

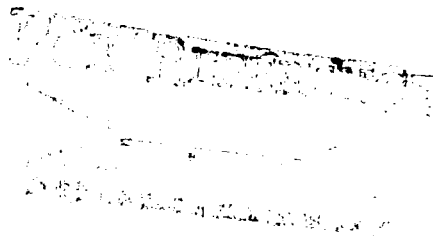
NASA-CR-3918 19850025821

NASA Contractor Report 3918

Design and Testing of an Energy-Absorbing Crewseat for the F/FB-111 Aircraft

Volume III—Data From Seat Testing

S. Joseph Shane



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NASA Contractor Report 3918

Design and Testing of an
Energy-Absorbing Crewseat
for the F/FB-111 Aircraft

Volume III—Data From Seat Testing

S. Joseph Shane

Simula Inc.

Phoenix, Arizona

Prepared for
Langley Research Center
under Contract NAS1-17387



National Aeronautics
and Space Administration

Scientific and Technical
Information Branch

1985



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1.0 INTRODUCTION

This volume presents data from the testing of an energy-absorbing crewseat in an F/FB-111 crew module. A complete description of the program is contained in Volume I: Final Report. Data from the dynamic test series on the seat is contained in Volume II.

Dynamic testing of the energy-absorbing seat and the operational F/FB-111 seat in an F/FB-111 crew module was conducted at NASA Langley Research Center. The testing is described in Section 4.0 of Volume I, and the resulting data are presented in Sections 2.0 through 14.0 of this volume.

Table 1 lists the data recorded. The four axes recorded on the seat pan include a measurement along the seat back tangent line as well as the three major axes. The seat deflection was measured along the seat back tangent line, but the dynamic response of the linear string potentiometers could not accurately show the seat stroke. Final seat stroke was measured and is recorded in Volume I.

DRI is presented using the same three acceleration measurements used in the seat testing: seat pan z-axis, seat pan along the back tangent line, and dummy pelvis z-axis.

The test conditions are listed at the beginning of each chapter. To be positive, the sign convention for the crew module orientation is for the following earth reference conditions:

- Pitch - nose up
- Roll - right wing down
- Yaw - nose right.

TABLE 1. RECORDED DATA FROM CREW MODULE TESTING

<u>Description of Data (Number of Channels)</u>	<u>Filter Class*</u>
Acceleration	
Left Bulkhead (3)	Class 60
Right Bulkhead (3)	Class 60
Left Seat Pan (4)	Class 180
Capsule Center of Gravity (C.G.)	Class 60
Left Dummy Pelvis	Class 180
Right Dummy Pelvis	Class 180
Right Dummy Chest	Class 180
Left Dummy Head	666 Hz
Right Dummy Head	666 Hz
Forces	
Left Seat Pan (3)	Class 60
Right Seat Pan (3)	Class 60
Exit Port Pressures (6)	Class 60
Seat Deflection (2)	Class 60
Dynamic Response Index (3)	-

* Class 60 and Class 180 filters per SAE Recommended Practice J211b.

