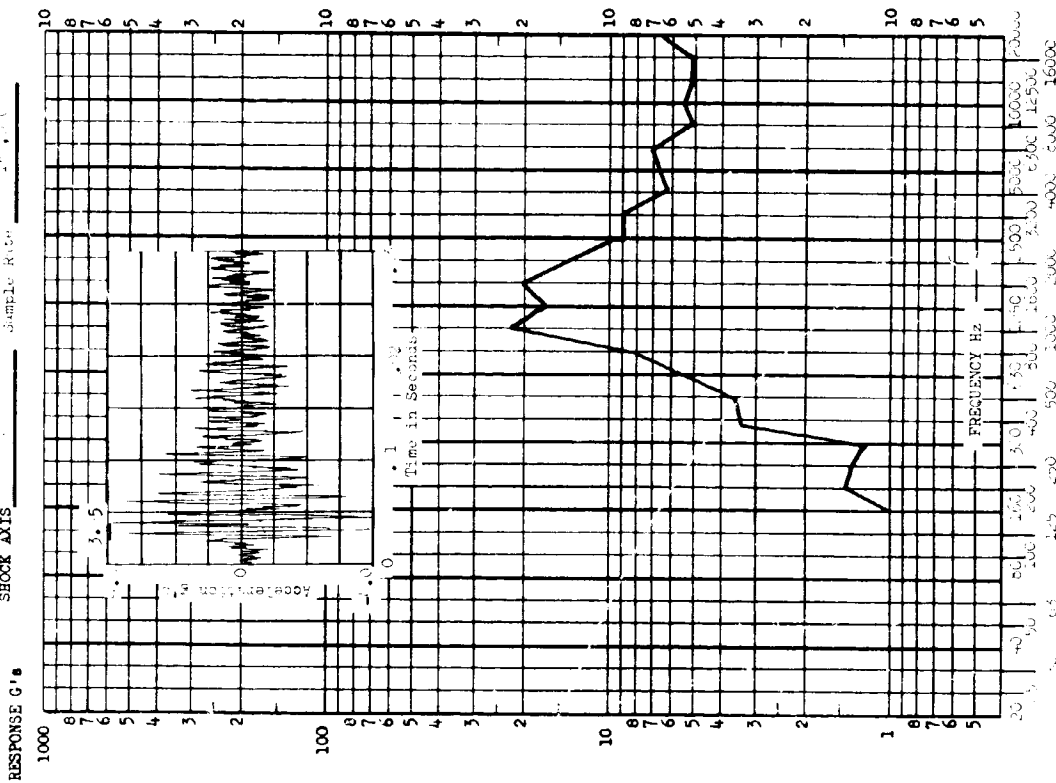
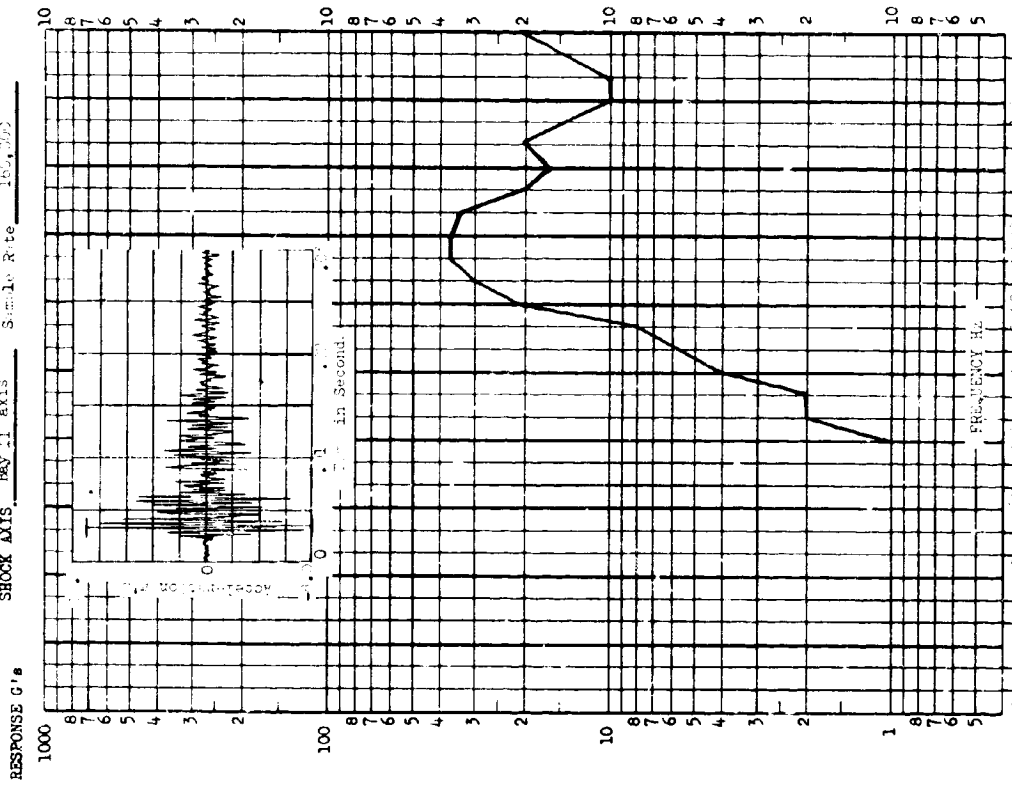


FIGURE IV.B.3-7

TEST ITEM Solar Panel Deploy Eject Event
 ACCEL. NO. 367 TEST DATE _____
 SHOCK AXIS XZ axis Sample Rate 160,000



TEST ITEM Solar Panel Deploy Event
 ACCEL. NO. 367 TEST DATE _____
 SHOCK AXIS XZ axis Sample Rate 160,000

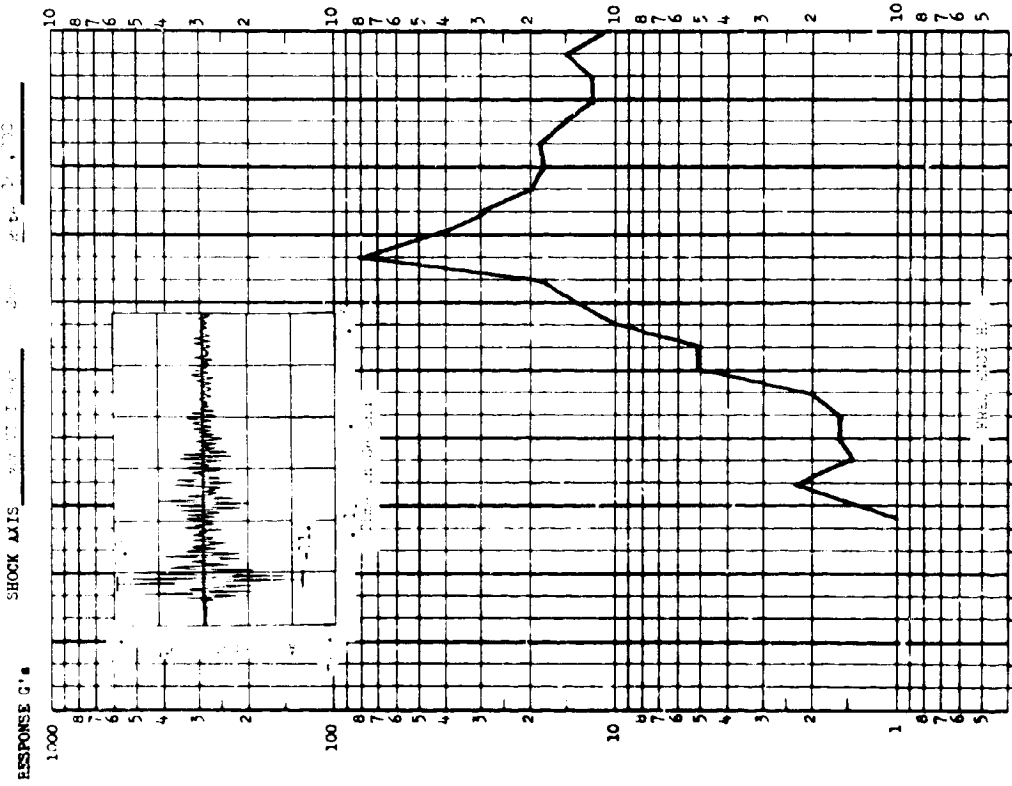
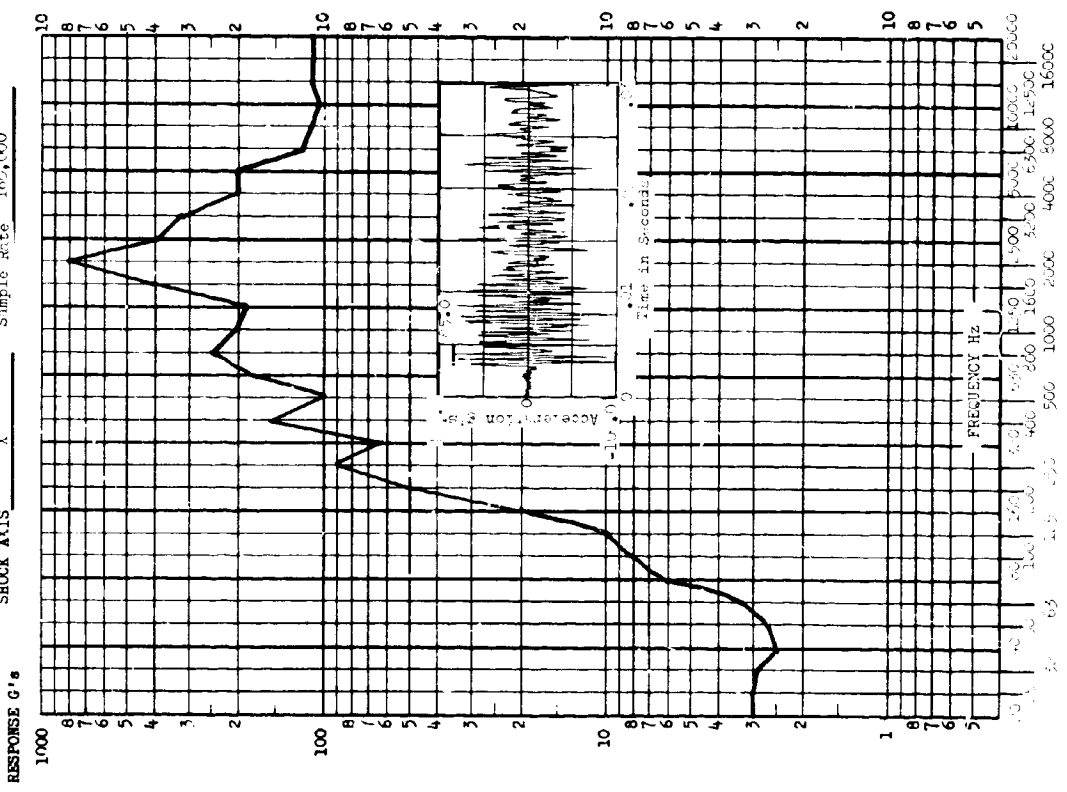


FIGURE IV.B.3-9

TEST ITEM M67-1 ** Solar Panel Deploy Eject event
 ACCEL. NO. 104 TEST DATE _____
 SHOCK AXIS X Sample Rate 166,000



TEST ITEM M67-1 ** Solar Panel Deploy Eject event
 ACCEL. NO. 104 TEST DATE _____
 SHOCK AXIS X Sample Rate 166,000

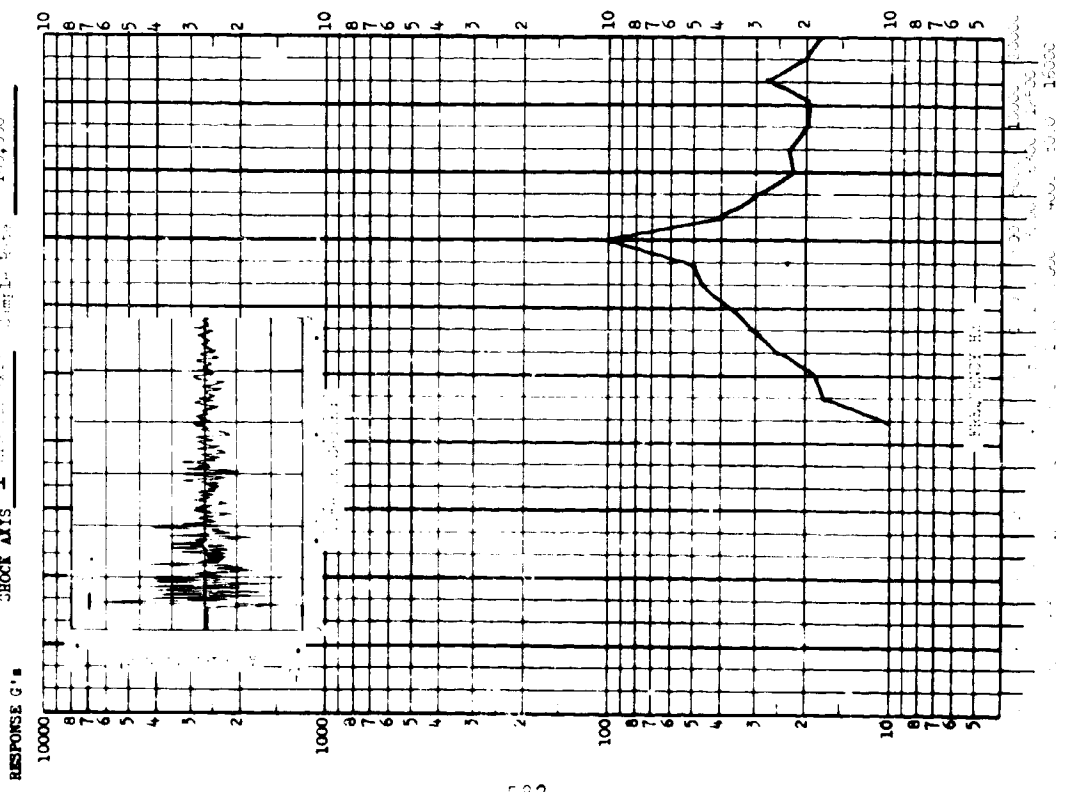


FIGURE IV.B.3-10

SECTION IV.B.4

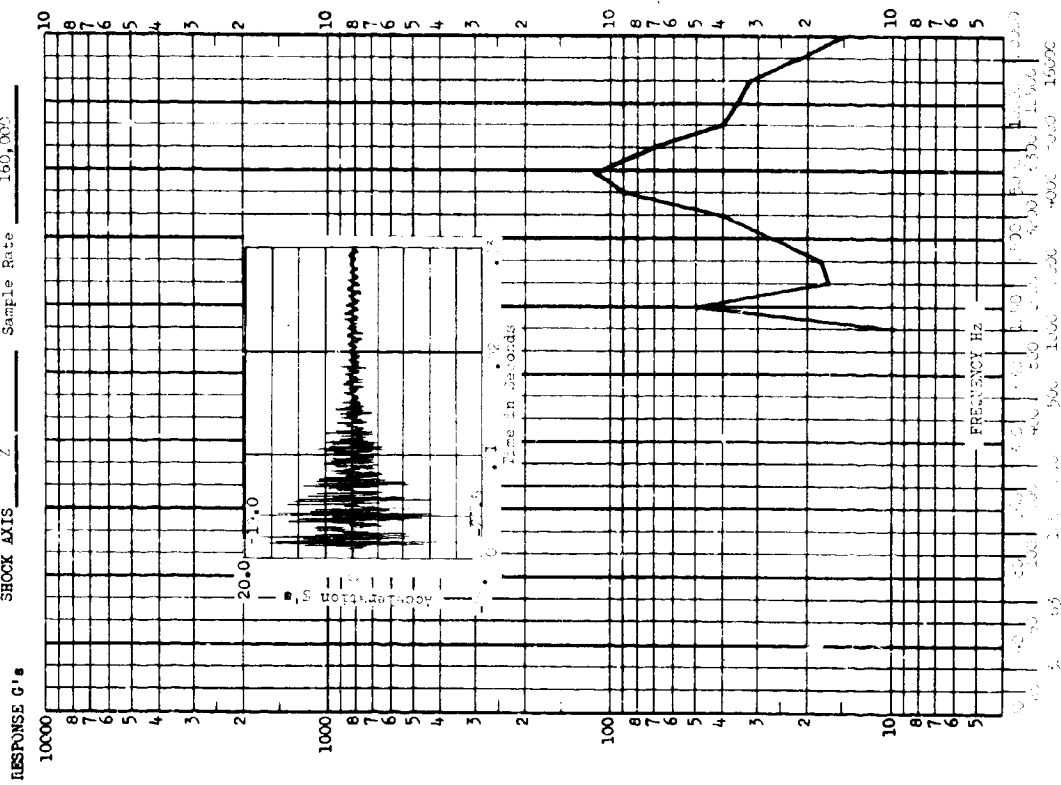
M67-1 PIPS 1 EVENT

One test of the post injection propulsions system pyro 1 was conducted for the M67-1. The pyrotechnic employed was a pin-pulling device. Seventeen shock spectra for this event are presented along with their corresponding time histories in Figures IV.B.4-1 through IV.B.4-9 as indexed in Table IV.B.4-1.

TABLE IV.B.4-1
INDEX OF DATA LOCATIONS

<u>Accelerometer Numbers</u>	<u>Figure Number</u>
R3, F4	IV.B.4-1
F4A, B1A	IV.B.4-2
B2A, B3A	IV.B.4-3
BB1, BB2	IV.B.4-4
BB3, SS4A	IV.B.4-5
SS5A, S ^o 6A	IV.B.4-6
IC4, 3T3	IV.B.4-7
MCV1, MCV4	IV.B.4-8
MC4	IV.B.4-9

TEST ITEM M67-1 ** PITS I
 ACCEL. NO. P4 TEST DATE
 SHOCK AXIS Z Sample Rate 160,000



TEST ITEM M67-1 ** PITS I
 ACCEL. NO. 7 TEST DATE
 SHOCK AXIS Z Sample Rate 160,000

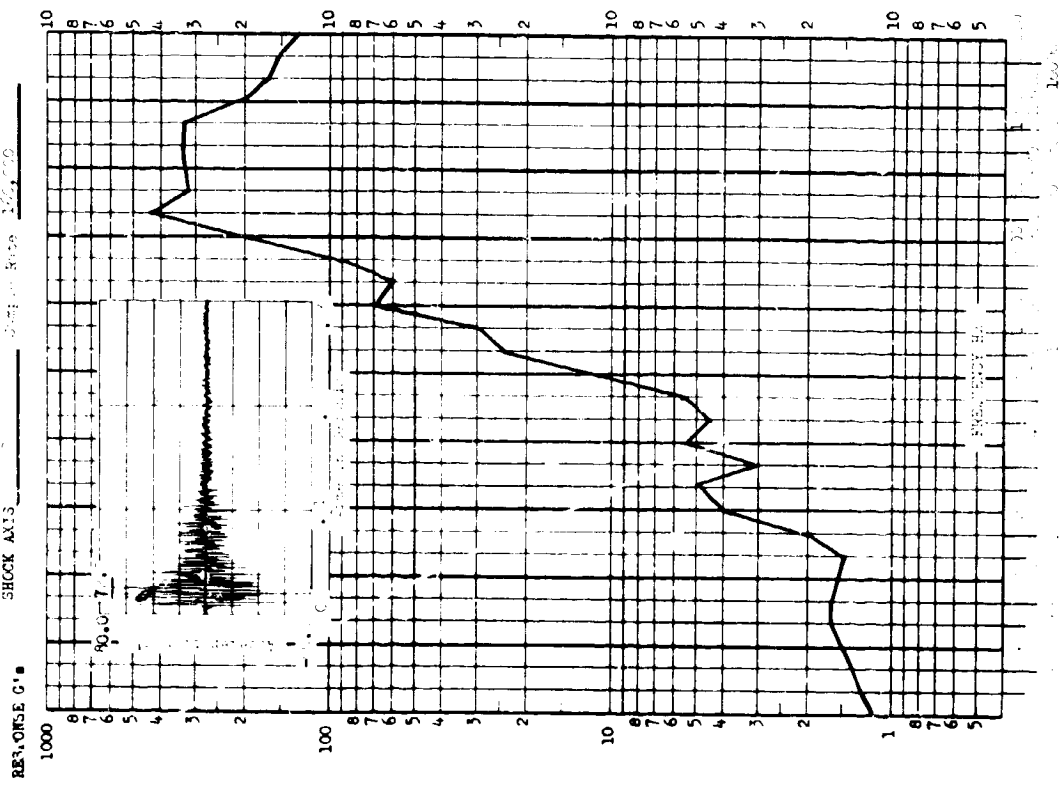
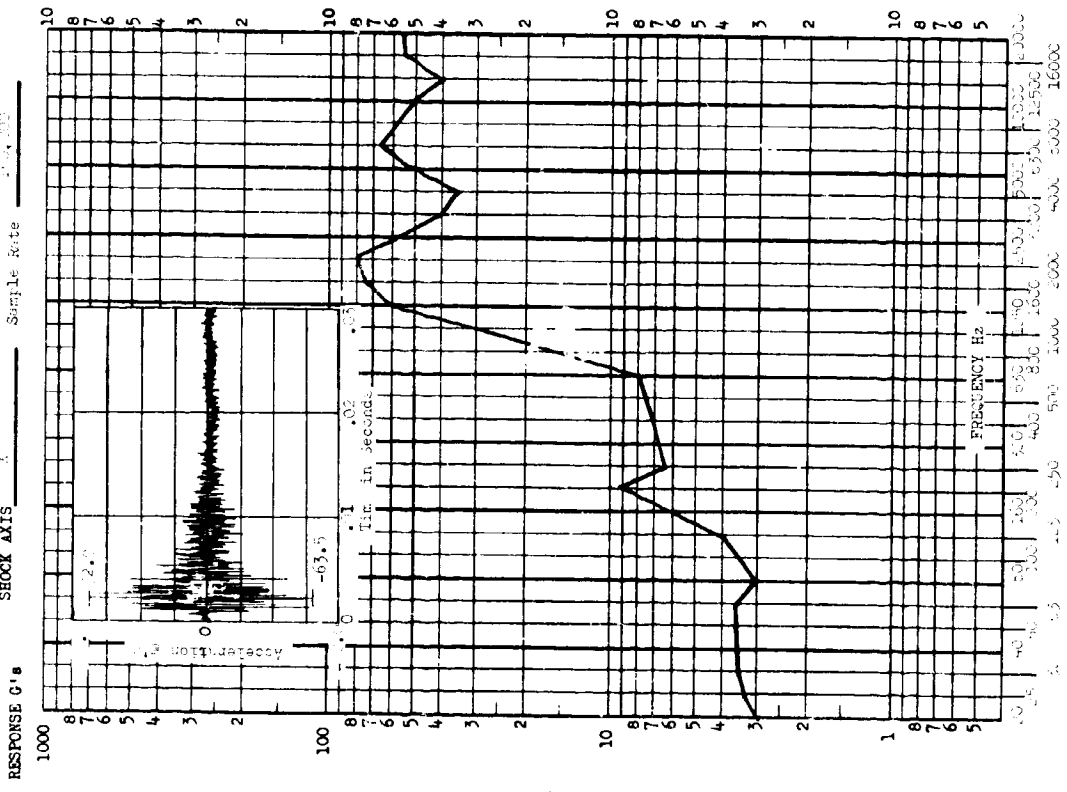


FIGURE IV.B.4-1

TEST ITEM: M6-1 ** FIG 1
 ACCEN. NO.: 141
 TEST DATE: 17 JUN 60
 SHOCK AXIS: X
 Sample Rate: 10000



TEST ITEM: M6-1 ** FIG 1
 ACCEN. NO.: 141
 TEST DATE: 17 JUN 60
 SHOCK AXIS: X
 Sample Rate: 10000

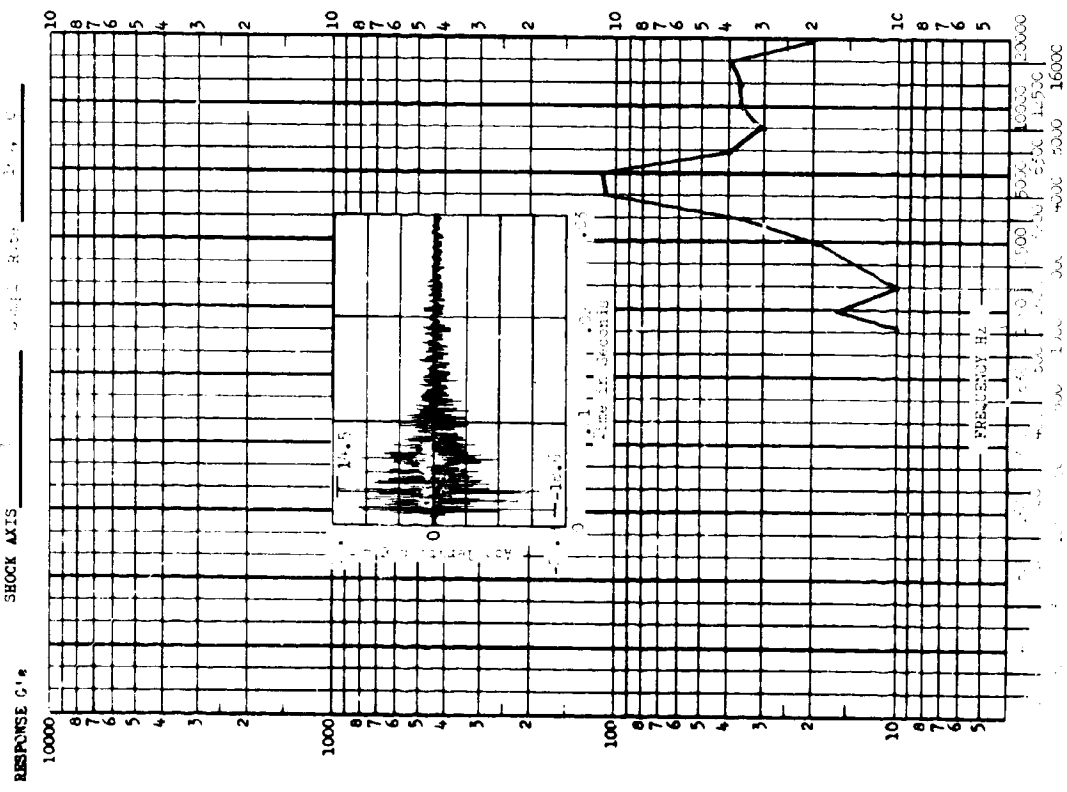
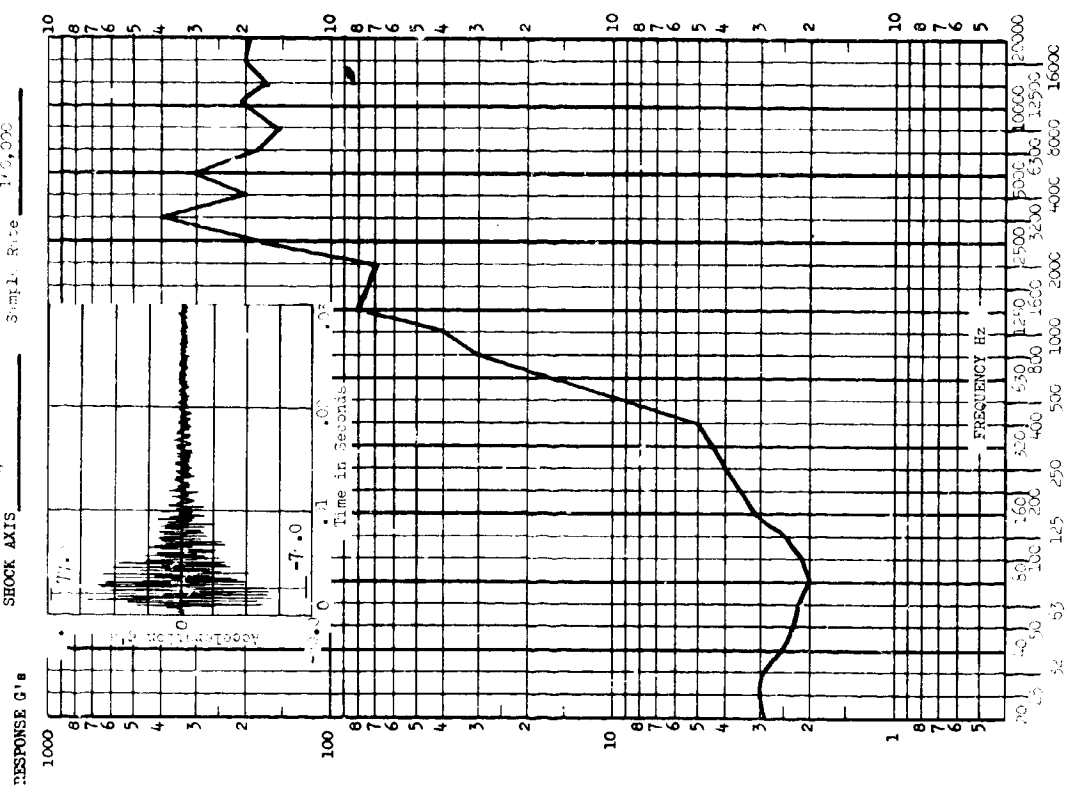


FIGURE IV.B.4-2

TEST ITEM: [REDACTED]
 ACCEL. NO.: [REDACTED] TEST DATE: [REDACTED]
 SHOCK AXIS: [REDACTED] Sample Rate: 175,000



TEST ITEM: [REDACTED]
 ACCEL. NO.: [REDACTED] TEST DATE: [REDACTED]
 SHOCK AXIS: [REDACTED] Sample Rate: 175,000

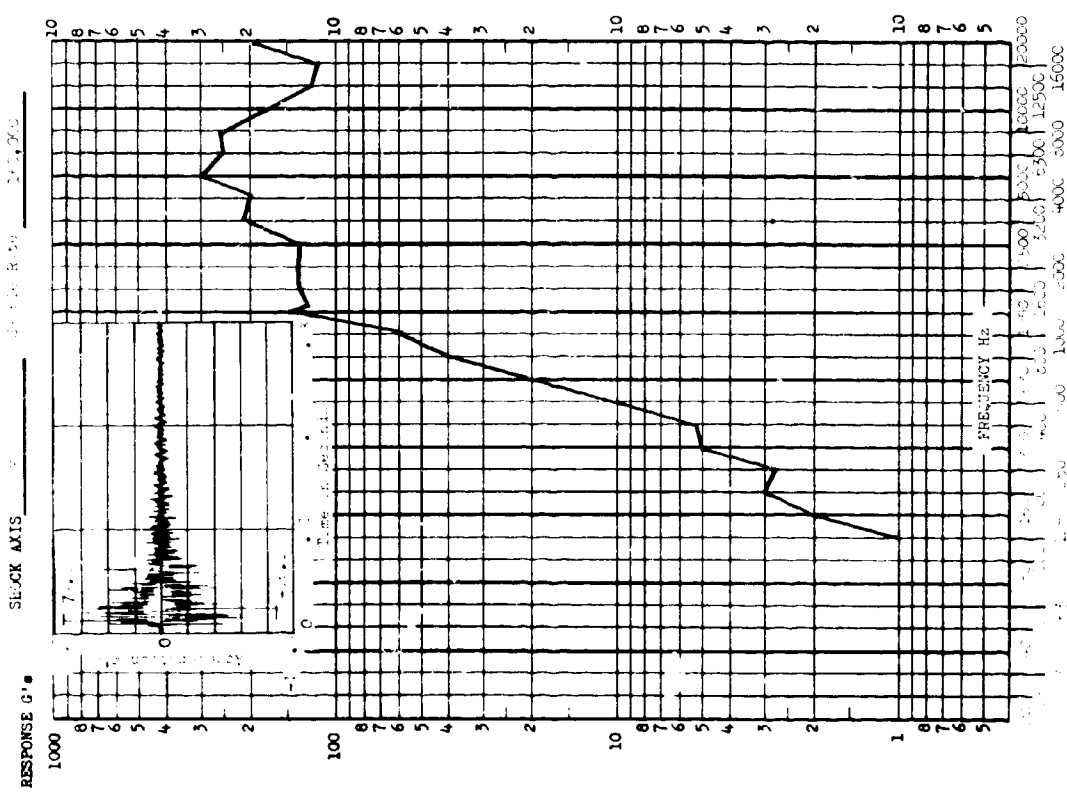


FIGURE IV.B.4-3

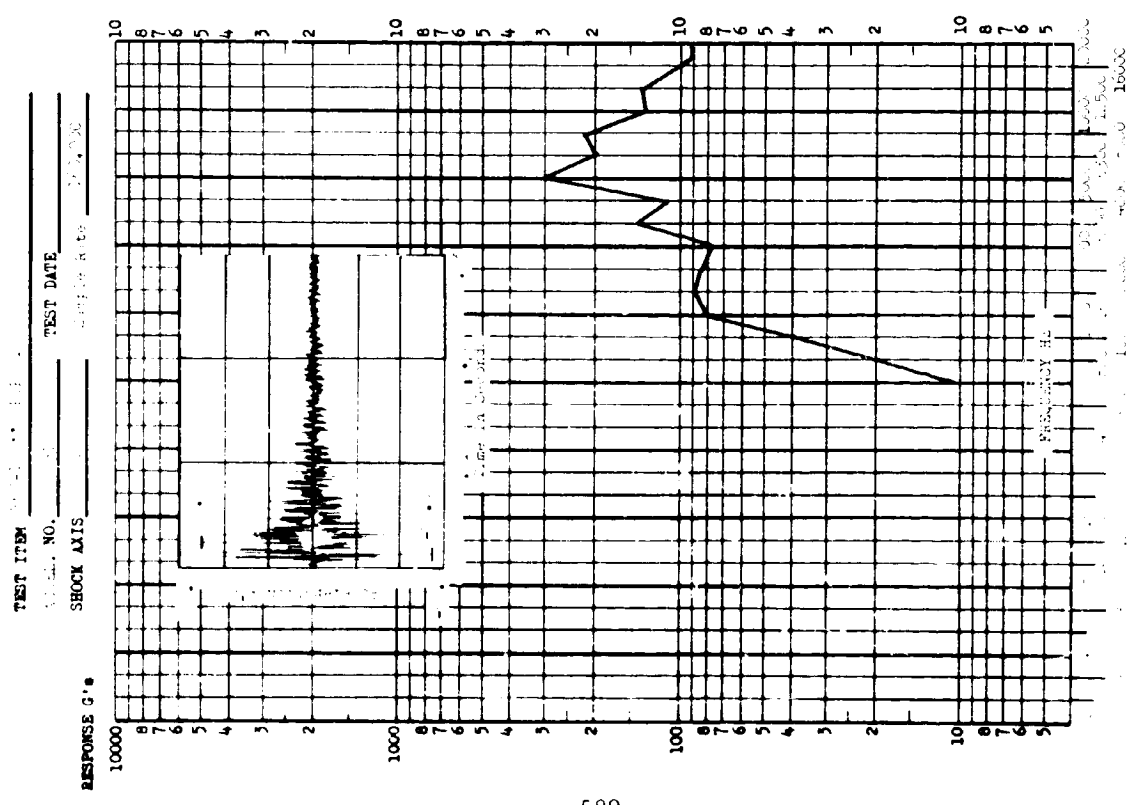
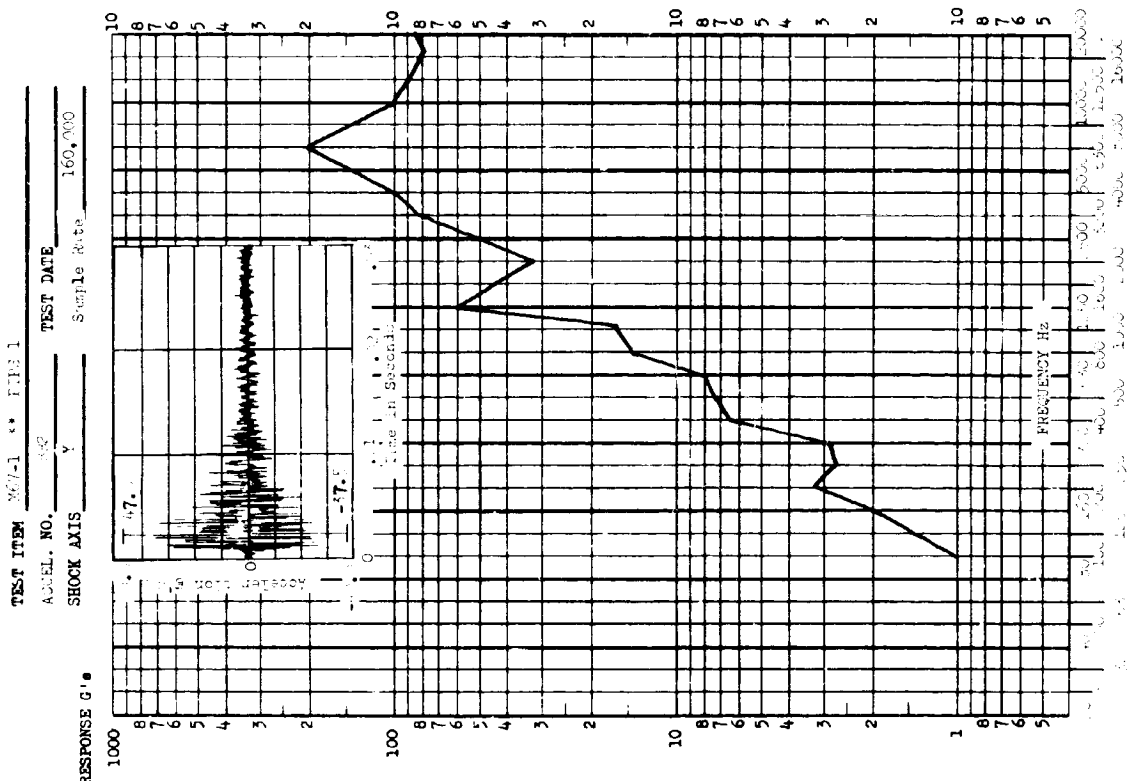
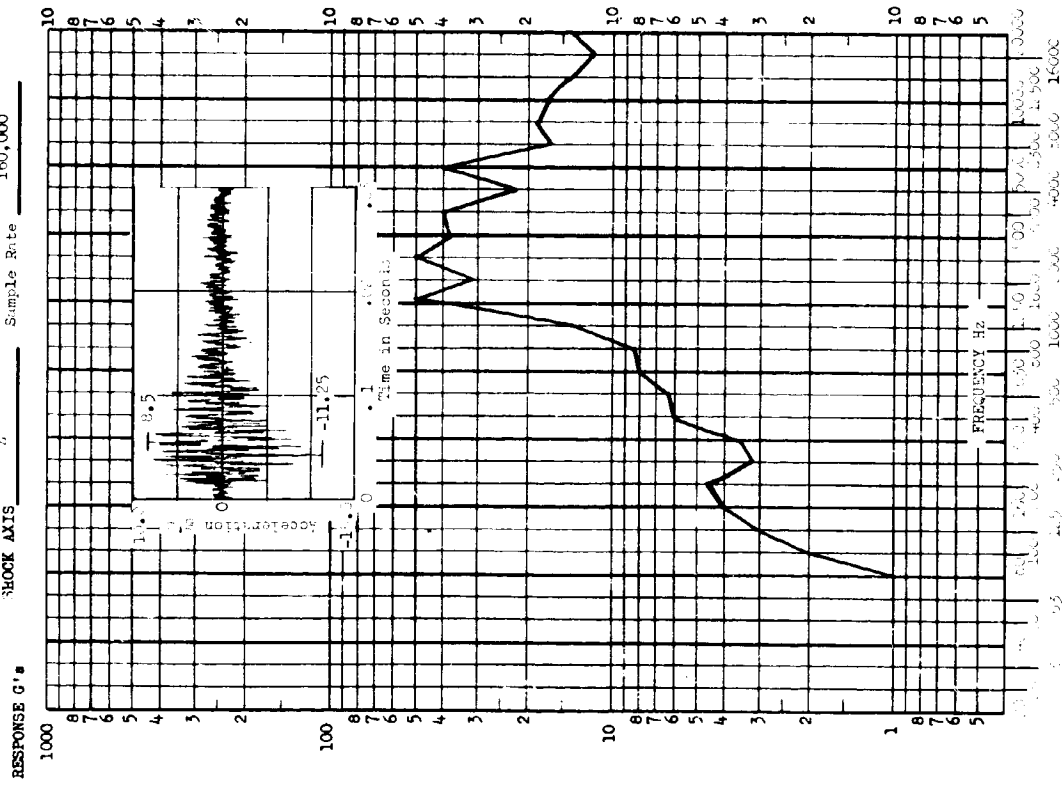


FIGURE IV.B.4-4

TEST ITEM M67-1 ** PIPS 1
 ACCEL. NO. 034A TEST DATE
 SHOCK AXIS Z Sample Rate 160,000



TEST ITEM M67-1 ** PIPS 1
 ACCEL. NO. 034A TEST DATE
 SHOCK AXIS Z Sample Rate 160,000

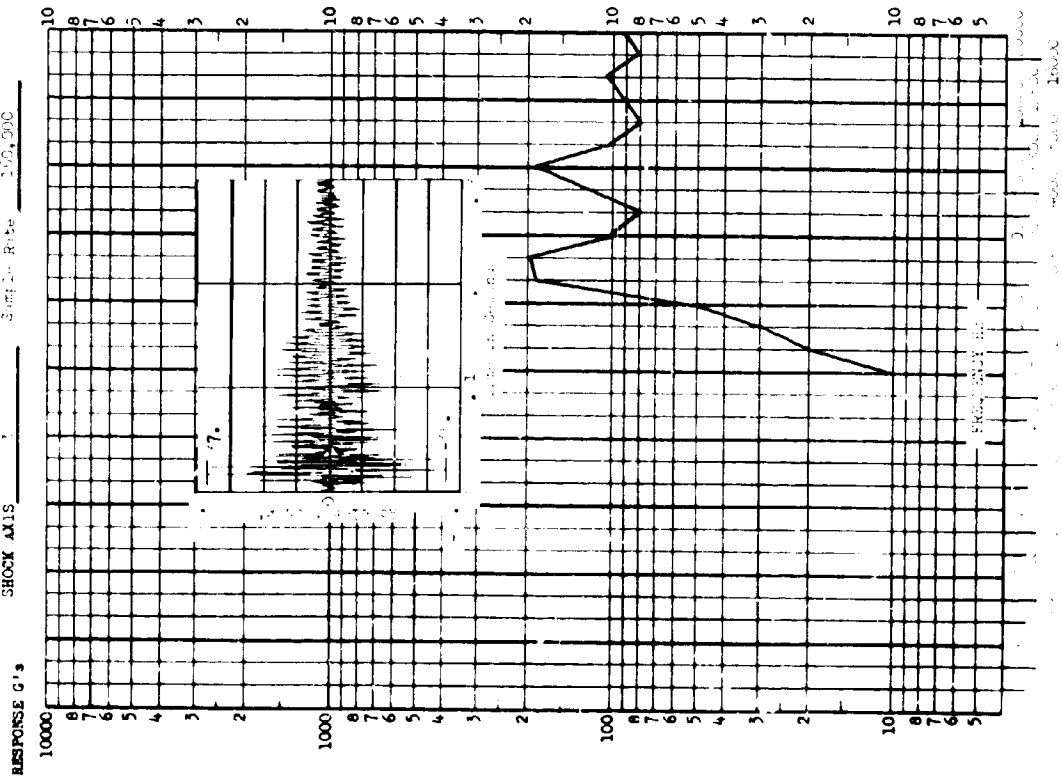
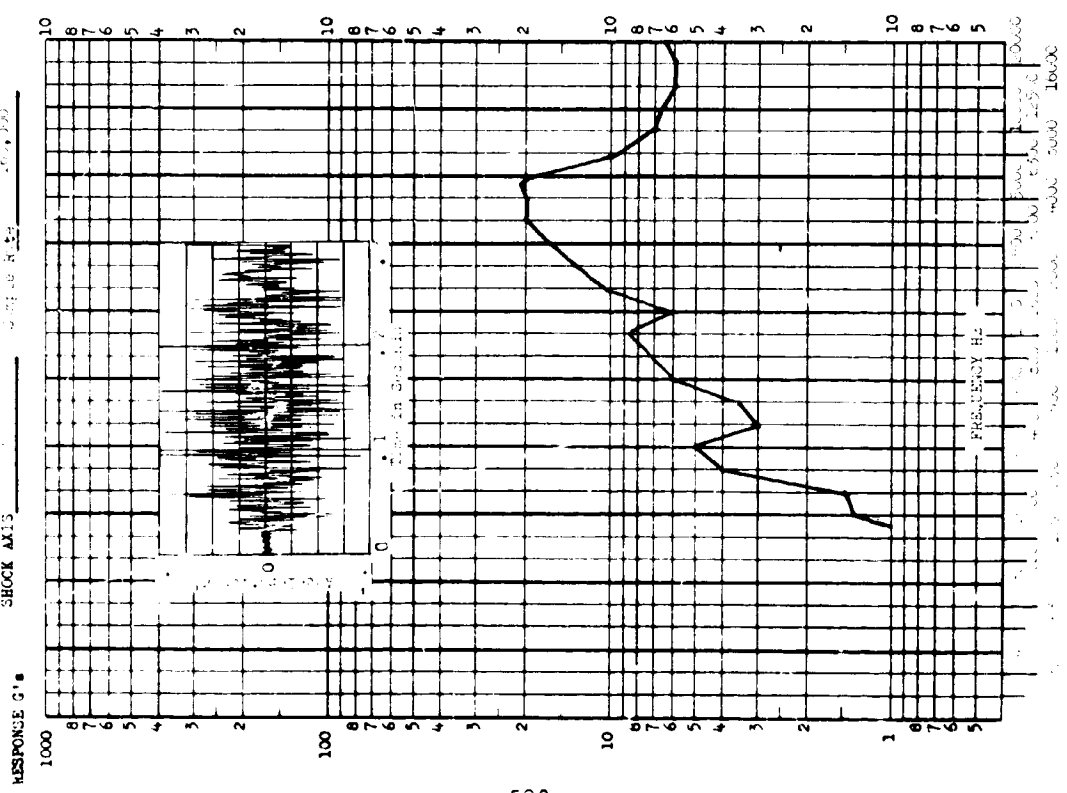


FIGURE IV.B.4-5

TEST ITEM _____ TEST DATE _____
 ACCEL. NO. 14 TEST DATE _____
 SHOCK AXIS _____ Sample Rate 100,000



TEST ITEM _____ TEST DATE _____
 ACCEL. NO. 17 TEST DATE _____
 SHOCK AXIS _____ Sample Rate 100,000

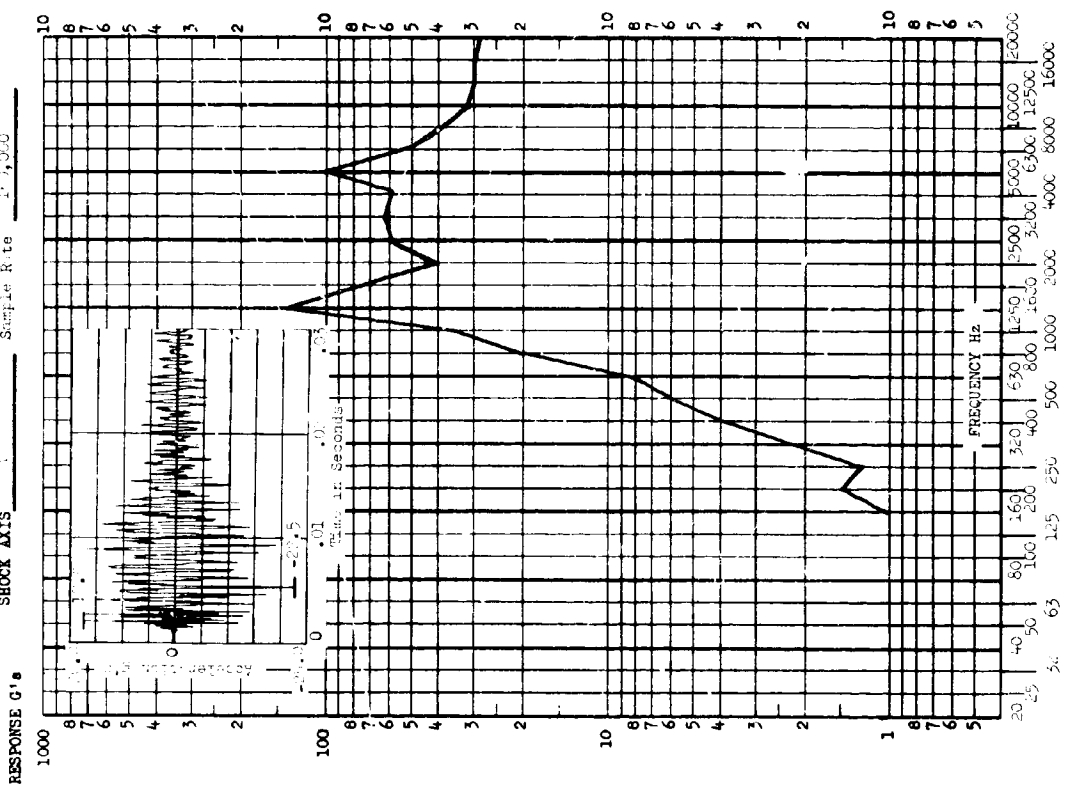
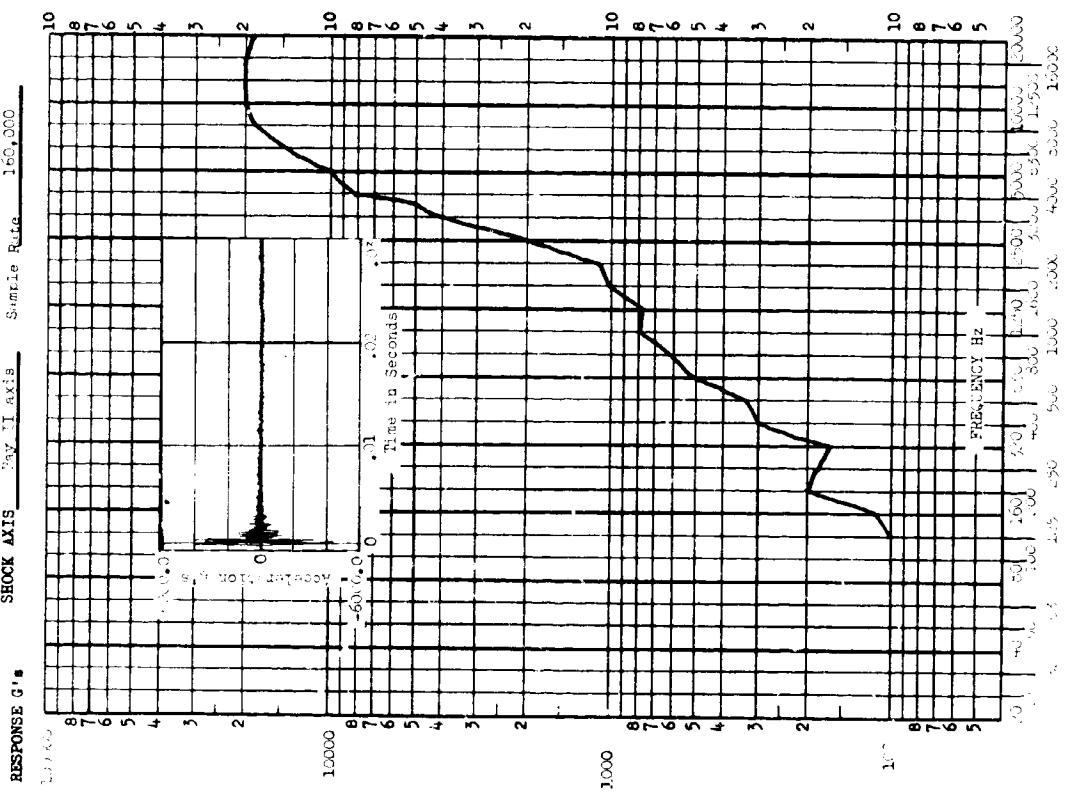