2.0 NASA TEST NO. 1

HORIZONTAL VELOCITY: 34 ft/sec

VERTICAL VELOCITY: 32 ft/sec

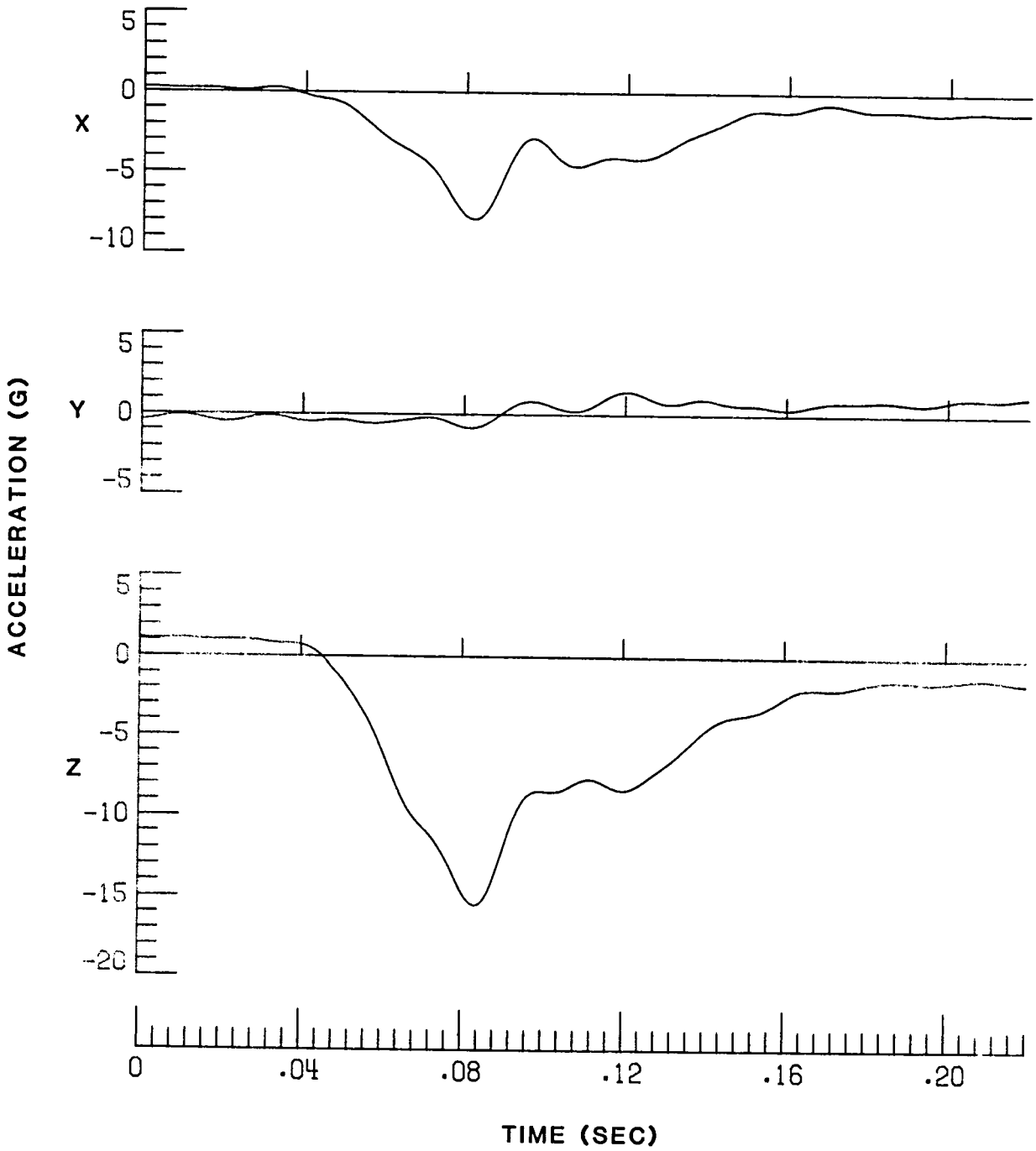