FIGURE IV.B.4-7

TEST ITEM M67-1 ** FIPS 1
 ACCEL. NO. MCV# TEST DATE
 SHOCK AXIS Ray II axis Sample Rate 160,000



TEST ITEM M67-1 ** FIPS 1
 ACCEL. NO. MCV# TEST DATE
 SHOCK AXIS Ray II axis Sample Rate 160,000

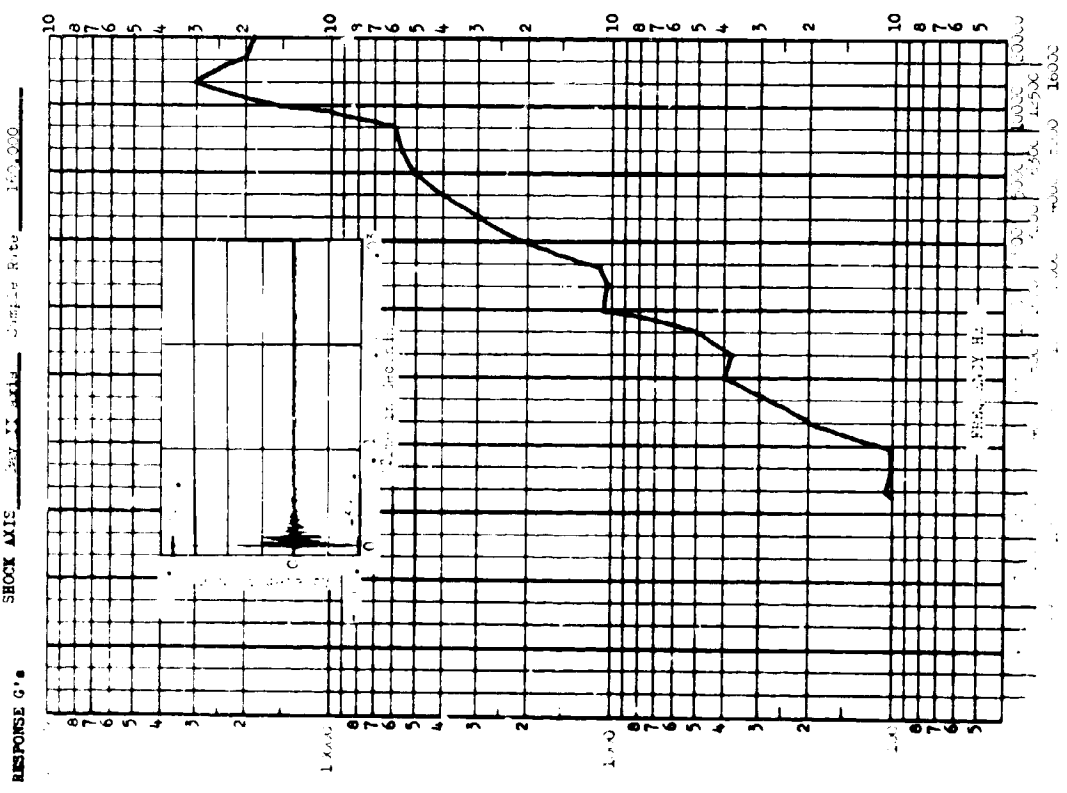


FIGURE IV.B.4-8

SECTION IV.B.5

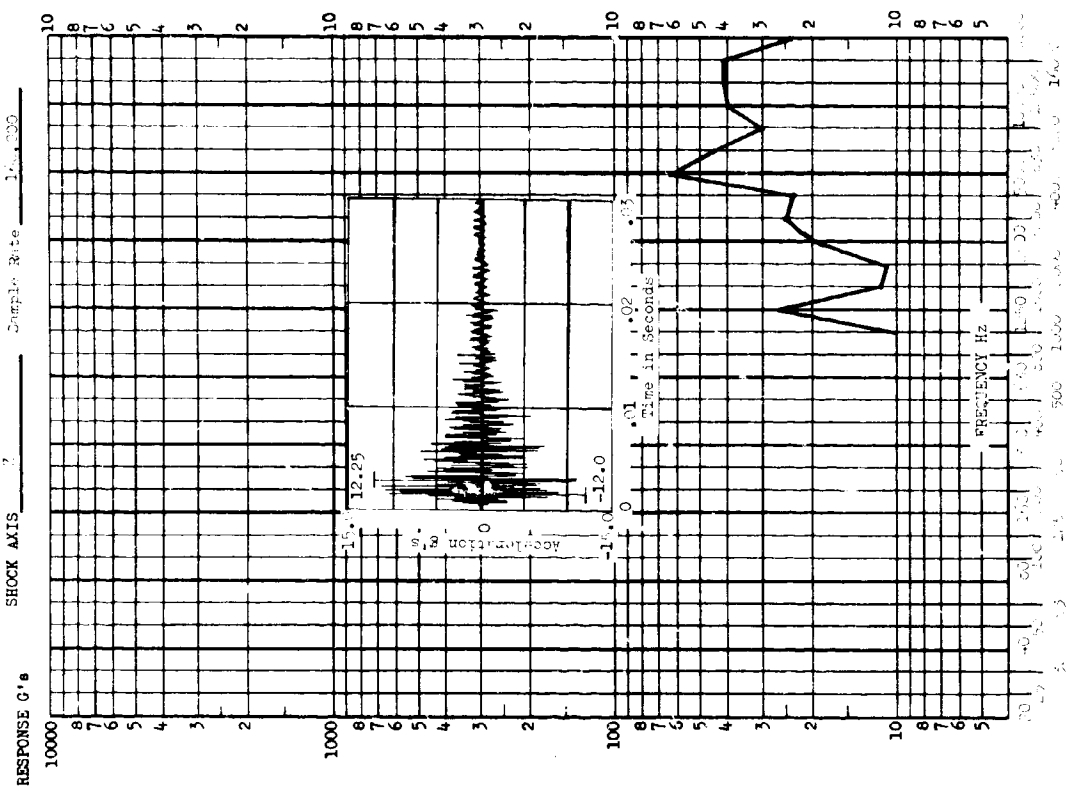
M67-1 PIPS 2 EVENT

One test of the post injection propulsion system pyro 2 was conducted for the M67-1. The pyrotechnic employed was a pin-pulling device. Seventeen shock spectra for this event are presented along with their corresponding time histories in Figures IV.B.5-1 through IV.B.5-9 as indexed in Table IV.B.5-1.

TABLE IV.B.5-1
INDEX OF DATA LOCATIONS

<u>Accelerometer Number</u>	<u>Figure Number</u>
B3, F4	IV.B.5-1
F3, F4A	IV.B.5-2
B2A, B3A	IV.B.5-3
BB1, BB2	IV.B.5-4
BB3, SS4A	IV.B.5-5
SS5A, SS6A	IV.B.5-6
IC4, 3T3	IV.B.5-7
MCV1, MCV4	IV.B.5-8
MC4	IV.B.5-9

TEST ITEM M1-2 11813
 SERIAL NO. 7 TEST DATE _____
 SHOCK AXIS Z Sample Rate 16,000



TEST ITEM M1-2 11813
 SERIAL NO. 7 TEST DATE _____
 SHOCK AXIS Z Sample Rate 16,000

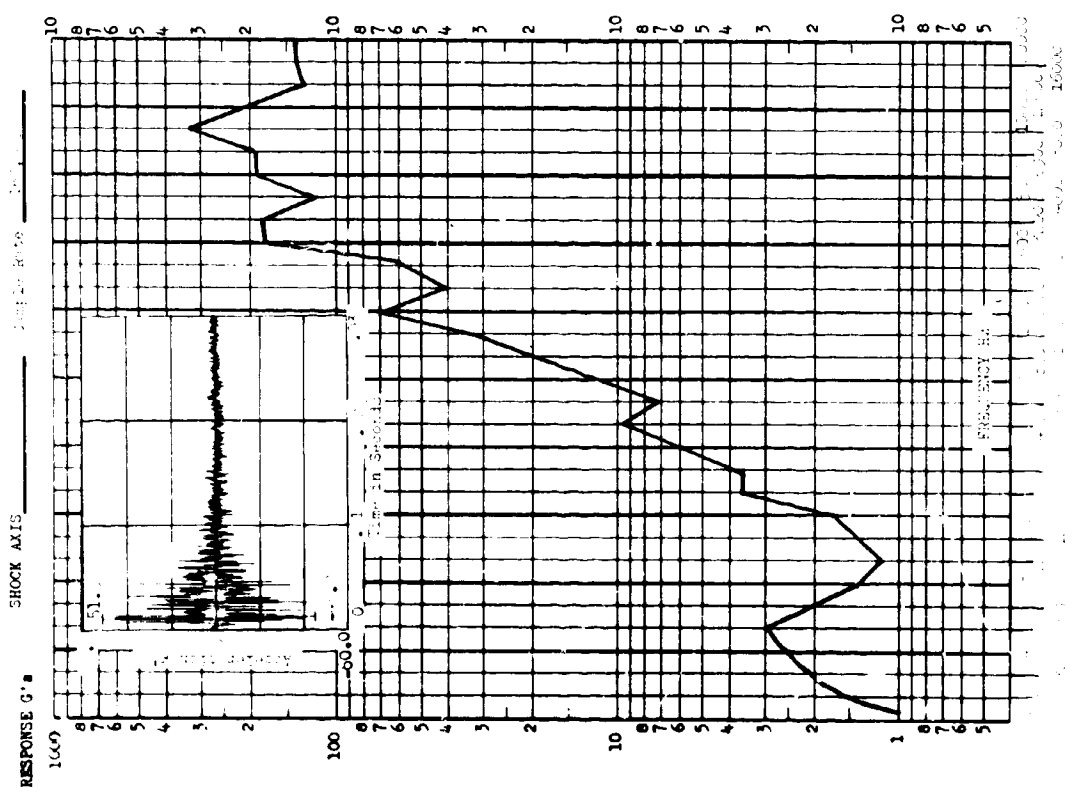
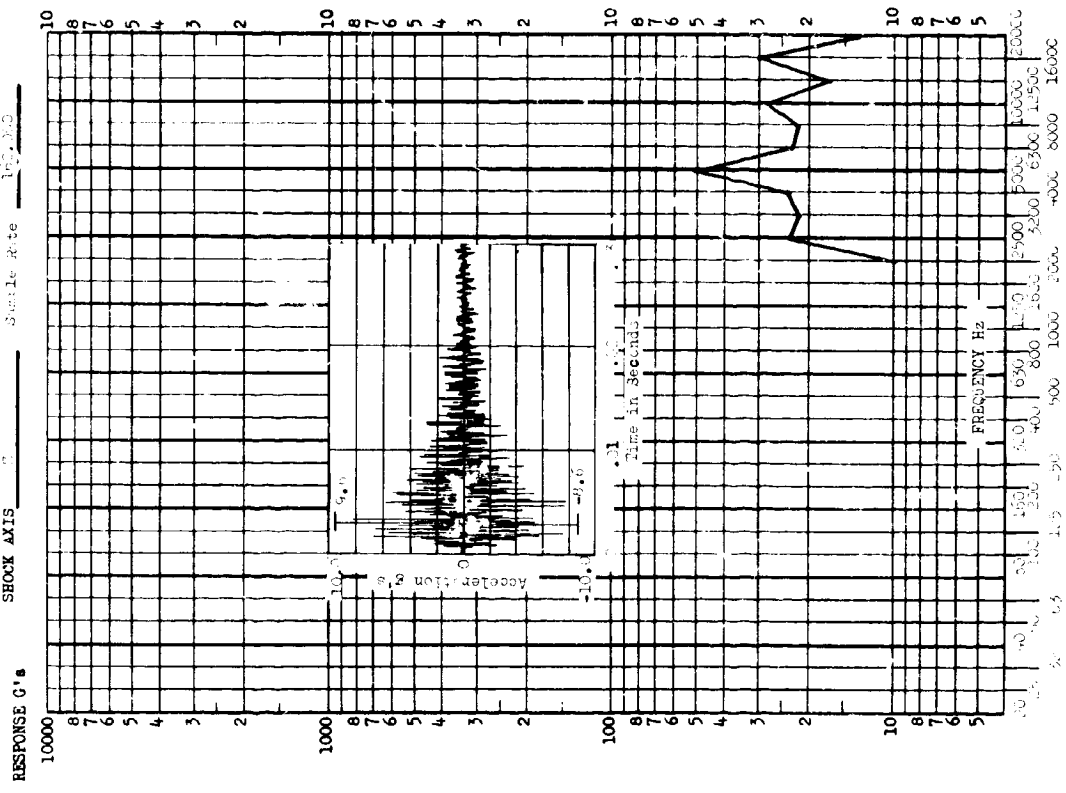


FIGURE IV.B.5-1

TEST ITEM: M-11 ** PITS 2
 ACCEL. NO.: P-1
 SHOCK AXIS: X
 TEST DATE: 10/1/50
 Shuttle Rate: 100 D.O.D.



TEST ITEM: M-11 ** PITS 2
 ACCEL. NO.: P-1
 SHOCK AXIS: X
 TEST DATE: 10/1/50
 Shuttle Rate: 100 D.O.D.

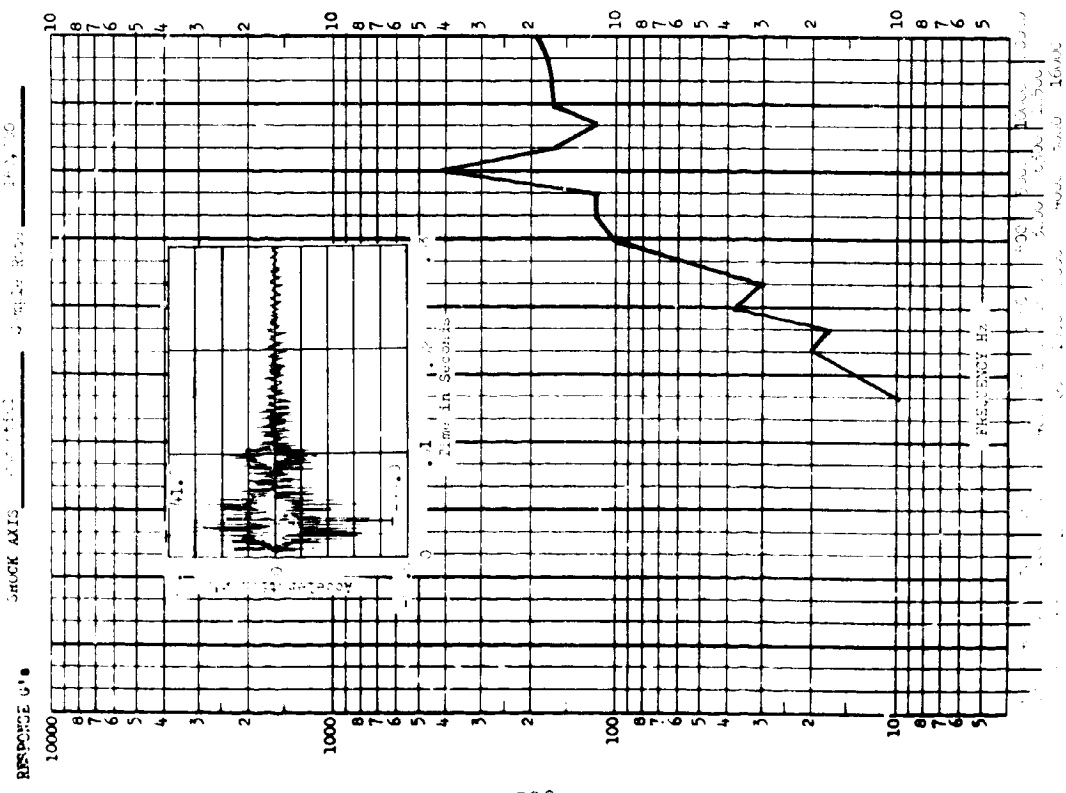
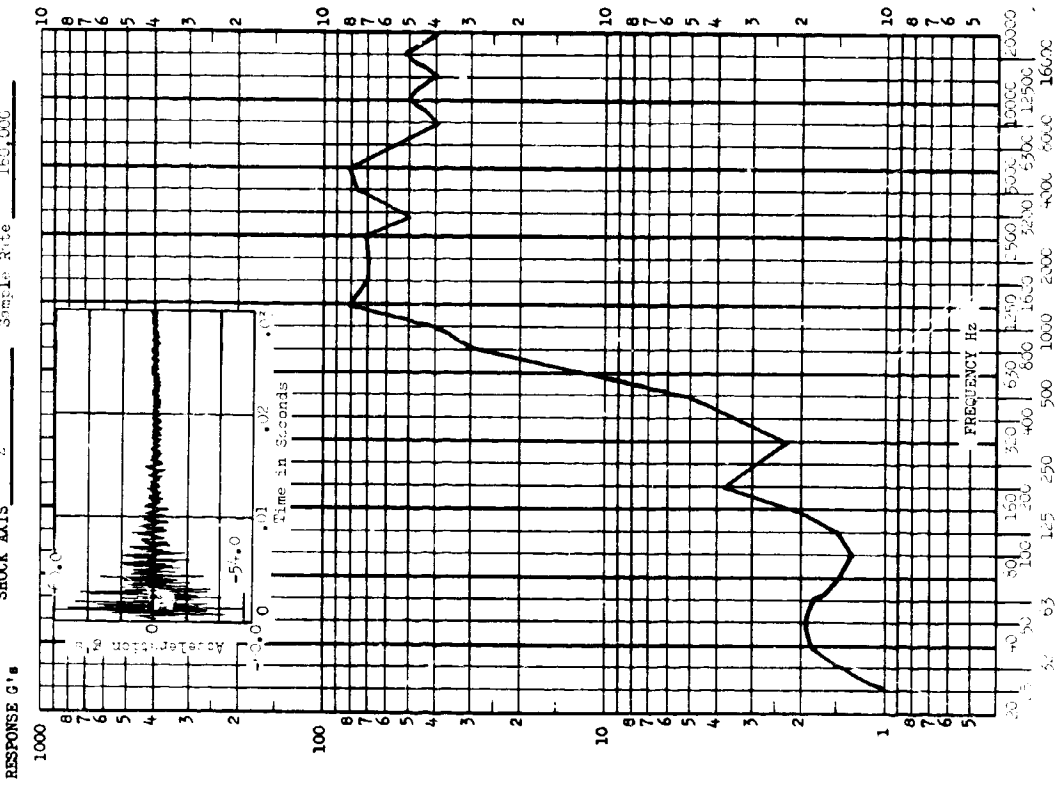


FIGURE IV.B.5-2

TEST ITEM 167-1 ** PINS 2
 ACCEL. NO. 574 TEST DATE
 SHOCK AXIS Z Sample Rate 160,000



TEST ITEM 167-1 ** PINS 2
 ACCEL. NO. 574 TEST DATE
 SHOCK AXIS Z Sample Rate 160,000

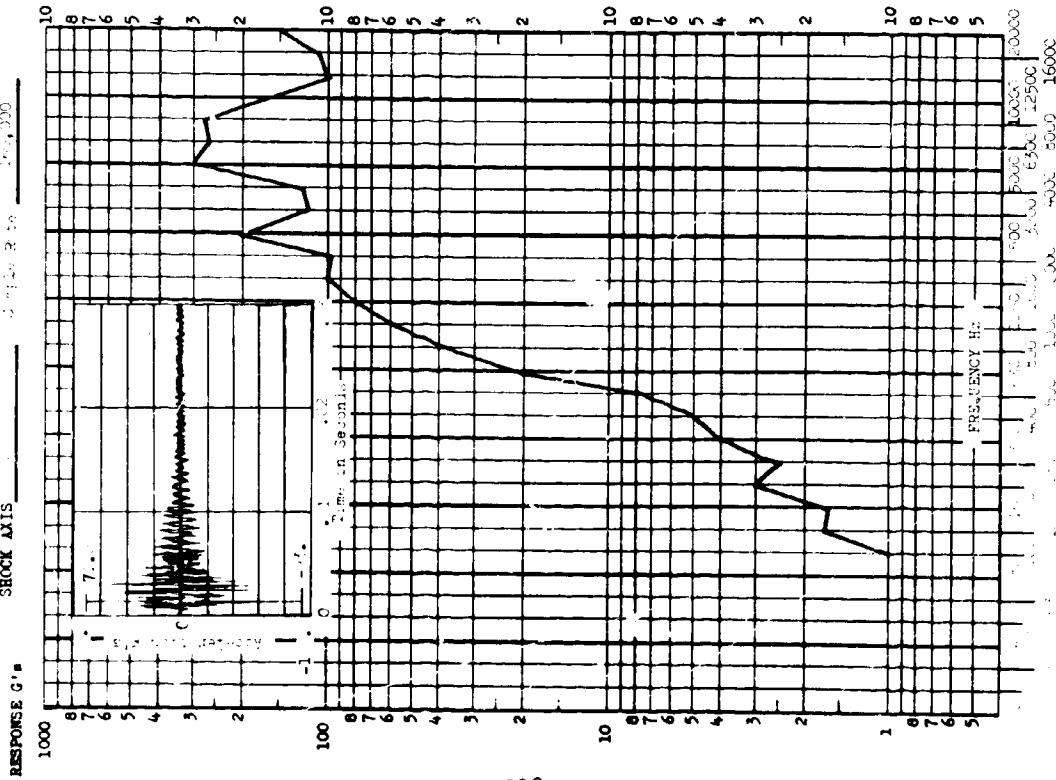
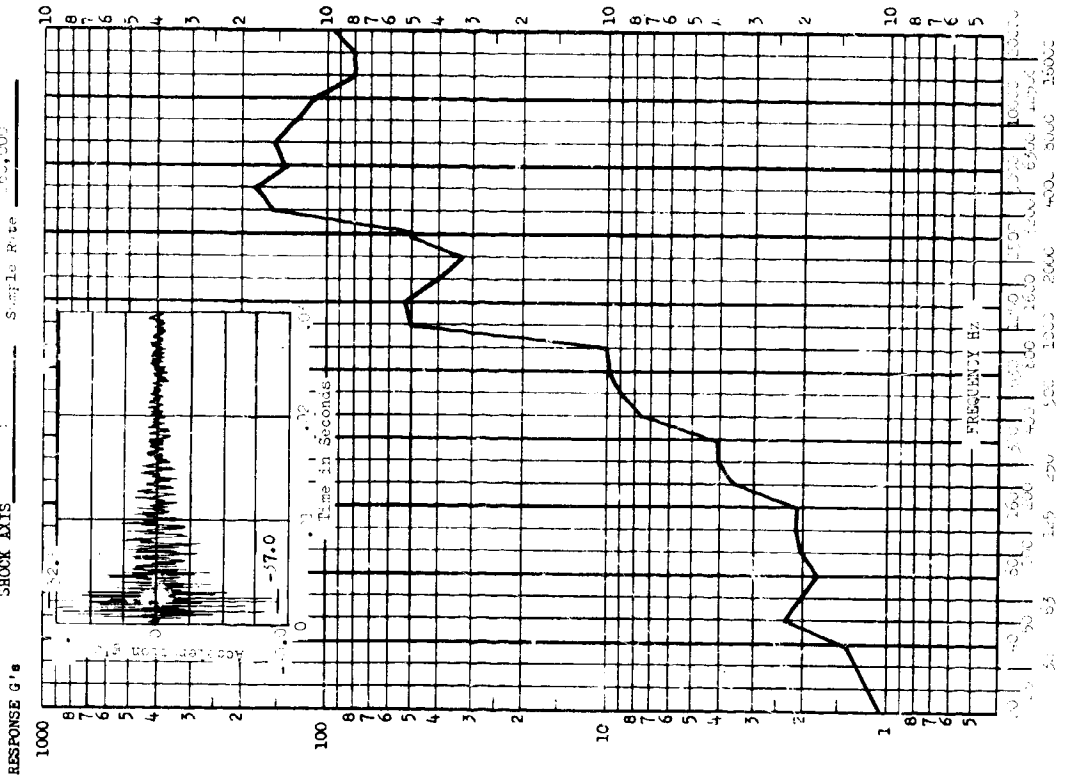


FIGURE IV.B.5-3

TEST ITEM: W7-1 ** P173 2
 ACCEL. NO.: 100
 TEST DATE: 160,300
 SHOCK AXIS: Y Sample Rate



TEST ITEM: W7-1 ** P173 2
 ACCEL. NO.: 100
 TEST DATE: 160,300
 SHOCK AXIS: Y Sample Rate

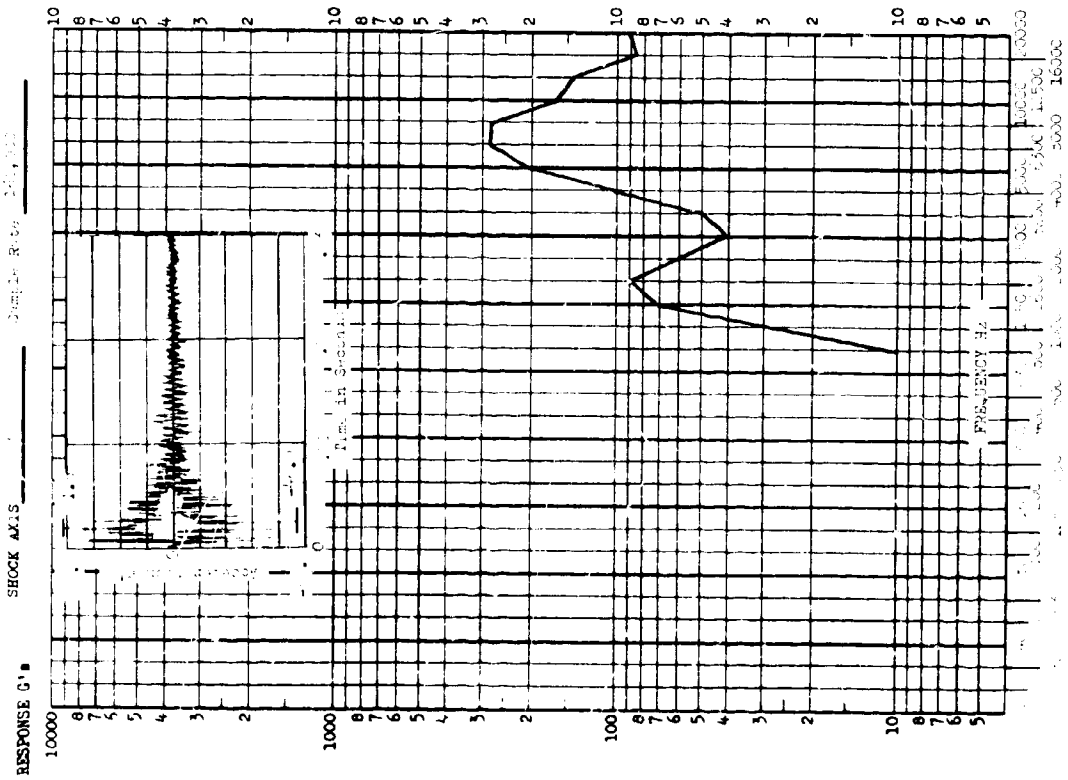


FIGURE IV.B.5-4

TEST ITEM: 100-111-1110
 A.C.E.L. NO.: 100-111-1110
 SHOCK AXIS: 5 mg/Sec Rate 1000 G

TEST ITEM: 100-111-1110
 A.C.E.L. NO.: 100-111-1110
 SHOCK AXIS: 5 mg/Sec Rate 1000 G

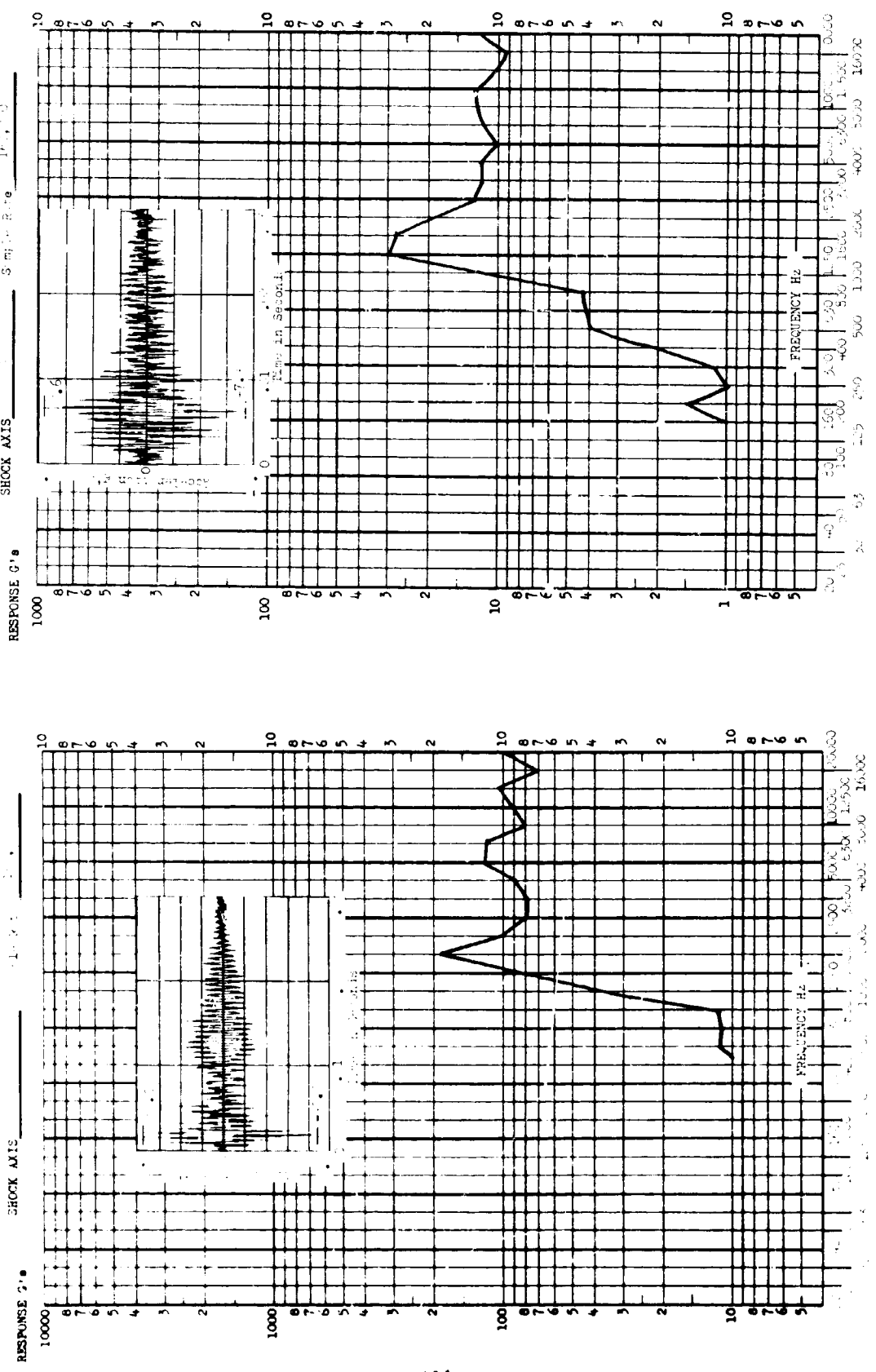
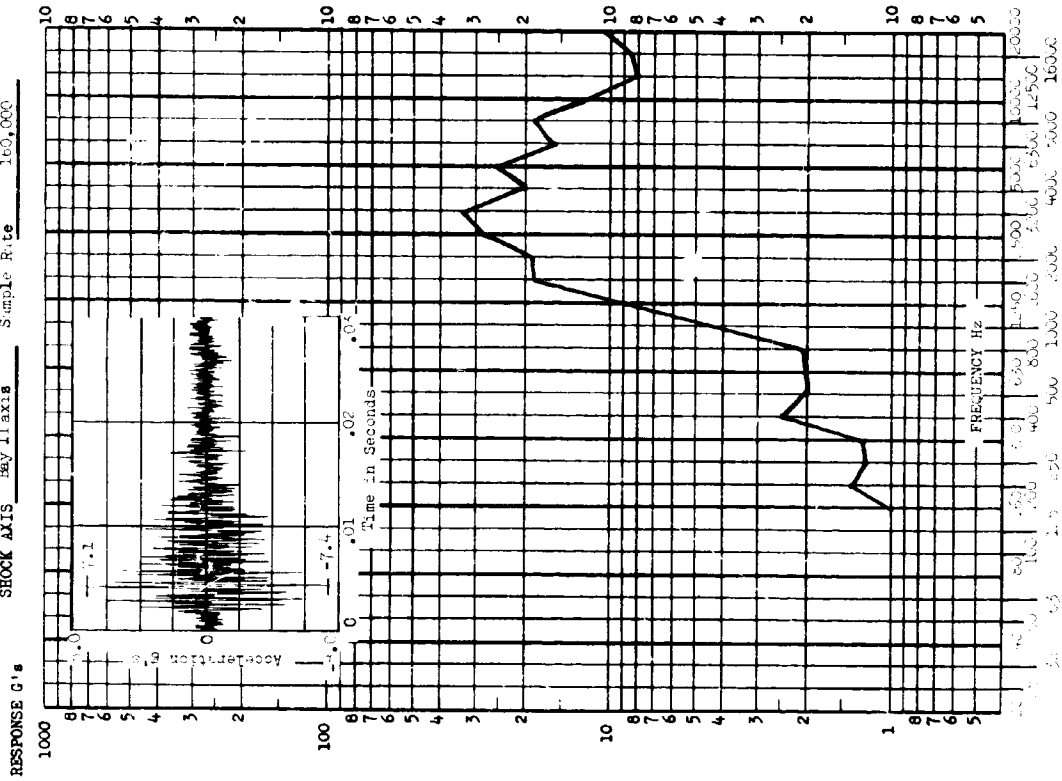


FIGURE IV.B.5-5

TEST ITEM W-7-1 ** P1P2 2
 ACCEL. NO. 386 TEST DATE _____
 SHOCK AXIS Bay II Axis Sample Rate 160,000



TEST ITEM W-7-1 ** P1P2 2
 ACCEL. NO. 386 TEST DATE _____
 SHOCK AXIS Bay II Axis Sample Rate 160,000

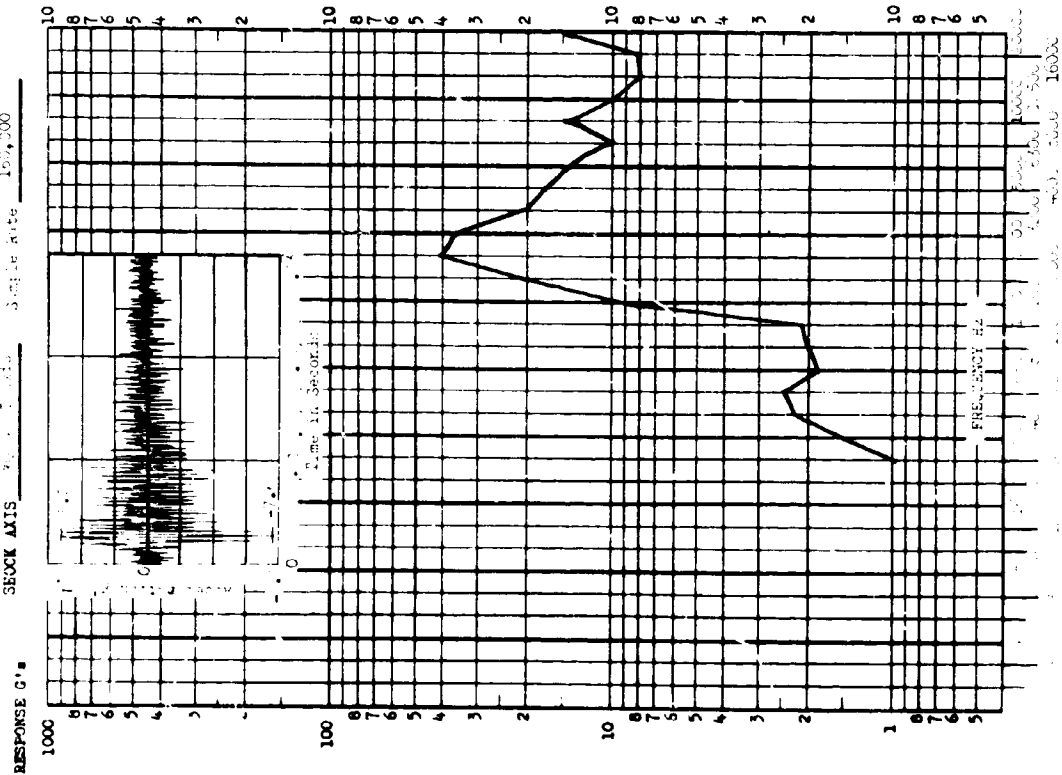
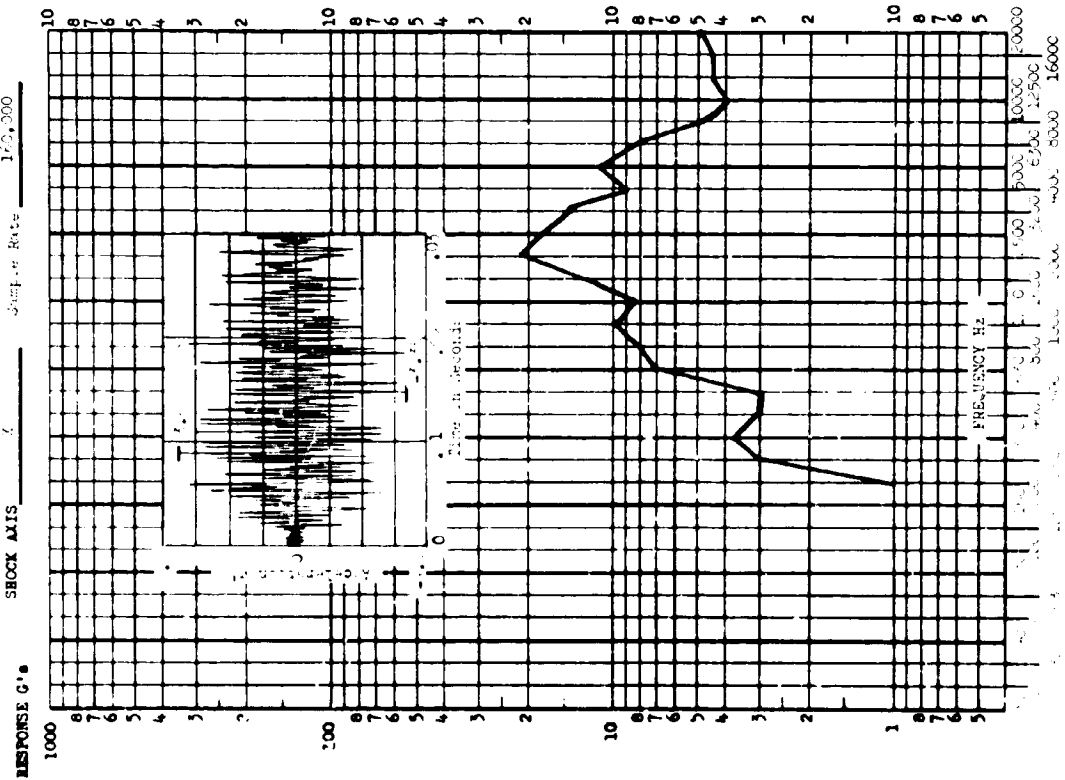


FIGURE IV.B.5-6

TEST ITEM: M-1 ** RIPS 2
 ACCEL. NO.: 104 TEST DATE:
 SHOCK AXIS: Y Sample Rate: 160,000



TEST ITEM: M-1 ** RIPS 2
 ACCEL. NO.: 313 TEST DATE:
 SHOCK AXIS: Y Sample Rate: 160,000

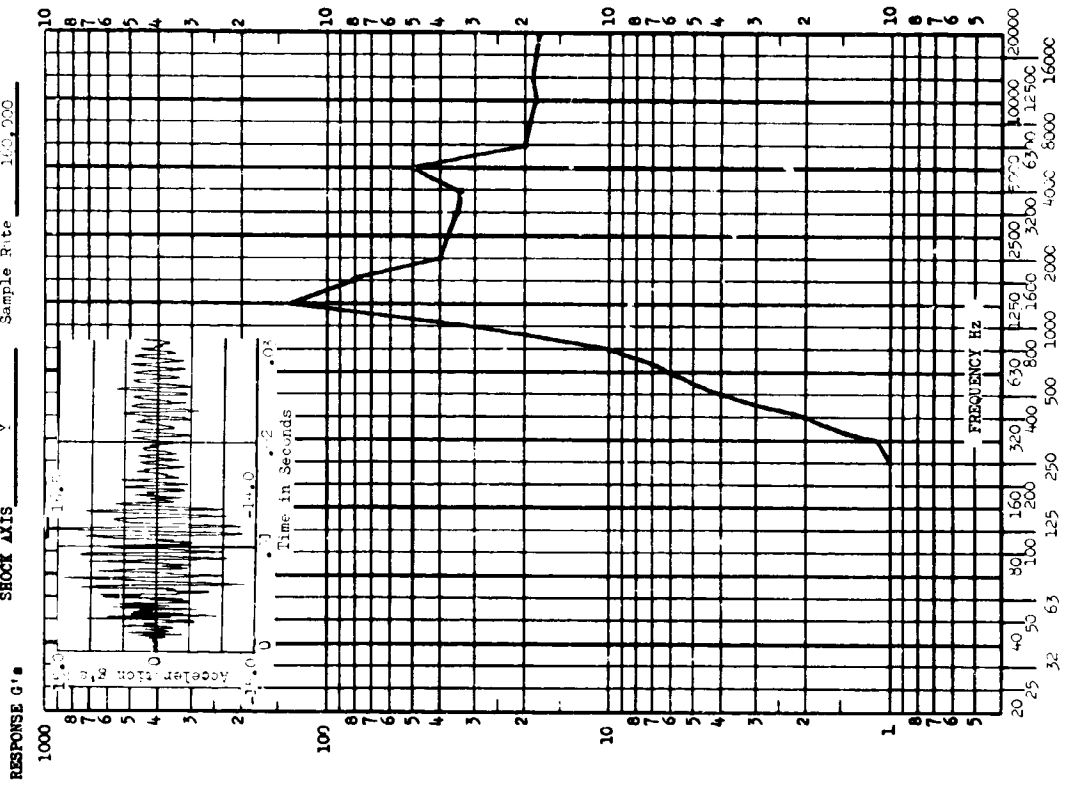
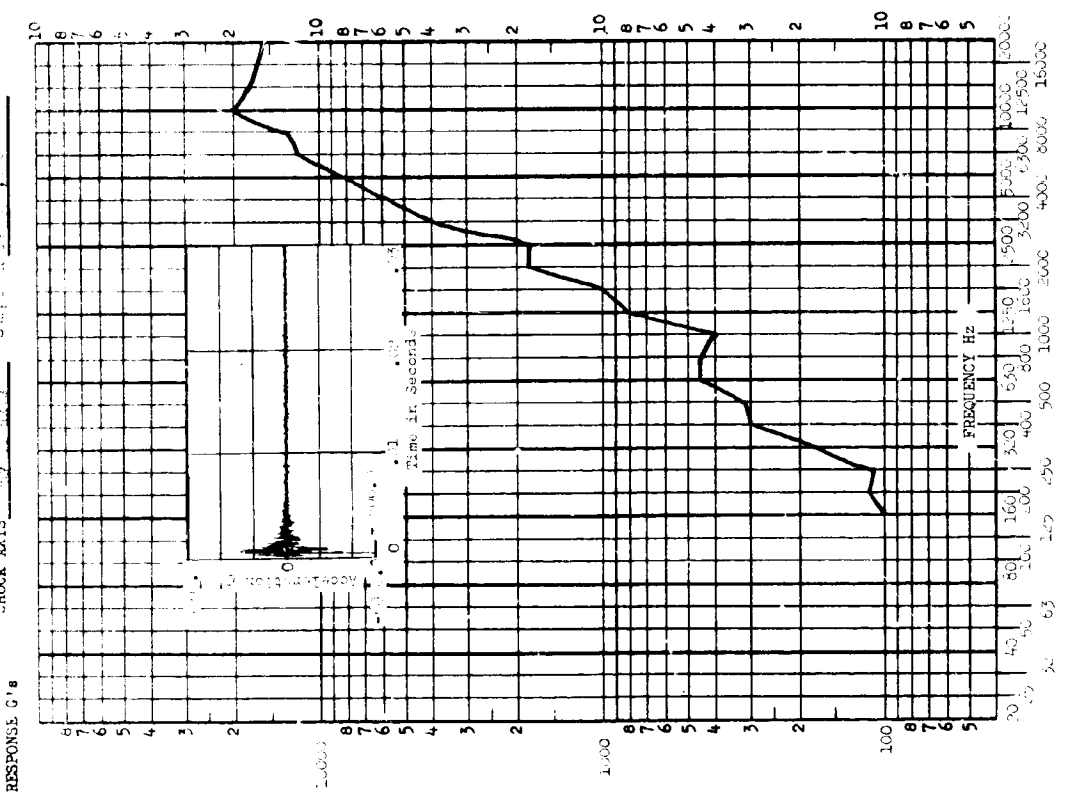


FIGURE IV.B.5-7

TEST ITEM _____ TEST DATE _____
 APPROX. NO. _____
 SHOCK AXIS _____



TEST ITEM _____ TEST DATE _____
 APPROX. NO. _____
 SHOCK AXIS _____

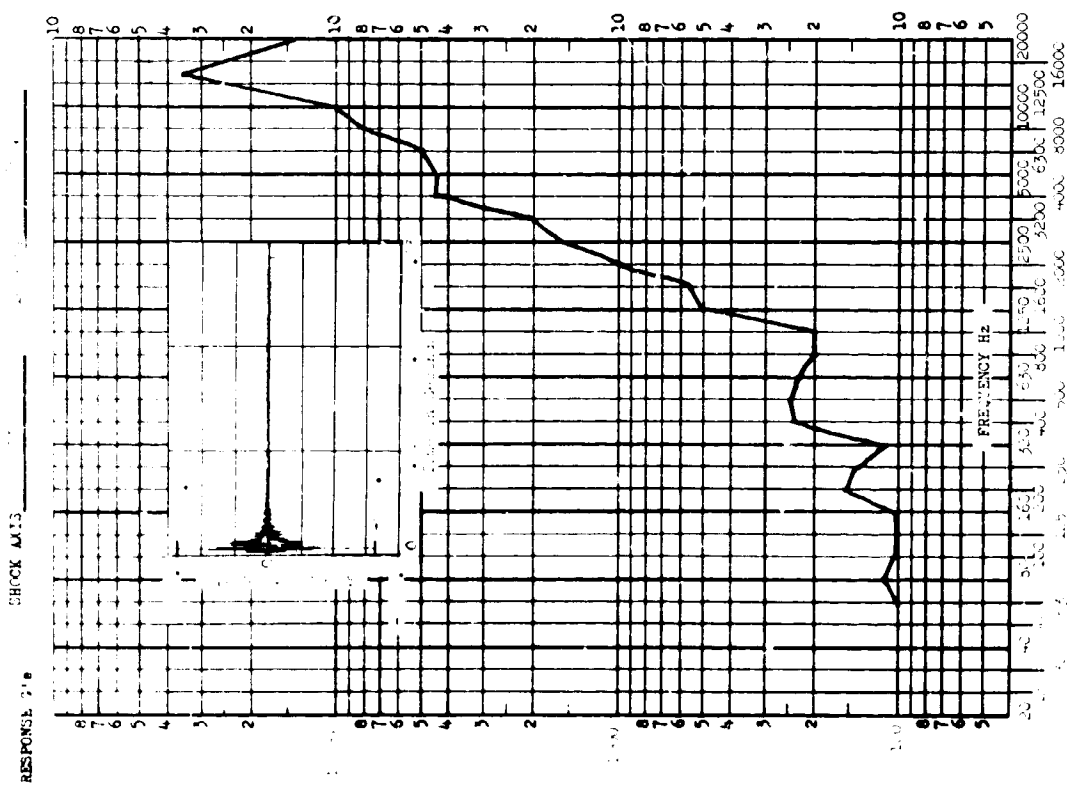


FIGURE IV.B-5-8

TEST ITEM _____ TEST DATE _____
 A/C NO. _____ SHOCK AXIS _____
 RESPONSE G's _____

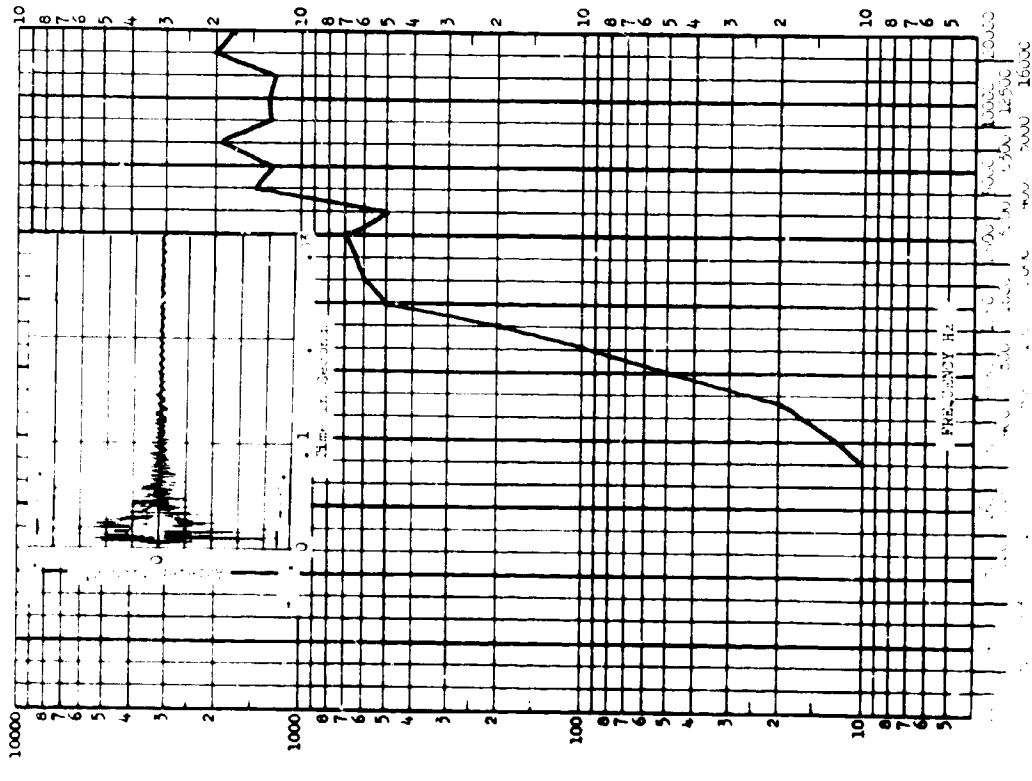


FIGURE IV.8.5-9

SECTION IV.B.6

M67 APAC EVENT

One firing of the high-gain antenna pointing angle change pyrotechnic was conducted on both M67-1 and M67-2. The pyrotechnic employed was a pin-pulling device. Fifteen shock spectra of this event are presented along with their corresponding time histories in Figures IV.B.6-1 through IV.B.6-8 as indexed in Table IV.B.6-1

TABLE IV.B.6-1

<u>Accelerometer Numbers</u>	<u>Configuration (s)</u>	<u>Figure Number</u>
B3, F4	M67-2	IV.B.6-1
F1	M67-1, -2	IV.B.6-2
F3	M67-1, -2	IV.B.6-3
F4A	M67-2	IV.B.6-4
B4, 3T3	M67-1	IV.B.6-5
B5, B6	M67-1	IV.B.6-6
SS4A, SS5A	M67-1	IV.B.6-7
SS6A, AS2	M67-1	IV.B.6-8

TEST ITEM _____
 TEST NO. _____ TEST DATE _____
 SHOCK AXIS _____

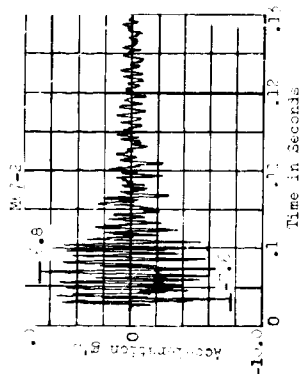
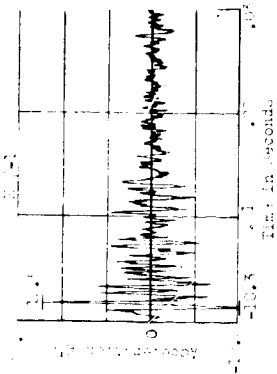
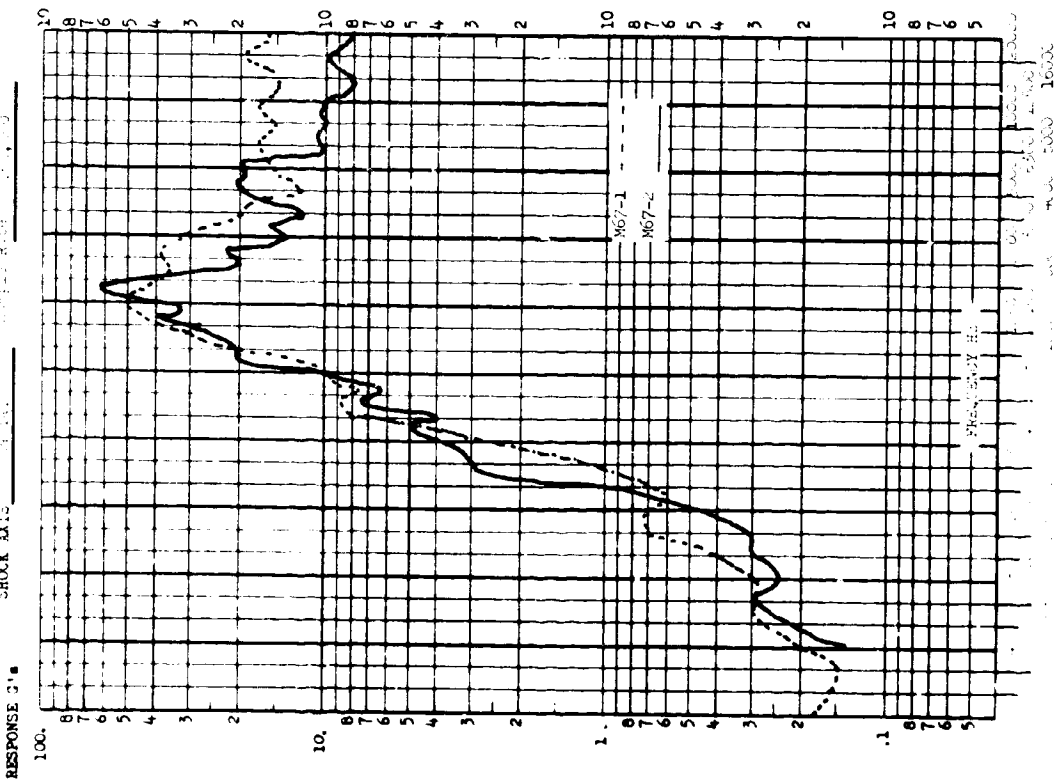


FIGURE IV.B.6-2

TEST ITEM _____
 TEST NO. 87 TEST DATE _____
 SHOCK AXIS TRANSMITTER UNIT NUMBER 166700

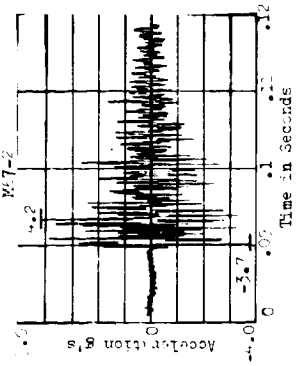
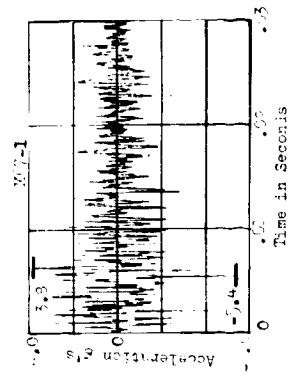
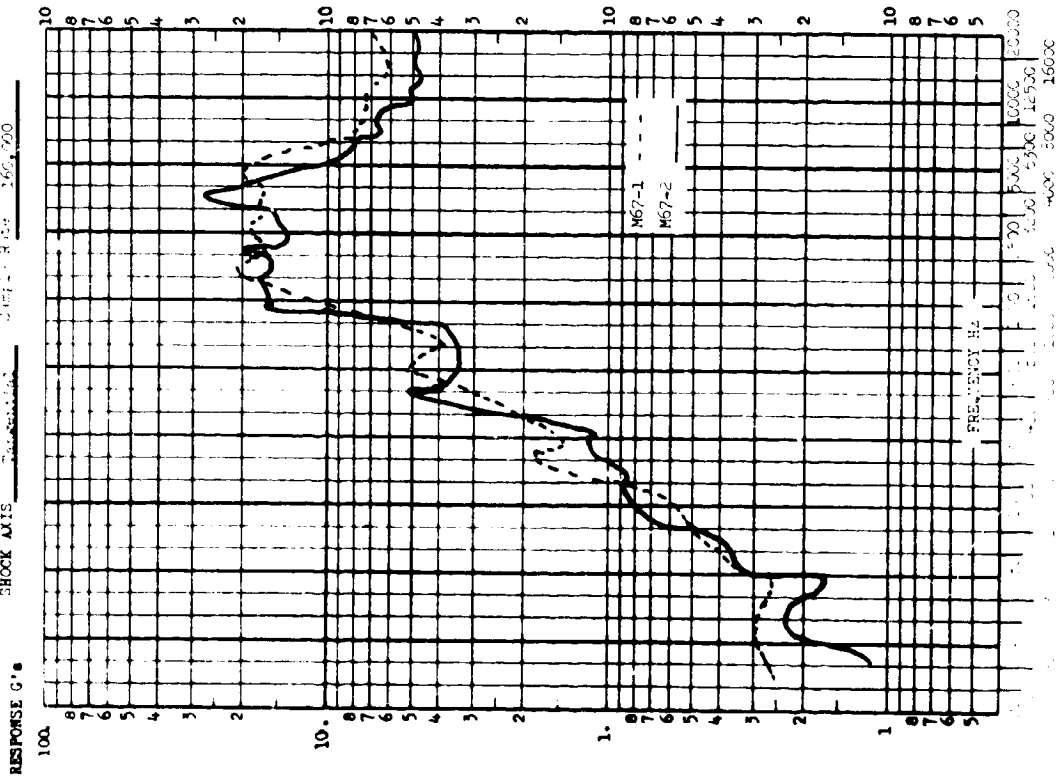


FIGURE IV.B.6-3

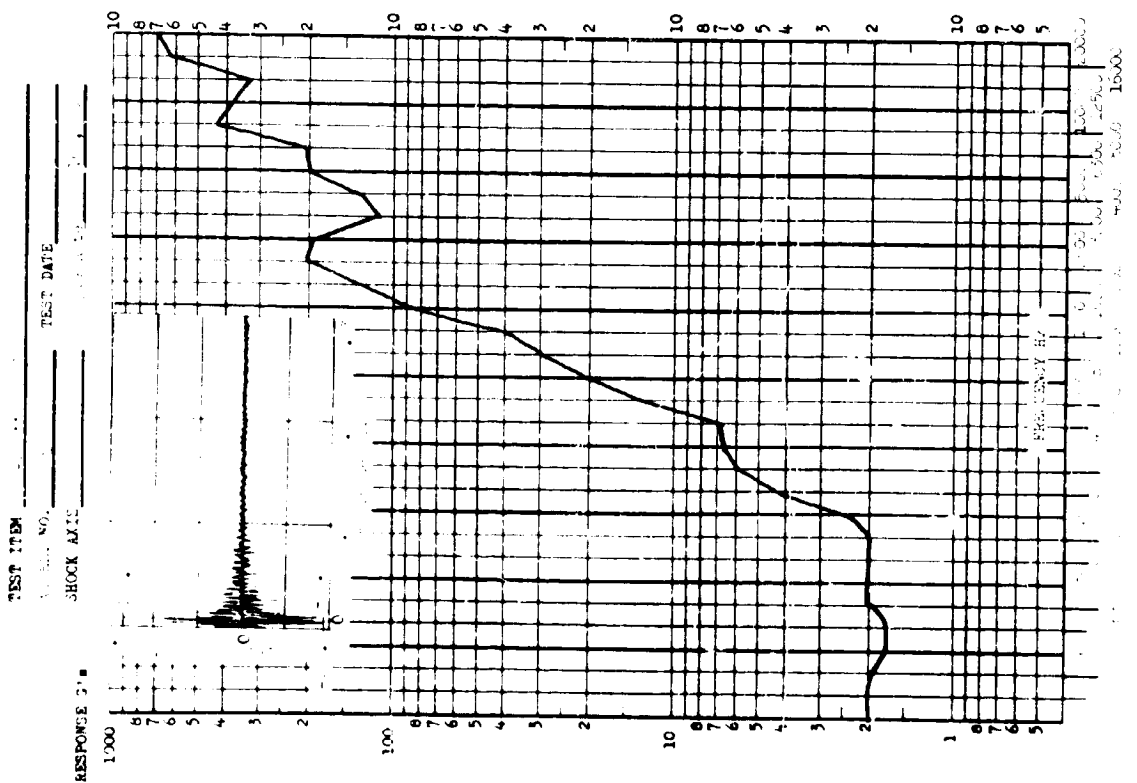
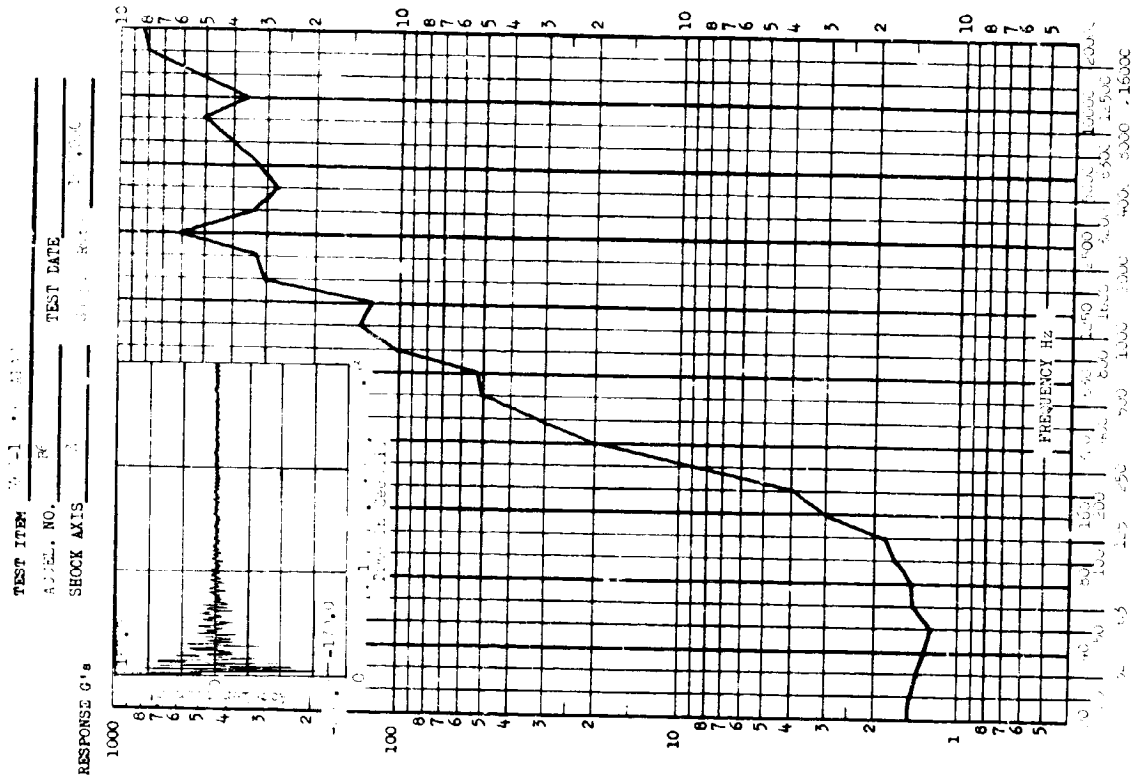
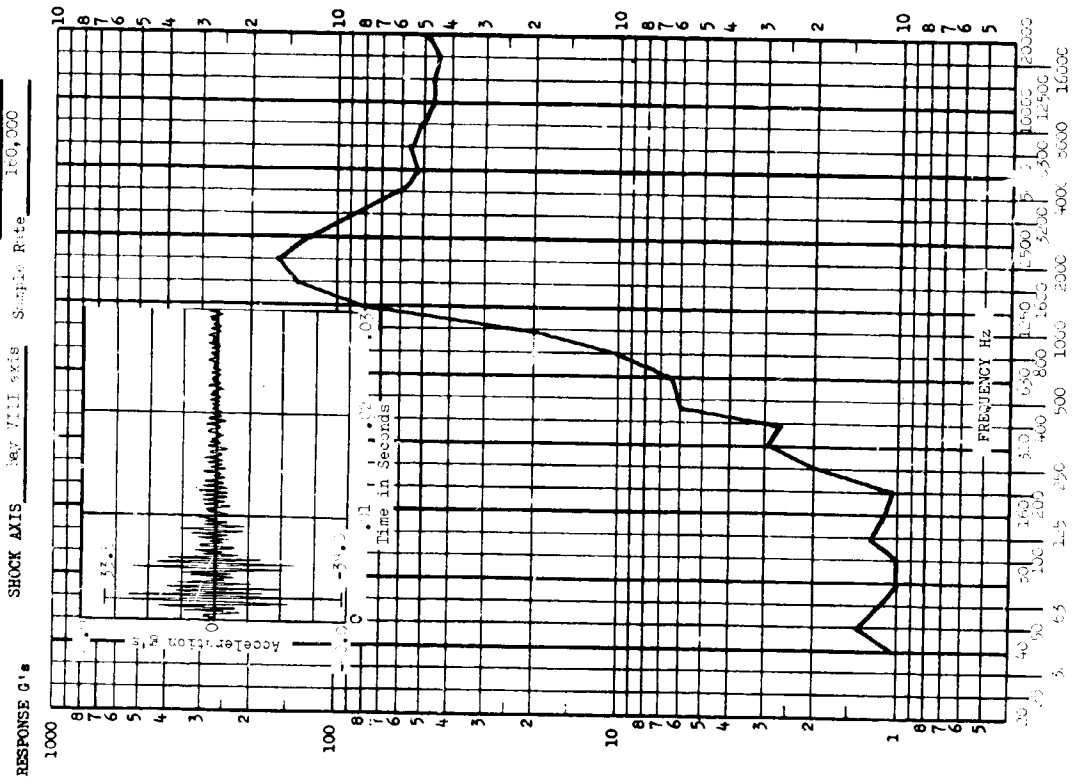


FIGURE IV.B.6-6

TEST ITEM: M-1 ** AFAC
 ACCEL. NO.: 0354
 SHOCK AXIS: Xp-Yp-Zp
 TEST DATE: _____
 SAMPLE RATE: 100,000



TEST ITEM: _____
 ACCEL. NO.: _____
 SHOCK AXIS: _____
 TEST DATE: _____
 SAMPLE RATE: _____

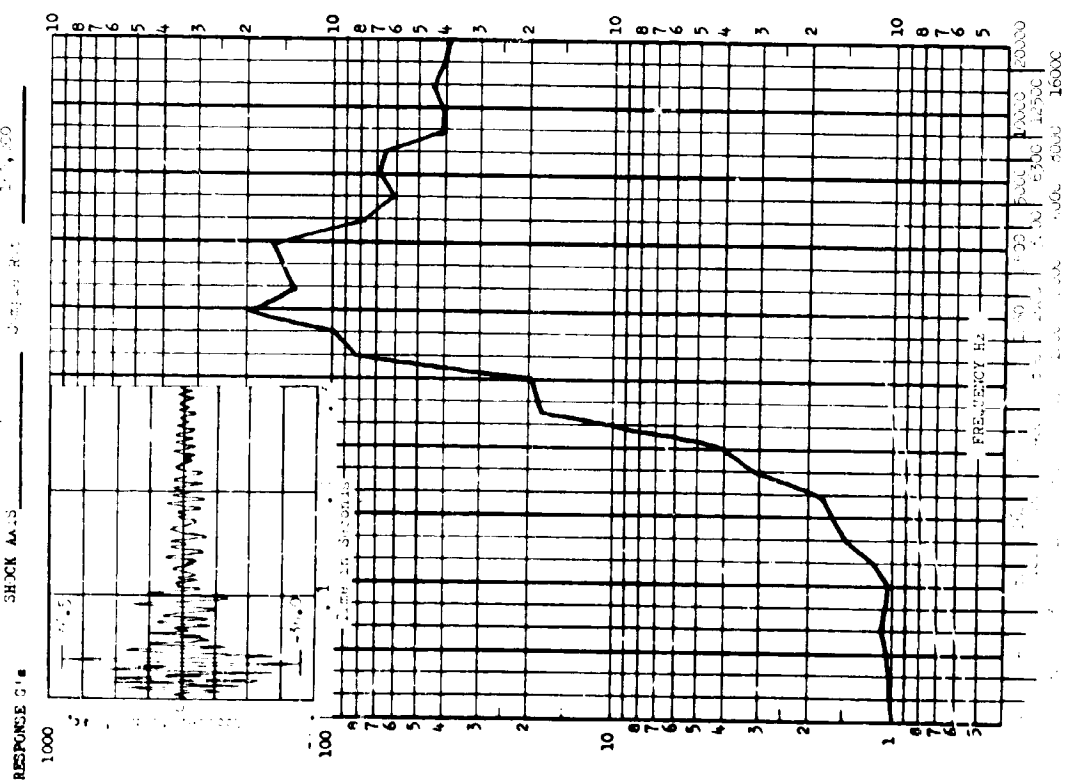
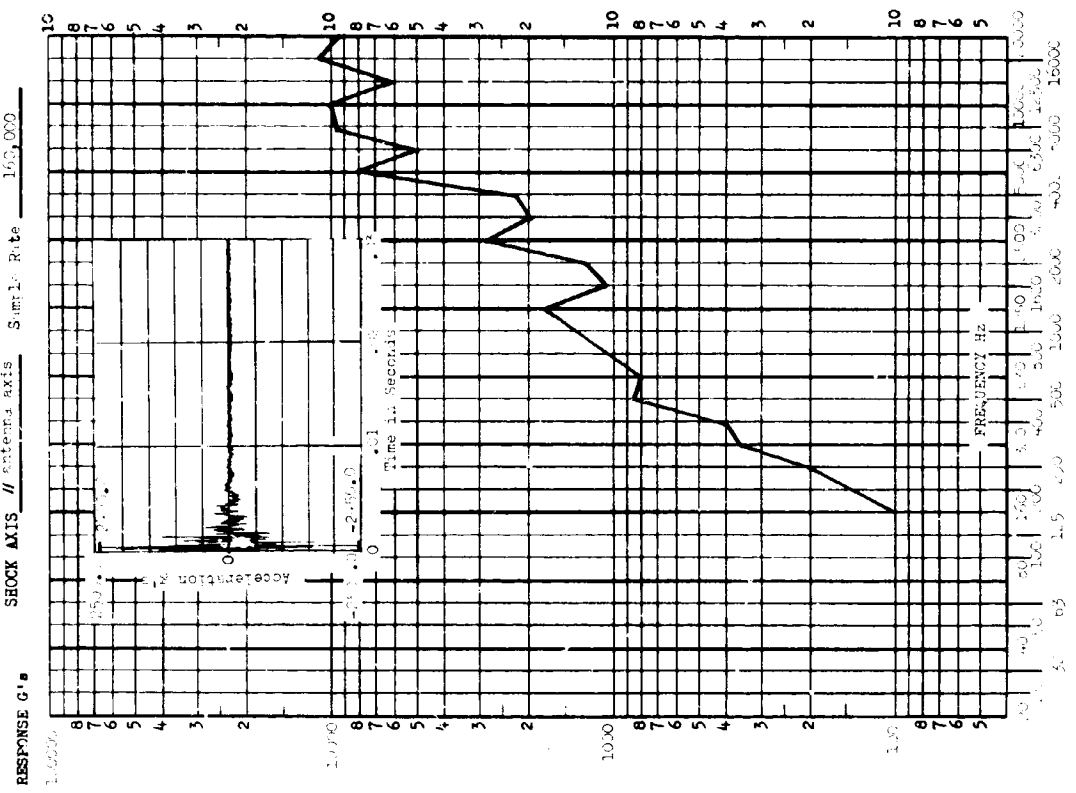


FIGURE IV.B.6-7

TEST ITEM WV-1 ** APAC
 ACCEL. NO. A32 TEST DATE _____
 SHOCK AXIS // vertical axis Smt 2: Rate 16G/000



TEST ITEM WV-1 ** APAC
 ACCEL. NO. A32 TEST DATE _____
 SHOCK AXIS // vertical axis Smt 2: Rate 16G/000

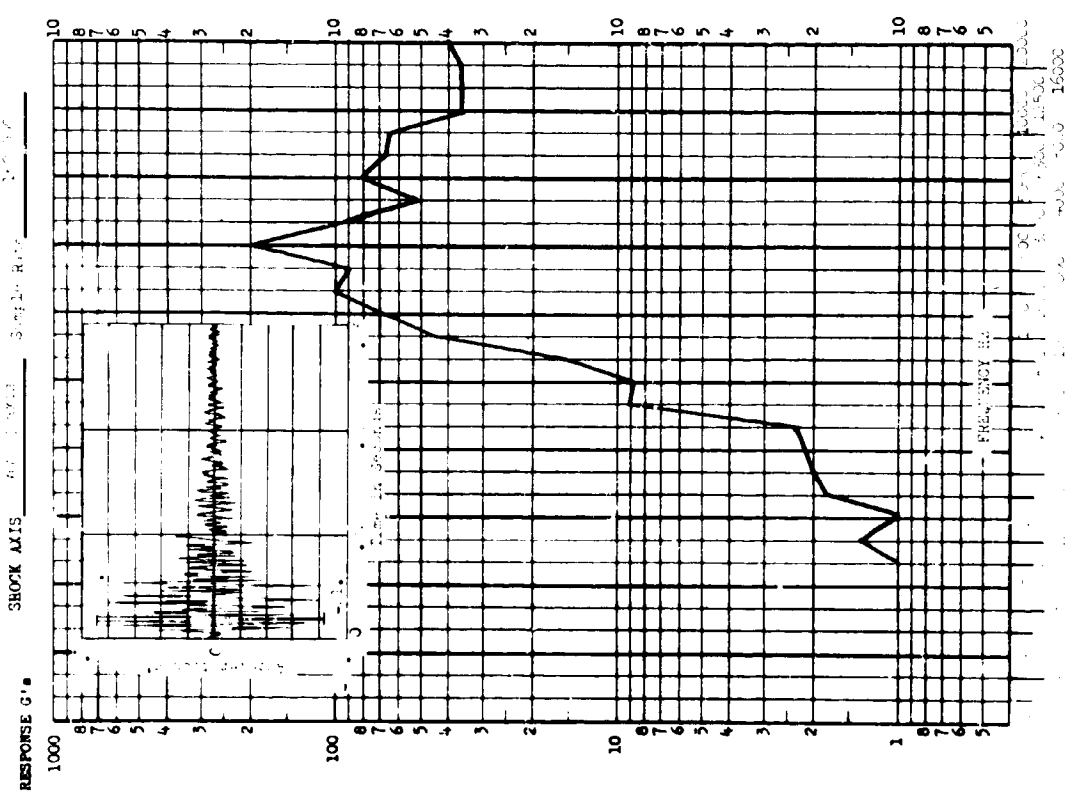


FIGURE IV.B.6-8

SECTION IV.B.7

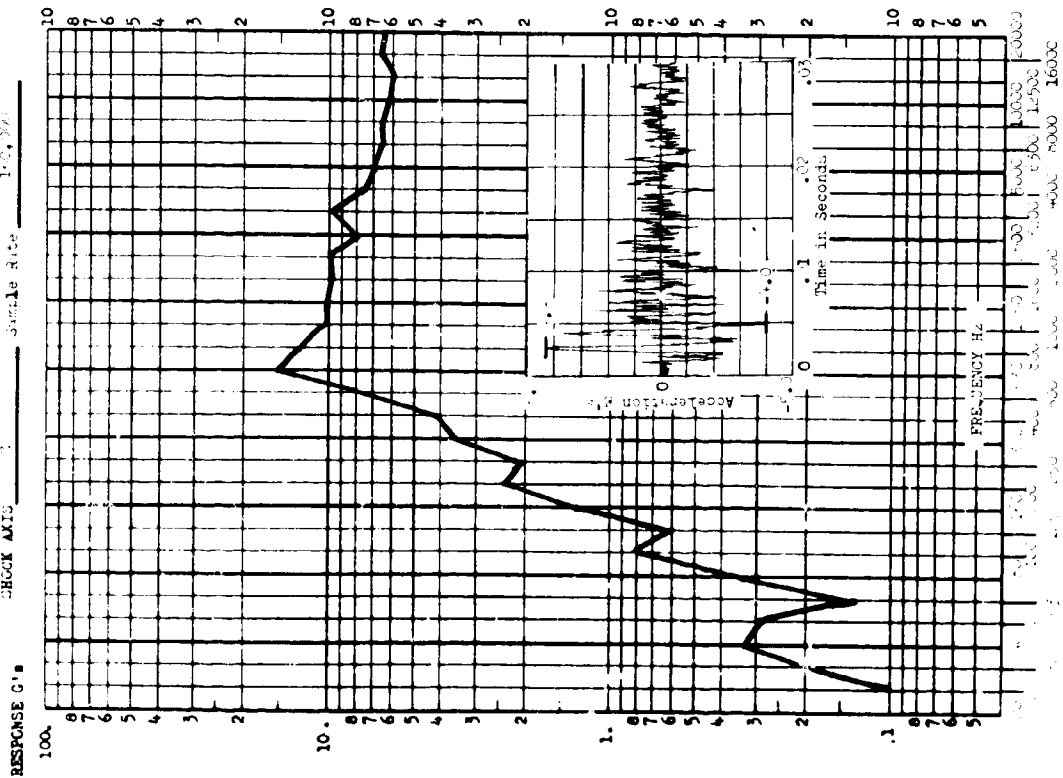
M67-1 UMBILICAL DOOR SLAM EVENT

Two umbilical door slam tests were conducted on the M67-1 configuration. The spring loaded umbilical door in the LMSC shroud was opened fully and allowed to slam shut. Although this was not a pyrotechnic event, it was considered important to ascertain the mechanical shock levels produced in the Mariner vehicle due to the door slam event. Seventeen shock spectra envelopes of this event are presented along with typical time histories as Figures IV.B.7-1 through IV.B.7-9 as indexed in Table IV.B.7-1.

TABLE IV.B.7-1
INDEX OF DATA LOCATIONS

<u>Accelerometer Numbers</u>	<u>Figure Number</u>
B3, F4	IV.B.7-1
F1, F3	IV.B.7-2
F4A, B1A	IV.B.7-3
B2A, B3A	IV.B.7-4
BB1, BB2	IV.B.7-5
BB3, AS2	IV.B.7-6
IC4, 3T3	IV.B.7-7
MCV1, MCV4	IV.B.7-8
MC4	IV.B.7-9

TEST ITEM _____
 ACCEL. NO. _____ TEST DATE _____
 SHOCK AXIS _____ Sample Rate 150,000



TEST ITEM _____
 ACCEL. NO. _____ TEST DATE _____
 SHOCK AXIS _____ Sample Rate 150,000

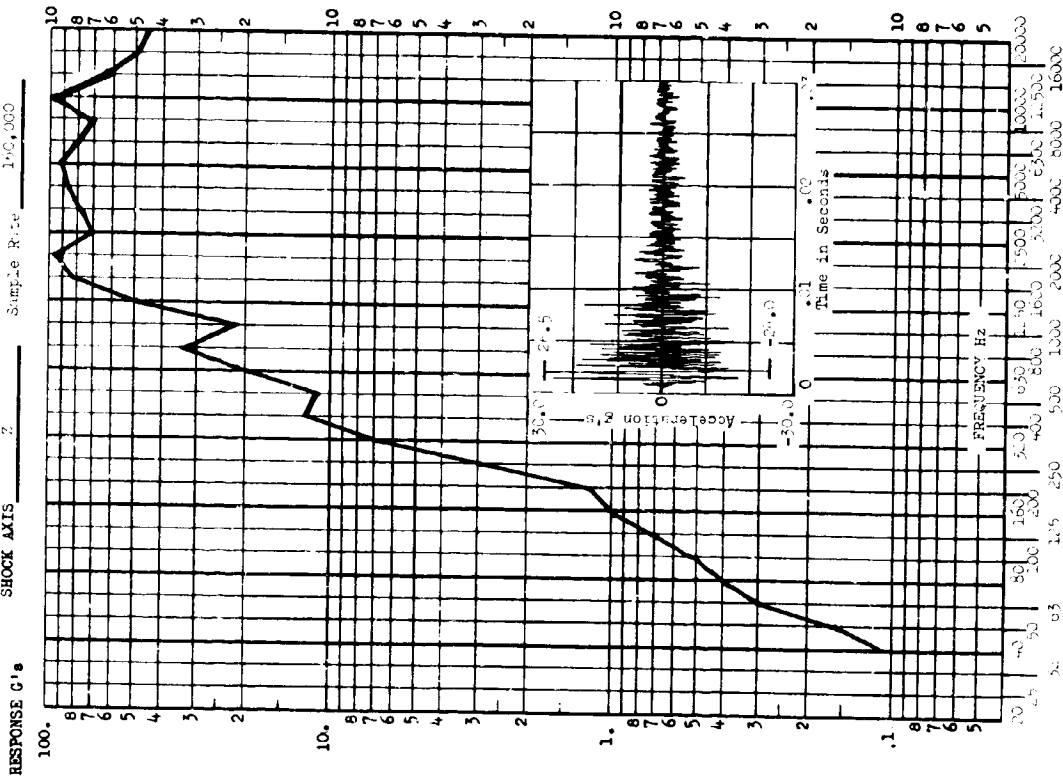


FIGURE IV.B.7-1

TEST ITEM _____
 ADJ. NO. _____
 SHOCK AXIS _____

TEST ITEM _____
 ADJ. NO. _____
 SHOCK AXIS _____

TEST DATE _____
 Sample Rate _____

TEST DATE _____
 Sample Rate _____

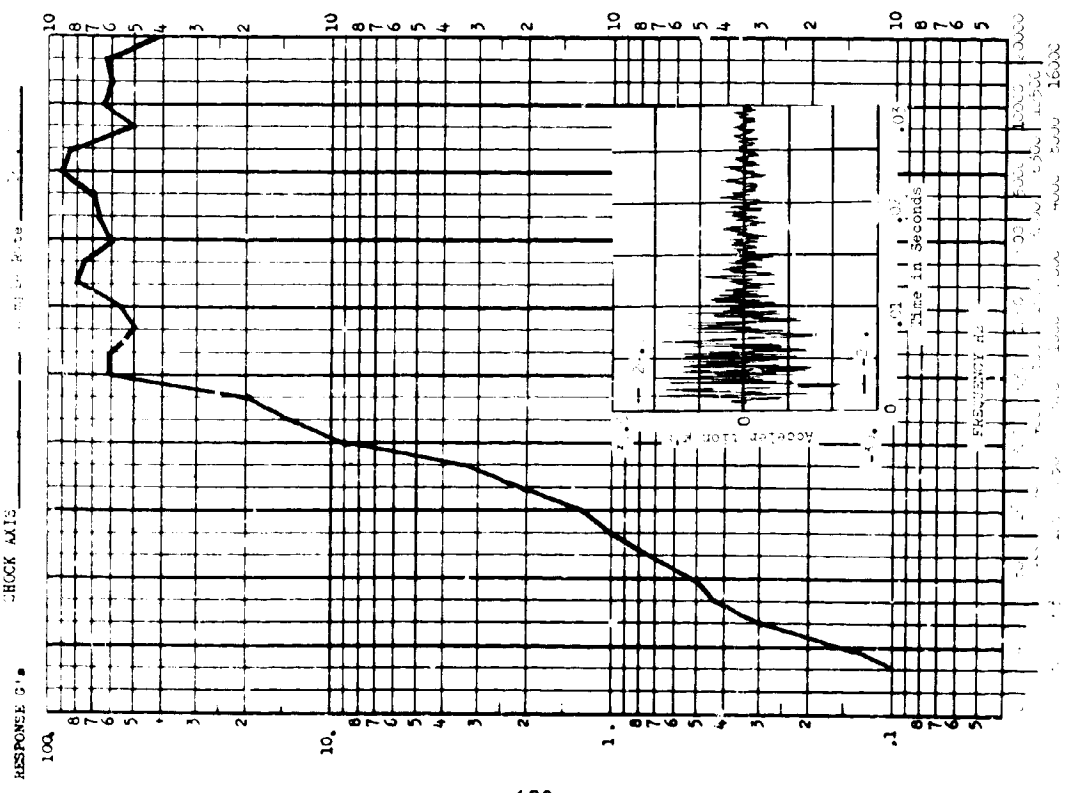
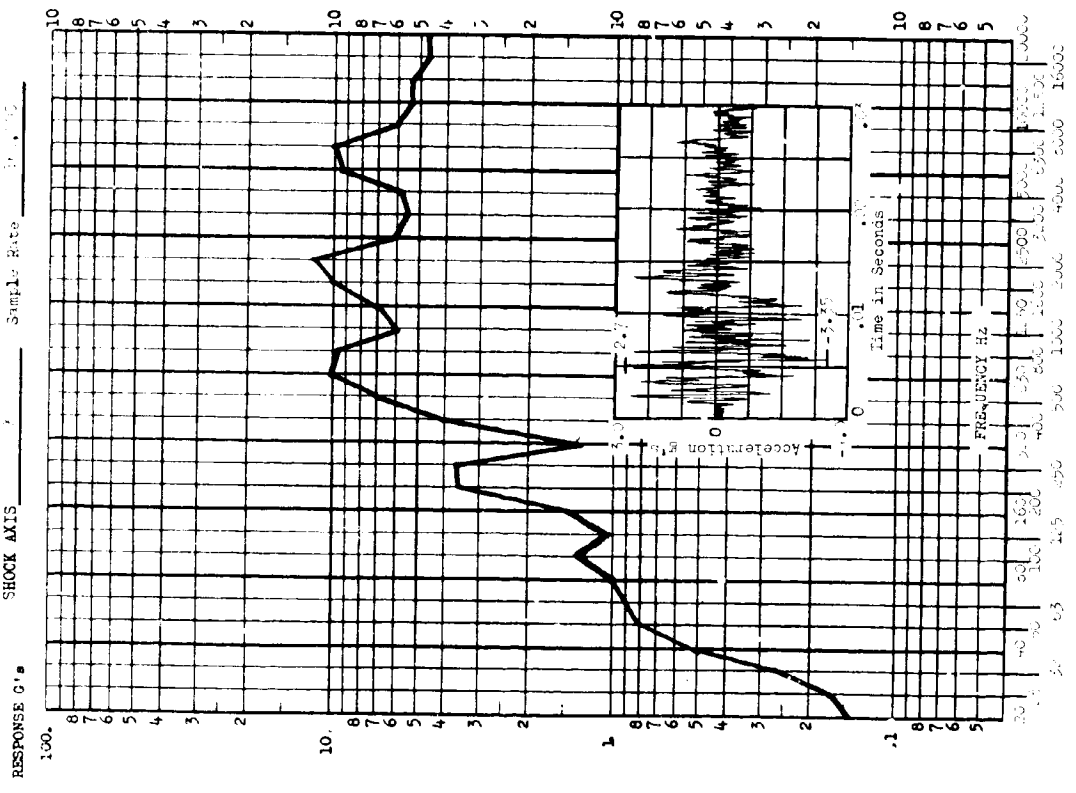
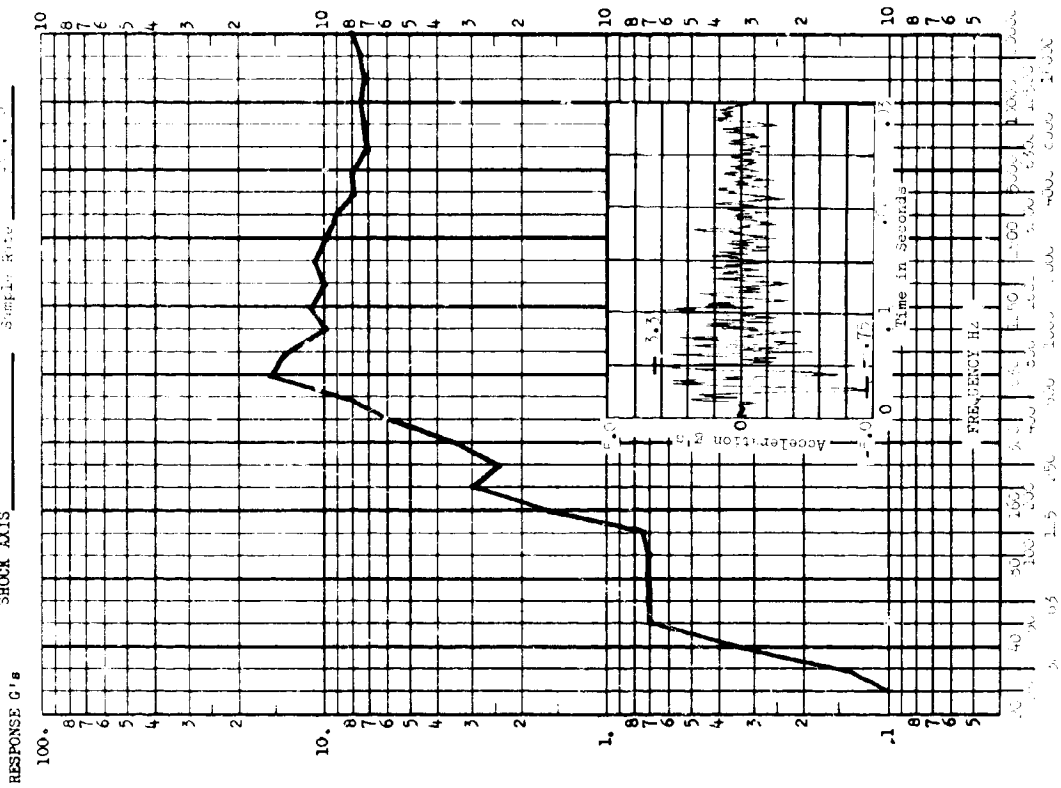


FIGURE IV.B.7-3

TEST ITEM _____
 SERIAL NO. _____ TEST DATE _____
 SHOCK AXIS _____ Sample Rate _____



TEST ITEM _____
 SERIAL NO. _____ TEST DATE _____
 SHOCK AXIS _____ Sample Rate _____

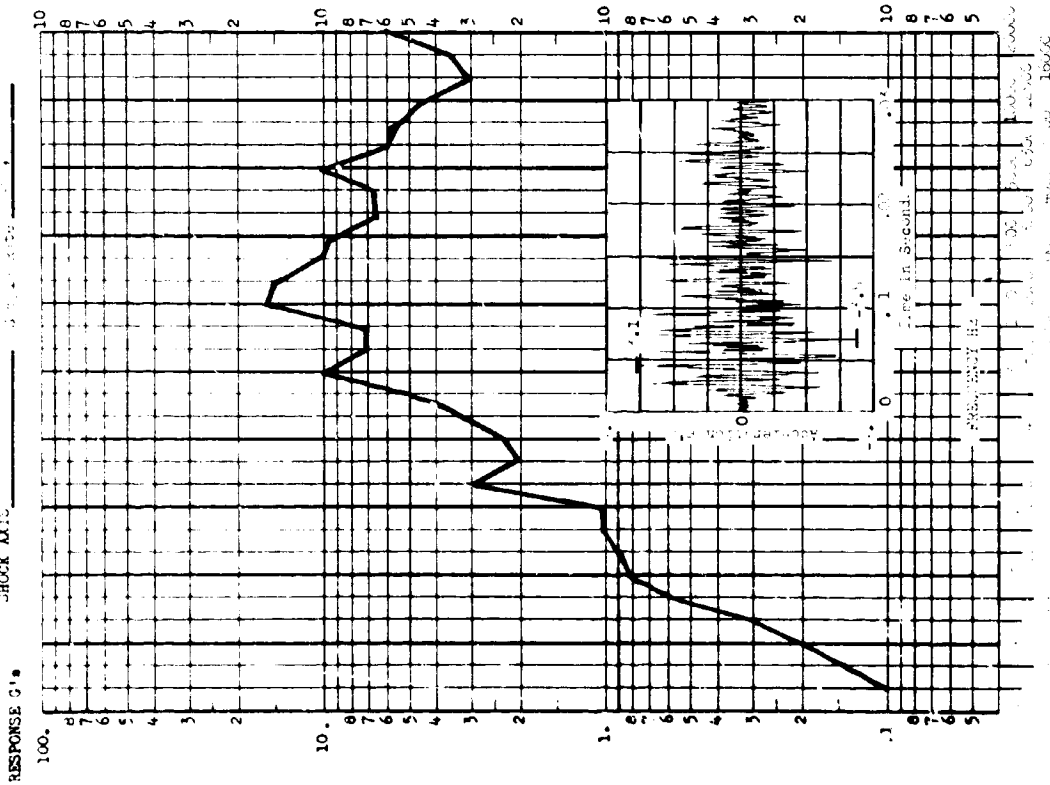
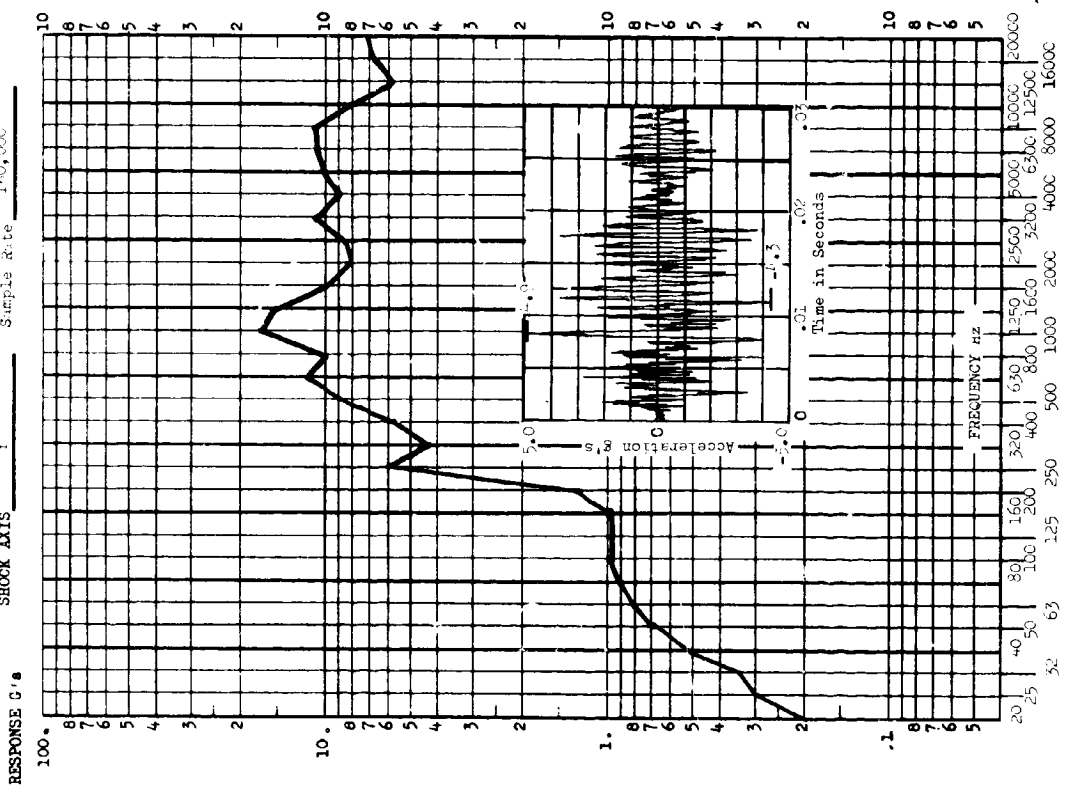


FIGURE IV.B.7-4

TEST ITEM: Terminal Door Seal Gasket
 ACCEL. NO.: 1000
 TEST DATE: 1-10-68
 SHOCK AXIS: Y
 Sample Rate: 100,000



TEST ITEM: Terminal Door Seal Gasket
 ACCEL. NO.: 1000
 TEST DATE: 1-10-68
 SHOCK AXIS: Y
 Sample Rate: 100,000