CREW MODULE PITCH: - 13⁰

CREW MODULE ROLL: 0⁰

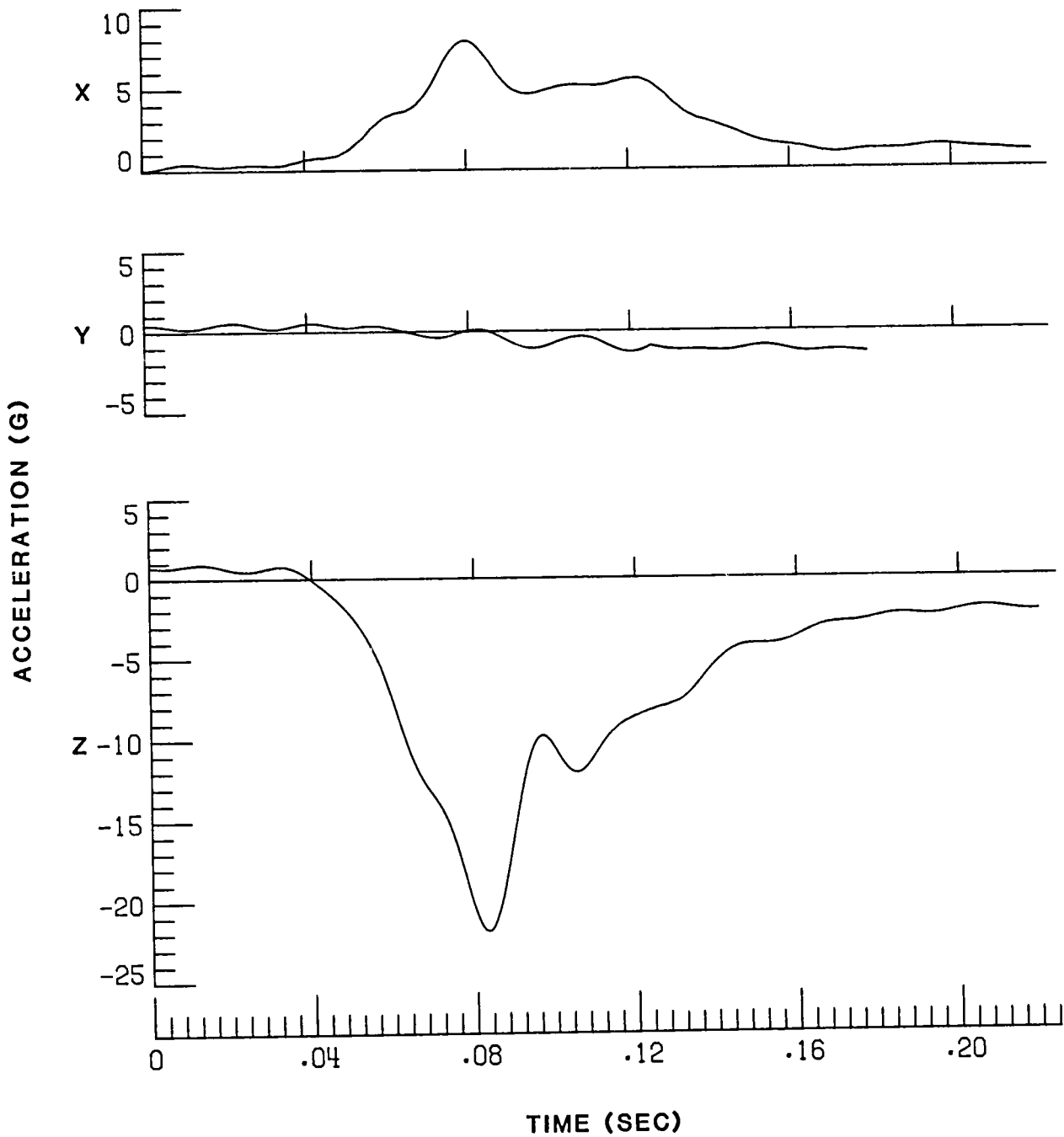
CREW MODULE YAW: 45⁰