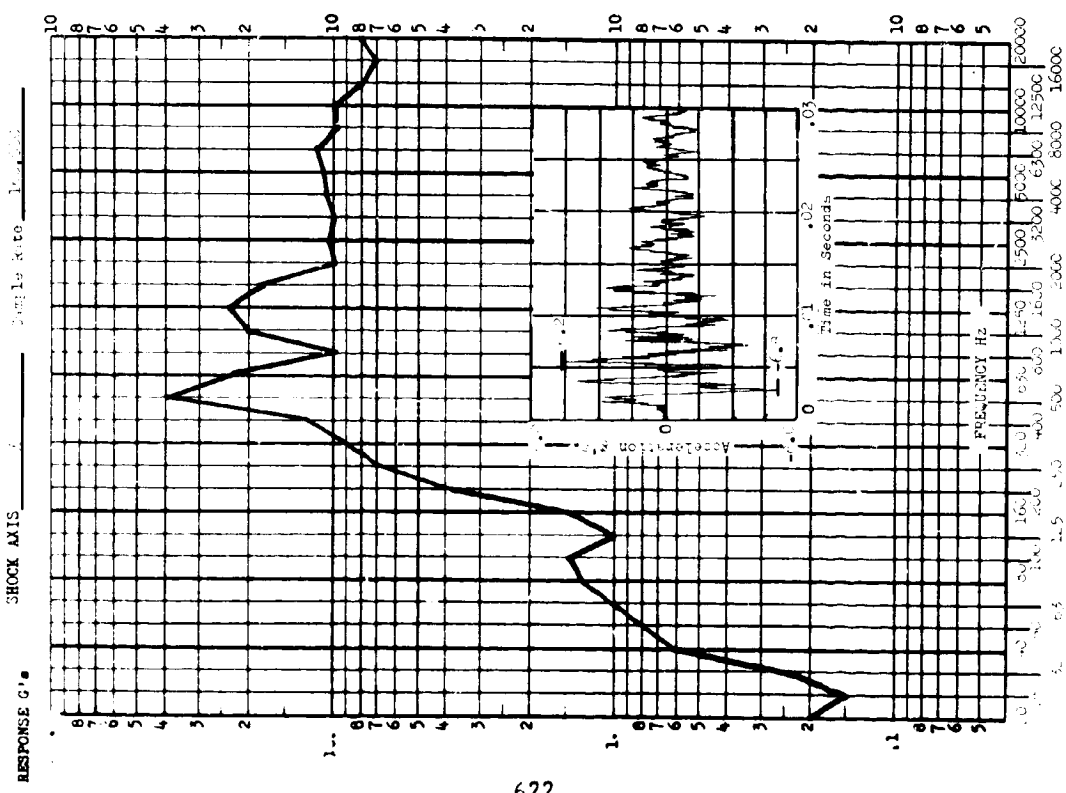
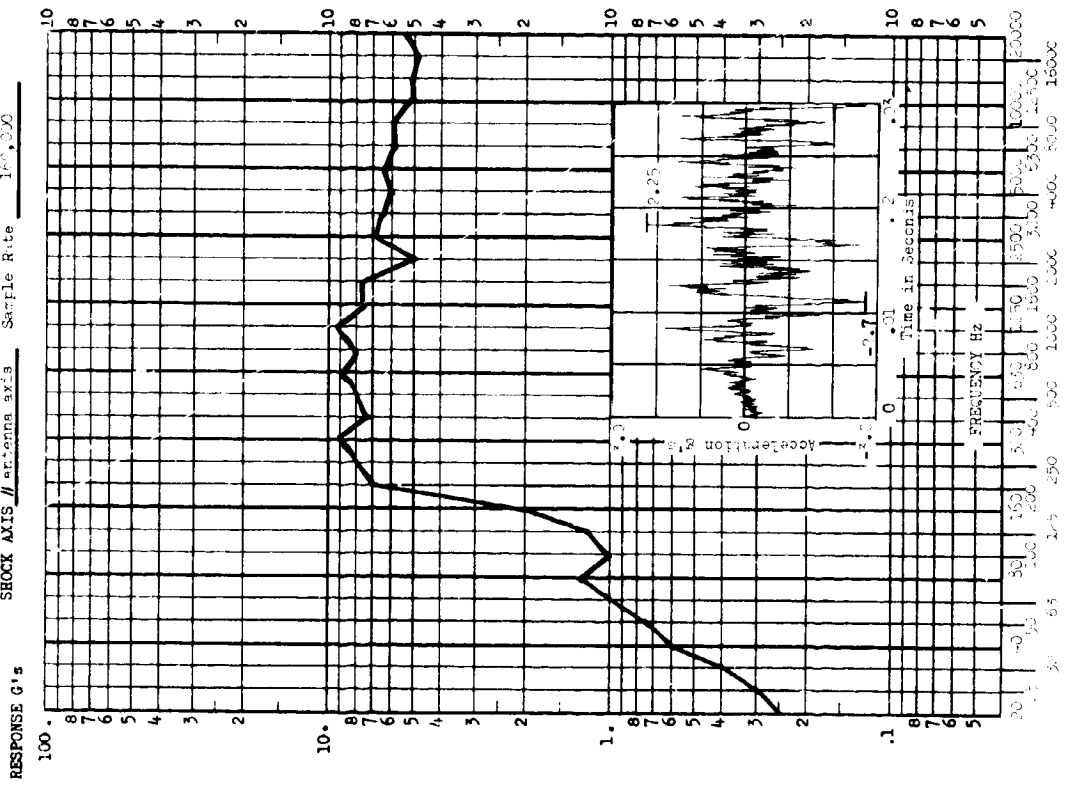


FIGURE IV.B.7-5

TEST ITEM: Umbilical Icon Flam Event
 ACCEL. NO.: 482 TEST DATE:
 SHOCK AXIS // antenna axis Sample Rate: 100,000



TEST ITEM: Umbilical Icon Flam Event
 ACCEL. NO.: 887 TEST DATE:
 SHOCK AXIS // antenna axis Sample Rate: 100,000

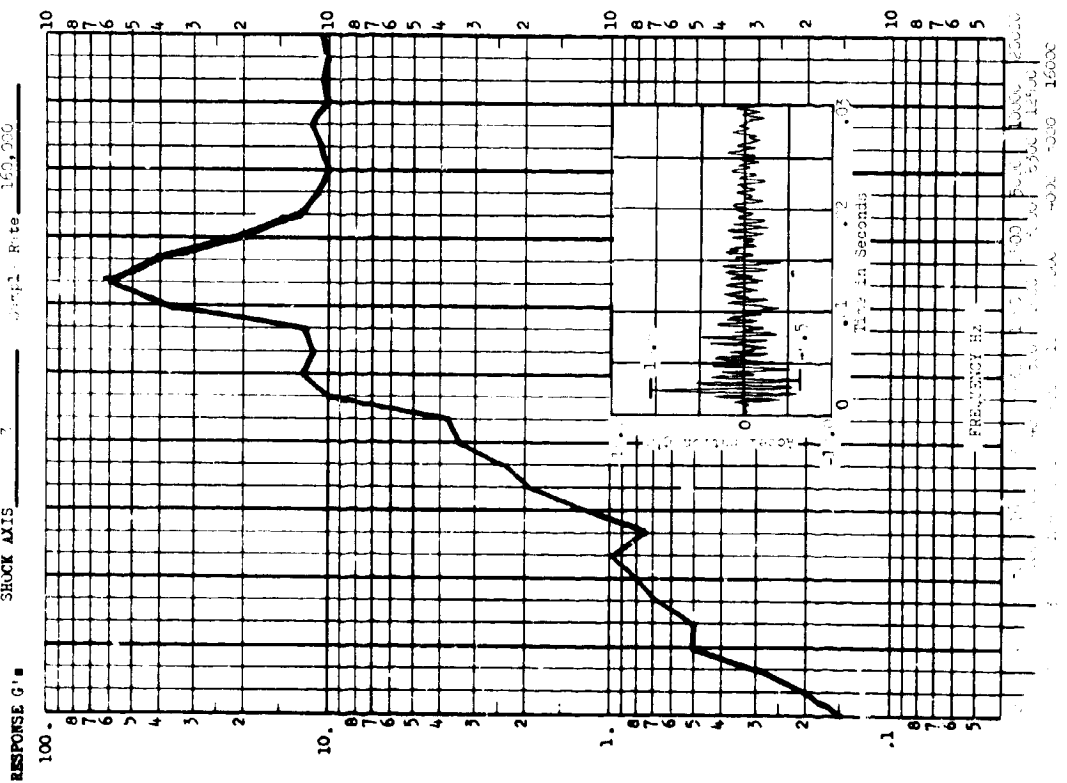
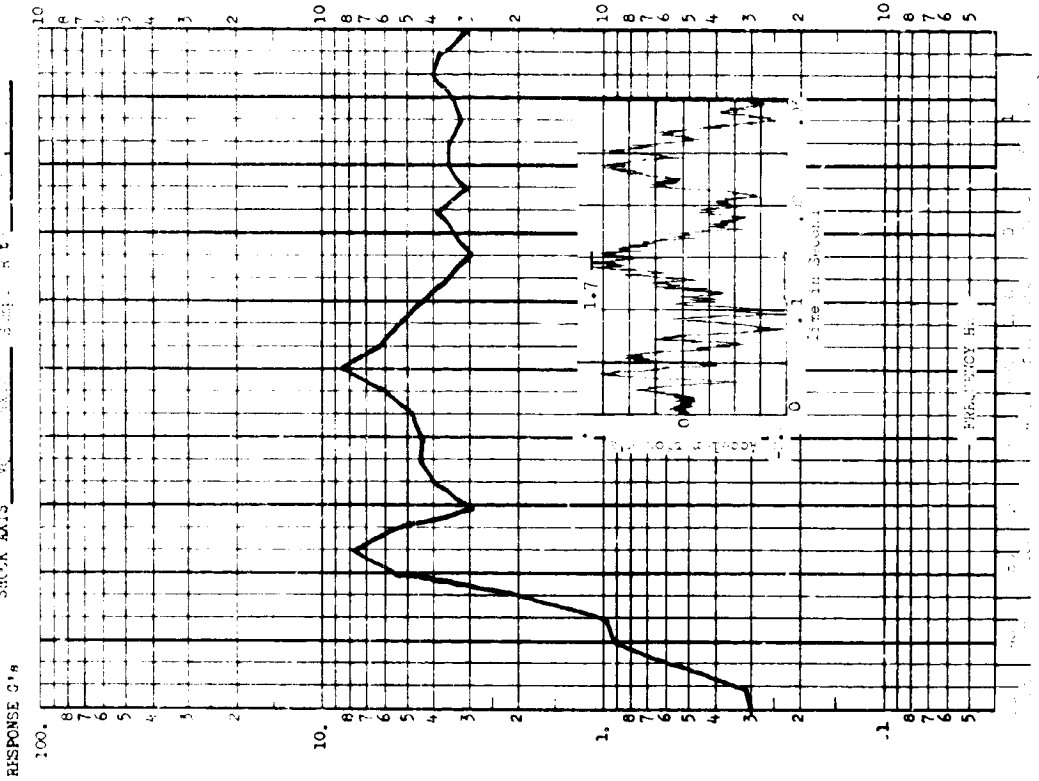


FIGURE IV.B.7-6

TEST ITEM _____
 TEST NO. _____ TEST DATE _____
 SHOCK AXIS _____



TEST ITEM _____
 TEST NO. _____ TEST DATE _____
 SHOCK AXIS _____

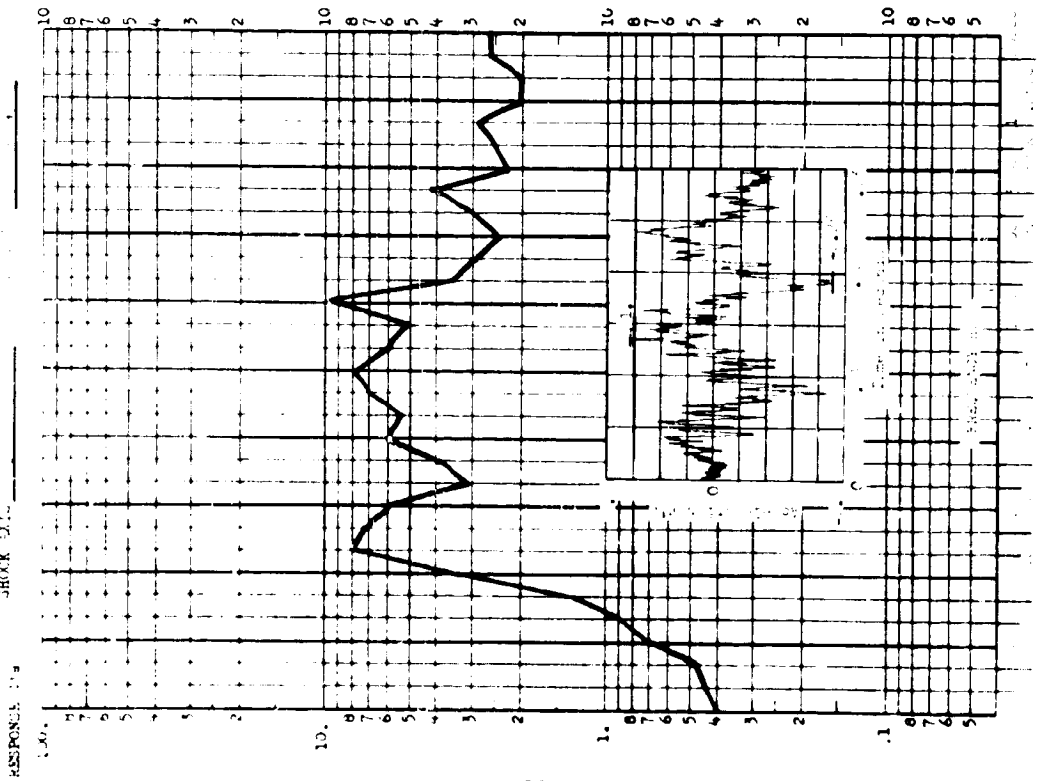


FIGURE IV.3.7-8

TEST ITEM: Small Arms Fire - Blank Event
 Aerial No.: 1000 TEST DATE: _____
 SHOOT AXIS: Horizontal Axis Sample Rate: 160,000

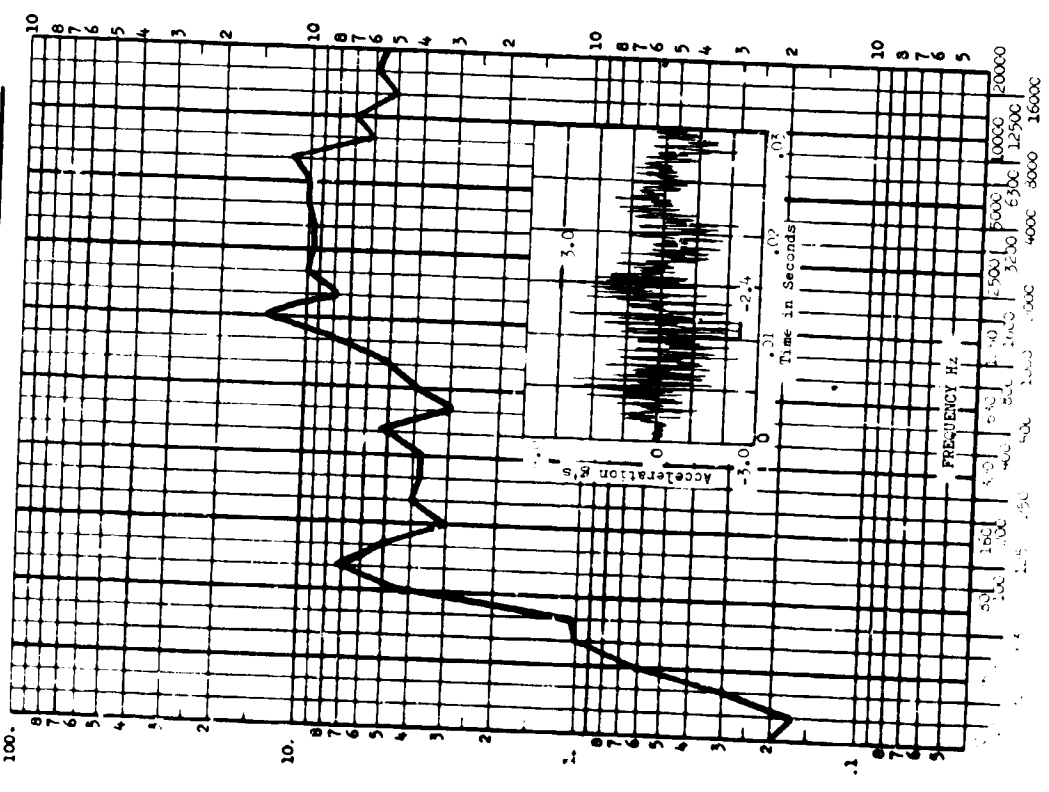


FIGURE IV.B.7-9

PART IV.C

PYROTECHNIC SHOCK DATA COMPILED FOR
SURVEYOR PYROTECHNIC ACCEPTANCE TESTS

PART IV.C

SHOCK EVENTS FROM SURVEYOR FLIGHTS

DESCRIPTION OF FLIGHT ARTICLES

Two different configurations of the Surveyor vehicle were flown. The first two flights, designated SD-1 and SD-2, were dynamic models of the operational spacecraft as depicted in Figure IV.C.-1. Each consisted of an operation-type spaceframe with dummy components simulating the mass properties of those items they represented. These spacecraft were the same overall physical size as the operational vehicle, being approximately 86 inches across at the widest point (landing legs folded) and approximately 100 inches tall. The SD-1 spacecraft weighed approximately 1600 lb, and the SD-2 weighed approximately 2200 lbs, which was the weight of the operational spacecraft. The seven operational Surveyor spacecraft launches that succeeded the dynamic model flights were designated SC-1 through SC-7 and had the configuration depicted in Figure IV.C.-2.

DESCRIPTION OF EVENTS

Shock data were recorded and reduced for all the transient events associated with each surveyor flight. Section IV.C.1 through IV.C.5 present

data for the events listed below:

- 1) Atlas/Centaur Separation (Section IV.C.1)
- 2) Shroud Separation (Section IV.C.2).
- 3) Insullation Panel Jettison (Section IV.C.3)
- 4) Omni Antenna Deploy (Section IV.C.4)
- 5) Other Shock Events of a non-pyrotechnic nature (Section IV.C.5)

Accompanying the data in each section is a brief description of the particular event and the pyrotechnic involved.

DESCRIPTION OF DATA

The following information is representative of the data reduction for all the data in Sections IV.C.1 through IV.C.5.

Type of analysis	digital
Sample rate	Table IV.C.-2
Frequency range	Table IV.C.-1
Frequency increments	Table IV.C.-2
Damping	$Q = 20$

DESCRIPTION OF ACCELEROMETERS

Locations: Table IV.C.1 and Figure IV.C.3

Axis Sensitivity: Table IV.C.1

COMMENTS

Because these data were taken from flight events, Part IV.C could have been presented in Division V. Also since the pyrotechnics for the various flight events are conventional, some of the data might just as well have been presented in Parts I.C and II.C.

Whenever a data sheet shows several spectra and one time history, the time history is "typical" for all the spectra and is not necessarily associated with anyone of them.

TABLE IV.C.1

ACCELEROMETER INFORMATION

<u>Accelerometer Number</u>	<u>Location</u>	<u>Sensitive Axis</u>	<u>Frequency Range (Hz)</u>	
			<u>SD Vehicles</u>	<u>SC Vehicles</u>
CY 490	Attach Point	X	2-125	-----
CY 500	Attach Point	Y	2-200	-----
CY 510	Attach Point	Tangential	2-300	-----
CY 520	Attach Point	Z	2-500	2-1150
CY 530	Attach Point	Z	2-700	2-970
CY 540	Attach Point	Z	2-800	2-970
CA7720	Adapter	Radial	-----	2-2300
CA7730	Adapter	Z	-----	2-970

TABLE IV.C.2

DATA REDUCTION STATISTICS

<u>Flight Designation No.s</u>	<u>Sample Rate</u>	<u>Frequency Increments</u>
SD-1 thru SC-2	10 times the highest frequency present on plots	50 points over the frequency range present on plots
SC-3 thru SC-7	20,000/second	20 points per decade

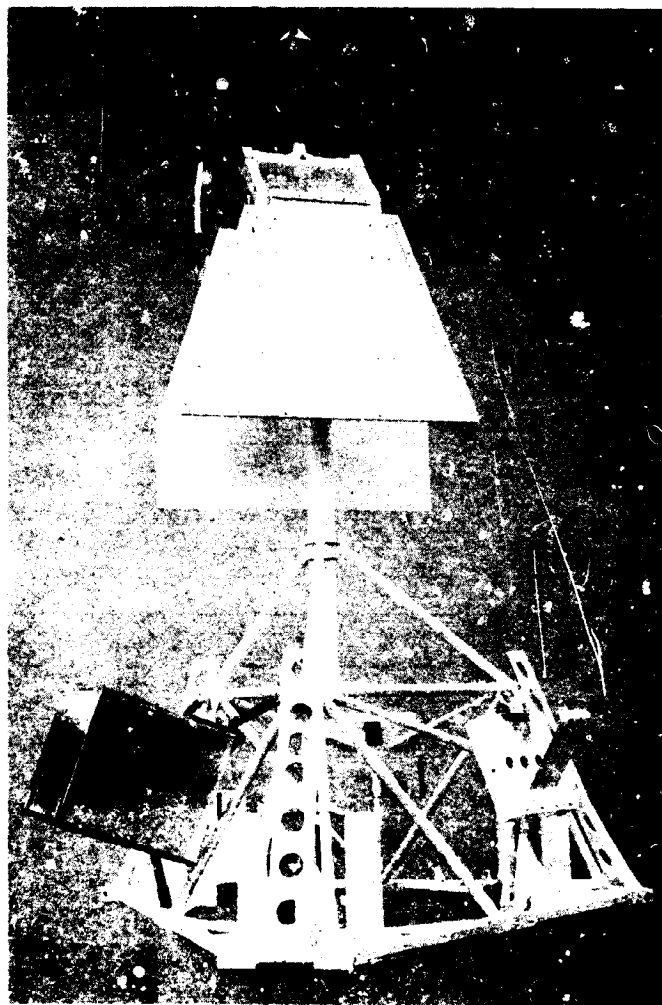


FIGURE IV.C.1. SURVEYOR DYNAMIC MODEL

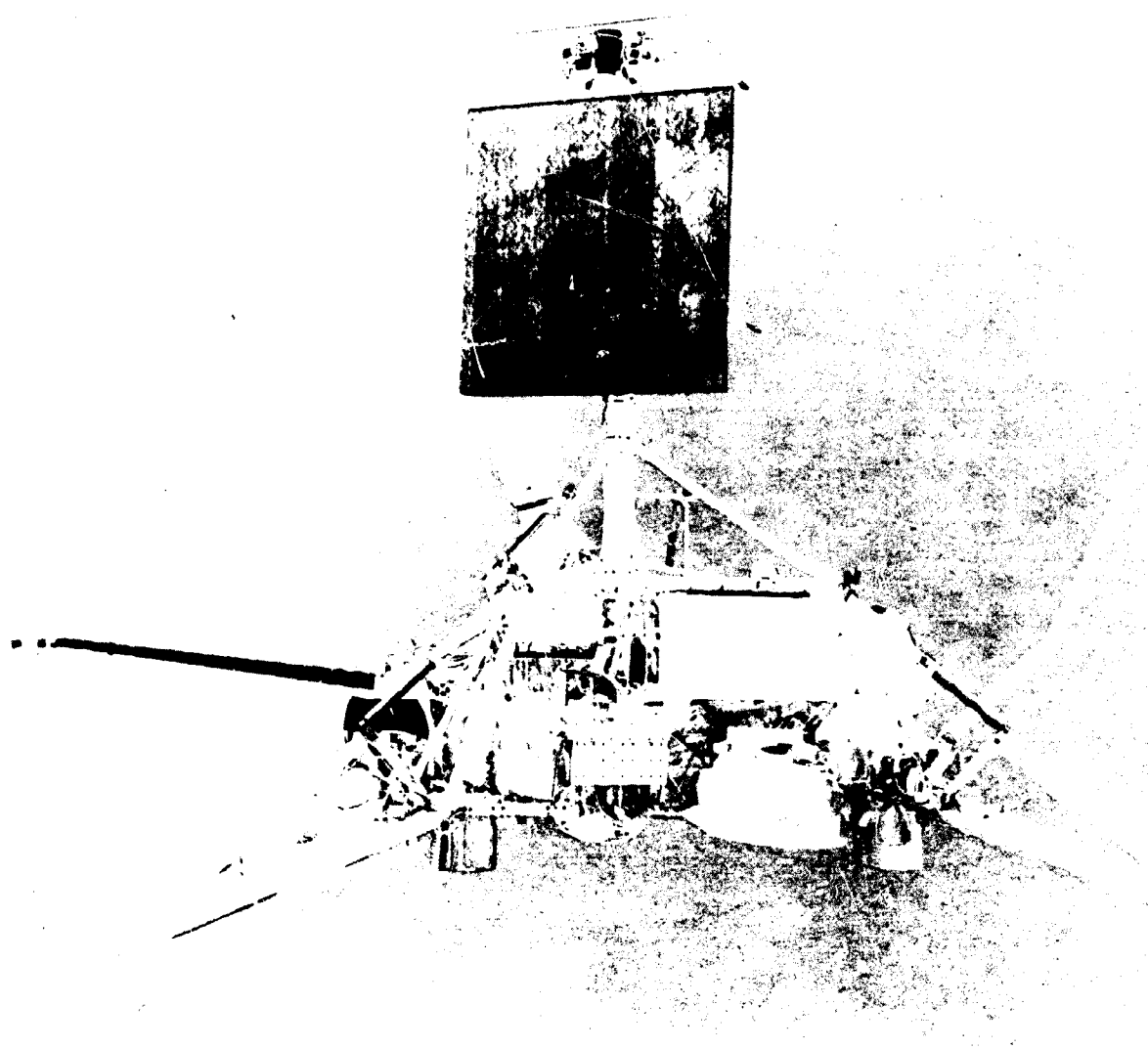


FIGURE IV.C.2. SURVEYOR SPACECRAFT

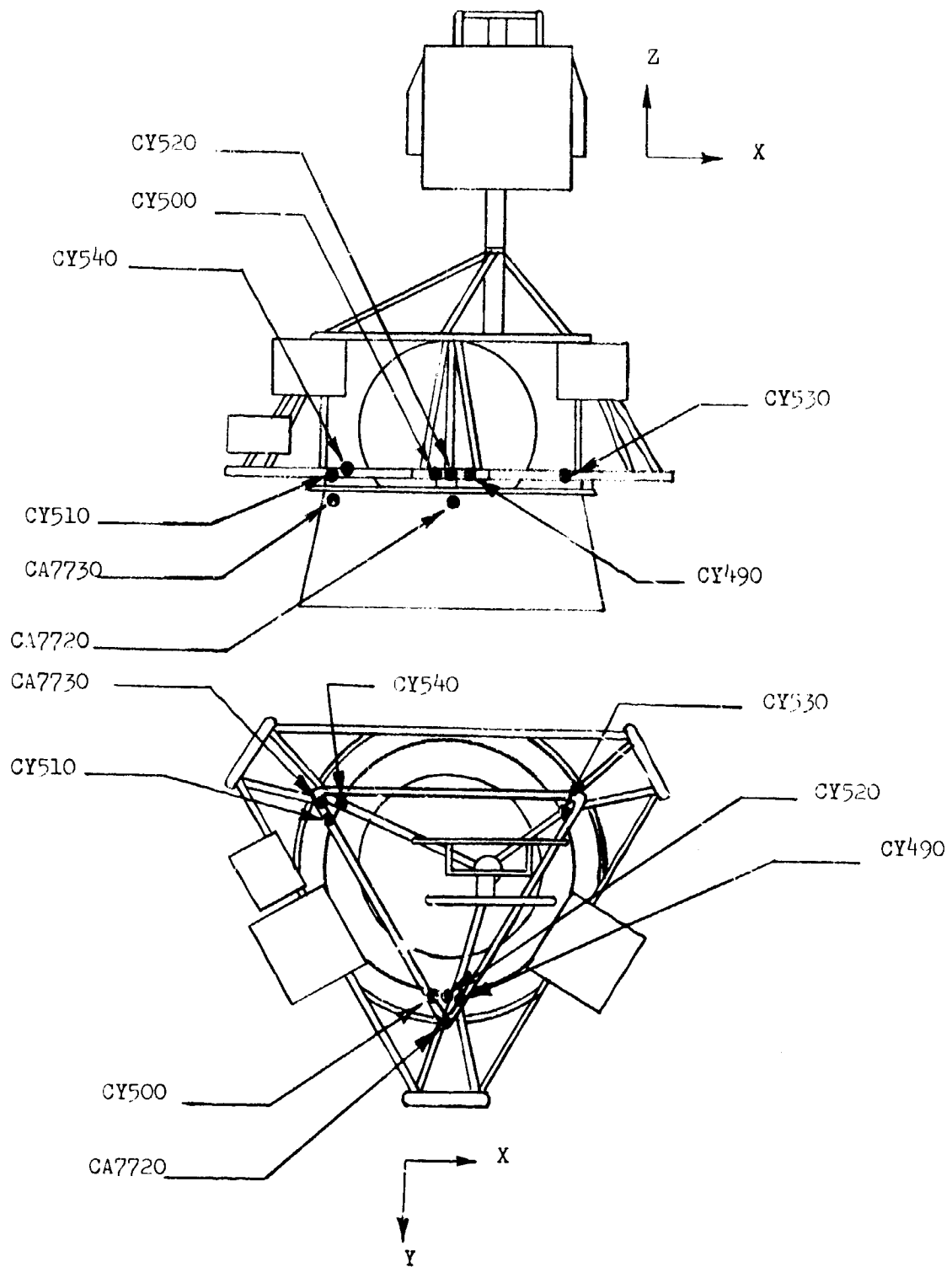


FIGURE IV.C.-5. ACCELEROMETER LOCATIONS

SECTION IV.C.1

ATLAS/CENTAUR SEPARATION EVENT

The Atlas/Centaur Separation utilized two circumferential strands of FLSJ at 15 grains per foot. This FLSC consisted of RDX core having a burning velocity of 6000 meters per second. The 15 shock spectra and 7 time histories for this event are presented in Figures IV.C.1-1 through IV.C.1-4 as indexed in Table IV.C.1-1.

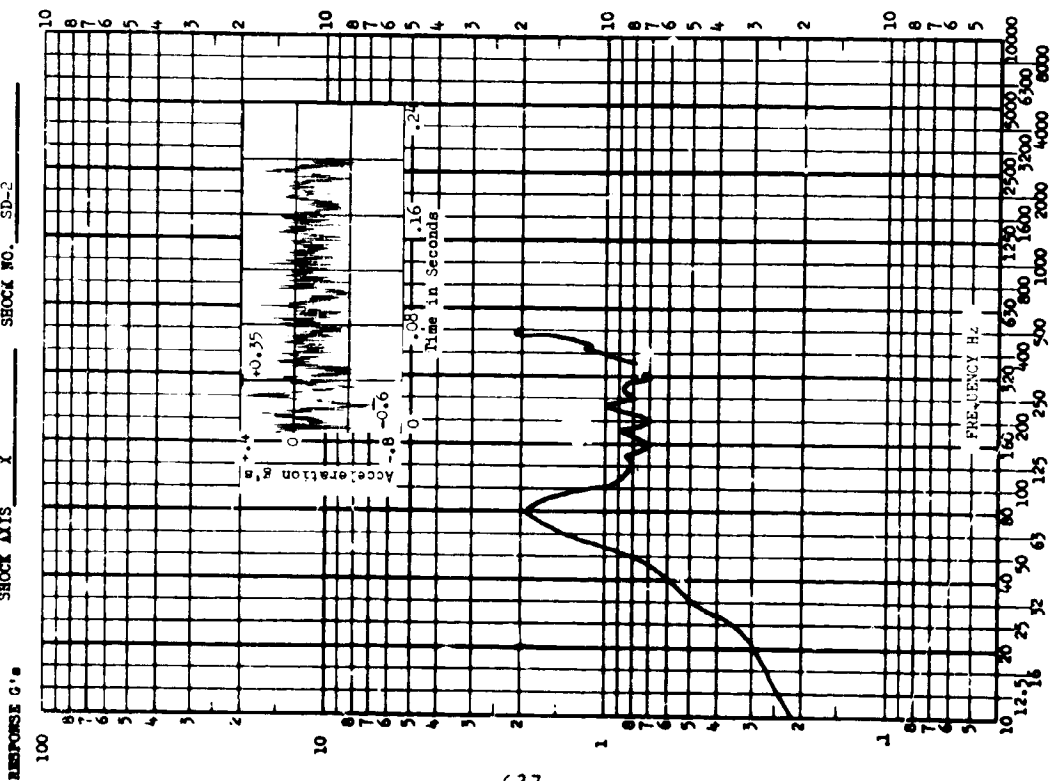
TABLE IV.C.1-1

INDEX OF DATA CONTAINED IN THIS SECTION

<u>Accelerometer Numbers</u>	<u>Flight Designation Numbers</u>	<u>Figure Number</u>
CY 490	SD-2	IV.C.1-1
CY 500	SD-2	IV.C.1-1
CY 510	SD-2	IV.C.1-2
CY 520	SD-2; SC-1, -3, -4	IV.C.1-2
CY 530	SD-2, SC-1	IV.C.1-3
CA 7720	SC-5, -6, -7	IV.C.1-3
CA 7730	SC-5, -6, -7	IV.C.1-4

七

TEST ITEM Atlas/Centaur Separation
 ACCEL. NO. GY490 TEST DATE Sept. 15, 1968
 SHOCK AXIS X SHOCK NO. SD-2



TEST ITEM Atlas/Centaur Separation
 ACCEL. NO. GY500 TEST DATE September 15, 1968
 SHOCK AXIS Y SHOCK NO. SD-2

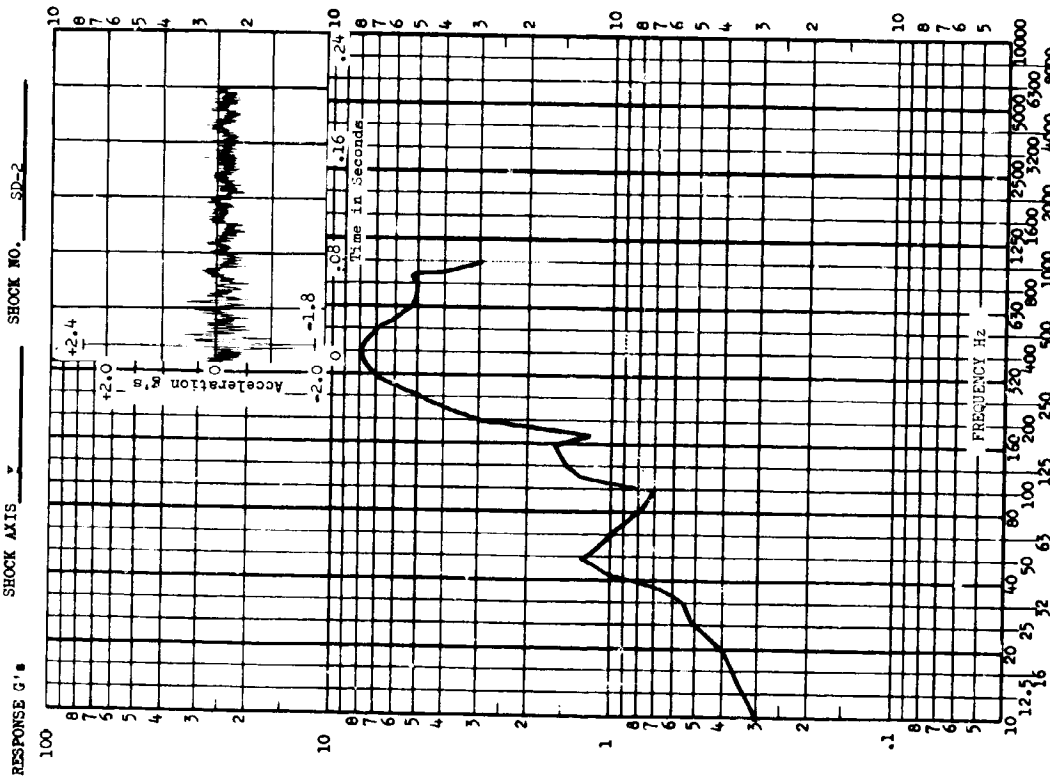
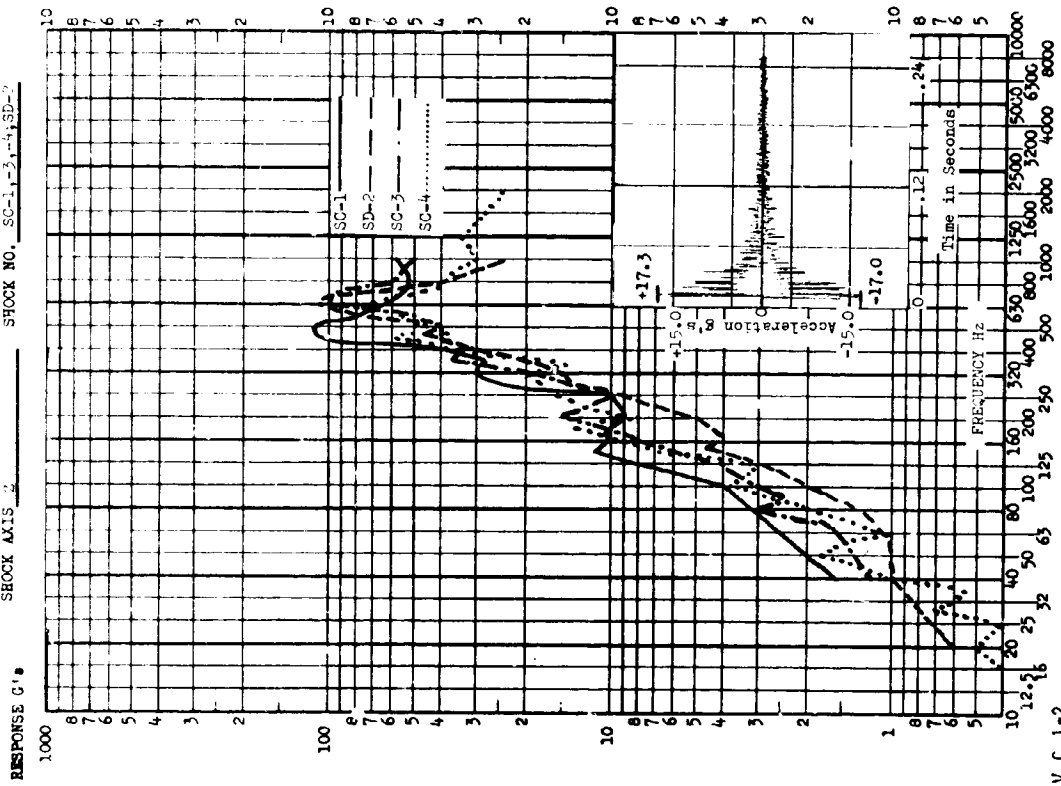


FIGURE IV.C.1-1

TEST ITEM Atlas/ventur Separation
 ACCEL. NO. CV530 TEST DATE Sept. 13, 1966
 SHOCK AXIS Z SHOCK NO. SC-1, 2, 3, 4, SD-2



TEST ITEM Atlas/Ventur Separation
 ACCEL. NO. CV530 TEST DATE Sept. 13, 1966
 SHOCK AXIS Z SHOCK NO. SC-1, 2, 3, 4, SD-2

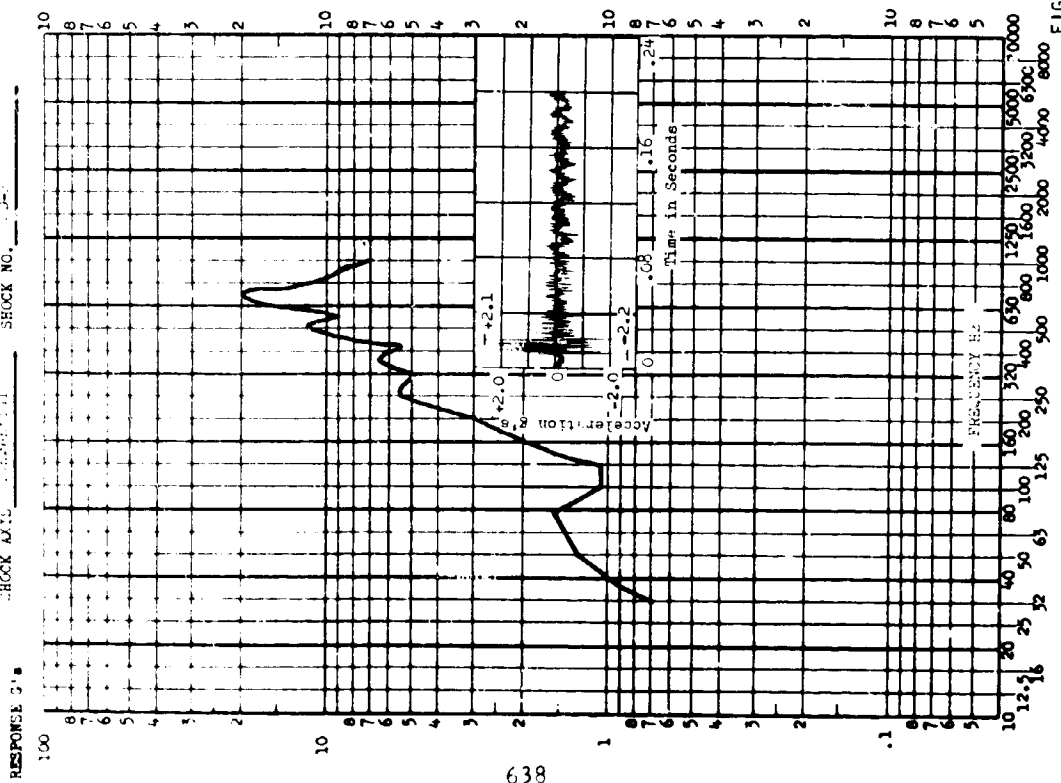
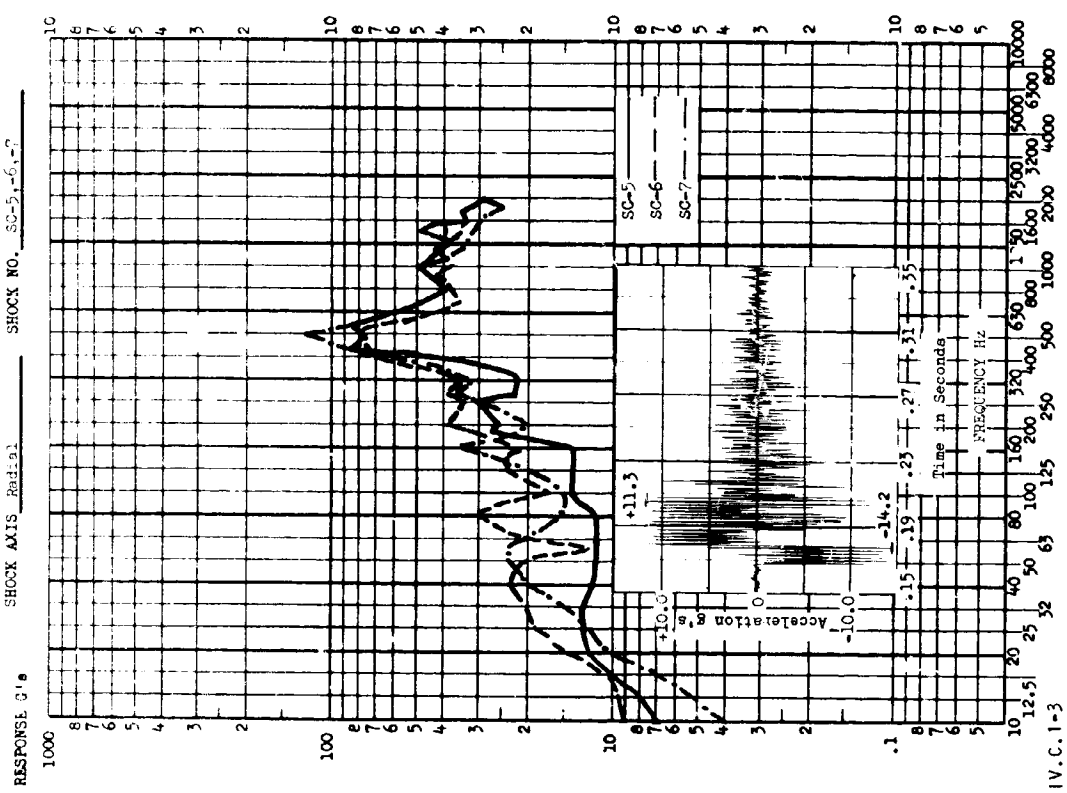


FIGURE IV.C.1-2

TEST ITEM Atlas/Centaur Separation
 ATT. NO. CA720 TEST DATE Sept. 15, 1968
 SHOCK AXIS Radial SHOCK NO. SC-5, 6, 7



TEST ITEM Atlas/Centaur Separation
 ATT. NO. CA720 TEST DATE Sept. 15, 1968
 SHOCK AXIS Radial SHOCK NO. SC-1, 2

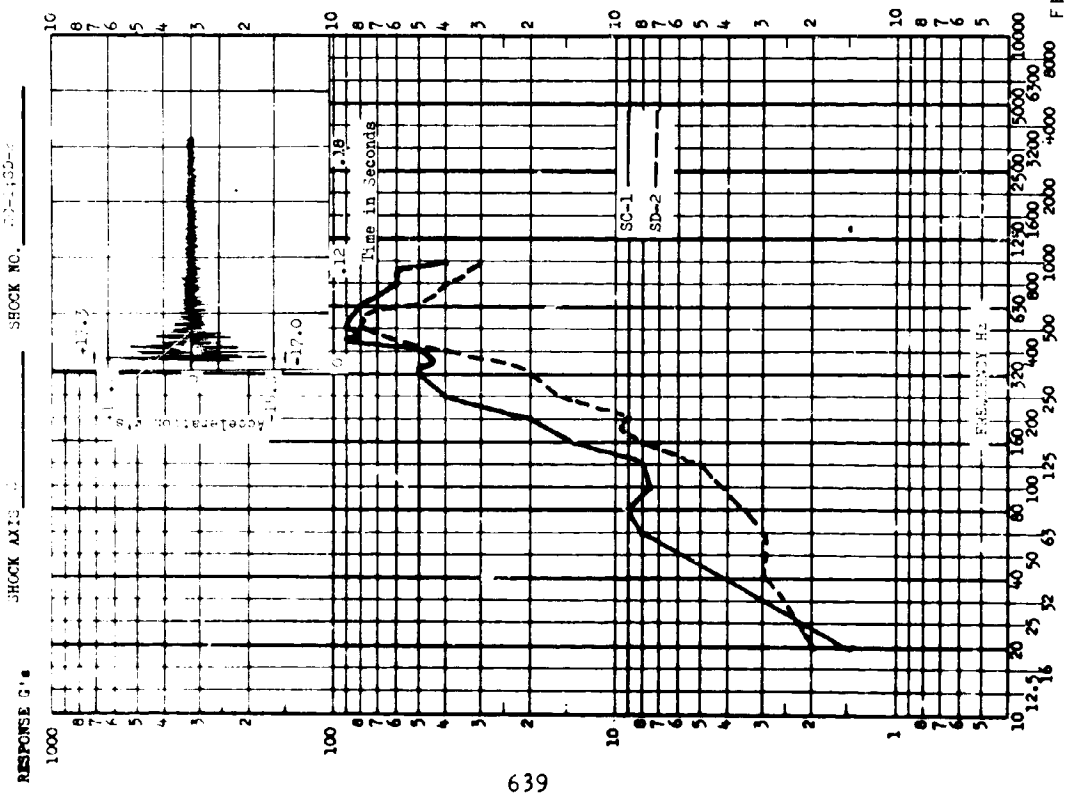


FIGURE IV.C.1-3

TEST ITEM Atlas/Centaur Separation
 ACCEL. NO. CA7730 TEST DATE Sept. 15, 1968
 SHOCK AXIS Z SHOCK NO. SC-5,-6,-7

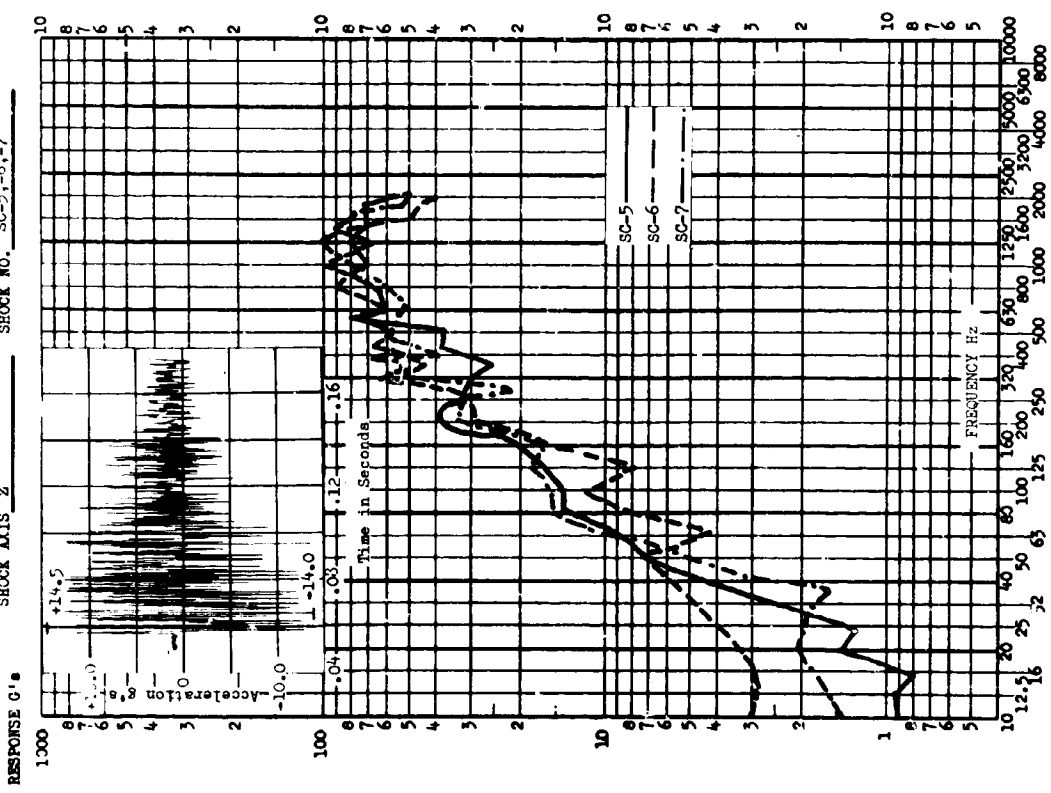


FIGURE IV.C.1-4

SECTION IV.C.2

SHROUD SEPARATION EVENT

The Surveyor Shroud Separation involved the use of 16 pyro latch assemblies. Each latch consisted of a dual cartridge separation nut. The nut and pressure cartridge specifications are shown below:

Separation nut - Part Number 939321 manufactured
by Hi Shear Corporation

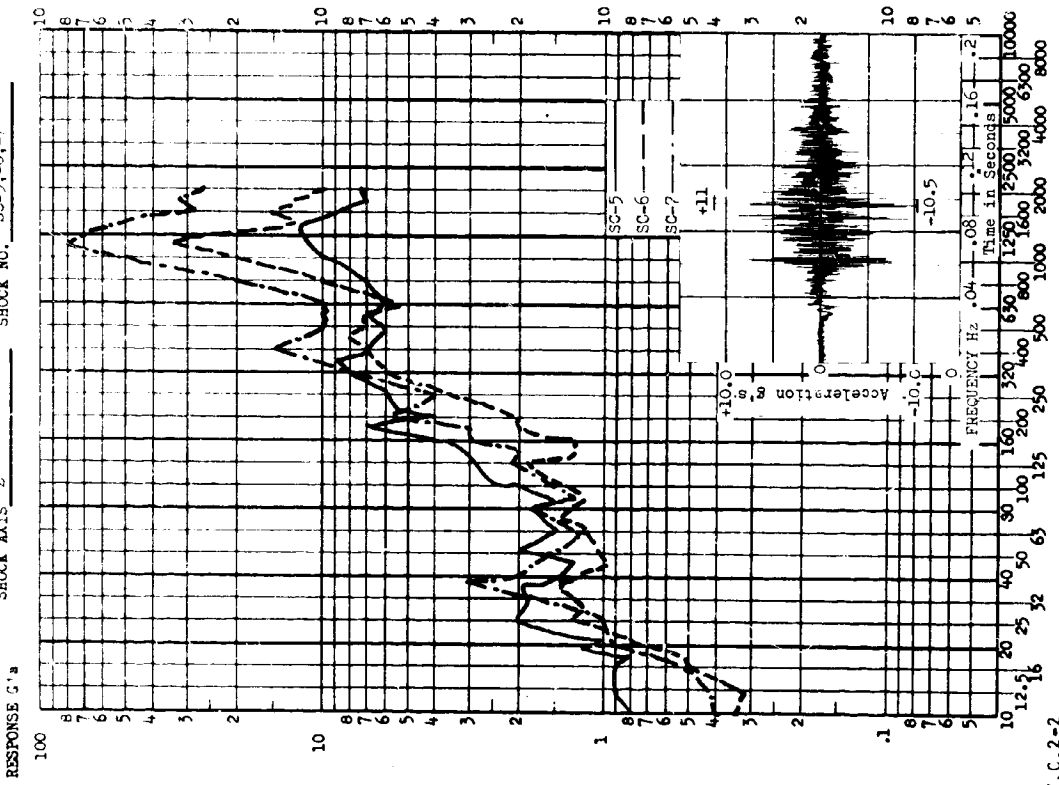
Pressure Cartridge - Part Number 939693
manufactured by Hi Shear
Corporation

This section presents 11 shock spectra along with 4 of the corresponding time histories for this event in Figures IV.C.2-1 and IV.C.2-2 as indexed in Table IV.C.2-1.