LEFT SEAT: Energy Absorbing

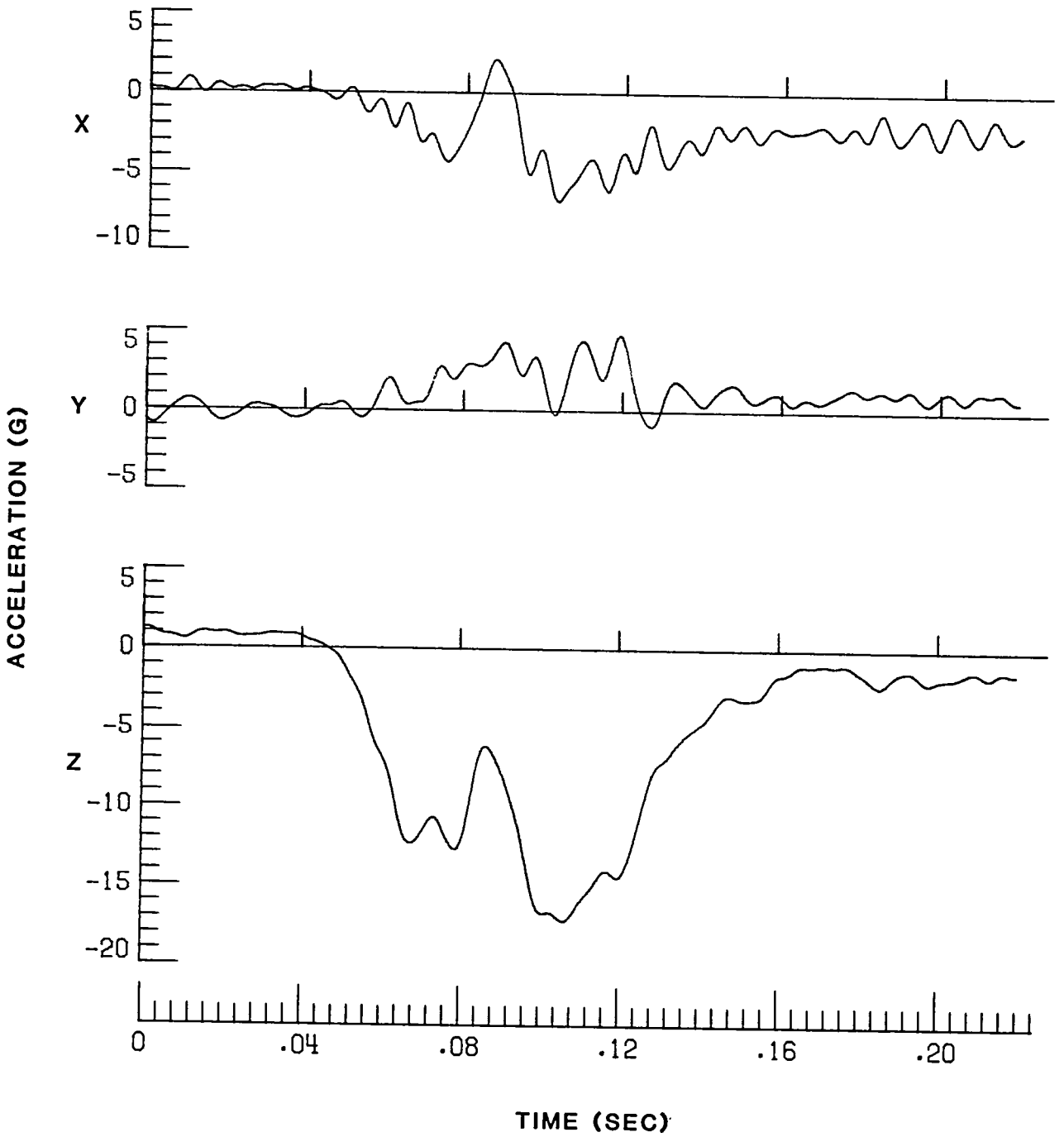
RIGHT SEAT: Energy Absorbing



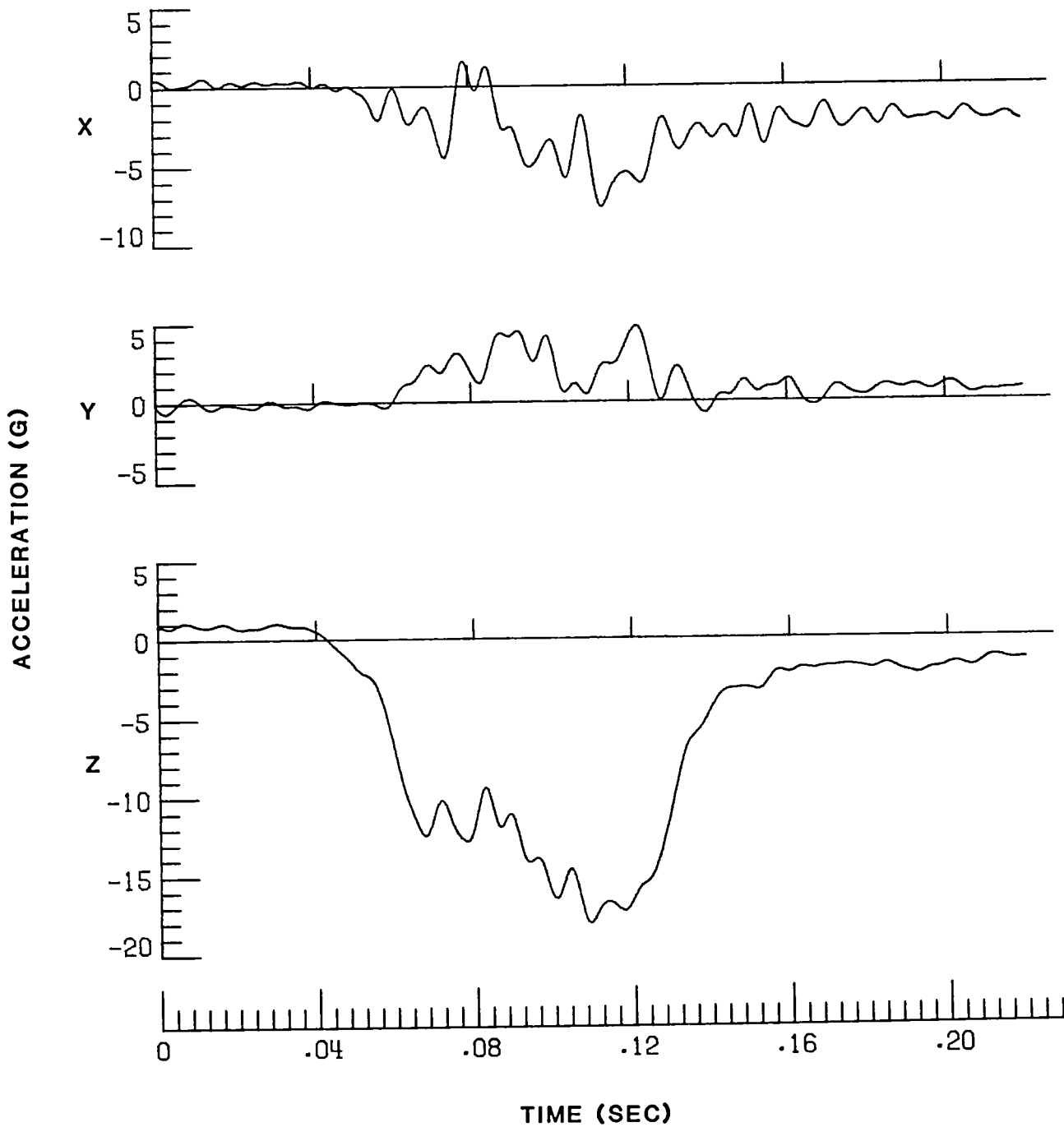