TABLE III.C.2-1
INDEX OF DATA CONTAINED IN THIS SECTION

<u>Accelerometer Numbers</u>	<u>Flight Designation No.s</u>	<u>Figure Numbers</u>
CY 520	SD-2; SC-1, -3, -4	IV.C.2-1
CY 540	SD-2	IV.C.2-1
CA 7720	SC-5, -6, -7	IV.C.2-2
CA 7730	SC-5, -6, -7	IV.C.2-2

TEST ITEM Surveyor Airpod Separation
 MODEL NO. 660730 TEST DATE Sept. 15, 1968
 SHOCK AXIS Z SHOCK NO. SC-5, 6, 7



TEST ITEM Surveyor Airpod Separation
 MODEL NO. 660730 TEST DATE Sept. 15, 1968
 SHOCK AXIS Z SHOCK NO. SC-5, 6, 7

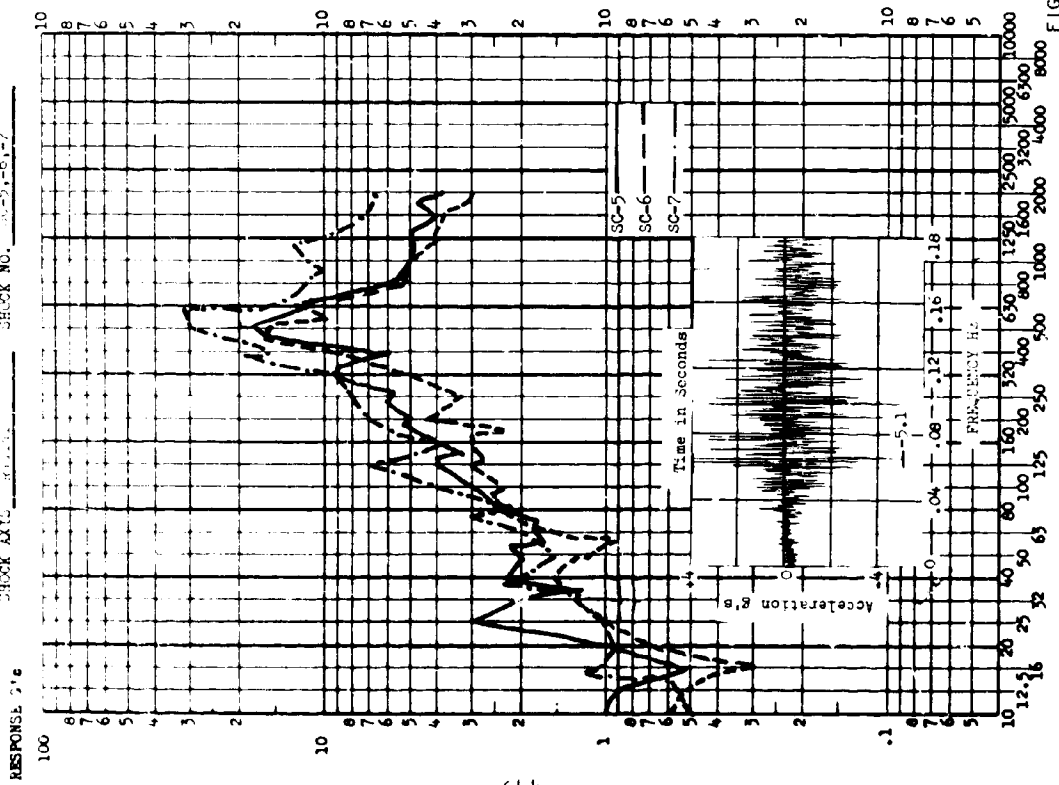


FIGURE IV.C.2-2

SECTION IV.C.3

INSULATION PANEL JETTISON EVENT

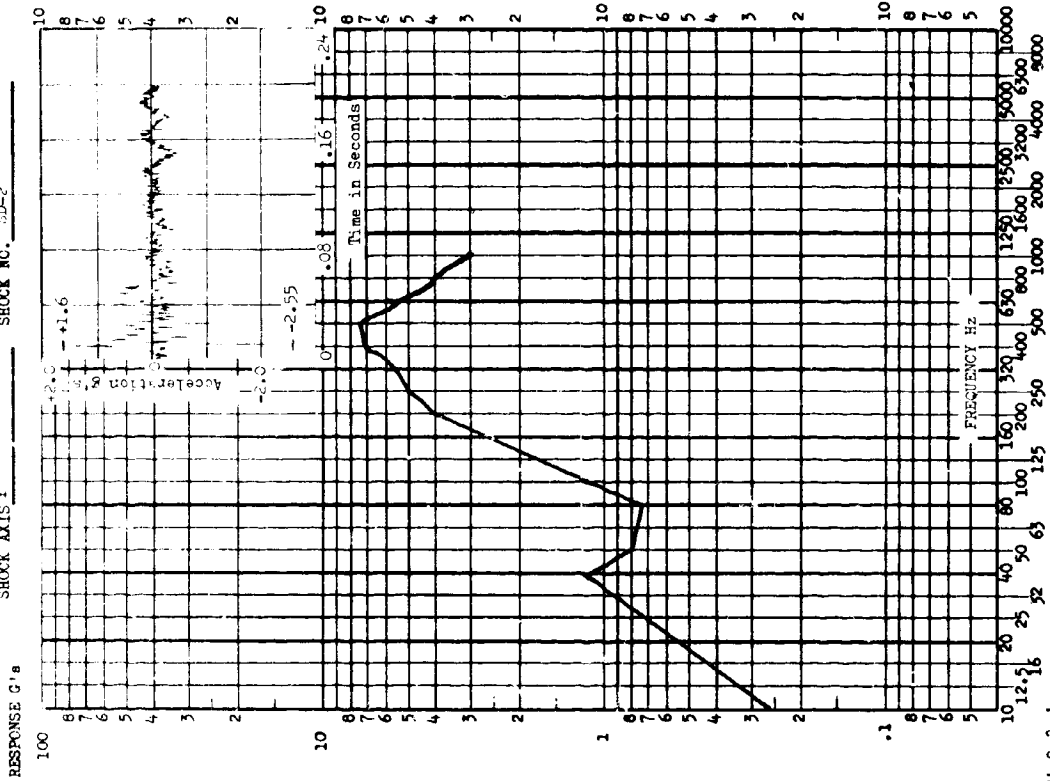
The data presented in this section includes 14 shock spectra and 7 of the corresponding time histories for the Centaur Insulation Panel Jettison events during the Surveyor flights. FLSC and MDF were the pyrotechnics used to jettison the panels. The pyrotechnic configuration employed in the Surveyor mission was identical to that discussed in Section I.A.6, Centaur Insulation Panel Jettison Tests. Reference to this section is made for a more detailed description of the pyrotechnic event. The data are presented in Figures IV.C.3-1 through IV.C.3-4 as indexed in Table IV.C.3-1.

TABLE IV.C.3-1

INDEX OF DATA CONTAINED IN THIS SECTION

<u>Accelerometer Numbers</u>	<u>Flight Designation No.s</u>	<u>Figure Number</u>
CY 490	SD-2	IV.C.3-1
CY 500	SD-2	IV.C.3-1
CY 510	SD-2	IV.C.3-2
CY 520	S _d -2, SC-1, -3, -4	IV.C.3-2
CY 530	SD-2	IV.C.3-3
CA 7720	SC-5, -6, -7	IV.C.3-3
CA 7730	SC-5, -6, -7	IV.C.3-4

TEST ITEM Surveyor Insulation Panel Jettison
 A.D.E. NO. 21500 TEST DATE Sept. 15, 1968
 SHOCK AXIS Y SHOCK NO. 3D-2



TEST ITEM Surveyor Insulation Panel Jettison
 A.D.E. NO. 21500 TEST DATE Sept. 15, 1968
 SHOCK AXIS X SHOCK NO. 3D-2

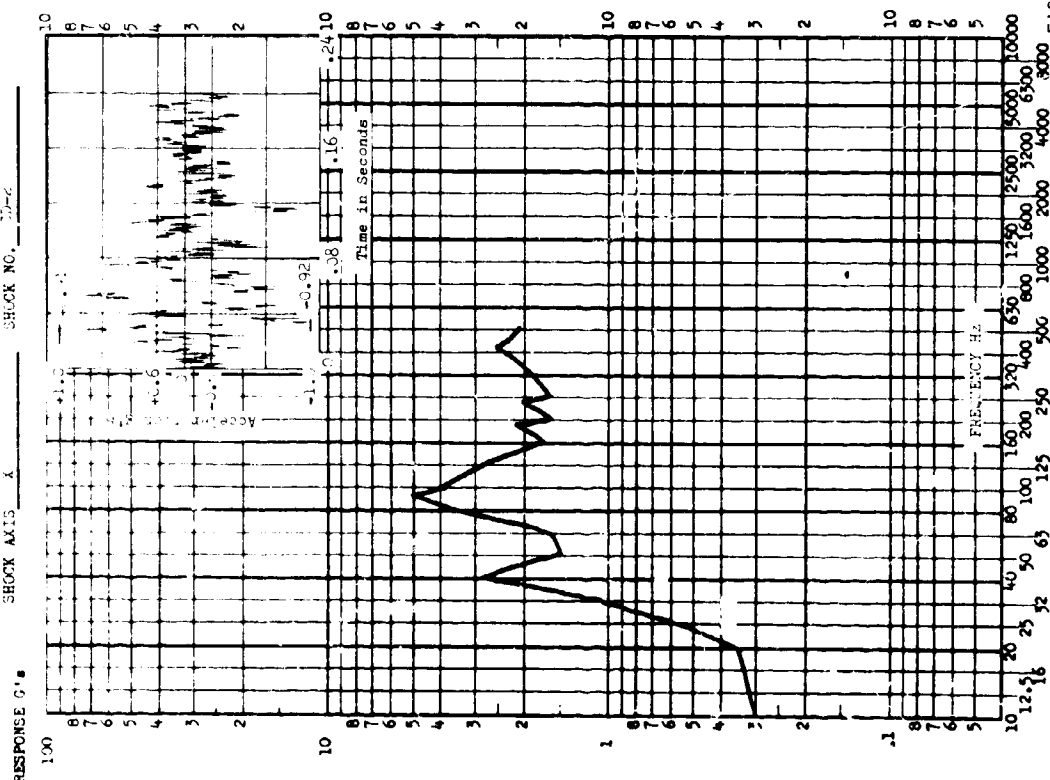
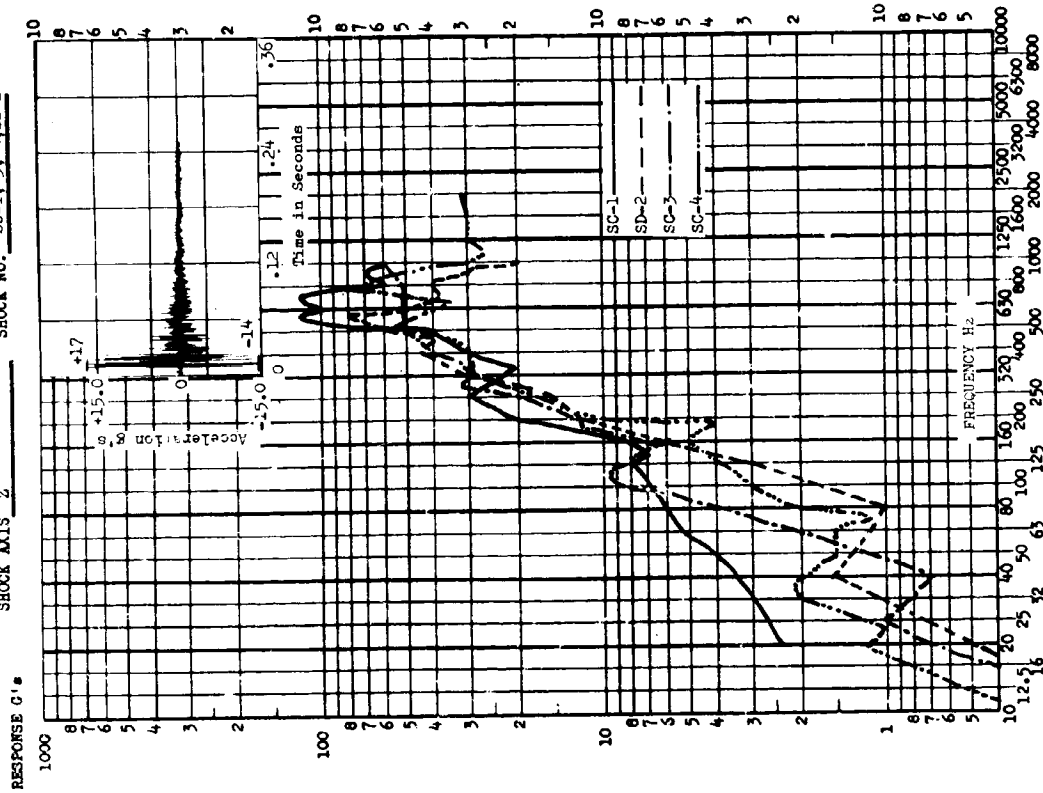


FIGURE IV.C.3-1

TEST ITEM Survivor Insulation Panel Jettison
 ACCEL. NO. CY20 TEST DATE Sept. 15, 1968
 SHOCK AXIS Z SHOCK NO. SC-1, 3, 4; SD-2



TEST ITEM Survivor Insulation Panel Jettison
 ACCEL. NO. CY10 TEST DATE Sept. 15, 1968
 SHOCK AXIS Inertial SHOCK NO. JD-2

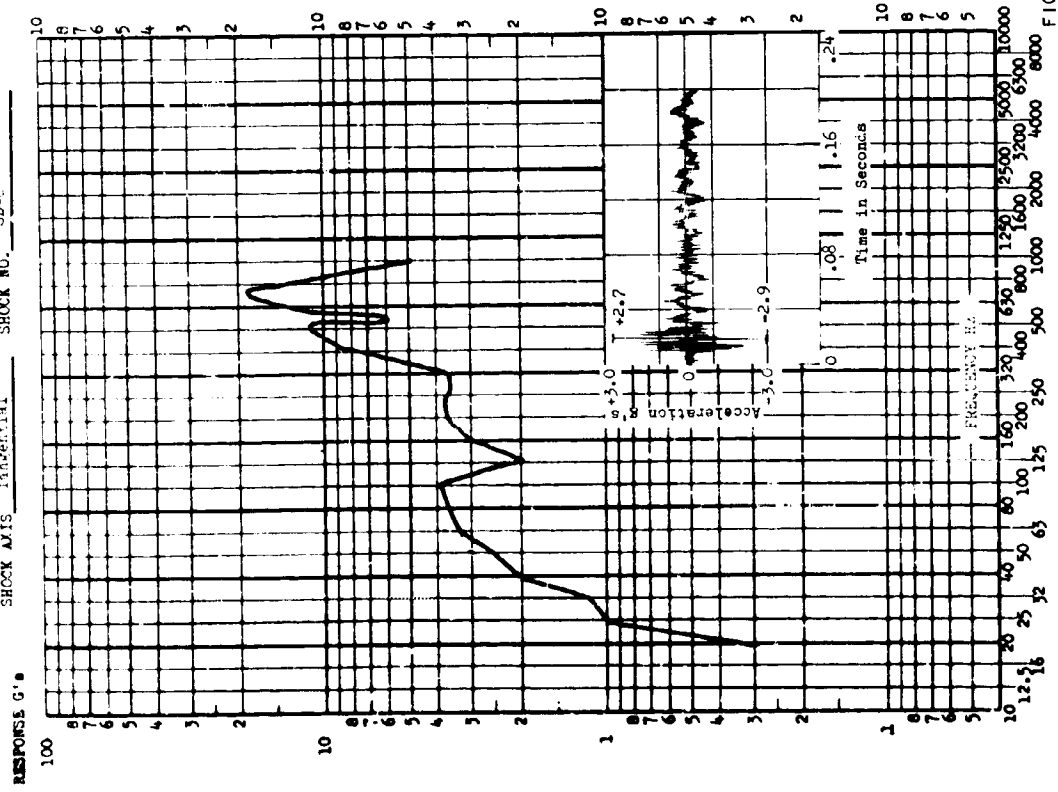
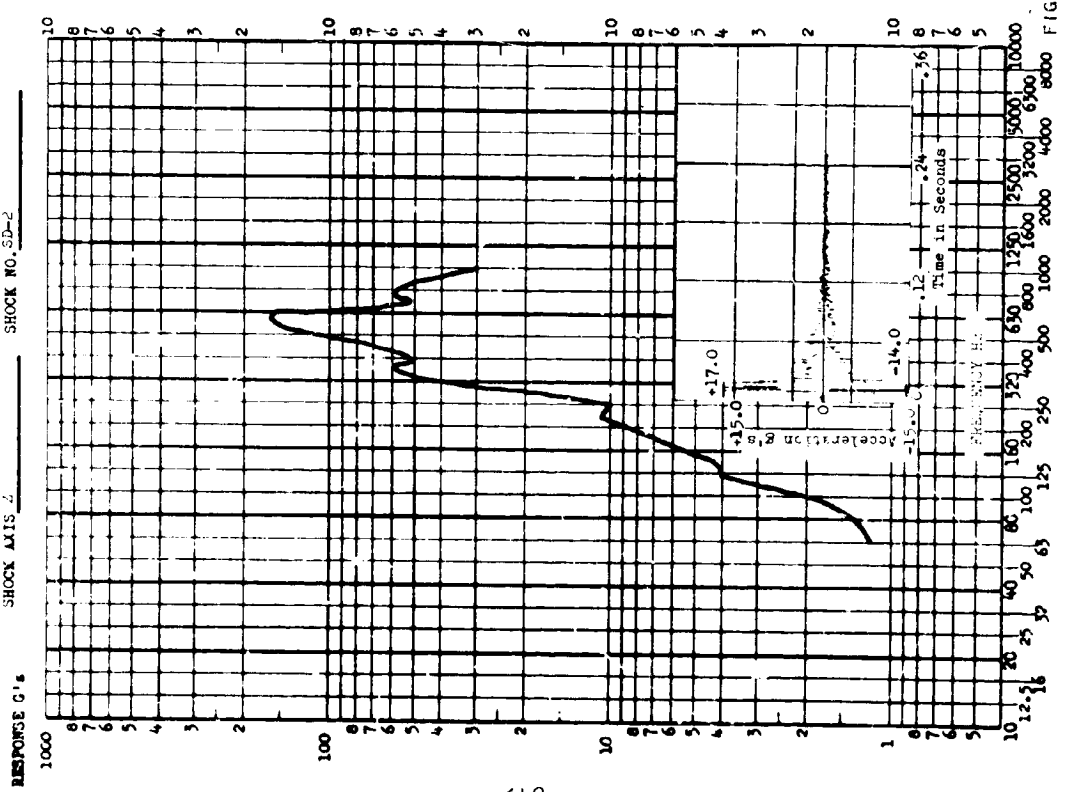


FIGURE IV.C.3-2

TEST ITEM Surveyor Insulation Panel Jettison
 ACCEL. NO. 21530 TEST DATE Sept. 15, 1968
 SHOCK AXIS Z SHOCK NO. SD-2



TEST ITEM Surveyor Insulation Panel Jettison
 ACCEL. NO. GA7720 TEST DATE Sept. 15, 1968
 SHOCK AXIS Radial SHOCK NO. SC-5, 6, 7

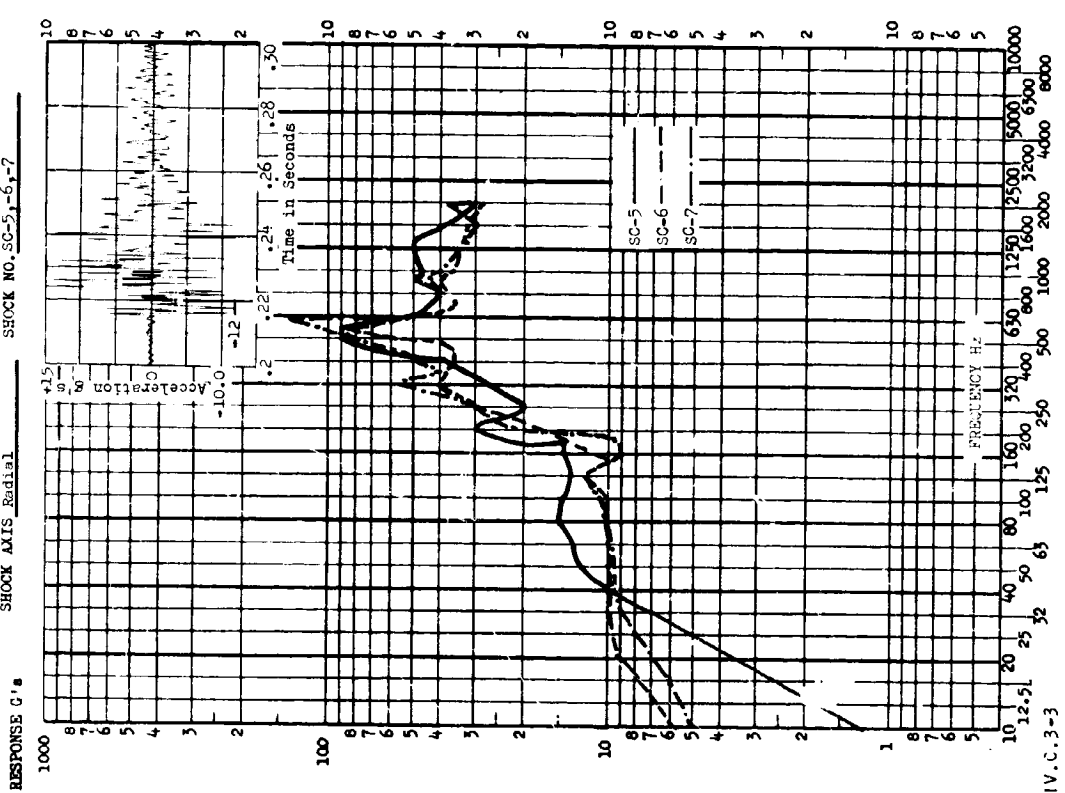


FIGURE IV.C.3-3

TEST ITEM: Survivor Insulation Panel Jettison
 TEST NO.: SA772G TEST DATE: Sept. 15, 1968
 SHOCK AXIS: Z SHOCK NO.: SC-5, -6, -7

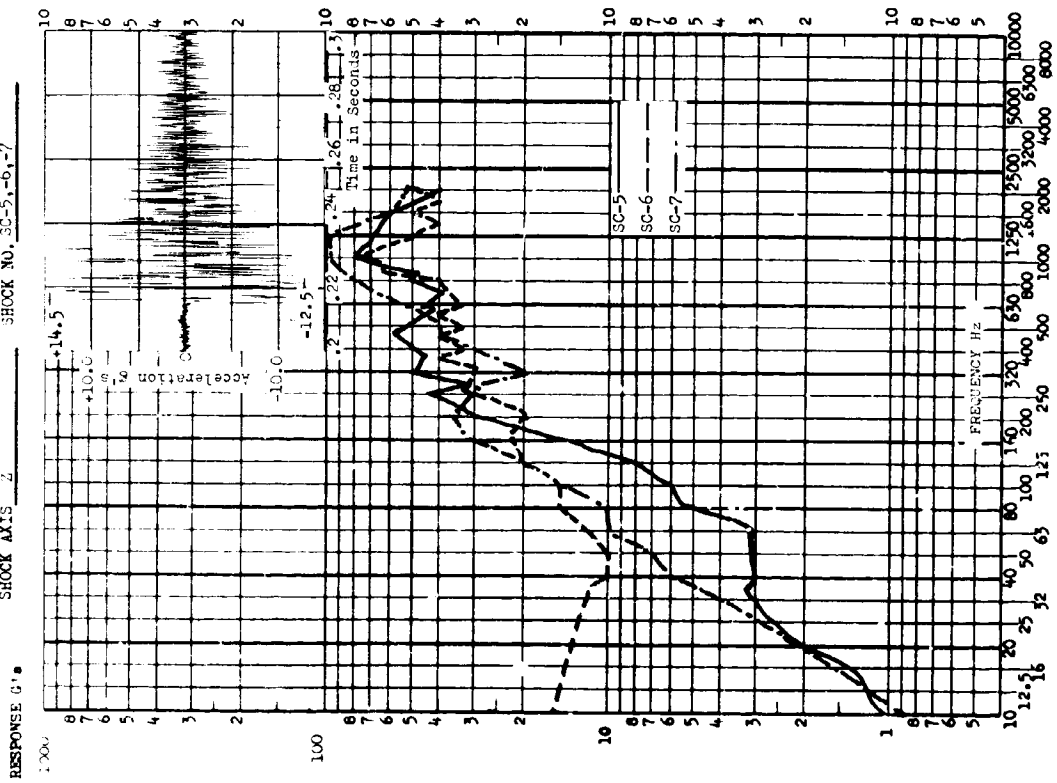


FIGURE IV.C.3-4

SECTION IV.C.4

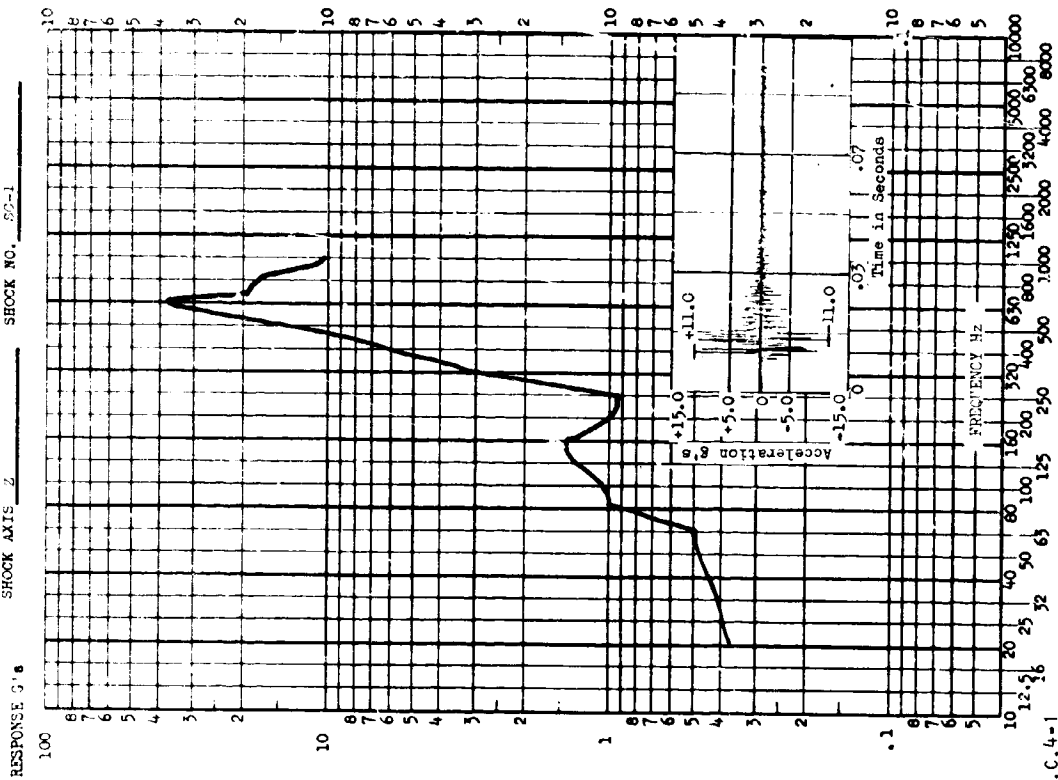
OMNI ANTENNA DEPLOY EVENT

This section presents 10 shock spectra along with 4 of the corresponding time histories for the Surveyor OMNI Antenna Deploy event. These data are shown in Figures IV.C.4-1 and IV.C.4-2 as indexed in Table IV.C.4-1.

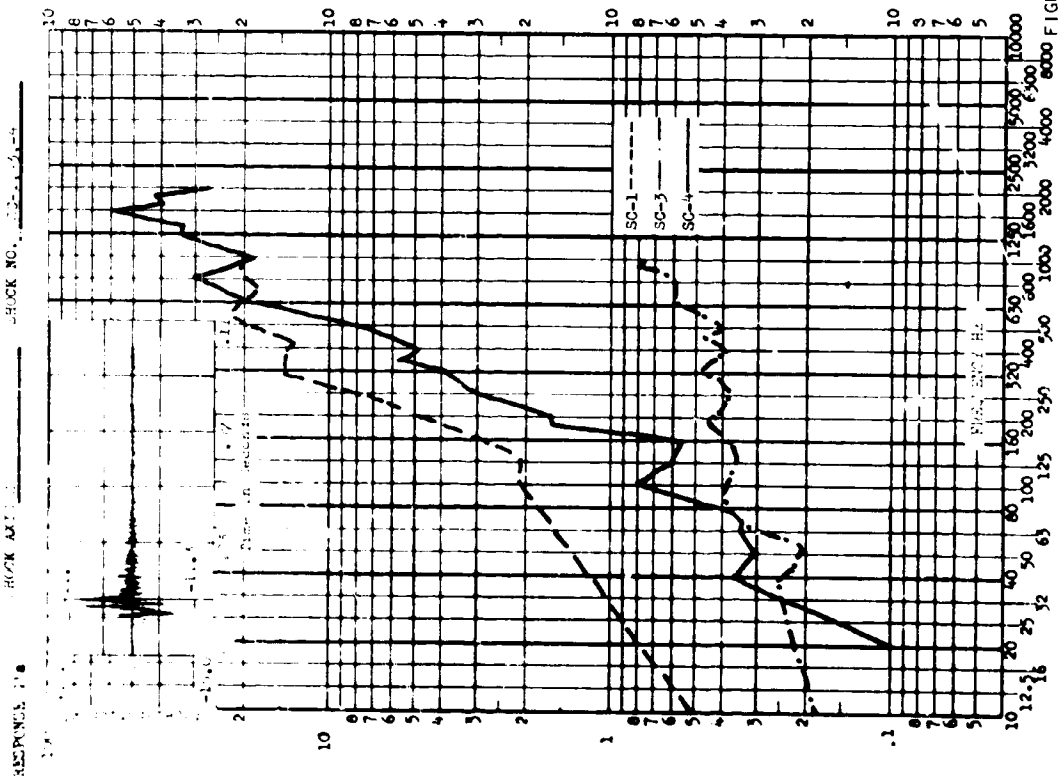
TABLE IV.C.4-1
INDEX OF DATA CONTAINED IN THIS SECTION

<u>Accelerometer Number</u>	<u>Flight Designation No.s</u>	<u>Figure Number</u>
CY 520	SC-1, -3, -4	IV.C.4-1
CY 540	SC-1	IV.C.4-1
CA 7720	SC-5, -6, -7	IV.C.4-2
CA 7730	SC-5, -6, -7	IV.C.4-2

TEST ITEM Omni Antenna Deploy
 ADEL. NO. C1540 TEST DATE Sept. 15, 1966
 SHOCK AXIS Z SHOCK NO. 52-1



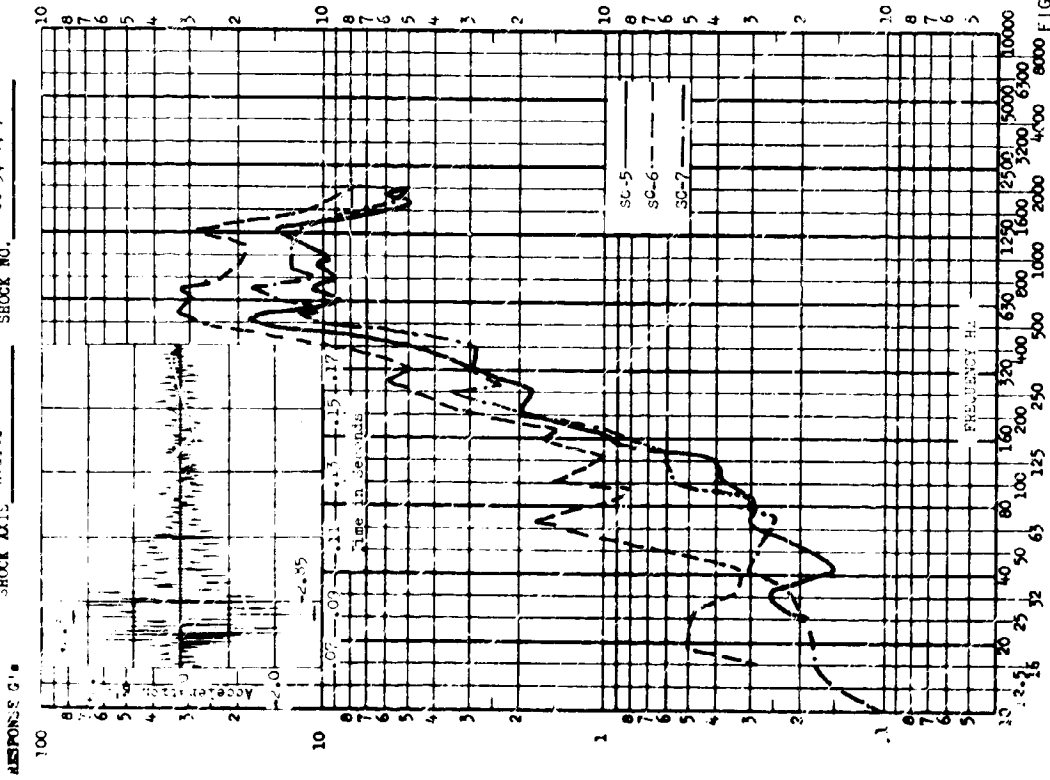
TEST ITEM Omni Antenna Deploy
 ADEL. NO. C1540 TEST DATE Sept. 15, 1966
 SHOCK AXIS Z SHOCK NO. 52-1



IV.C.4-1 8000 FIGURE

TEST ITEM: Omni Antenna Deploy
 ACCEL. NO.: 37710
 SHOCK AXIS: Roll/1

TEST DATE: Sept. 15, 1968
 SHOCK NO.: SC-5, 6, 7



TEST ITEM: Omni Antenna Deploy
 ACCEL. NO.: CA7730
 SHOCK AXIS: Z

TEST DATE: Sept. 15, 1968
 SHOCK NO.: SC-5, 6, 7

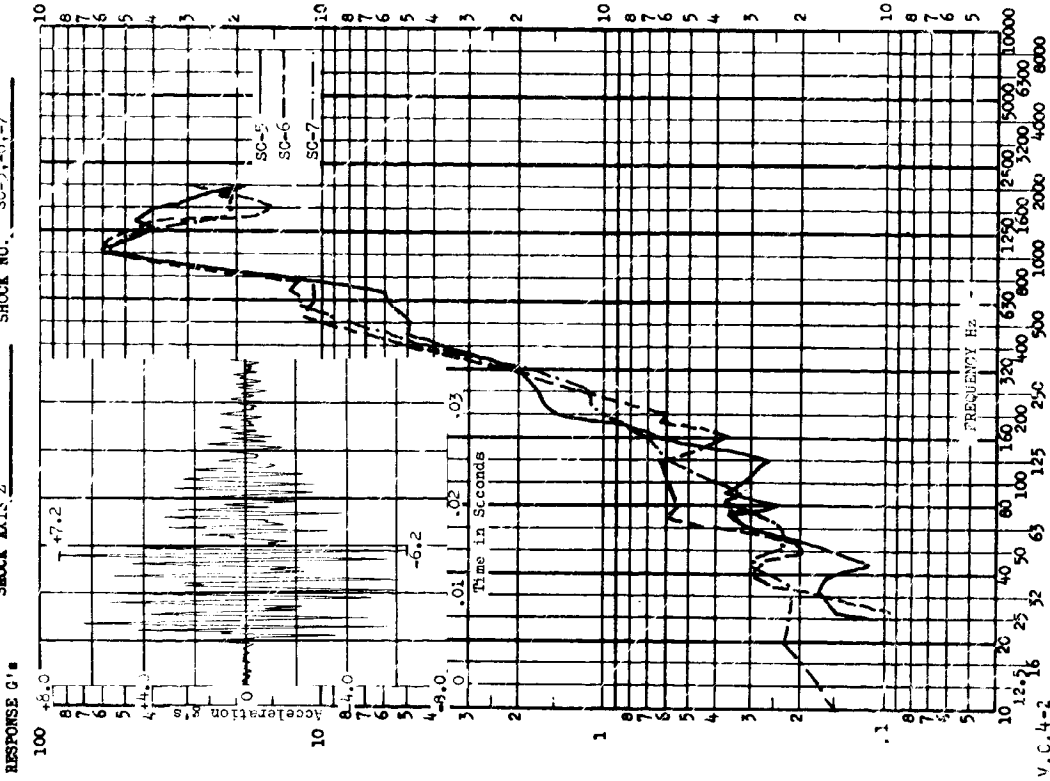


FIGURE IV.C.4-2

SECTION IV.C.5

NON-PYROTECHNIC SHOCK EVENTS

The data presented in this section includes 21 shock spectra and 9 time histories for Surveyor flight events that were not of pyrotechnic origin. These data describe the shock produced by the two main engine cutoff events, the landing gear extension, and landing gear lock events. These shock spectra are presented along with their corresponding time histories in Figures IV.C.5-1 through IV.C.5-5 as indexed in Table IV.C.5-1.

TABLE IV.C.5-1

INDEX OF DATA CONTAINED IN THIS SECTION

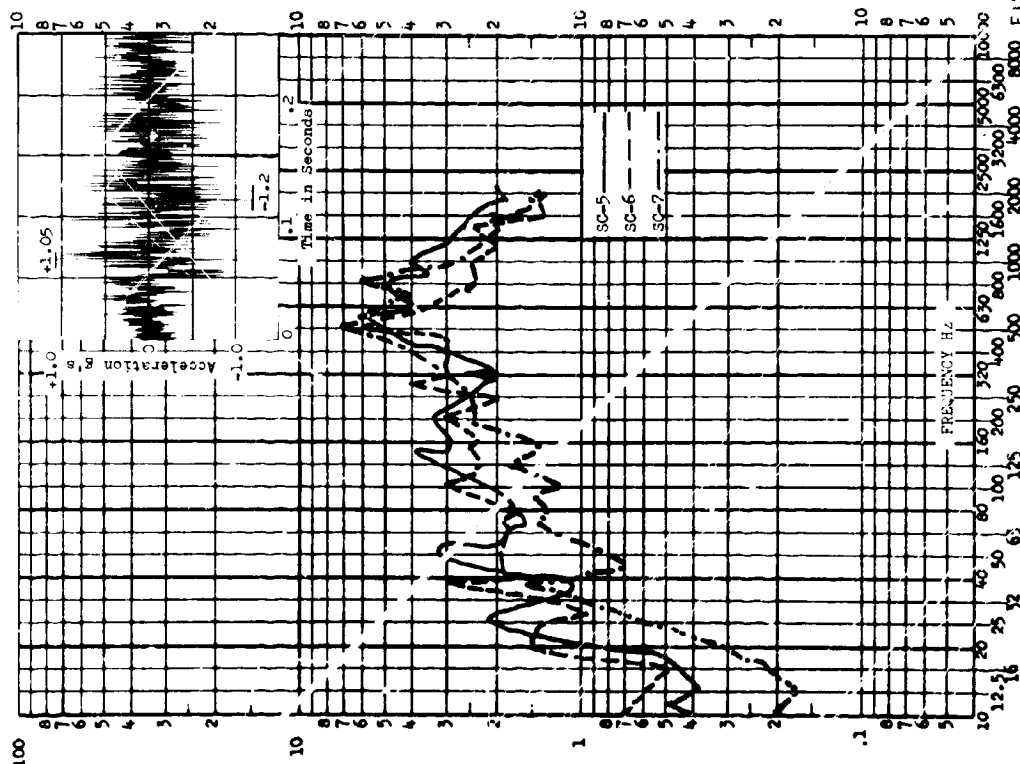
<u>Event</u>	<u>Accelerometer Number</u>	<u>Flight Designation No.s</u>	<u>Figure Number</u>
Centaur Main Engine Cut- off	CA 7720	SC-5, -6, -7	IV.C.5-1
Centuar Main Engine Cut- off 2	CA 7720	SC-5, -6, -7	IV.C.5-1
Landing	CY 540	SC-1	IV.C.5-2
Gear	CY 520	SC-1, -3, -4	IV.C.5-2
Extension	CA 7720	SC-5, -6	IV.C.5-3
	CA 7730	SC-5, -6	IV.C.5-3
Landing	CY 520	SC-1, -3, -4	IV.C.5-4
Gear	CA 7720	SC-5, -6	IV.C.5-5
Lock	CA 7730	SC-5, -6	IV.C.5-5

TEST ITEM Centaur Main Engine Cutoff

ACCEL. NO. CA7720 TEST DATE Sept. 15, 1968

SHOCK AXIS Radial SHOCK NO. SC-5,-6,-7

RESPONSE G's



TEST ITEM Centaur Main Engine Cutoff 2

ACCEL. NO. CA7720 TEST DATE Sept. 15, 1968

SHOCK AXIS Radial SHOCK NO. SC-5,-6,-7

RESPONSE G's

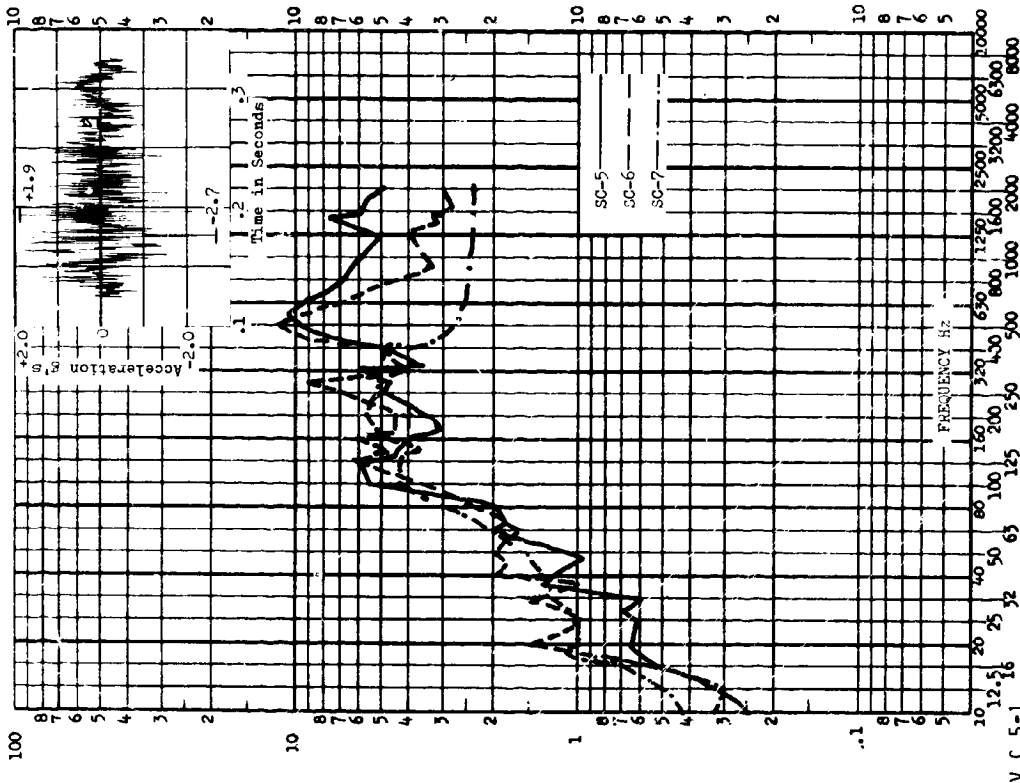
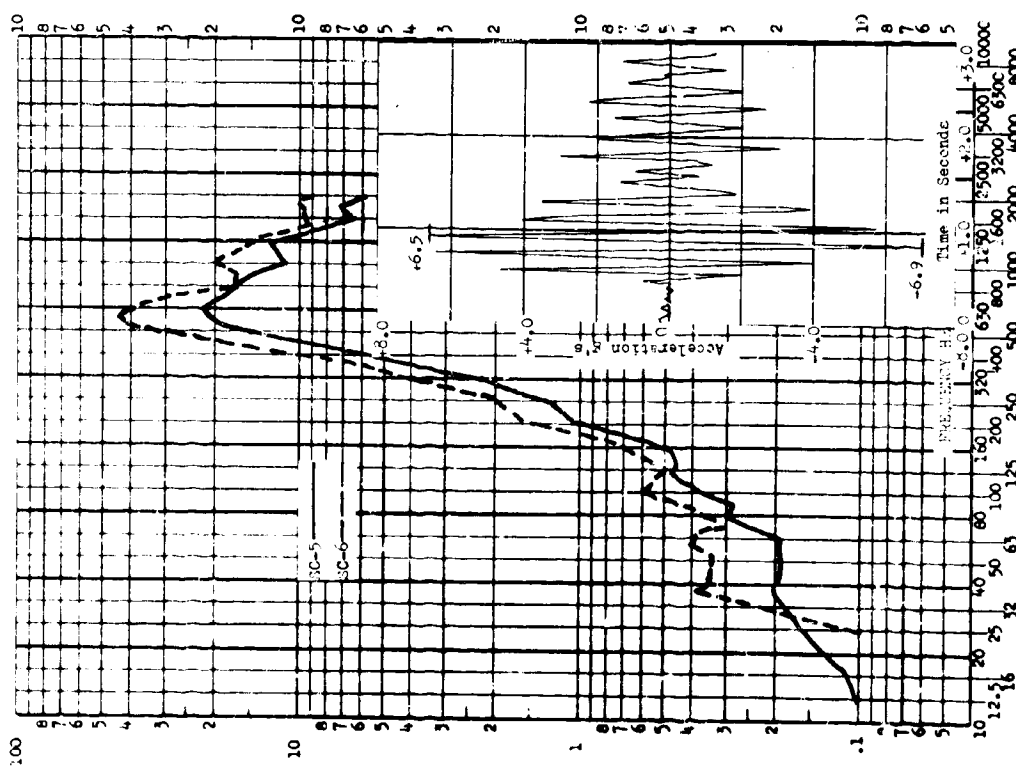


FIGURE IV.C.5-1

TEST ITEM Landing Gear Extension
 TEST DATE Sept. 15, 1962
 SHOCK AXIS 2

RESPONSE G's



TEST ITEM Landing Gear Extension
 TEST DATE Sept. 15, 1962
 SHOCK AXIS 2

RESPONSE G's

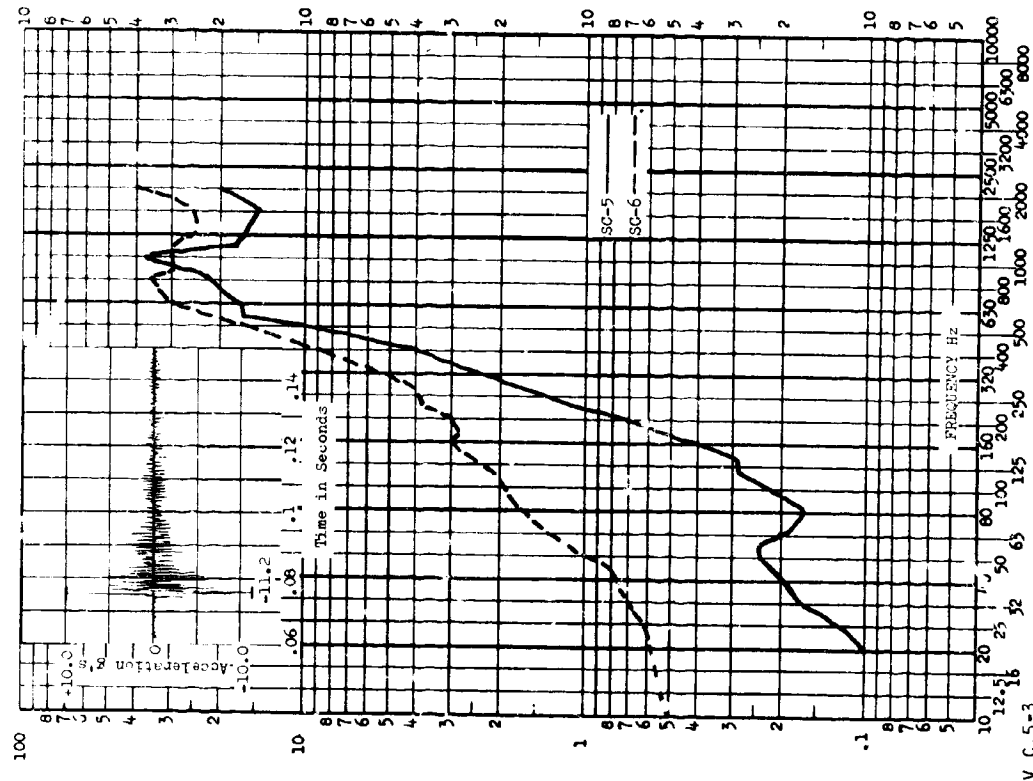


FIGURE IV.C-5-3

TEST ITEM: Landing Gear Link
 TEST NO. 0Y50C TEST DATE Sept. 1, 1968
 SHOCK AXIS 2 SHOCK NO. SC-1, 2, 3

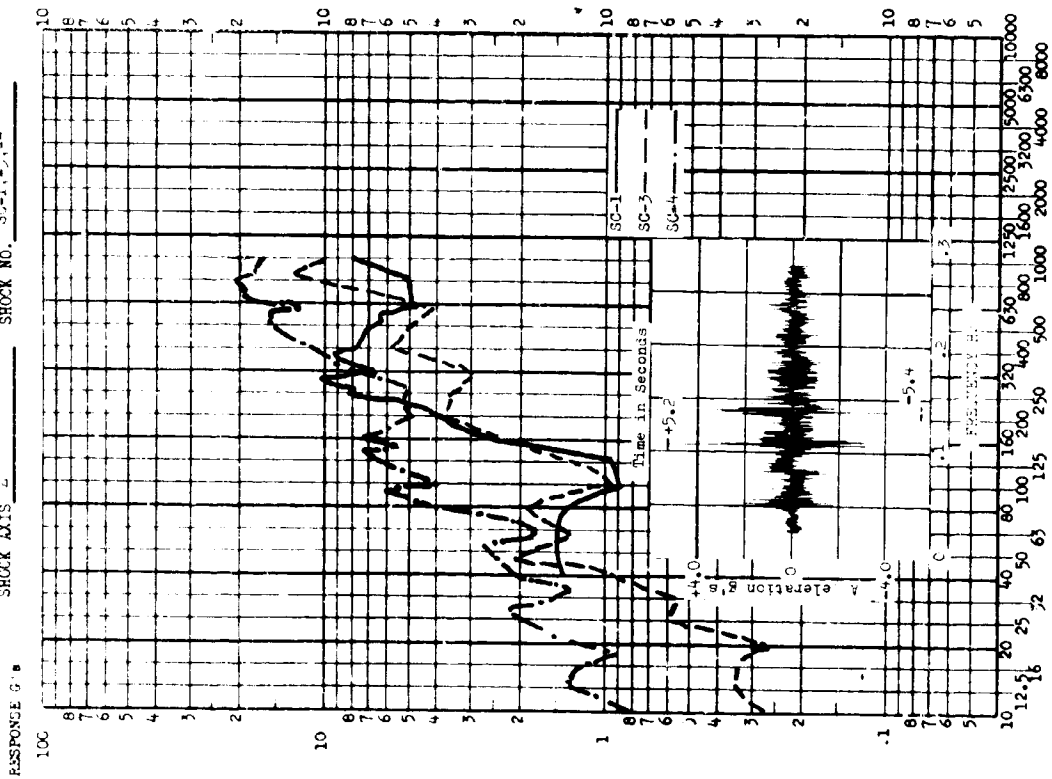
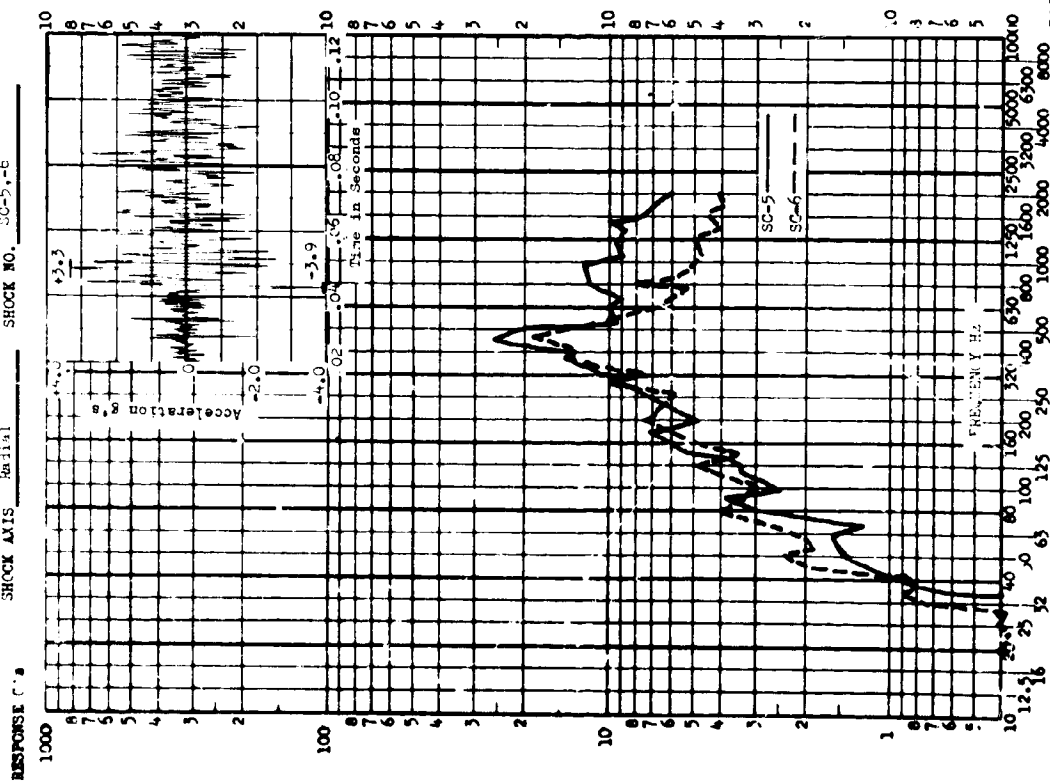


FIGURE IV.C.5-4

TEST ITEM Landing Gear Lock
 ACCEL. NO. 6A7730
 SHOCK AXIS Radial
 TEST DATE Sept. 15, 1968
 SHOCK NO. SC-5,-6



TEST ITEM Landing Gear Lock
 ACCEL. NO. 6A7730
 SHOCK AXIS Z
 TEST DATE Sept. 15, 1968
 SHOCK NO. SC-5,-6

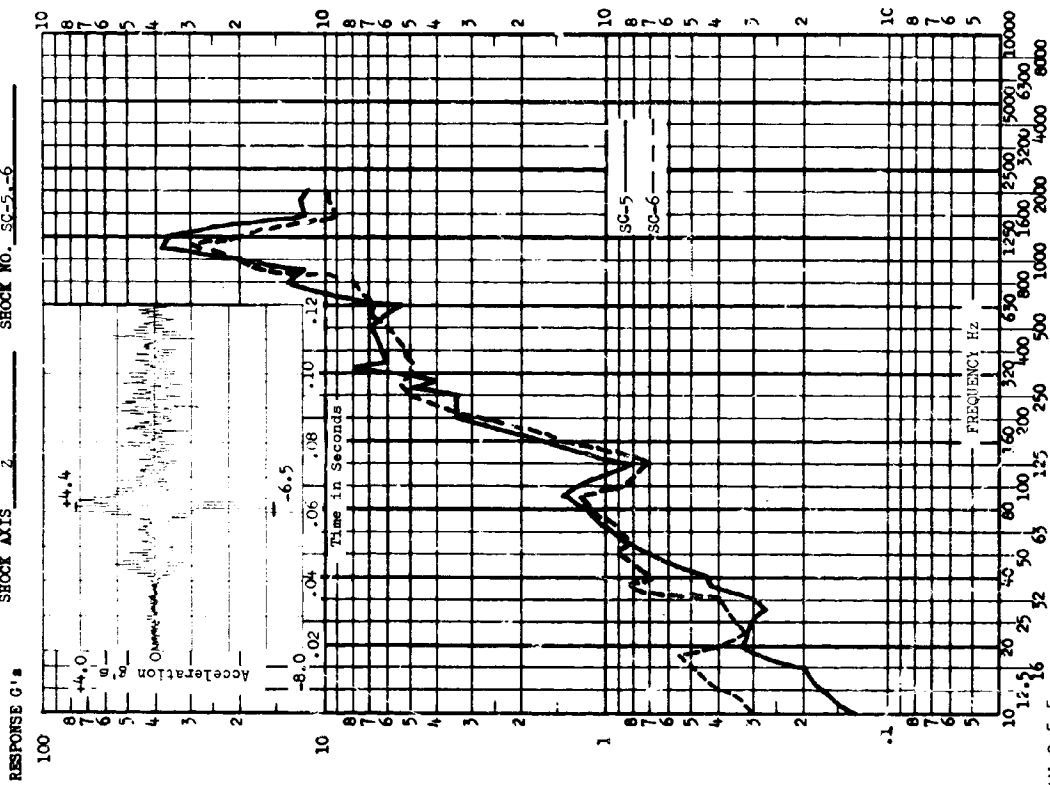


FIGURE IV.C.5-5

DIVISION V

FLIGHT-PYROTECHNIC SHOCK DATA

FOREWORD TO DIVISION V

Division V contains pyrotechnic shock data from four flight tests. Due to the limitations of telemetry systems the amount of data is small, totaling 41 spectra for the four sections. These four sections were organized into a separate division to show the type of data that have been obtained from flight measurements.

TABLE OF CONTENTS

Page No.

DIVISION V

Flight-Pyrotechnic Shock Data

Section	Title	Number of Shock Spectra	
V.1	Flight of Lunar Orbiters I and II-Shroud Jettison	7	665
V.2	Flight Test of Delta Vehicle (TOS-A)-Solid Motor and Fairing Jettison	7	671
V.3	Flight Test of Delta Vehicle 43 (BIOS-A)-Spacecraft Separation	12	682
V.4	Flight Test of Delta Vehicle 51 (BIOS-B)-Spacecraft Separation and Fairing Jettison	15	693
Location of Additional Data			707

SECTION V.1

FLIGHT OF LUNAR ORBITERS I AND II-SHROUD JETTISON

DESCRIPTION OF EVENT

During the course of Lunar Orbiter flights I and II, standard Atlas-Agena pyrotechnics were used to separate and jettison an over the nose fairing to expose the orbiter.

DESCRIPTION OF DATA

No. of shock spectra	7
Type of analysis	digital
Sample rate	8000/second
Frequency range	to 1000 Hz
Damping	Q=10

These shock spectra are presented as Figures V.1-2 and V.1-3.

DESCRIPTION OF STRUCTURE

Figure V.1-1

DESCRIPTION OF ACCELEROMETERS

Table V.1-1 and Figure V.1-1

COMMENTS

Three contacts, were made in an effort to obtain additional information regarding these events; however, the description above was all that could be learned.

From comparing the frequency limits to which the data are presented with the frequency information in Table V.1-1, the following is noted:

<u>Accelerometer Number</u>	<u>Frequency limits for which the shock spectra are not questionable</u>
12	160 Hz
13	220 Hz
17	790 Hz
18	1000 Hz

TABLE V.1-1

FLIGHT INSTRUMENTATION DATA

<u>Accelerometer Number</u>	<u>Location</u>	<u>Sensitive Axis</u>	<u>Accelerometer Frequency Response (Hz)</u>	<u>Channel Frequency Response (Hz)</u>	<u>Data Location Figure Number</u>
12	Spacecraft	Transverse	5- 800	160	V.1-2
13	Spacecraft	Longitudinal	5-1100	220	V.1-2
17	Spacecraft Adapter	Longitudinal	20-2000	790	V.1-3
18	Spacecraft Adapter	Transverse	20-2000	1050	V.1-3

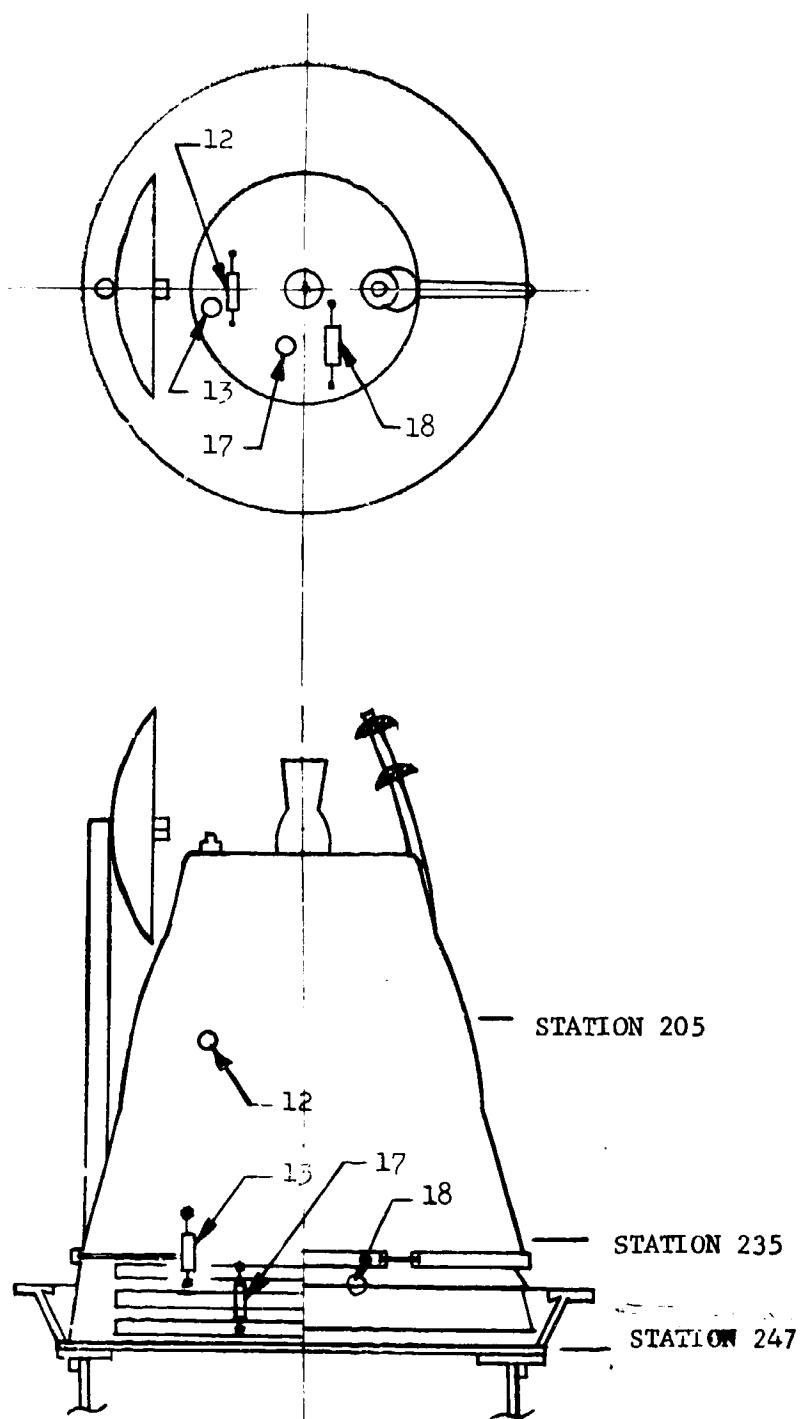
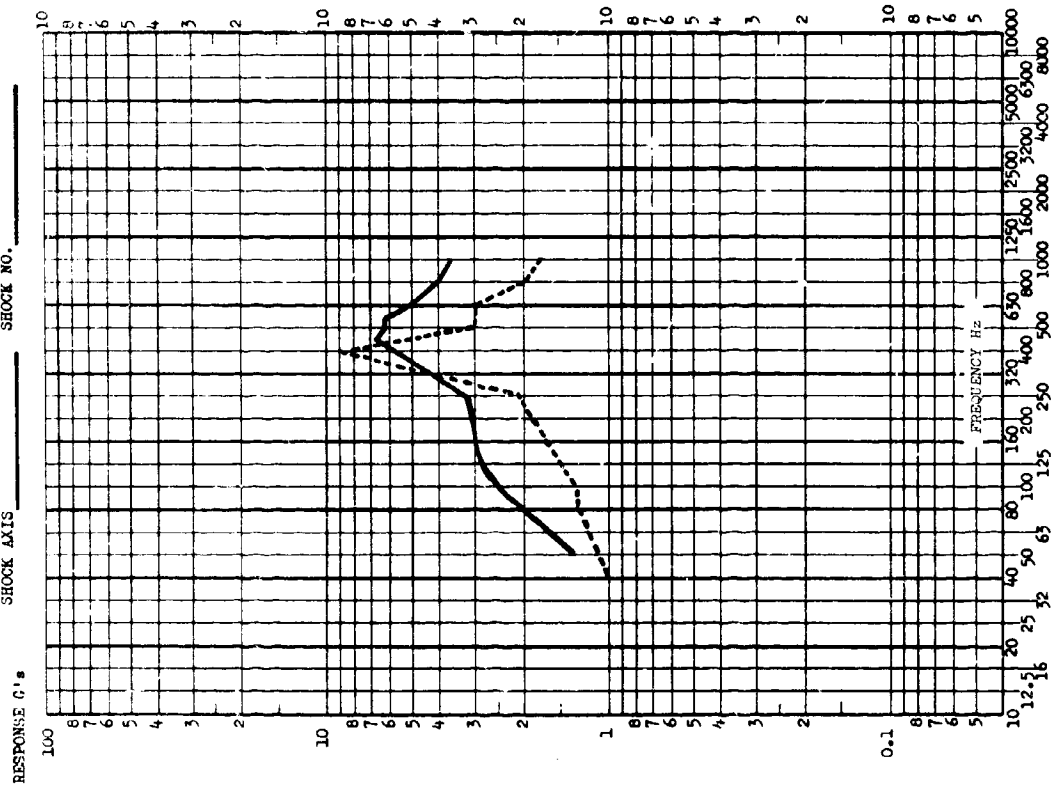


FIGURE V.1-1

Accelerometer Locations on the Lunar Orbiter

TEST ITEM Lunar Orbiter I & Lunar Orbiter II
 ACCEL. NO. 13 TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____



TEST ITEM Lunar Orbiter I & Lunar Orbiter II
 ACCEL. NO. 12 TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

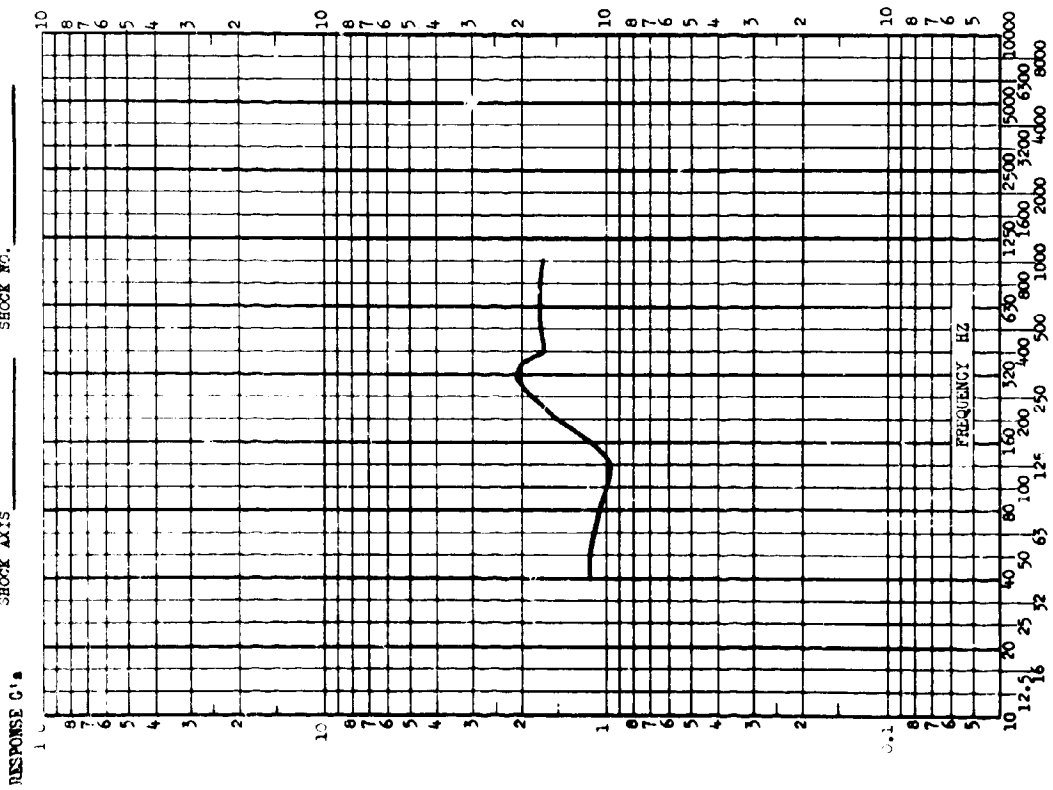
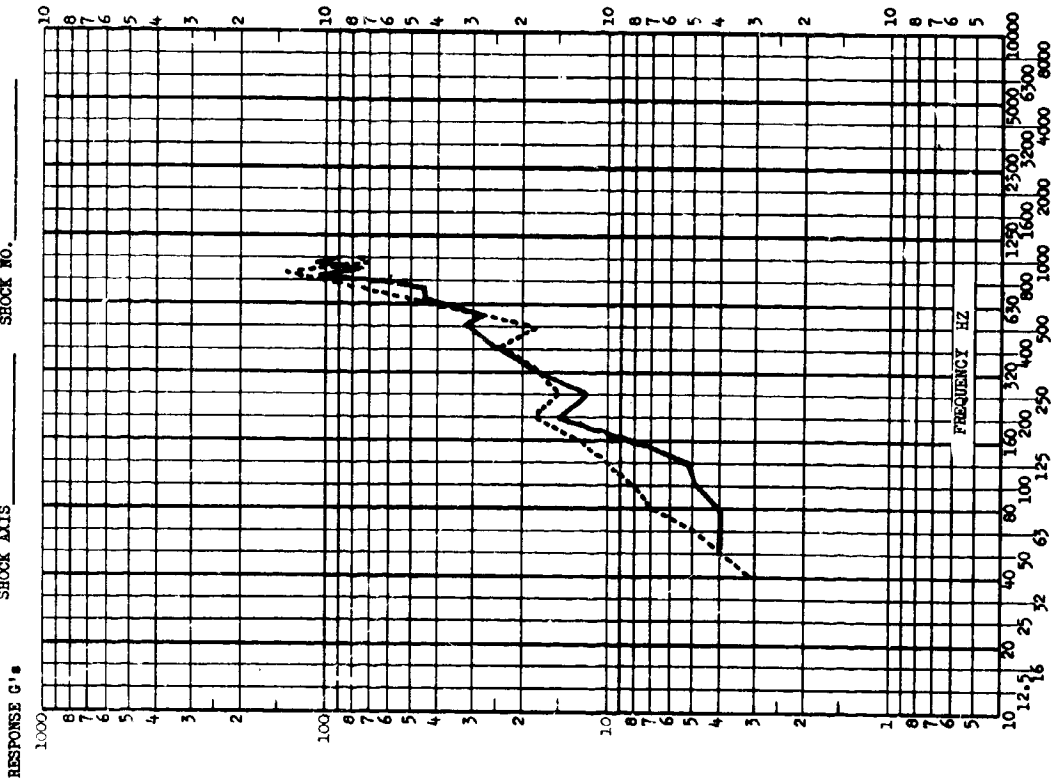


FIGURE V.1-2

TEST ITEM Lunar Orbiter I & Lunar Orbiter II
 ACCEL. NO. 17 TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____



TEST ITEM Lunar Orbiter I & Lunar Orbiter II
 ACCEL. NO. 18 TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

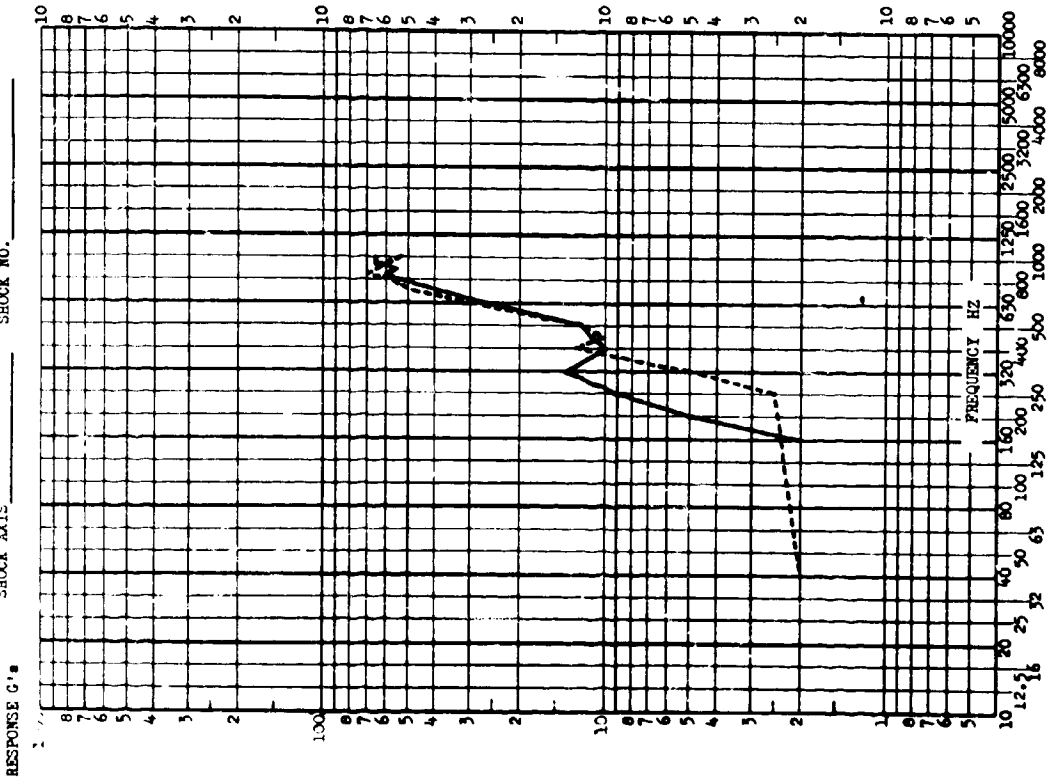


FIGURE V.1-3

SECTION V.2

FLIGHT TEST OF DELTA VEHICLE 41 ----- TOS-A .

DESCRIPTION OF EVENTS

During the flight of Delta Vehicle 41, there were two notable pyrotechnic events for which some data were available:

- 1) solid motor jettison (explosive bolts)
- 2) fairing jettison (explosive bolts)

Fairing jettison was initiated by the detonation of six explosive bolts at the separation plane. This released the six alternately spaced, preloaded spring actuators which imparted a relative velocity to the fairing. Figures V.2-1 and V.2-2 indicate the locations of the solid motors, the fairing, the separation plane, and the accelerometers.

DESCRIPTION OF DATA

Solid Motor Jettison Event

No. of time histories	5
Duration	Table V.2-1
No. of shock spectra	5
Type of analysis	digital
Sample rate	2500 per second
Frequency range	Table V.2-1
Frequency increments	40 points per octave

Damping Q=10

These data are presented with their corresponding time histories as Figures V.2-3 through V.2-6

Fairing Jettison

No. of time histories	2
Duration	Table V.2-1
No. of shock spectra	2
Type of analysis	digital
Sample rate	2500
Frequency range	Table V.2-1
Frequency increments	40 points per octave
Damping	Q=10

These shock spectra are presented with their corresponding time histories as Figure V.2-6

DESCRIPTION OF PYROTECHNIC

Six explosive bolts for the fairing jettison event. See Figure V.2-2 for location.

DESCRIPTION OF STRUCTURE

Figures V.2-1 and V.2-2

DESCRIPTION OF ACCELEROMETERS

Type: Table V.2-2

Location and axis of sensitivity: Table V.2-2 and Figures V.2-1 and V.2-2

DESCRIPTION OF DATA ACQUISITION SYSTEM

FM telemetry

COMMENTS

Due to the limitations of the accelerometers used, the shock spectra presented here are questionable above 50 hz (Table V.2-2).

TABLE V.2-1

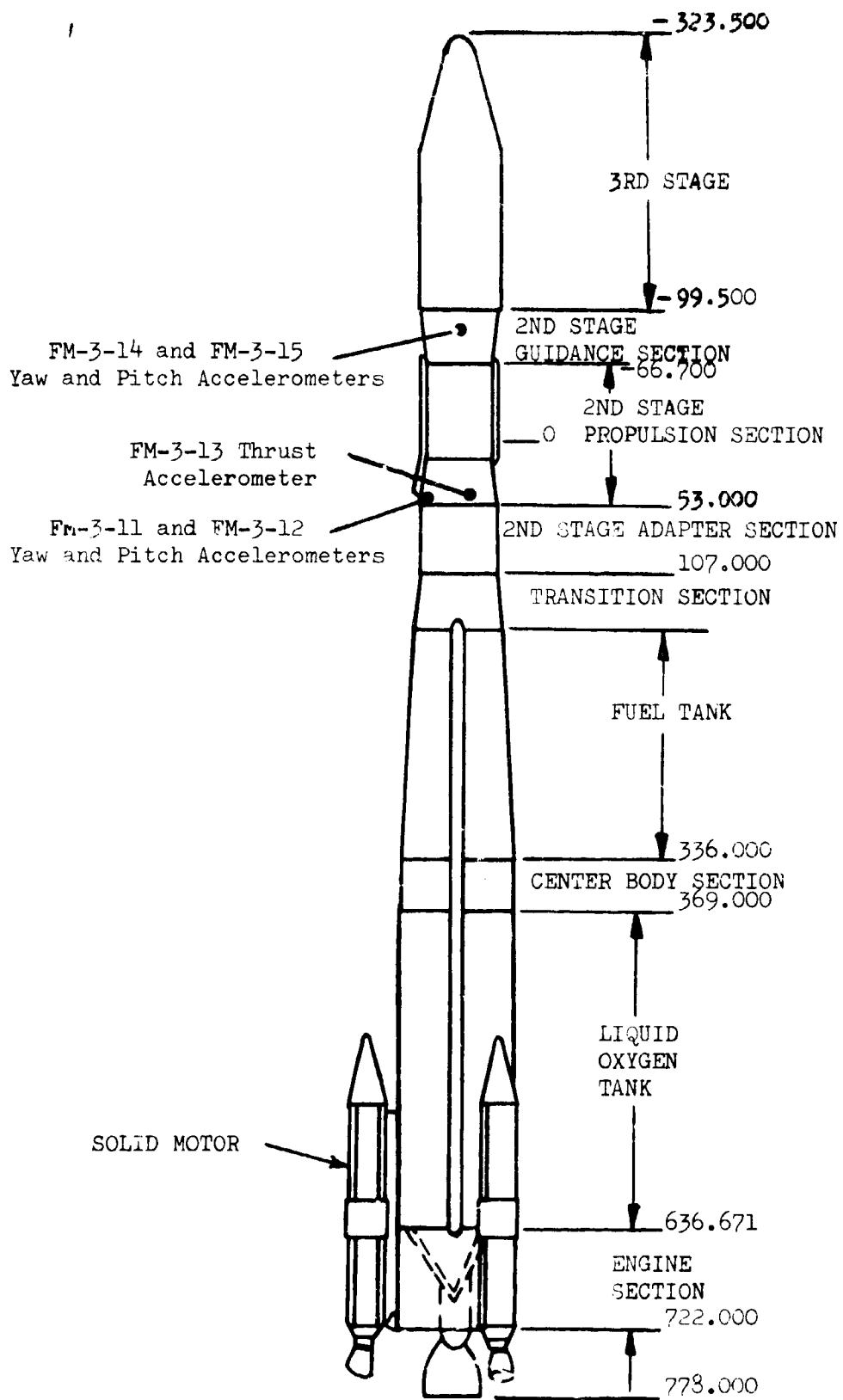
DATA REDUCTION INFORMATION

<u>Accelerometer Number</u>	<u>Duration of Time History Used in Shock Spectrum Analysis(seconds)</u>	<u>Frequency Range (limited by telemetry)</u>	<u>Figure Number</u>
Solid Motor Jettison Event			
FM-3-11	0.9	1.0-110 Hz	V.2-3
FM-3-12	0.9	1.0-160 Hz	V.2-3
FM-3-13	0.9	1.0-200 Hz	V.2-4
FM-3-14	0.7	1.0-300 Hz	V.2-4
FM-3-15	0.9	1.0-350 Hz	V.2-5
Fairing Jettison Event			
FM-3-14	0.8	1.0-300 Hz	V.2-6
FM-3-15	1.0	1.0-350 Hz	V.2-6

TABLE V.2-2

DESCRIPTION OF ACCELEROMETERS

<u>Accelerometer Number</u>	<u>Sensitive Axis</u>	<u>Location</u>	<u>Description of Accelerometers</u>
FM-3-11	yaw	sta. 47.2 quad. I-IV	Statham Strain Gauge Model A404TC-2 Valid Range=0-50 Hz
FM-3-12	pitch	sta. 47.2 quad. I-IV	Statham Strain Gauge Model A404TC-2 Valid Range=0-50 Hz
FM-3-13	thrust	sta. 44.8 quad. I-II	CEC Strain Gauge Valid Range=0-40 Hz
FM-3-14	yaw	cross beam intersec- tion sta. -90	Statham Strain Gauge Model A404TC-2 Valid Range=0-50 Hz
FM-3-15	pitch	cross beam intersec- tion sta. -90	Statham Strain Gauge Model A404TC-2 Valid Range=0-50 Hz



Accelerometer Locations on the Delta Vehicle 41.

FIGURE V.2

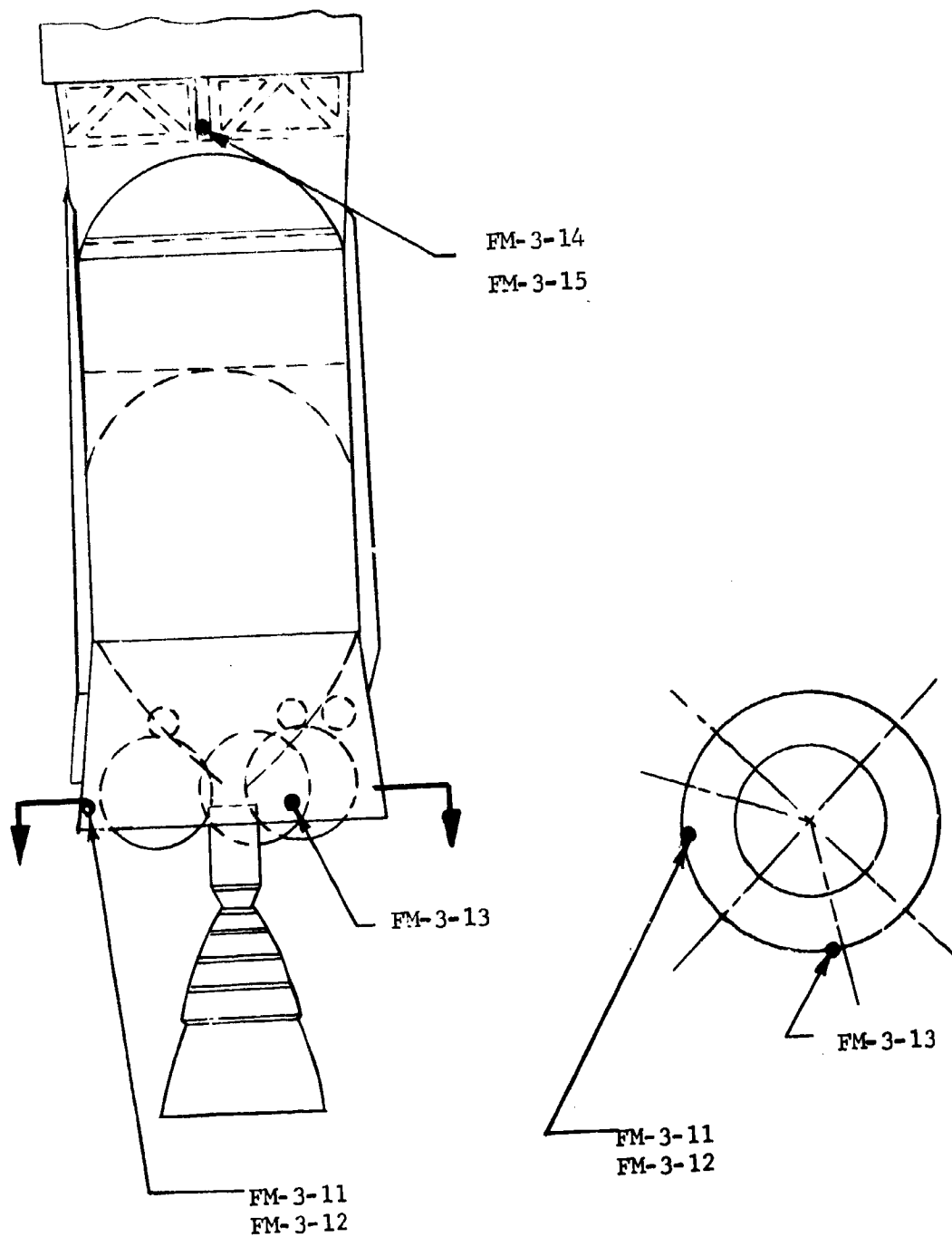
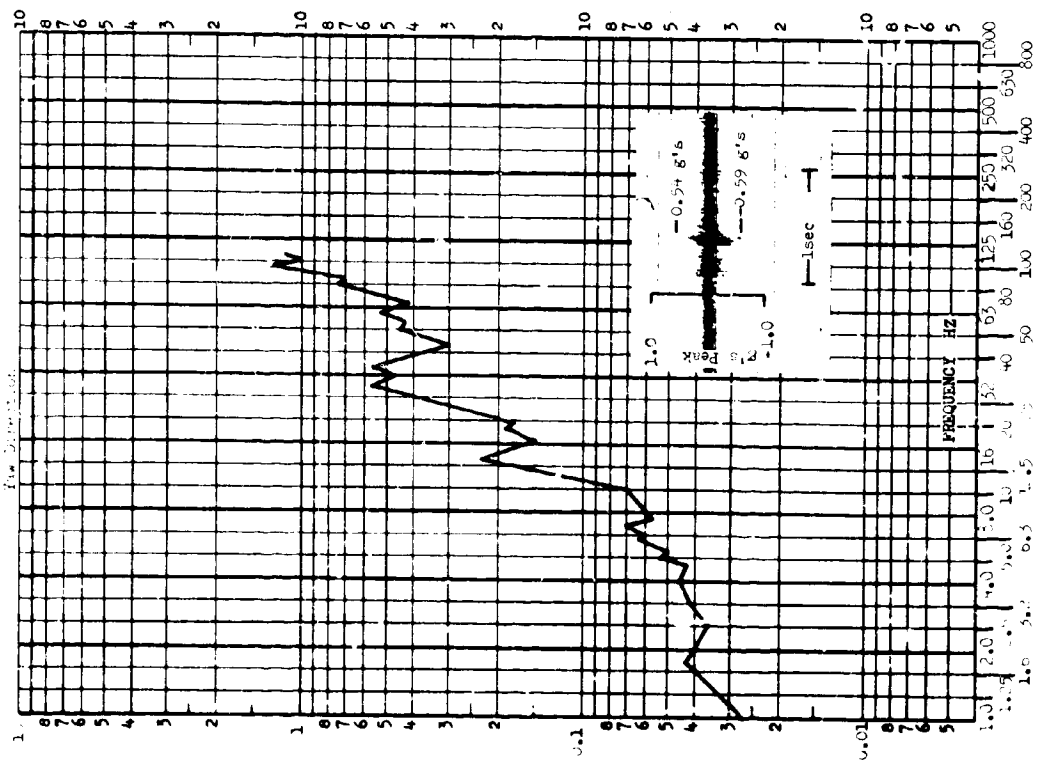


FIGURE V.2-2
ACCELEROMETER LOCATIONS

TEST ITEM Flight Test of PART NO. _____
Delta Vehicle 41 TEST DATE December 1966
 SHOCK AXIS Mount FM-2-11 SHOCK NO. 3211 Motor Jetison
 Pitch Direction



TEST ITEM Flight Test of PART NO. _____
Delta Vehicle 41 TEST DATE December 1966
 SHOCK AXIS Mount FM-3-12 SHOCK NO. 3212 Motor Jetison
 Pitch Direction

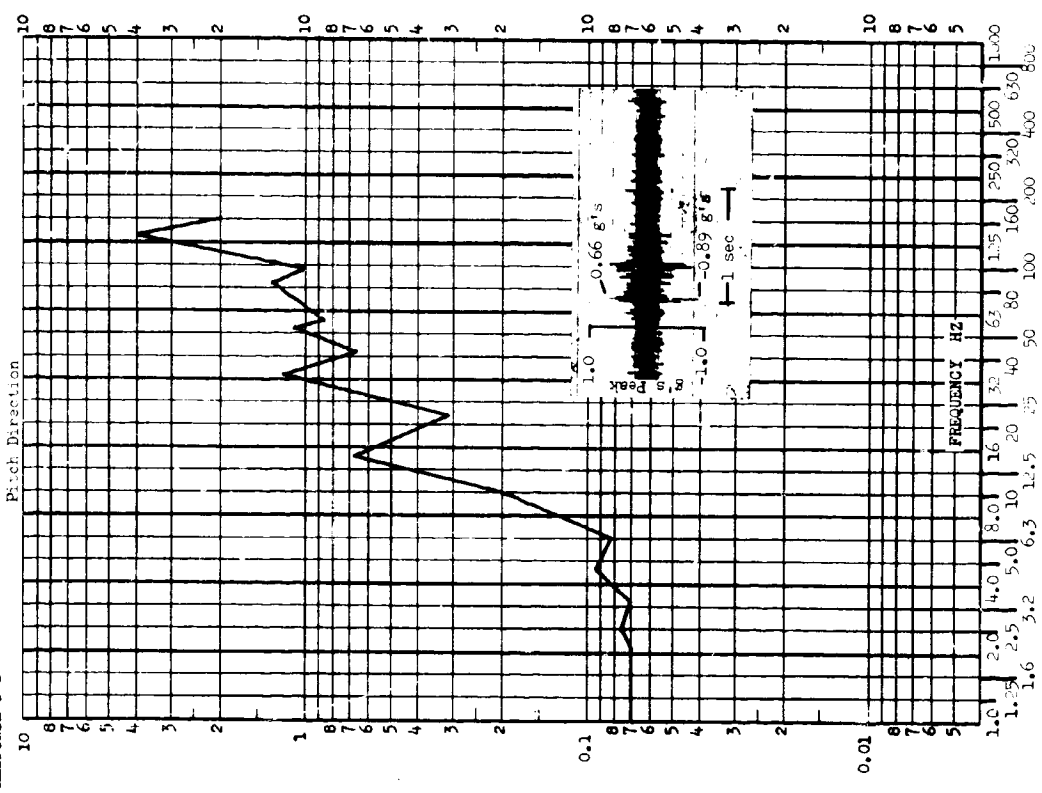
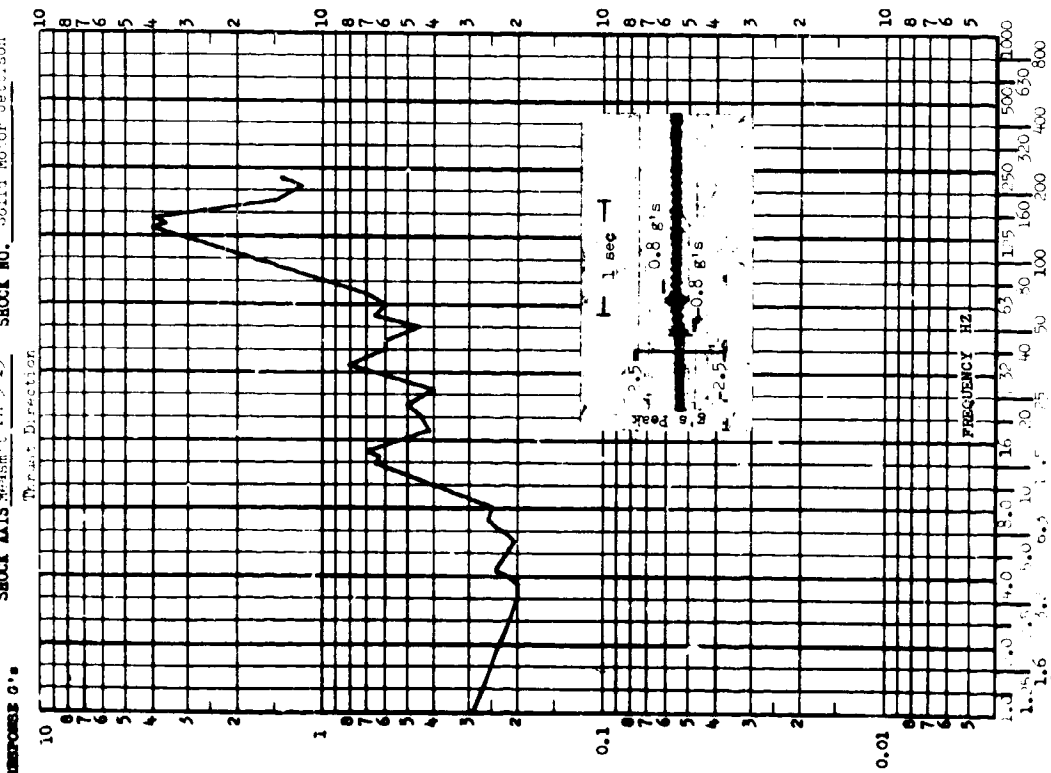


FIGURE V.2-3

TEST ITEM Flight Test of
Delta Variable #1
SHOCK AXIS Measmt FM-5-13
PART NO.
TEST DATE December 1966
SHOCK NO. Solid Motor Jetison



TEST ITEM Flight Test of
Delta Variable #1
SHOCK AXIS Measmt FM-5-24
PART NO.
TEST DATE December 1966
SHOCK NO. Solid Motor Jetison

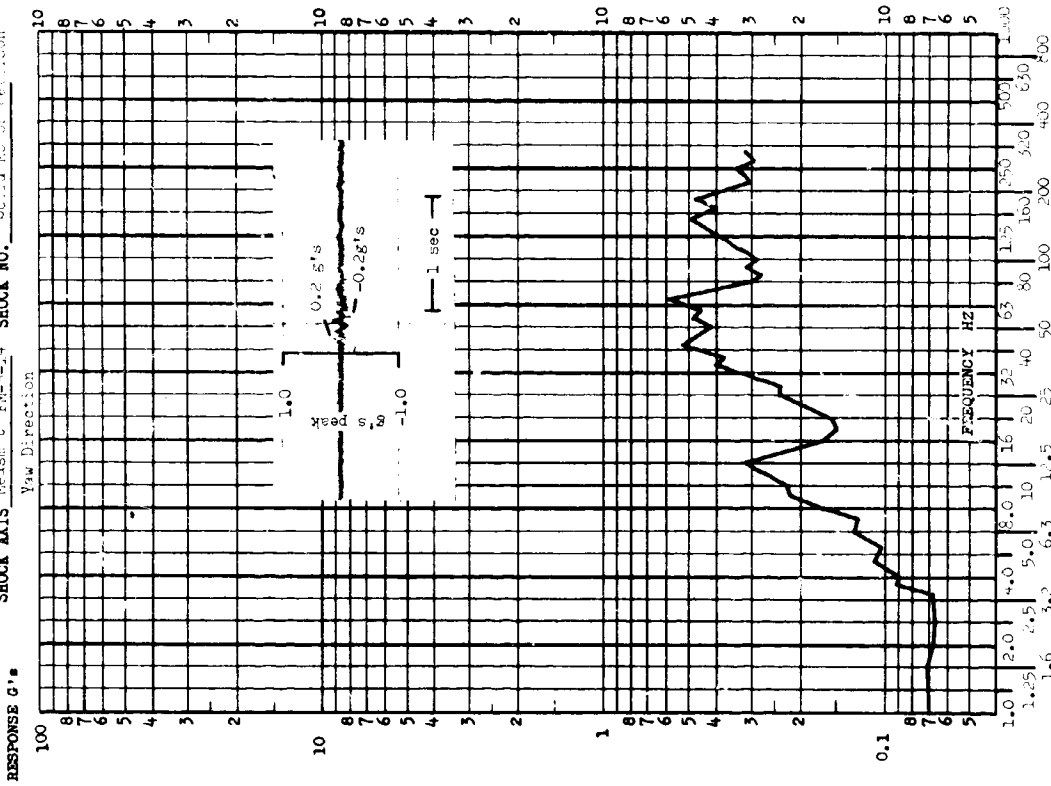


FIGURE V.2-4

TEST ITEM _____ PART NO. _____
 TEST DATE _____
 SHOCK AXIS _____ SHOCK NO. _____

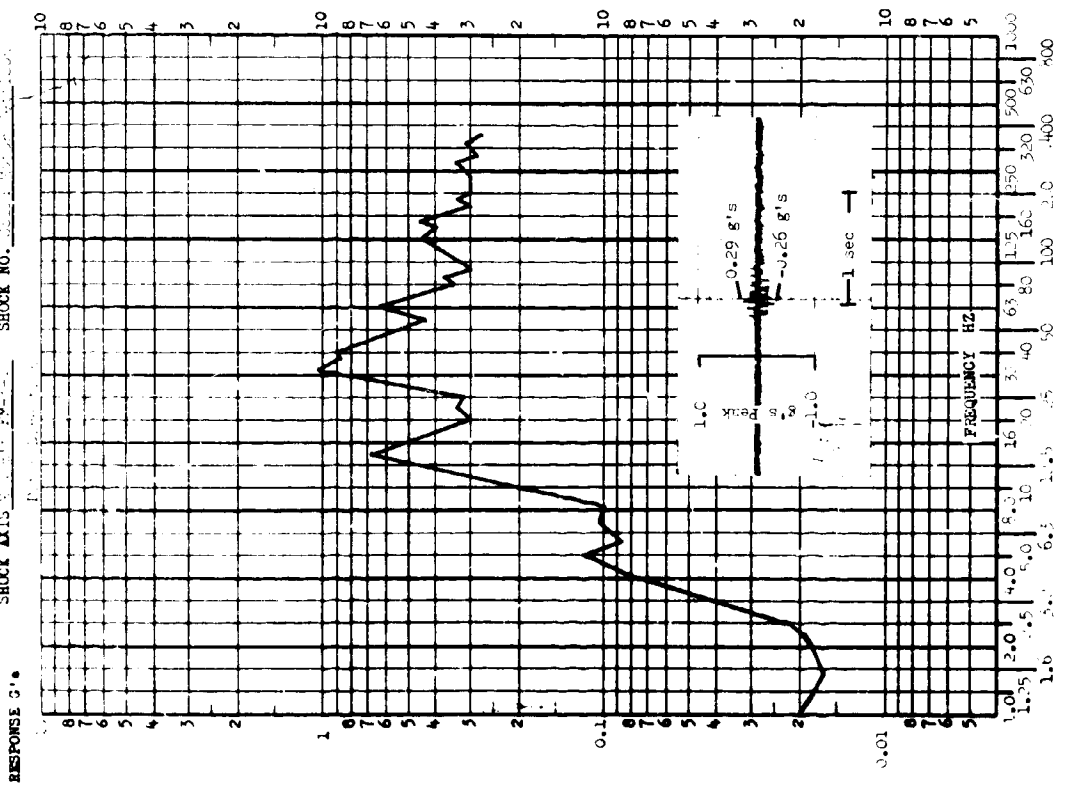
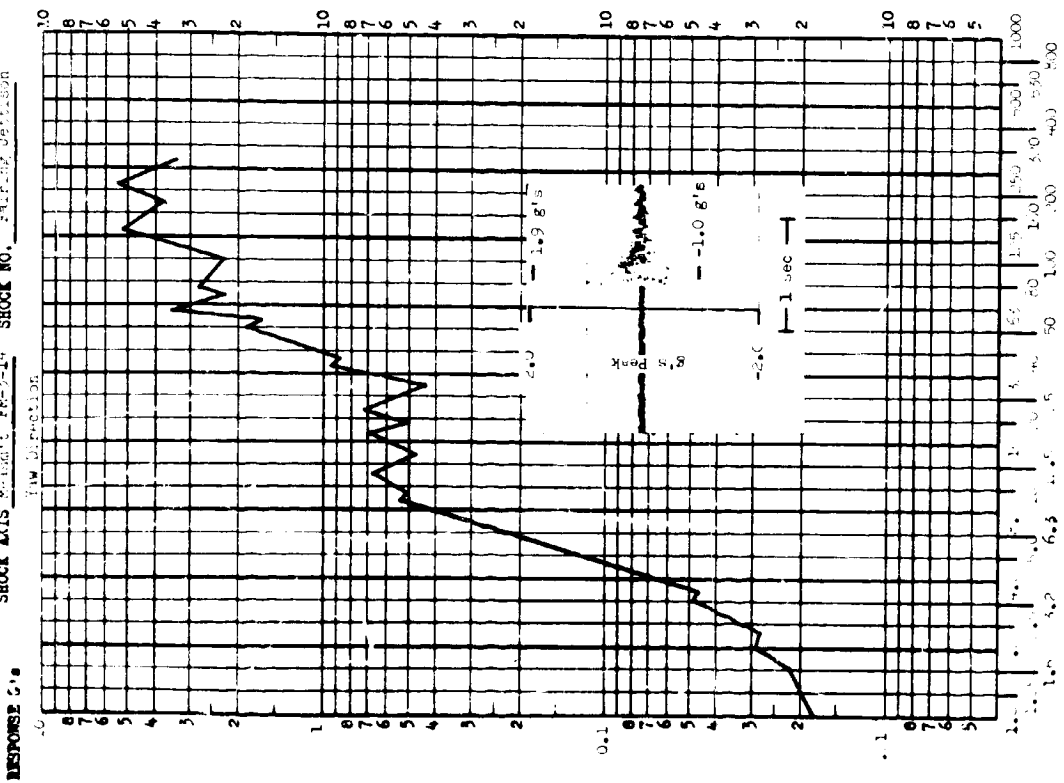


FIGURE V.2-5

SHOCK TEST ANALYSIS DATA SHEET

TEST ITEM Flight Test of PART NO.
Delta Vehicle #1 TEST DATE December 1966
 SHOCK AXIS Yaw SH-14 SHOCK NO. Parang Jetison



TEST ITEM Flight Test of PART NO.
Delta Vehicle #1 TEST DATE December 1966
 SHOCK AXIS Yaw SH-14 SHOCK NO. Parang Jetison

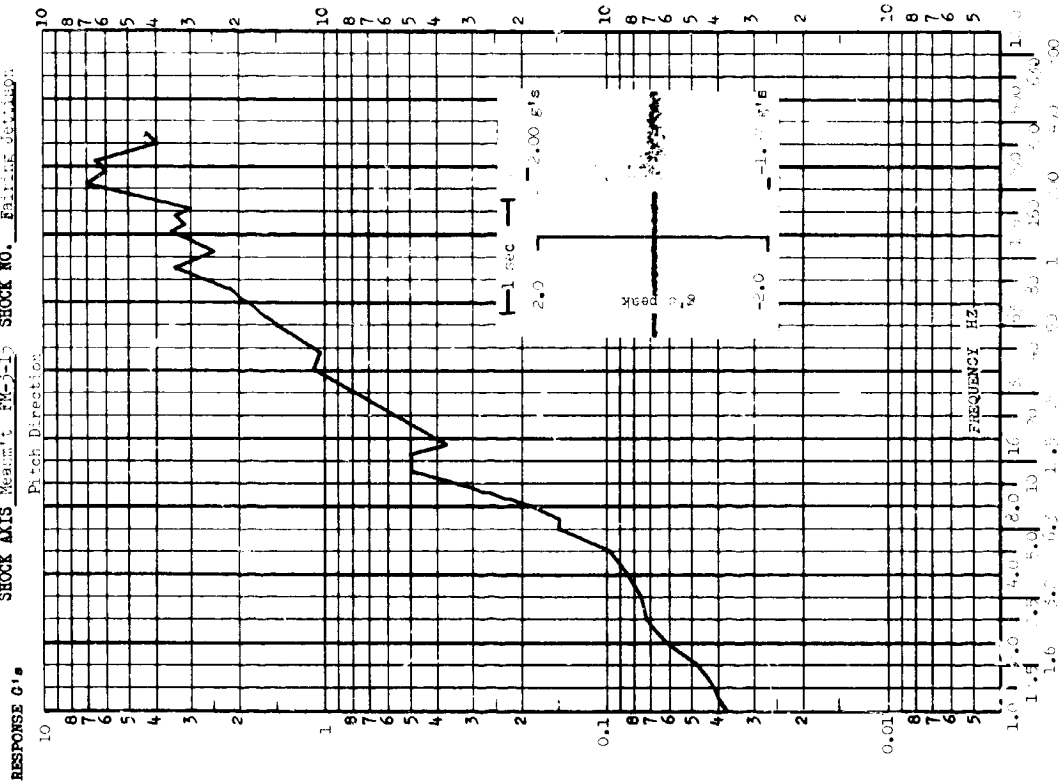


FIGURE V.2-6

SECTION V.3

FLIGHT TEST OF DELTA VEHICLE 43-BIOS-A

DESCRIPTION OF EVENT

During the flight of Delta Vehicle 43, two transient responses were observed at spacecraft separation. These transients were attributed to 1) a combination of explosive bolt detonation and explosive nut impact within its retainer and 2) bottoming of the actuator springs upon release. Figure V.3-1 illustrates the locations of the four explosive bolts alternately spaced with the four actuator springs.

DESCRIPTION OF DATA

Seven accelerometers were prepared to monitor this event; however, accelerometer FM-3-13 failed to transmit data earlier in the flight. The other six accelerometers in the separation region produced useful data depicting both events.

No. of time histories	12
Duration	0.2 second/event (approx.)
No. of shock spectra	12
Type of analysis	digital
Frequency range	Table V.3-1
Frequency increment	30 points per octave
Damping	0 = 10

These shock spectra are presented with their corresponding time histories as Figures V.3-3 through V.3-8.

DESCRIPTION OF PYROTECHNIC

Four explosive bolts.

DESCRIPTION OF STRUCTURE

Diameter = 58 inches

Weight = 940 pounds

See Figures V.3-1 and V.3-2

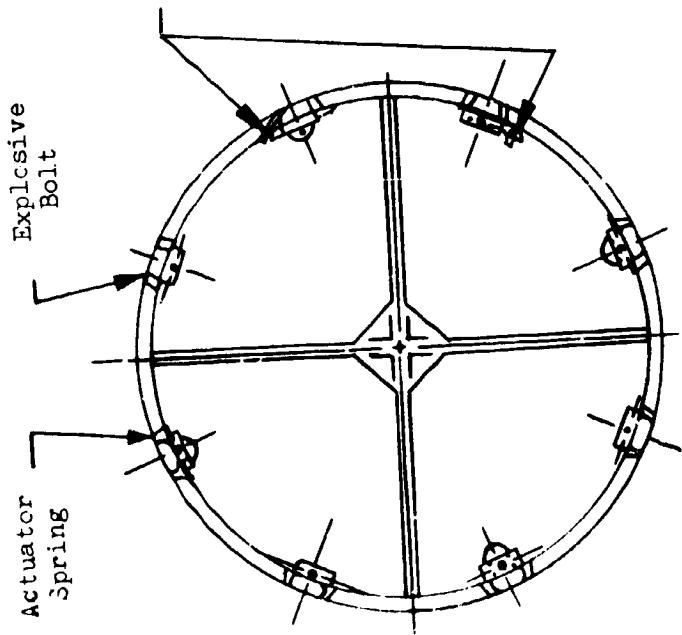
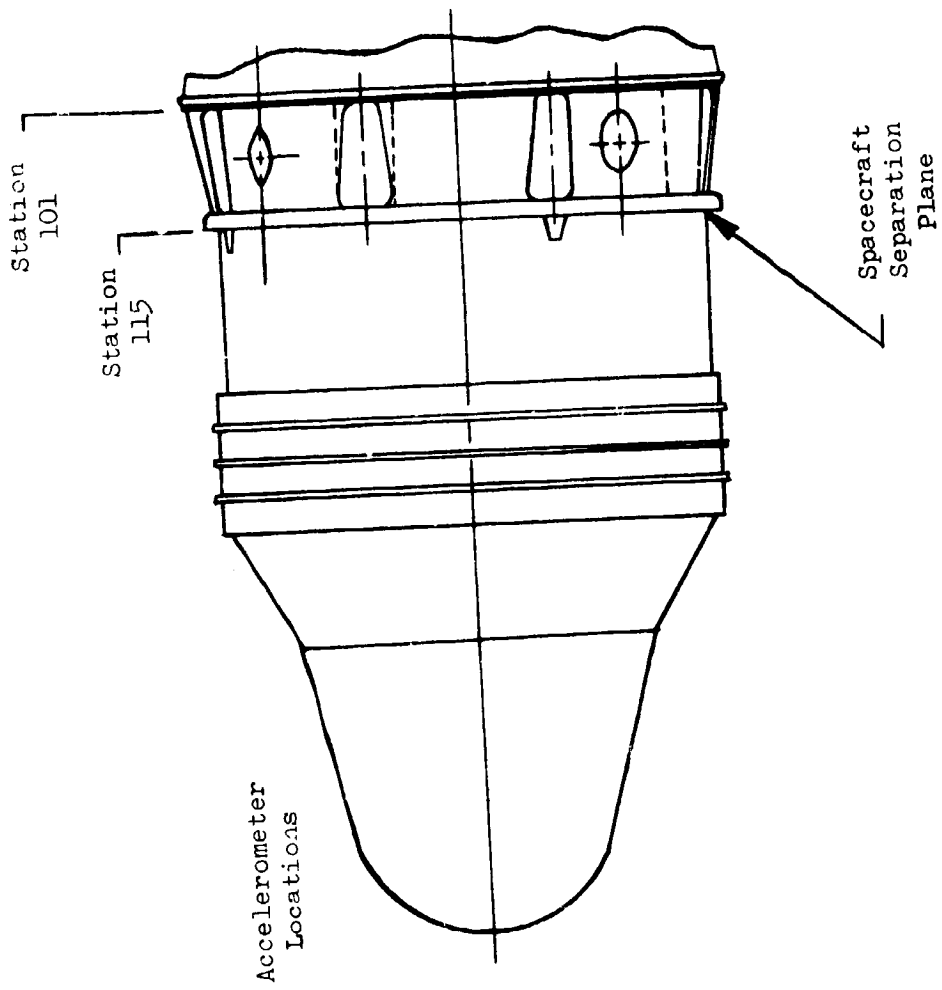
DESCRIPTION OF ACCELEROMETERS

Locations: Table V.3-1 and Figure V.3-2

Axis of sensitivity: Table V.3-1.

TABLE V.3-1
 INFORMATION ABOUT ACCELEROMETER
 AND DATA

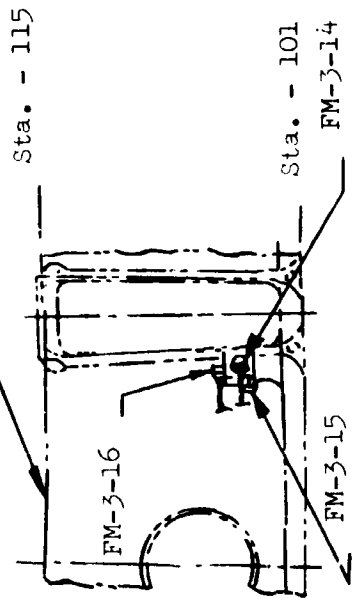
<u>Accelerometer Number</u>	<u>Location</u>	<u>Sensitive Axis</u>	<u>Frequency Range</u>	<u>Figure Number</u>
FM-3-11	Sta. 115	Tangential	660 Hz	V.3-3
FM-3-12	Sta. 115	Radial	900 Hz	V.3-4
FM-3-14	Sta. 101	Radial	1600 Hz	V.3-5
FM-3-15	Sta. 101	Tangential	2500 Hz	V.3-6
FM-3-16	Sta. 101	Thrust	5000 Hz	V.3-7
FM-3-17	Sta. 101	Tantential	5000 Hz	V.3-8



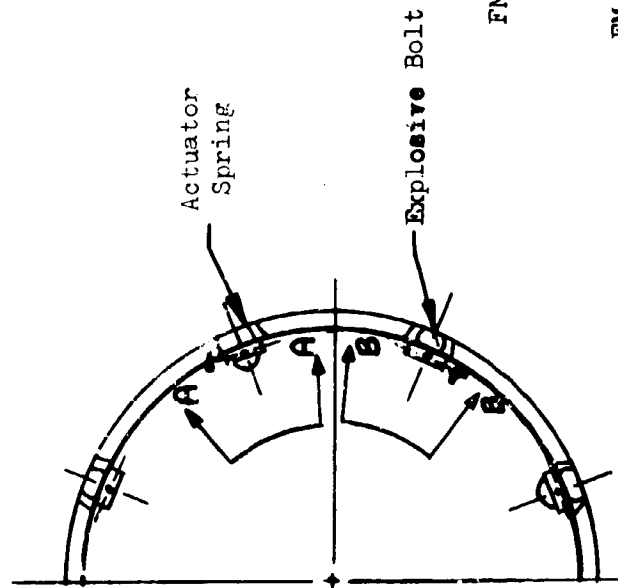
VIEW LOOKING AFT FROM
SPACECRAFT SEPARATION PLANE

Figure V.3-1. Location of Pyrotechnic Devices on the Delta 43-BIOS-A Spacecraft

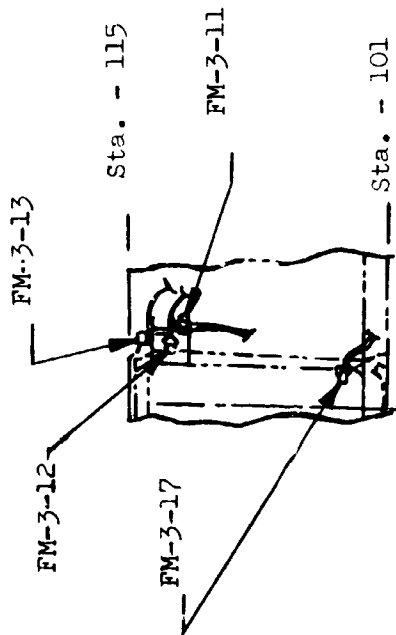
Spacecraft Separation Plane



SECTION A-A



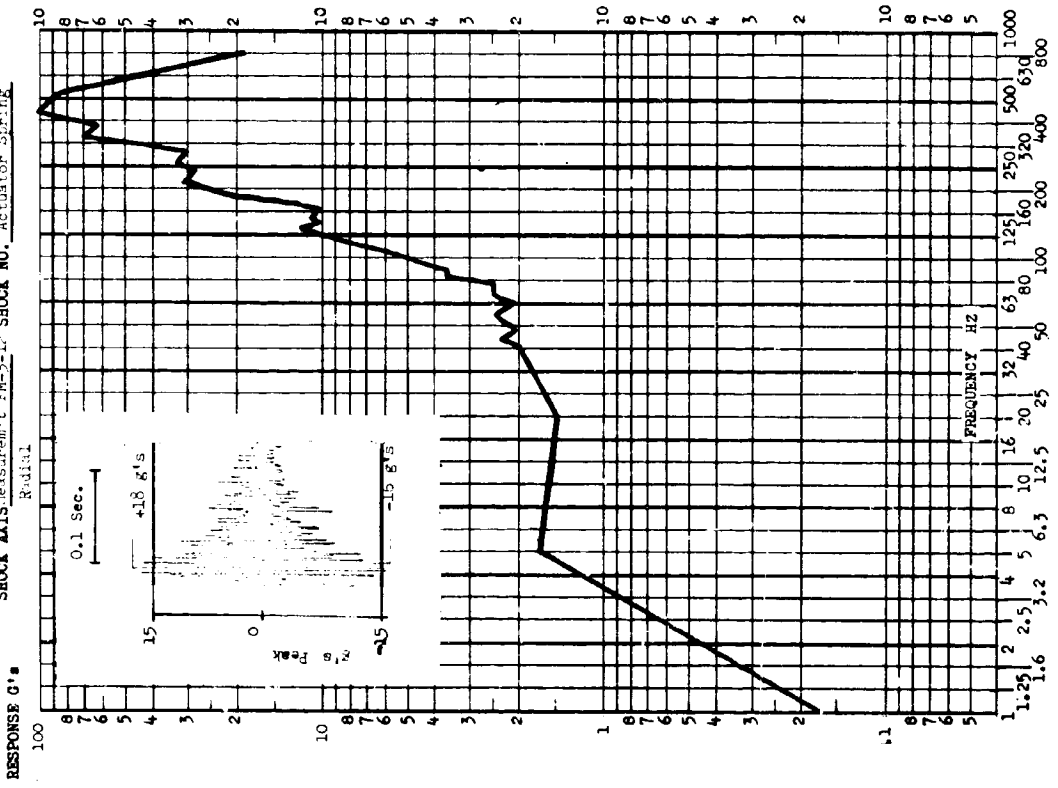
HALF VIEW LOOKING AFT
FROM SPACECRAFT
SEPARATION PLANE



SECTION B-B

Figure V.3-2. Description of Accelerometer Locations for the Delta 43-BIOS-A Separation

TEST ITEM Delta 43 Bins A
 Aircraft Dep.
 TEST DATE April 1967
 SHOCK AXIS Measurement EW-2-L SHOCK NO. Actuator Spring



TEST ITEM Delta 43 Bins A
 Aircraft Dep.
 TEST DATE April 1967
 SHOCK AXIS Measurement EW-2-L SHOCK NO. Actuator Spring

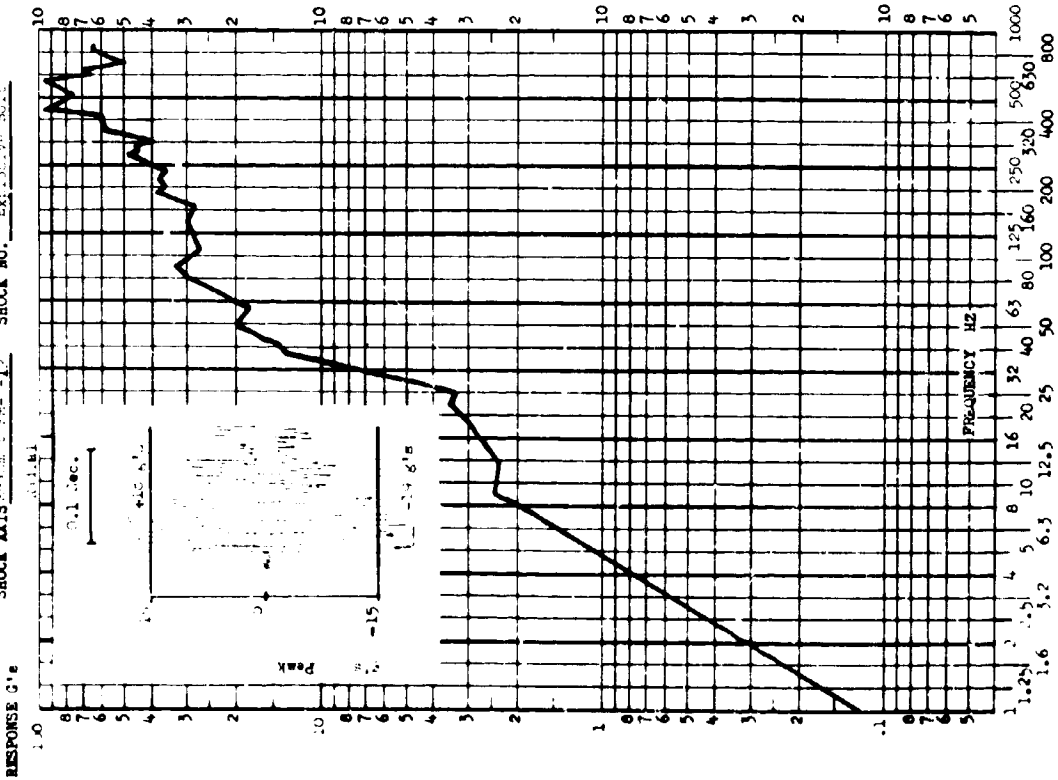
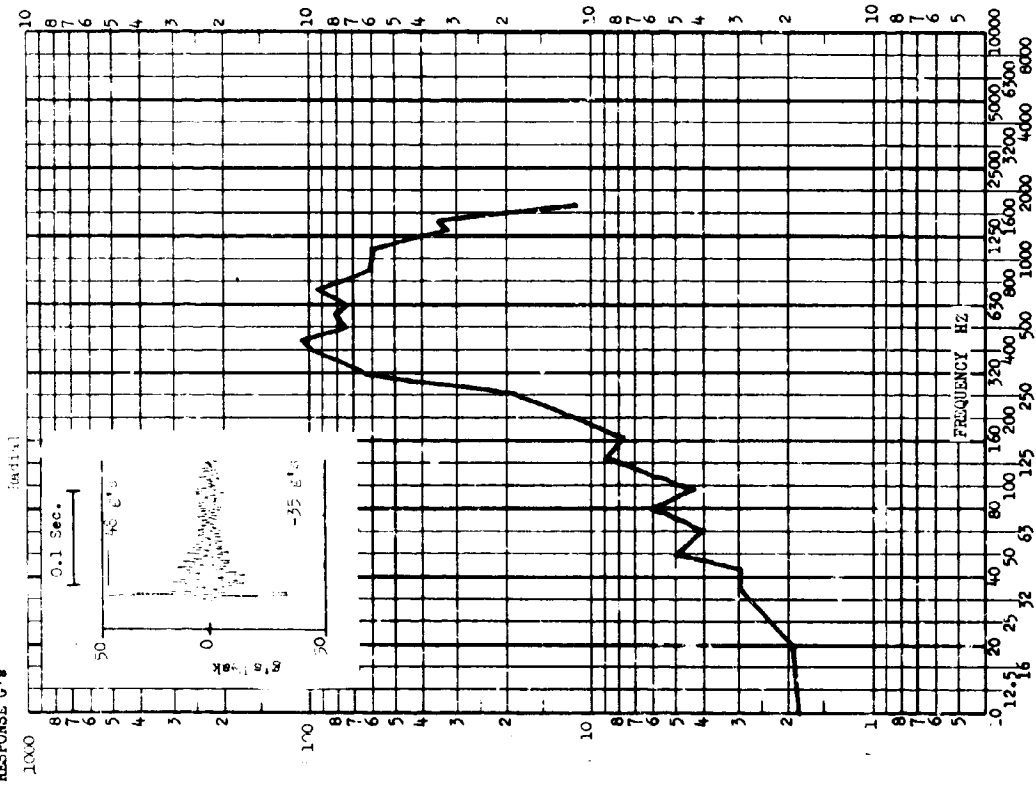


FIGURE V.3-4

TEST ITEM: Shock Test of Bomb
 TEST DATE: April 1967
 SHOCK AXIS: Vertical
 SHOCK NO.: Attenuator Spring



TEST ITEM: Shock Test of Bomb
 TEST DATE: April 1967
 SHOCK AXIS: Vertical
 SHOCK NO.: Attenuator Spring

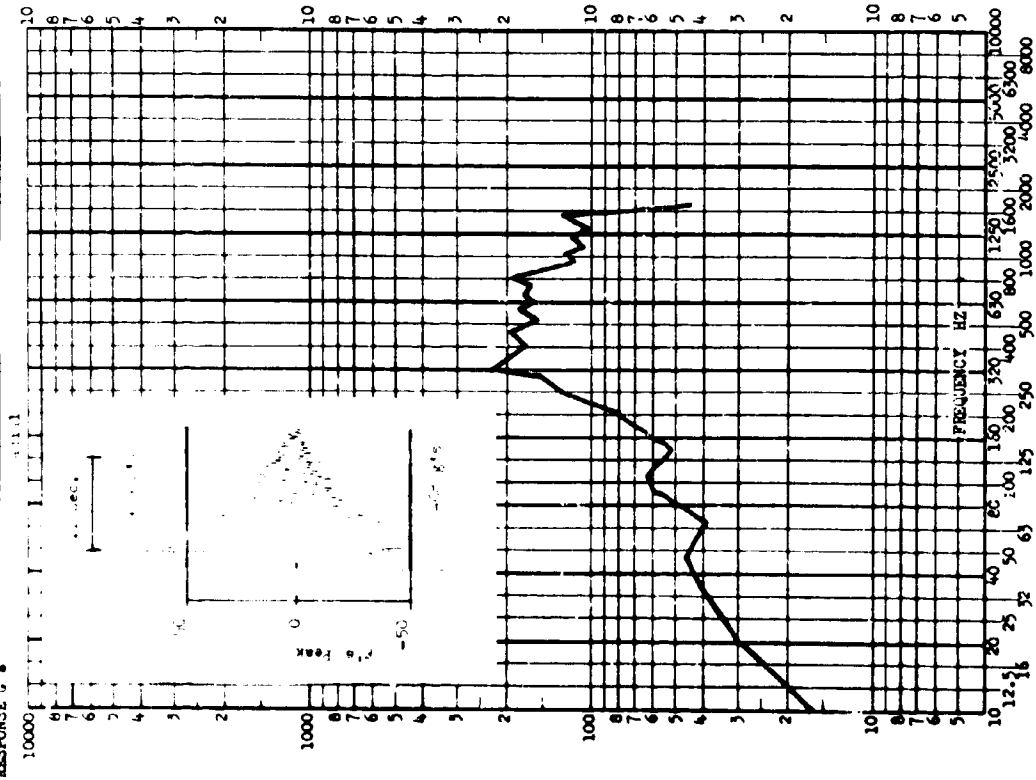


FIGURE V.3-5

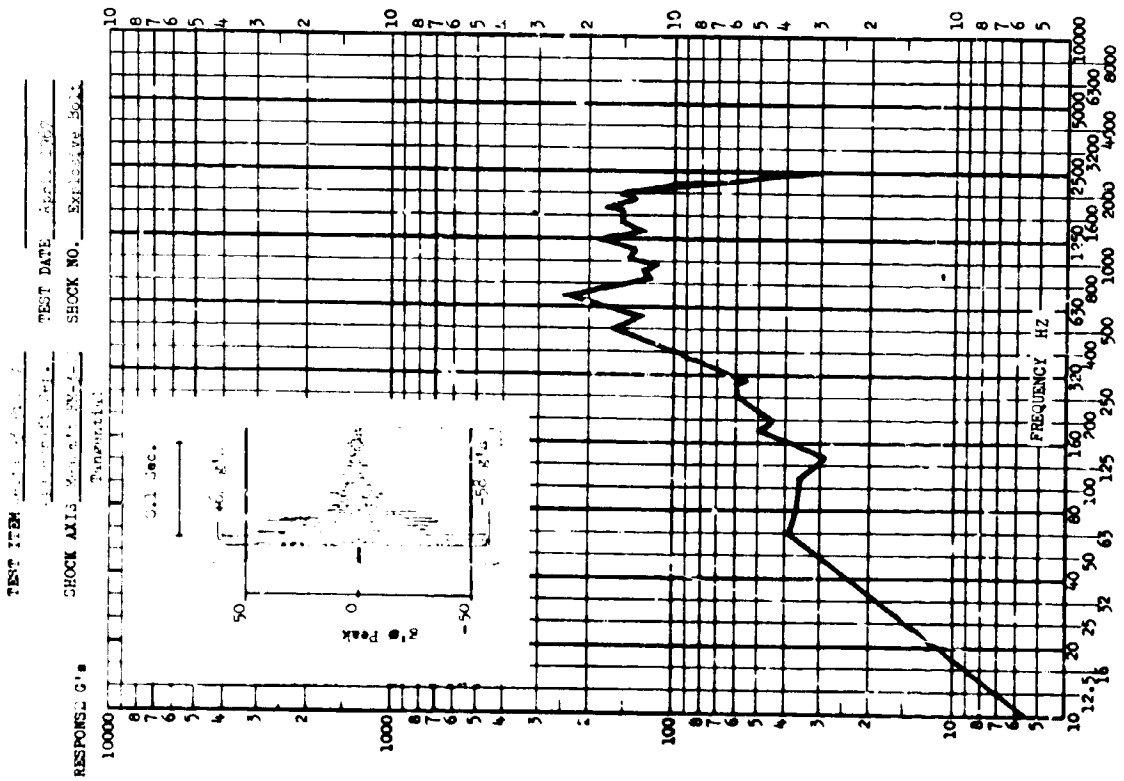
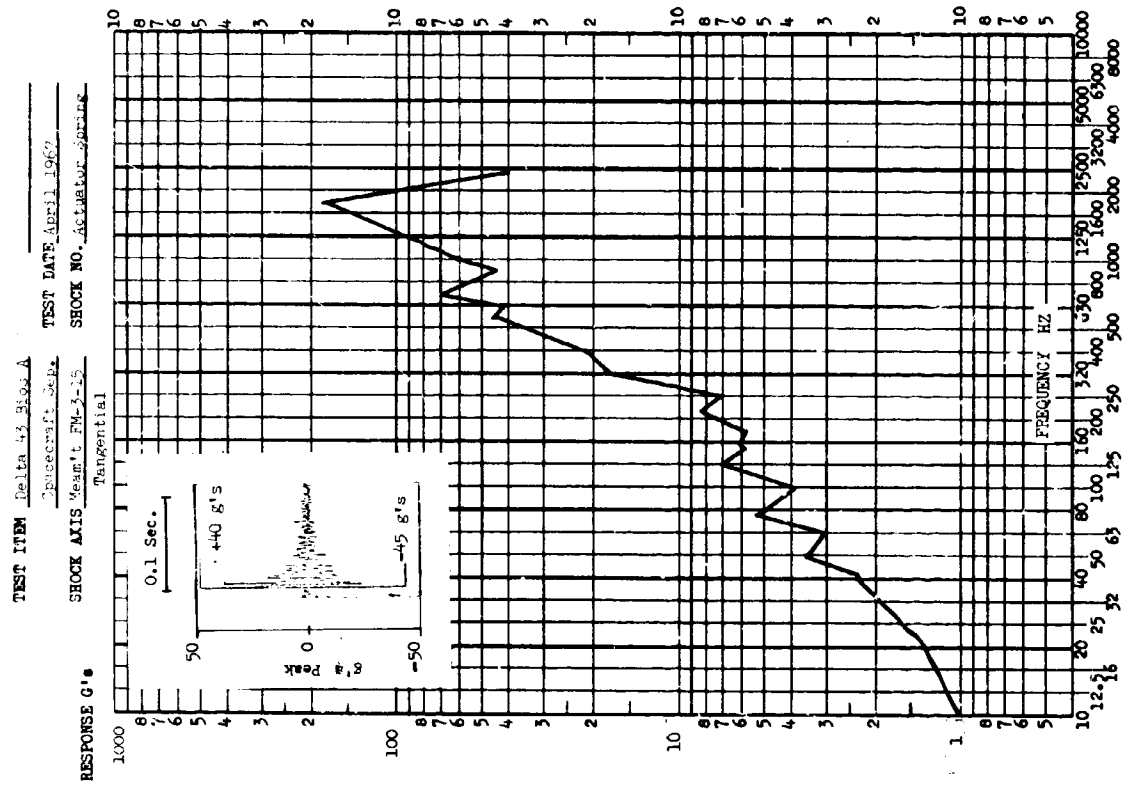
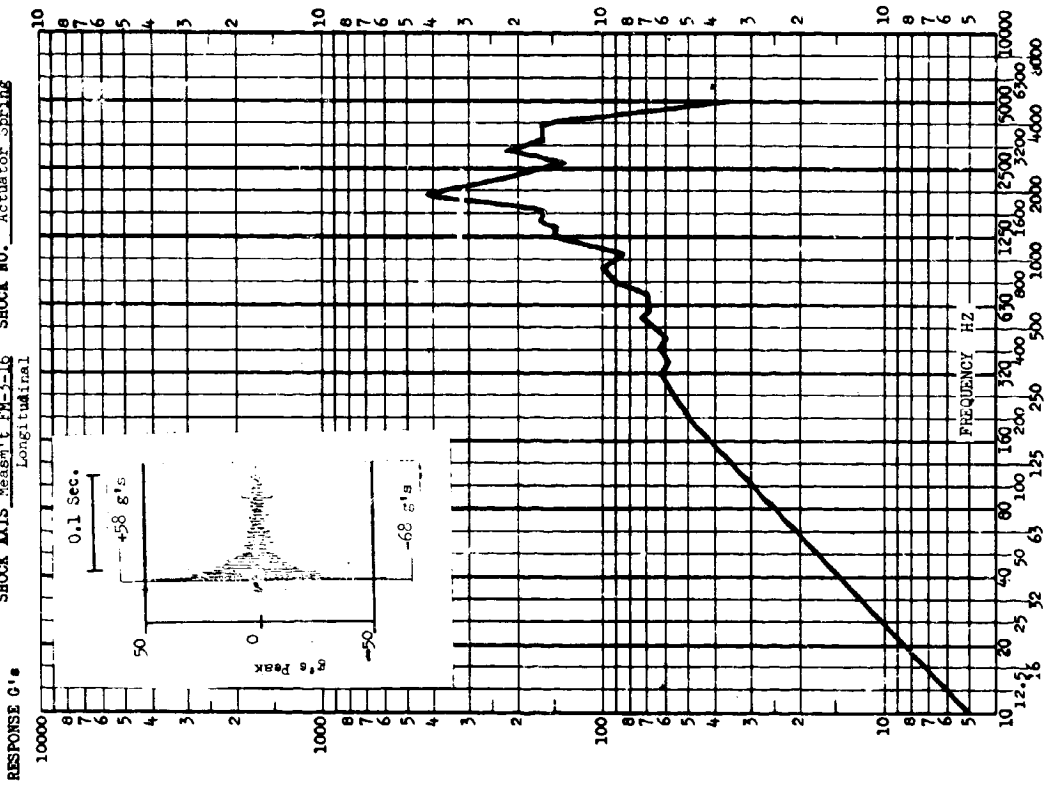


FIGURE V.3-6

TEST ITEM Delta 43 Blos 1 TEST DATE April 1967
Spacecraft Sepa
 SHOCK AXIS Measmt FM-16 SHOCK NO. Actuator Springs
Longitudinal



TEST ITEM Delta 43 Blos 1 TEST DATE April 1967
Spacecraft Sepa
 SHOCK AXIS Measmt FM-16 SHOCK NO. Expressive Bolt
Longitudinal

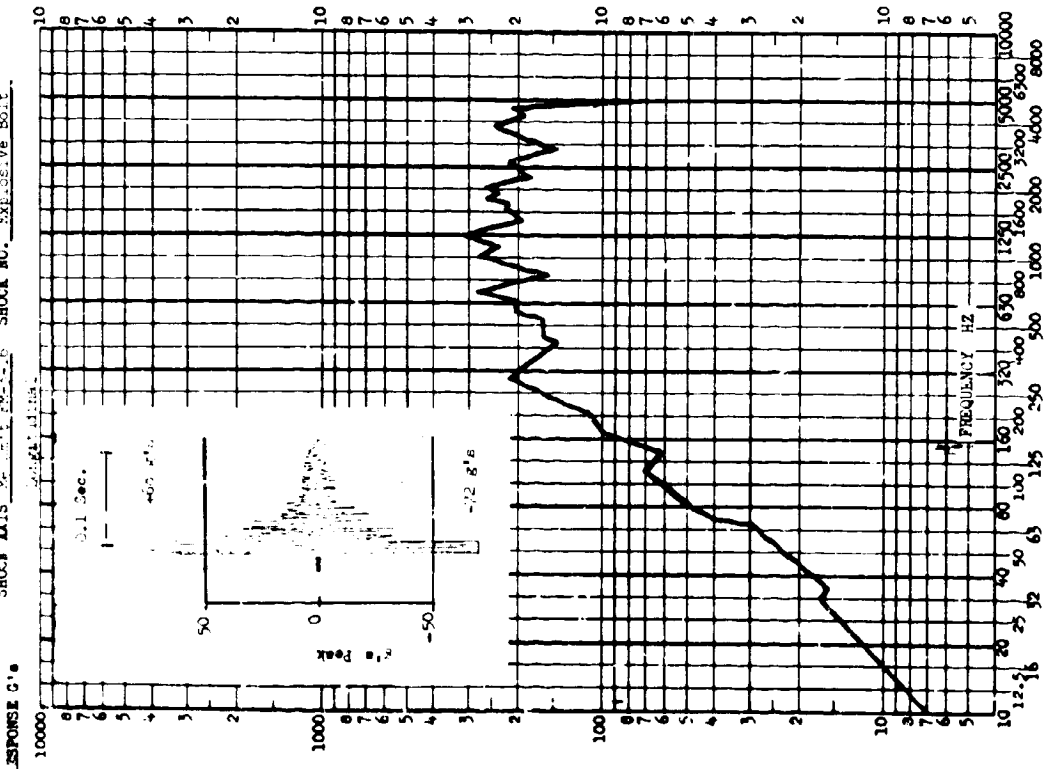


FIGURE V-3-7

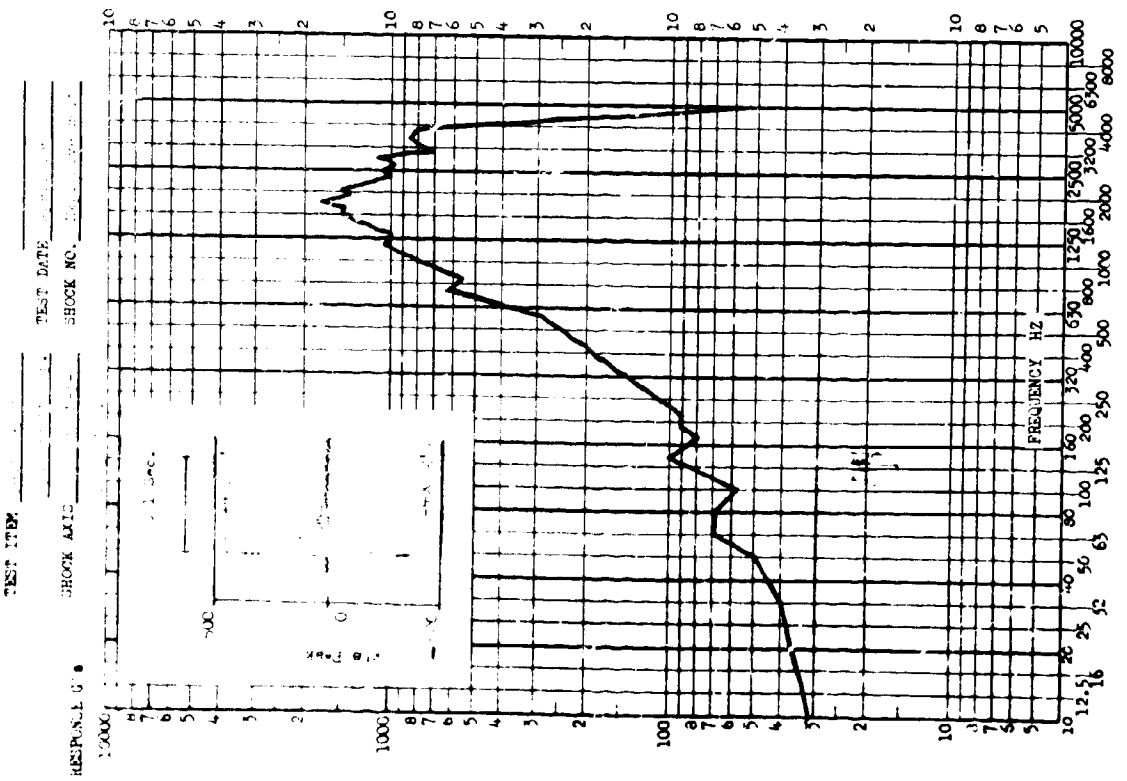
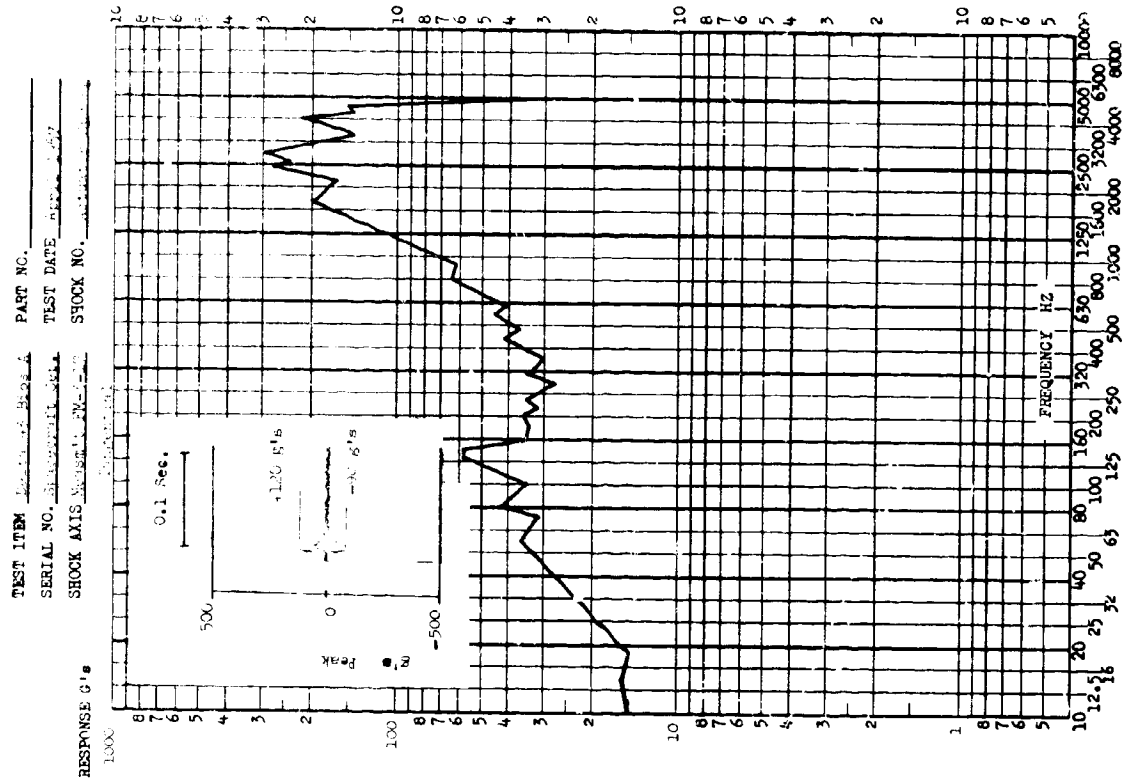


FIGURE V.3-8

SECTION V.4

FLIGHT TEST OF DELTA VEHICLE 51-BIOS-B

DESCRIPTION OF EVENT

During the flight of Delta Vehicle 51, there were two notable pyrotechnic events:

- 1) Fairing jettison (explosive bolts)
- 2) Spacecraft separation (explosive bolts)

The shock excitation imparted to the spacecraft adapter results from detonation of the six fairing explosive bolts and impact of each fairing half against the pivot brackets. This impact velocity was produced by six alternately spaced, preloaded spring actuators. The location of the fairing is indicated in Figure V.4-1.

During spacecraft separation, two distinct transients responses were observed. These transients were attributed to 1) a combination of explosive bolt detonation and explosive nut impact within its retainer and 2) bottoming of the actuator springs upon release. Figure V.4-2 illustrates the locations of the four explosive bolts alternately spaced with the four actuator springs.

DESCRIPTION OF DATA

Fairing Jettison Event

No. of time histories	5
Duration	(see time histories)
No. of shock spectra	5
Type of analysis	digital
Frequency range	Table V.4-1
Frequency increment	30 points per octave
Damping	$Q = 10$

These shock spectra are presented along with their corresponding time histories as Figures V.4-3 through V.4-5.

Spacecraft Separation Event (Explosive bolts and actuator springs)

No. of time histories	5
Duration	0.15 sec (approx.)
No. of shock spectra	10
Type of analysis	digital
Sample rate	
Frequency range	Table V.4-1
Frequency increment	30 points per octave
Damping	$Q = 10$

Table V.4-1

DESCRIPTION OF MEASUREMENTS

<u>Accelerometer Number</u>	<u>Location</u>	<u>Sensitive Axis</u>	<u>Frequency Range</u>	<u>Figure Number Fairing Event</u>	<u>Separation Event</u>
FM-3-10	Sta. 115 17.250 from Quad. III to Quad. II	Thrust	10-550 Hz	V.4-3	V.4-6
FM-3-11	"	Pitch	10-550 Hz	V.4-3	V.4-7
FM-3-12	"	Yaw	10-800 Hz	V.4-4	V.4-8
FM-3-13	Sta. 115 17.250 from Quad. II to Quad. III	Thrust	10-1000 Hz	V.4-4	V.4-9
FM-3-A	"	Tangen- tial	5-2000 Hz	V.4-5	V.4-10

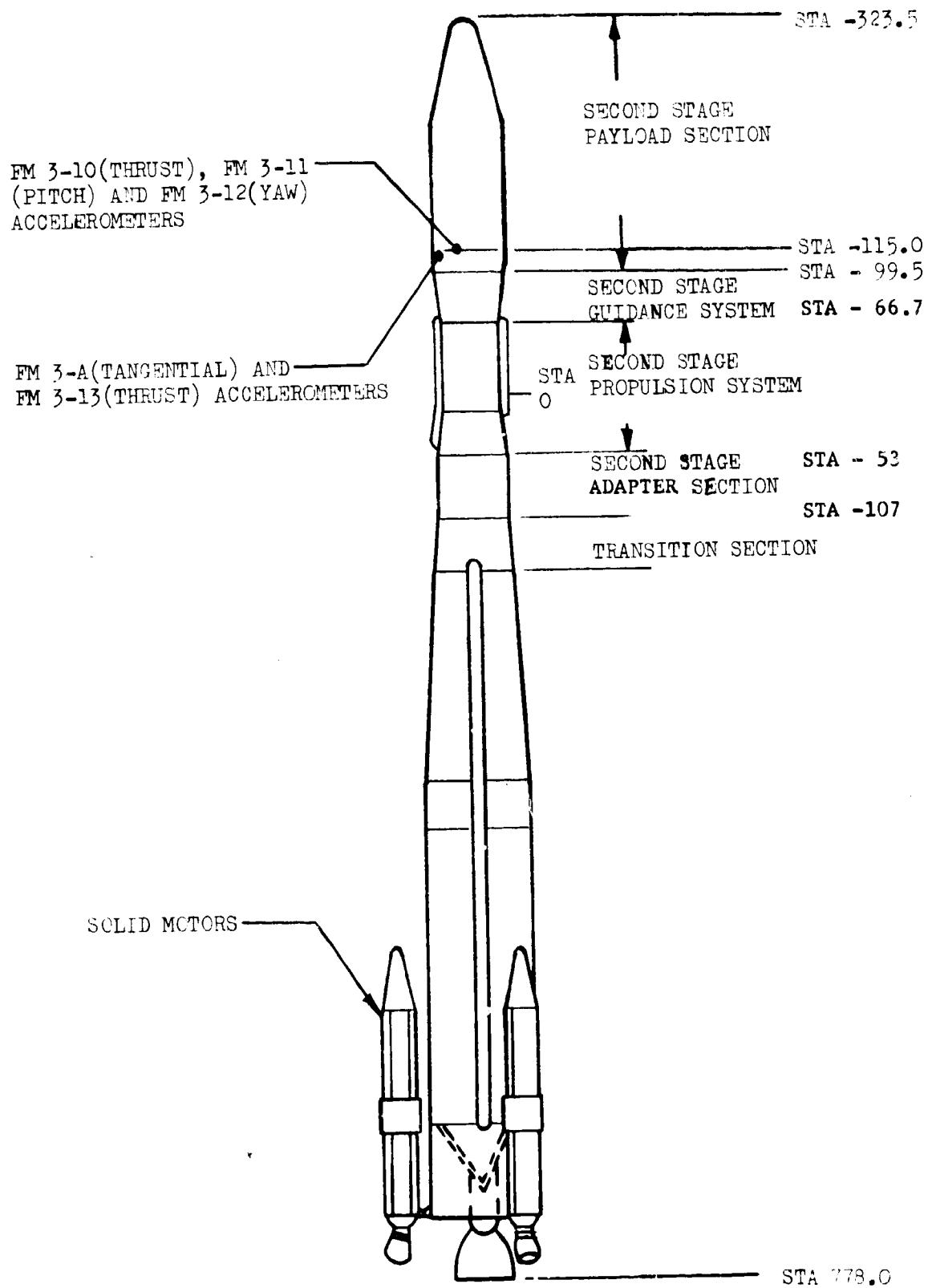


Figure V.4-1 Accelerometer Locations on the Delta Vehicle #51-BIOS-B

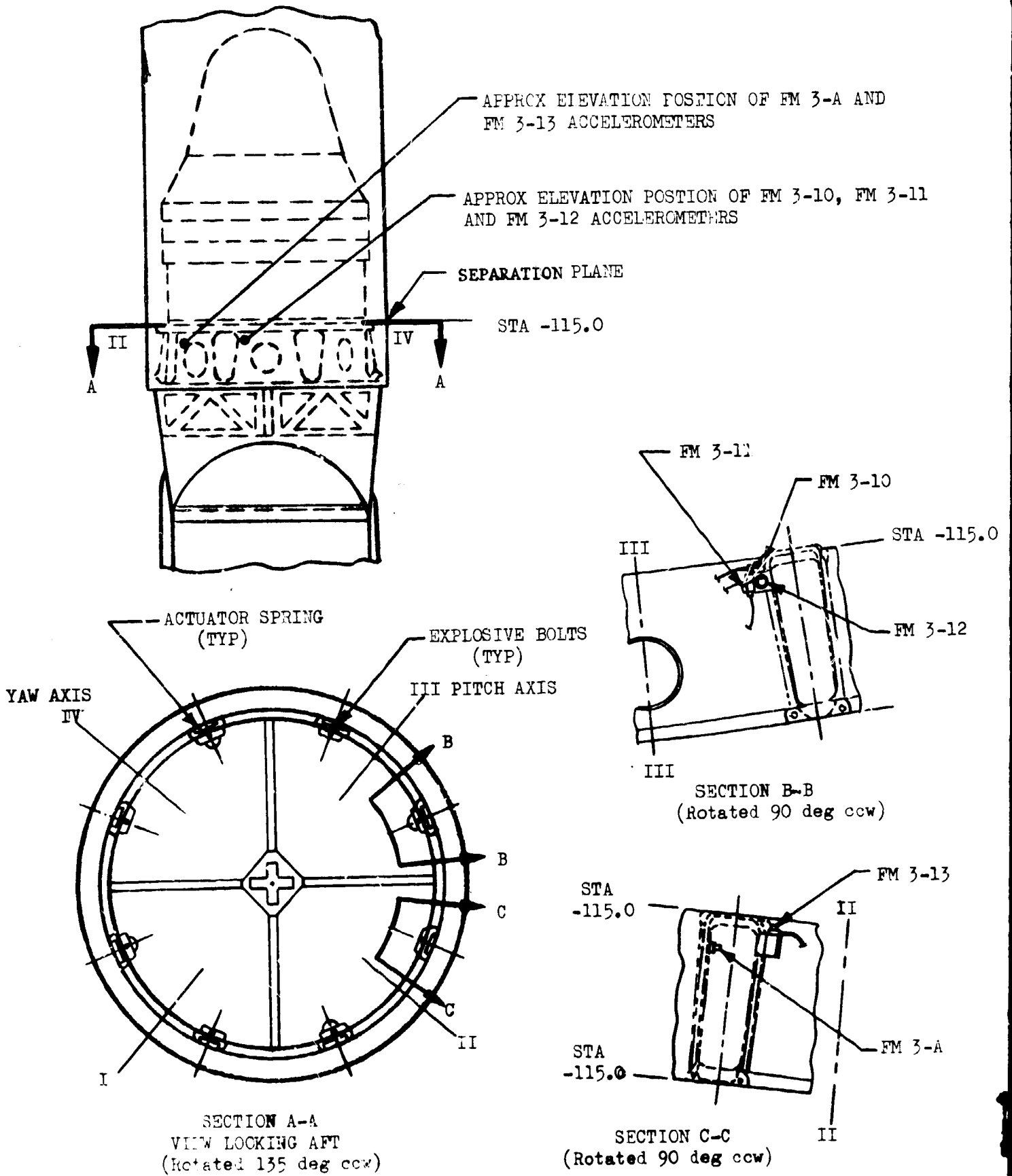


Figure V.4-2. Location of Accelerometers and Pyrotechnic

The number of shock spectra quoted for this event includes a spectrum for both the explosive bolt and actuator spring portions of the event for each of the five measurements. A careful examination of these time histories will reveal both portions of the event. These shock spectra and their corresponding time histories are presented as Figure V.4-6 through V.4-10.

DESCRIPTION OF PYROTECHNIC

Explosive bolts for both events.

DESCRIPTION OF STRUCTURE

Figure V.4-1 and V.4-2

DESCRIPTION OF ACCELEROMETERS

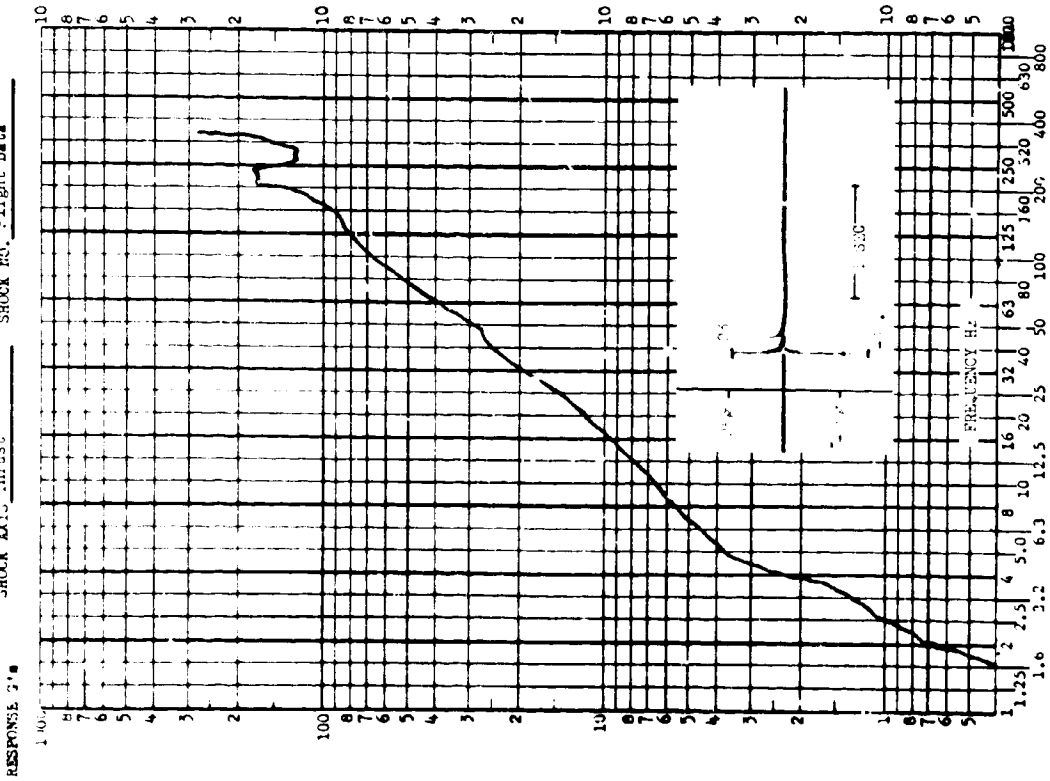
Type: Endevco (Model unknown)

Locations and Axis of Sensitivity: Table V.4-1
and Figures V.4-1 and V.4-2

COMMENTS

Notice that the data for the spacecraft separation includes a shock spectrum for both the separation event and the actuator spring release event. Although the time histories are difficult to read, those for the spacecraft separation reveal the presence of both events.

TEST ITEM Delta 51 Vehicle BICS-3, Spacecraft Separation
 MODEL NO. FM-3-10 TEST DATE December 1967
 SHOCK AXIS Thrust SHOCK NO. Flight Data



TEST ITEM Delta 51 Vehicle BICS-3, Spring Release
 MODEL NO. FM-3-10 TEST DATE December 1967
 SHOCK AXIS Thrust SHOCK NO. Flight Data

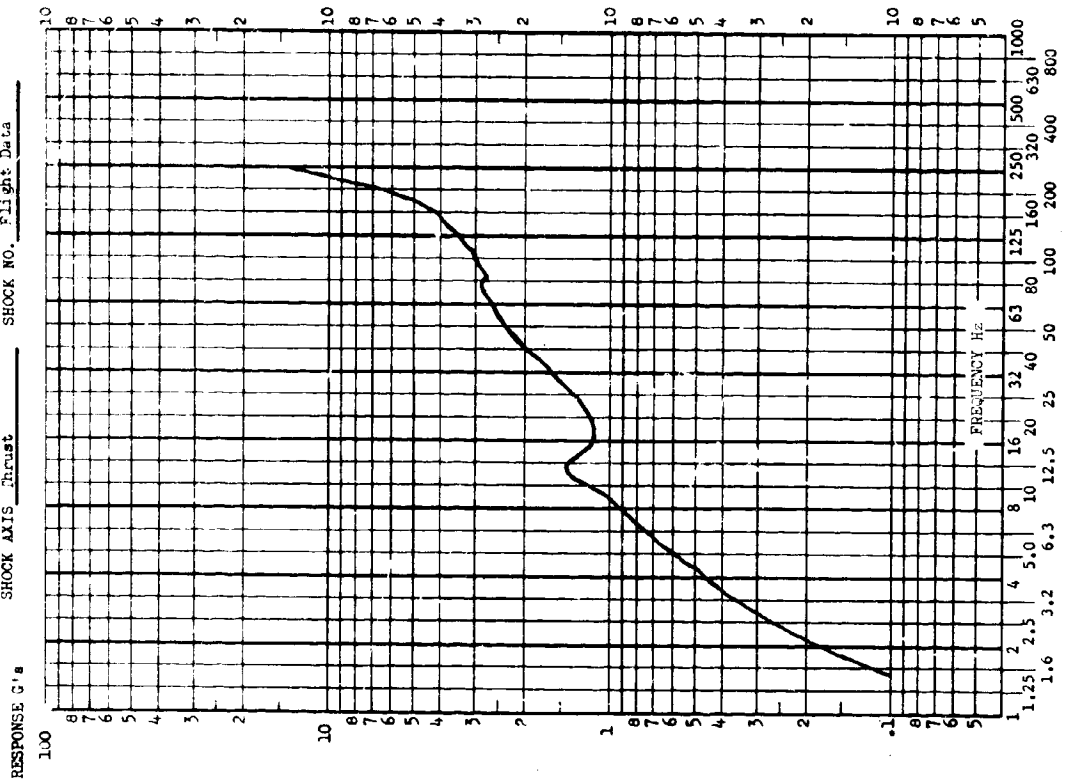


FIGURE V.4-3

TEST ITEM Delta D Vehicle Bicos, Spacecraft Separation
 ACCEL. NO. EM-2-11 TEST DATE December 1967
 SHOCK AXIS Pitch SHOCK NO. Flight Data

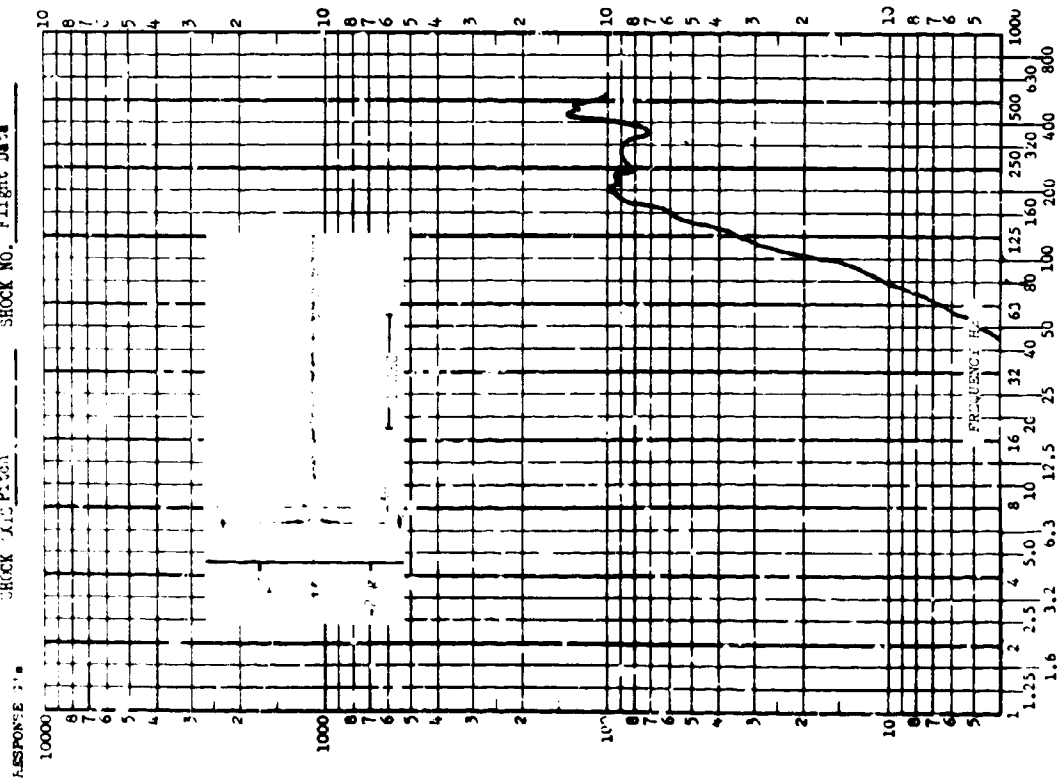
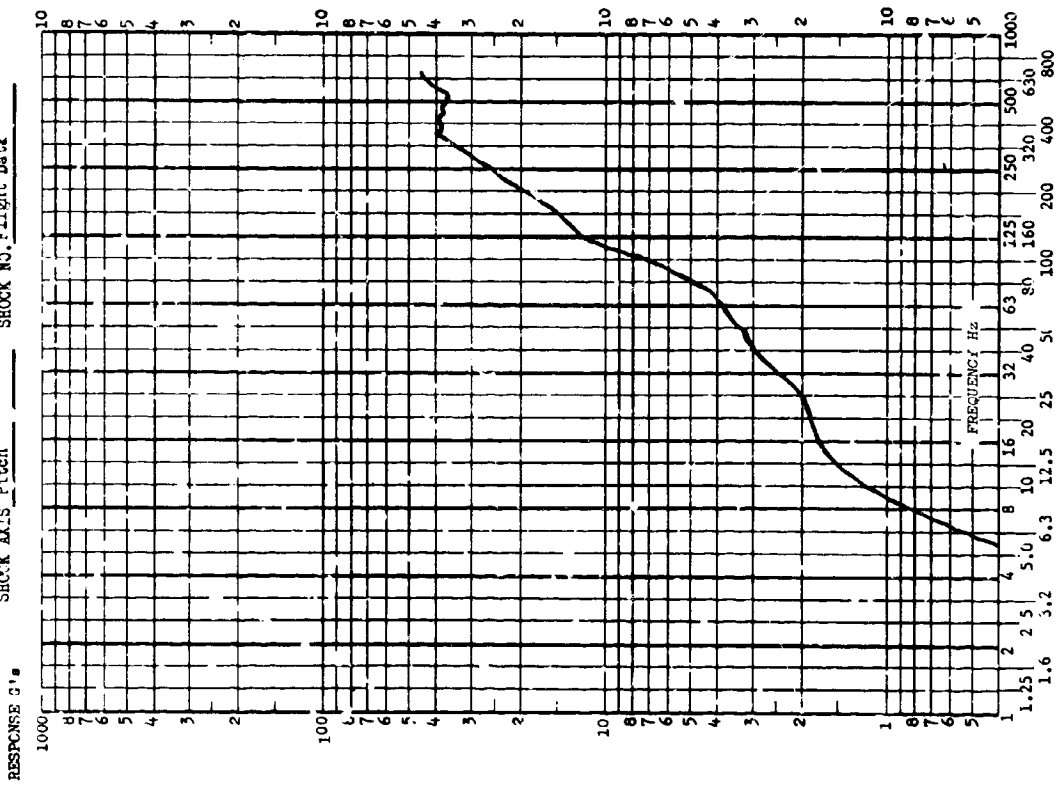
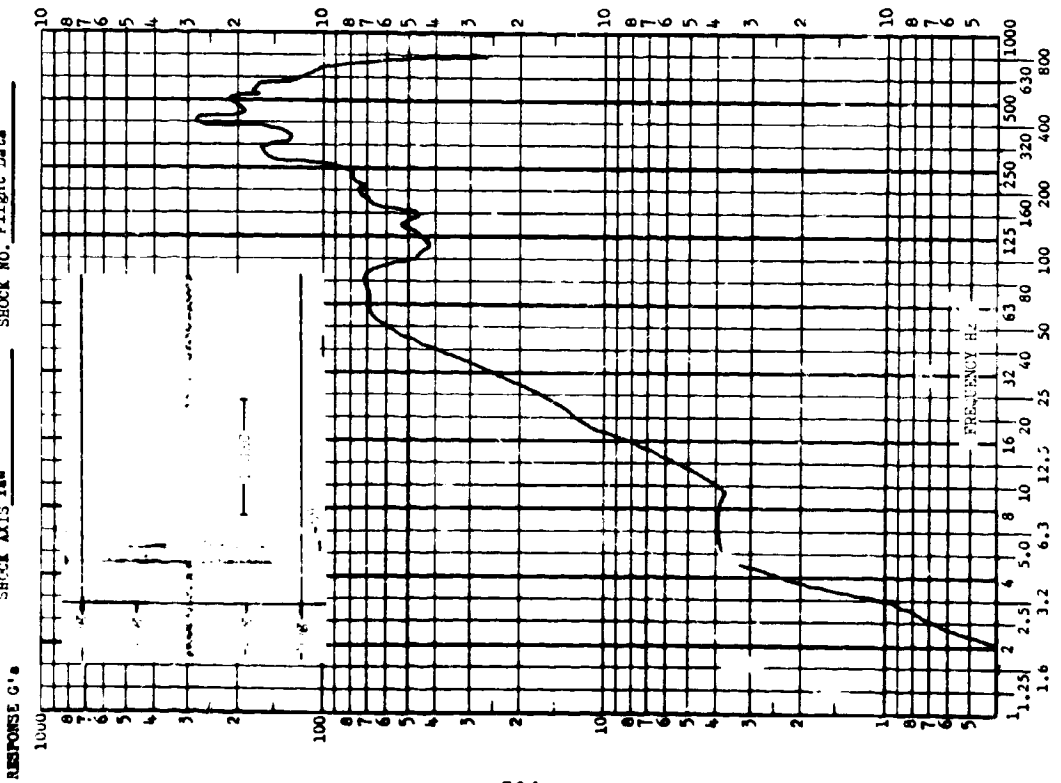


FIGURE V.4-4

TEST ITEM Delta 51 Vehicle Bicos-E Spring Release
 ACCEL. NO. EM-2-11 TEST DATE December 1967
 SHOCK AXIS Pitch SHOCK NO. Flight Data



TEST ITEM Delta 51 Vehicle B108-B, Spacecraft Separation
 ACCEL. NO. FM-3-12 TEST DATE December 1967
 SHOCK AXIS Yaw SHOCK NO. Flight Data



TEST ITEM Delta 51 Vehicle B108-B, Spring Release
 ACCEL. NO. FM-3-12 TEST DATE December 1967
 SHOCK AXIS Yaw SHOCK NO. Flight Data

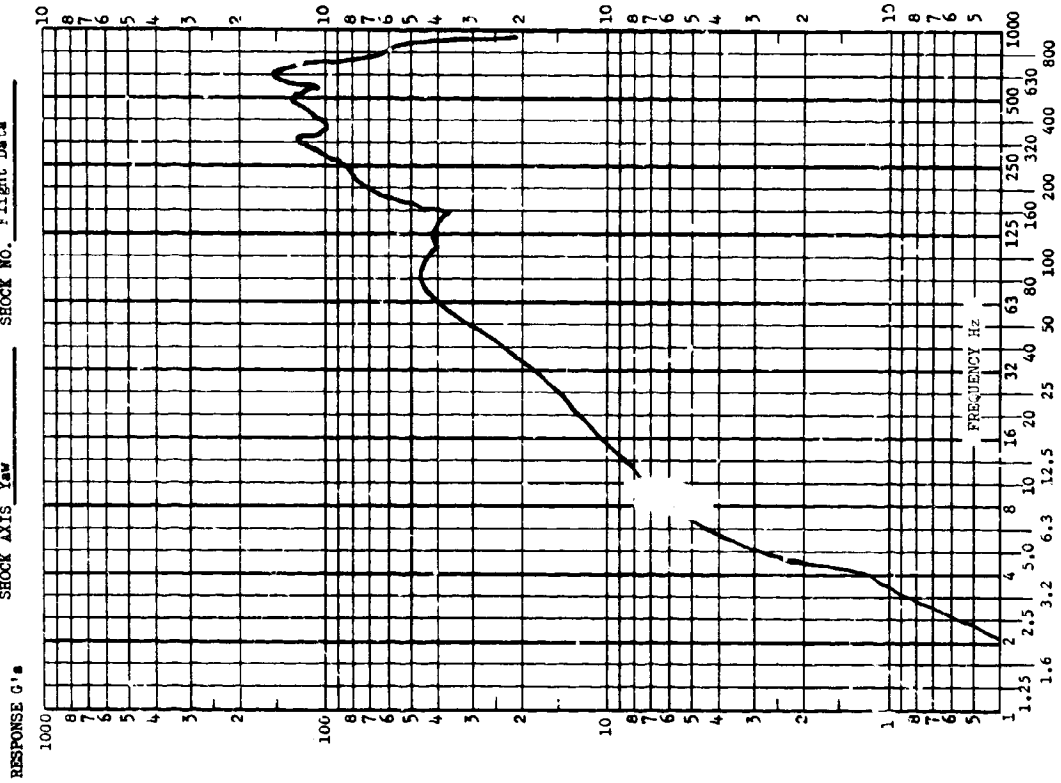
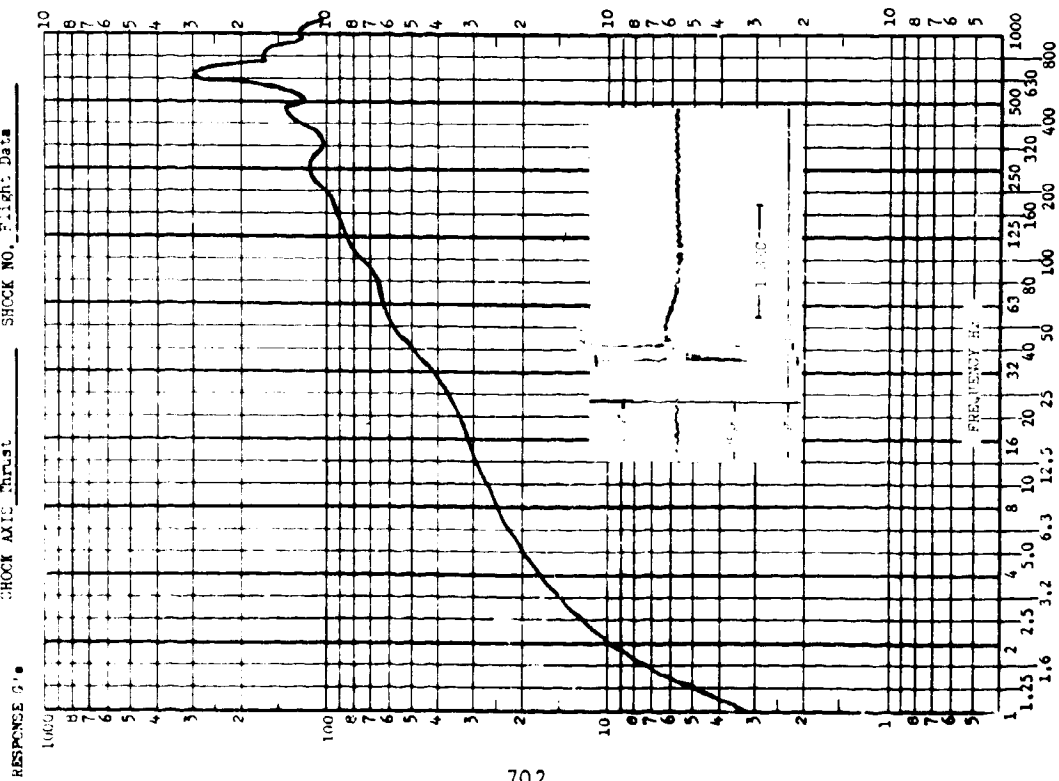


FIGURE V.4-5

TEST ITEM Delta 51 Vehicle B10S-E, Spacecraft Separation

ACCEL. NO. EM-3-43 TEST DATE December 1967
SHOCK AXIS Thrust SHOCK NO. Flight Data



TEST ITEM Delta 51 Vehicle B10S-B, Spring Release

ACCEL. NO. EM-3-13 TEST DATE December 1967
SHOCK AXIS Thrust SHOCK NO. Flight Data

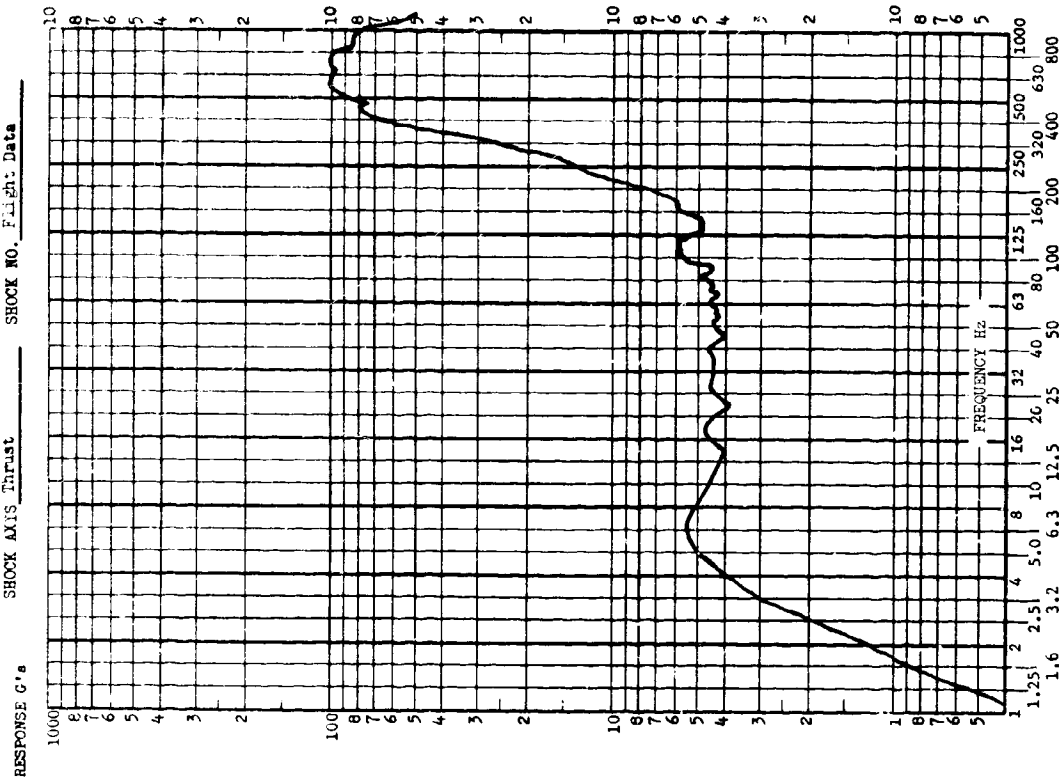
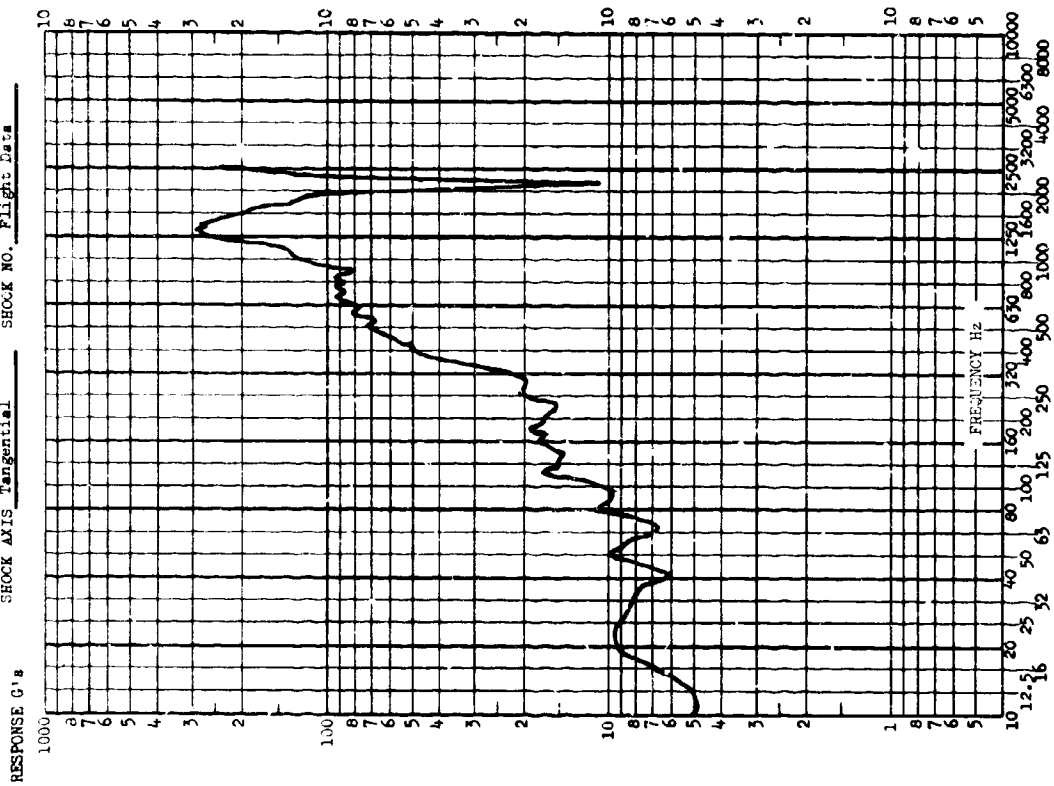


FIGURE V.4-6

TEST ITEM Delta 51 Vehicle BIOS-5, Spring Release
 ACCEL. NO. FN-3-A TEST DATE December 1967
 SHOCK AXIS Tangential SHOCK NO. Flight Data



TEST ITEM Delta 51 Vehicle BIOS-5, Space Separation
 ACCEL. NO. FN-3-A TEST DATE December 1967
 SHOCK AXIS Tangential SHOCK NO. Flight Data

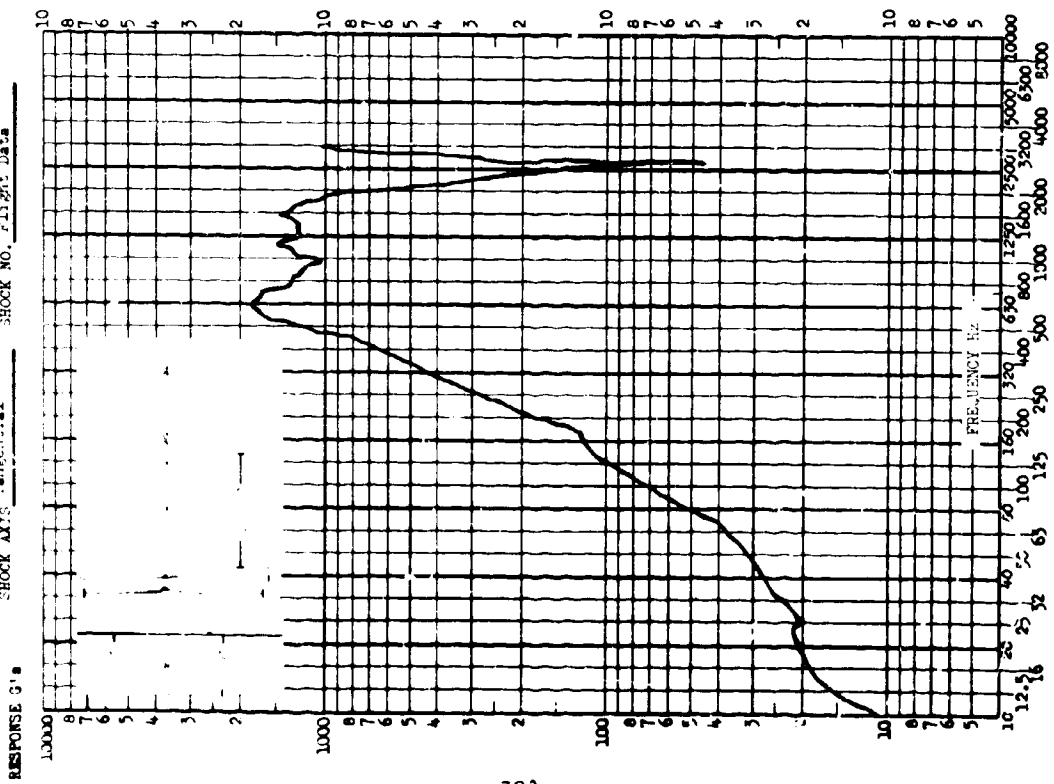
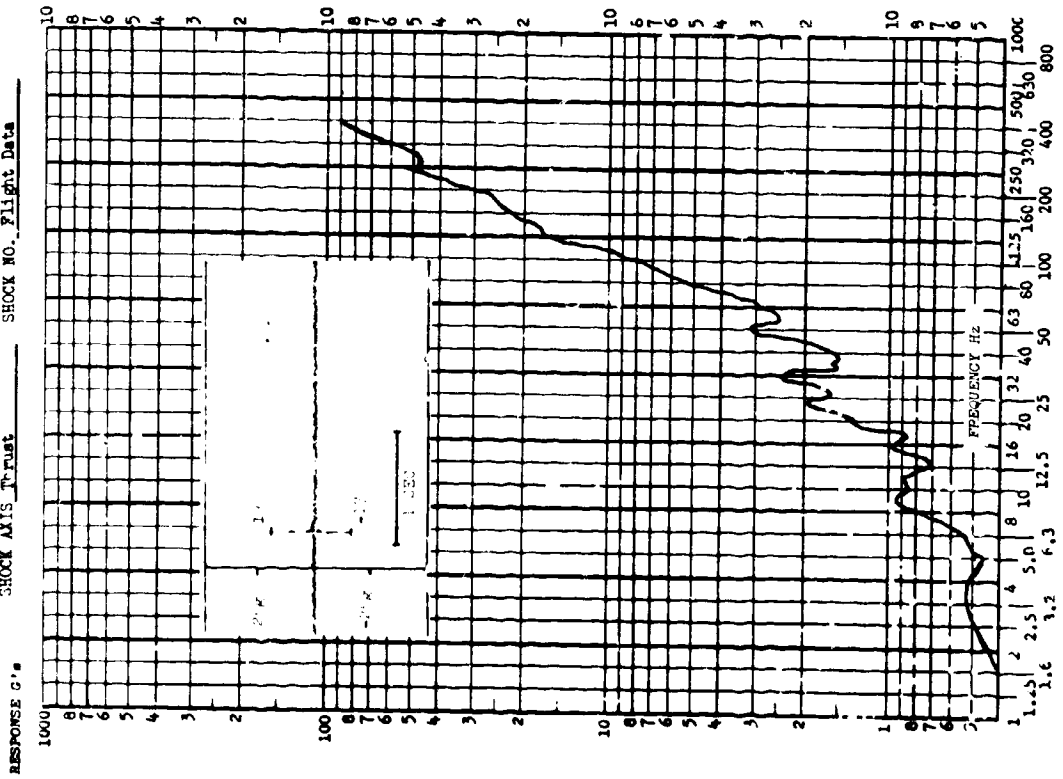


FIGURE V.4-7

TEST ITEM Delta 51 Vehicle BIOS-B, Fairing Jettison
 ACCEL. NO. FM-3-10 TEST DATE December 1967
 SHOCK AXIS Turnst SHOCK NO. Flight Data



TEST ITEM Delta 51 Vehicle BIOS-B, Fairing Jettison
 ACCEL. NO. FM-3-11 TEST DATE December 1967
 SHOCK AXIS Pitch SHOCK NO. Flight Data

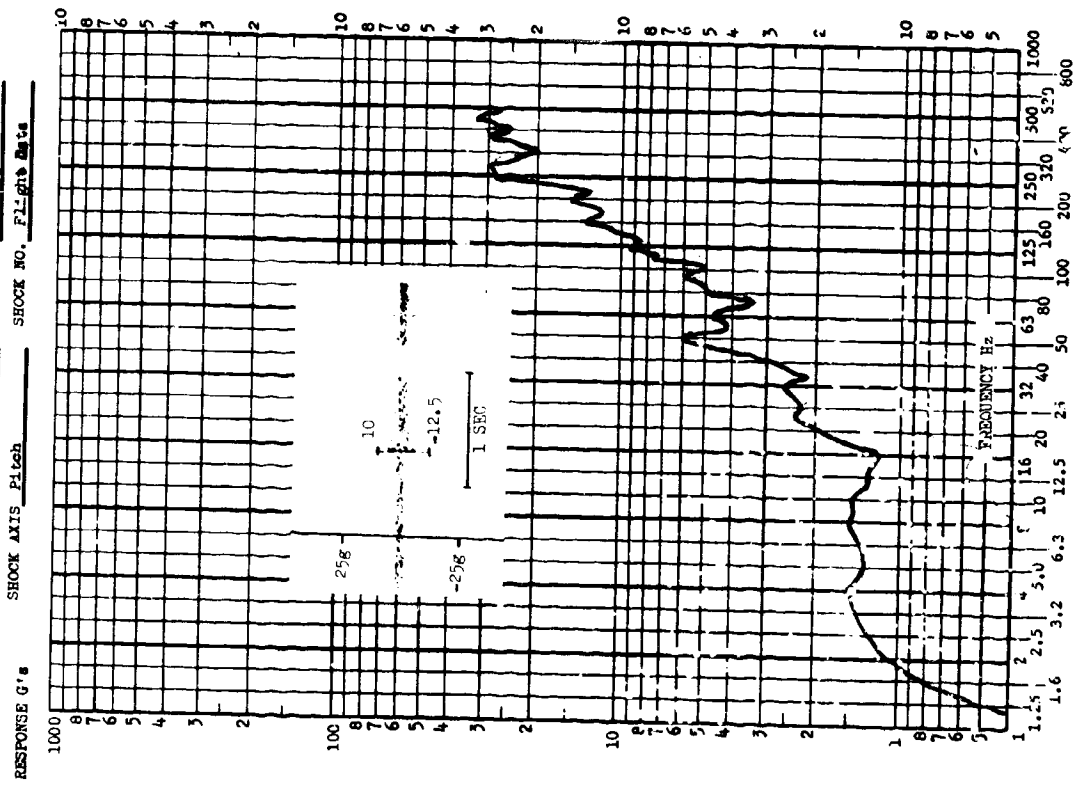
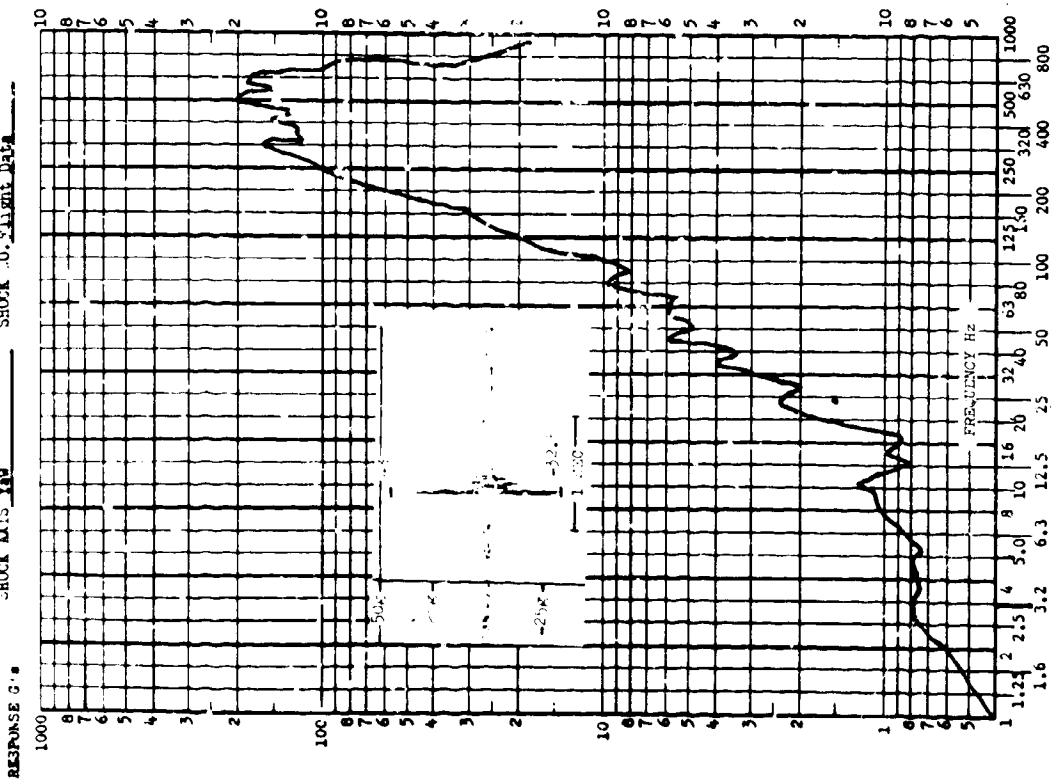


FIGURE V.4-8

TEST ITEM Delta 51 Vehicle BINS-E, Pairing Jettison
 SERIAL NO. FM-3-12 TEST DATE December 1967
 SHOCK AXIS Yaw SHOCK NO. Flight Data



TEST ITEM Delta 51 Vehicle BINS-E, Pairing Jettison
 SERIAL NO. FM-3-13 TEST DATE December 1967
 SHOCK AXIS Thrust SHOCK NO. Flight Data

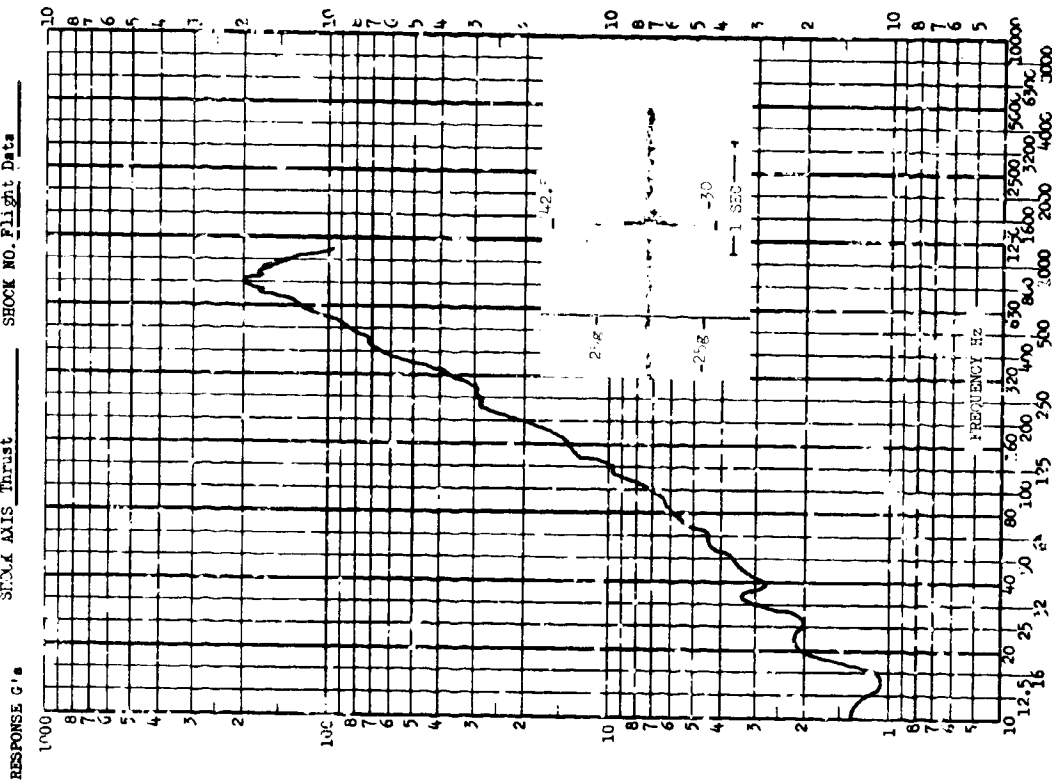


FIGURE V.4-9

TEST ITEM Delta 21 Vehicle eJOS-Boairing Jettison
 TEST NO. FM-3-A TEST DATE December 1967
 SHOCK AXIS Vertical SHOCK NO. Flight Data

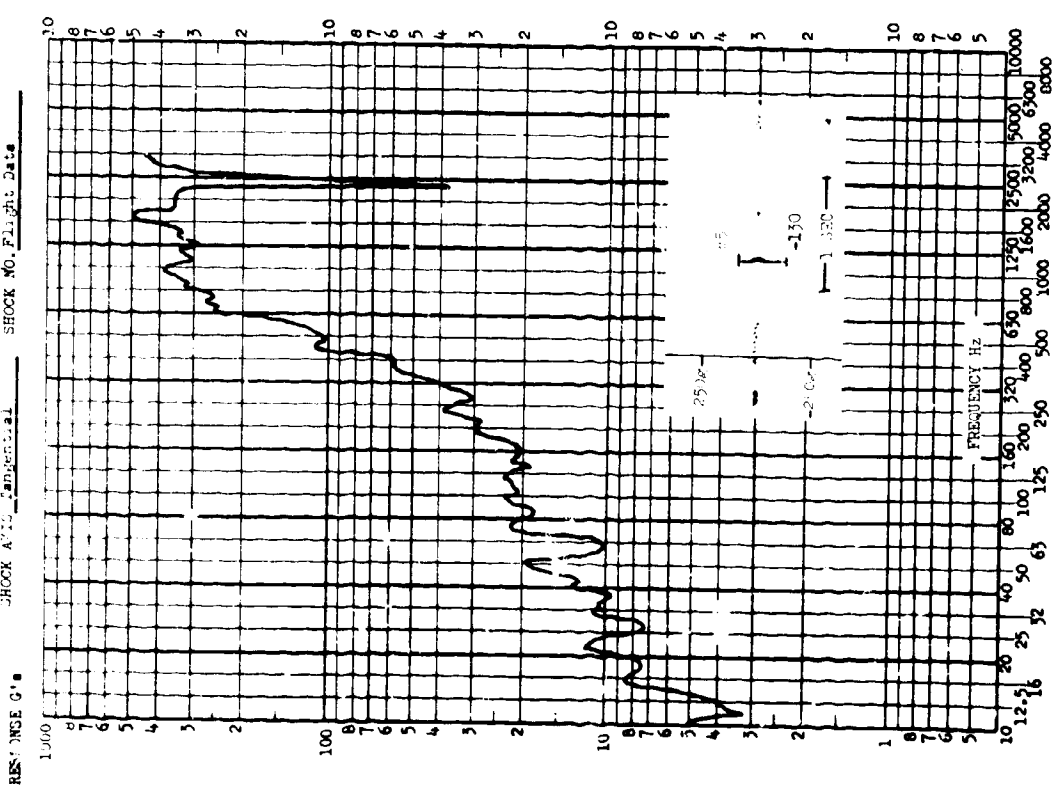


FIGURE V.4-10

LOCATION OF ADDITIONAL FLIGHT DATA

The Surveyor data presented in Part IV.C is all flight data and might well be compared with the other data in Division V to provide a more complete description of the characteristics to be associated with flight shock data.

END

DATE

FILMED

MAR 31 1971