LEFT BULKHEAD
NASA TEST NO. 1



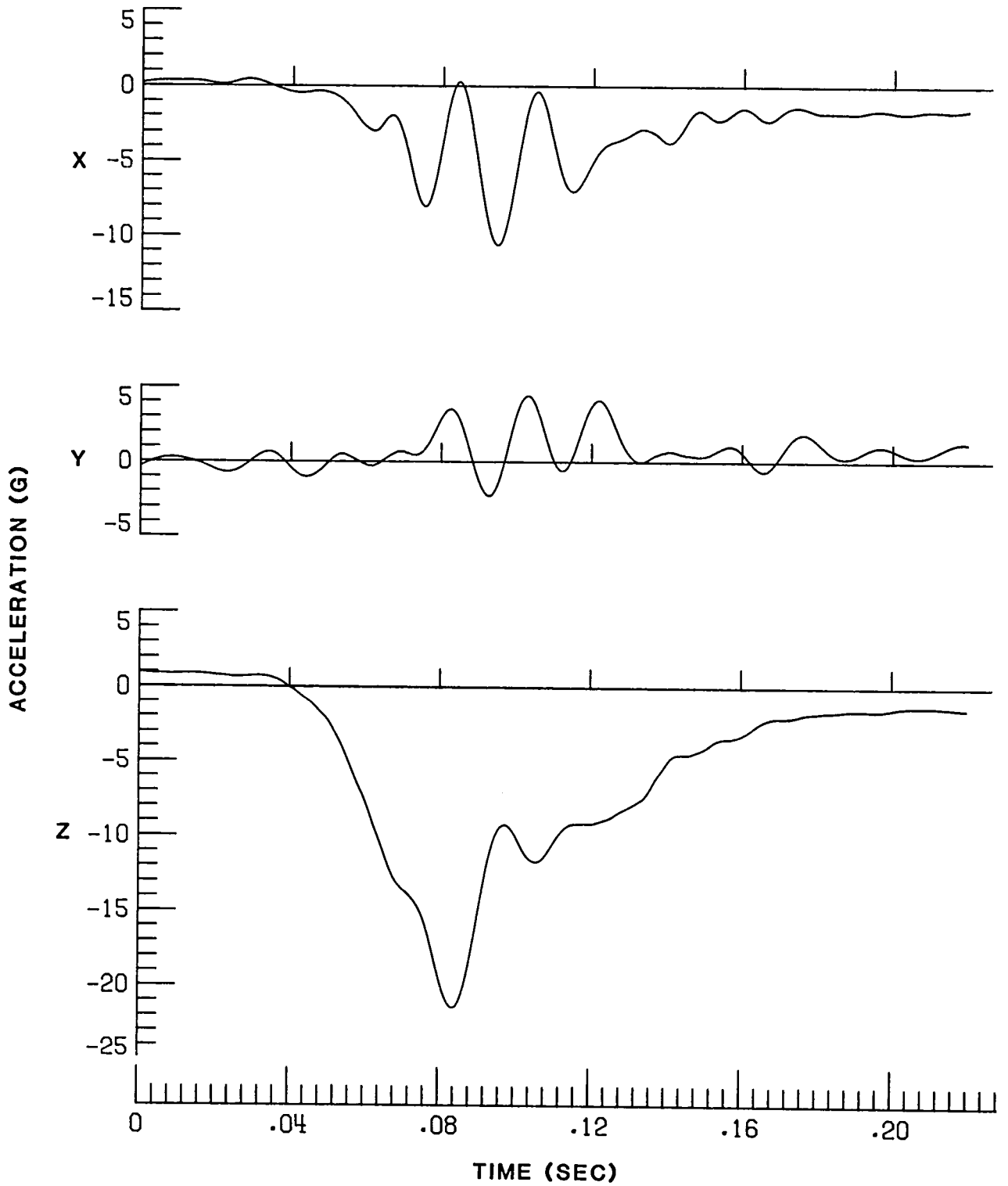
RIGHT BULKHEAD
NASA TEST NO. 1



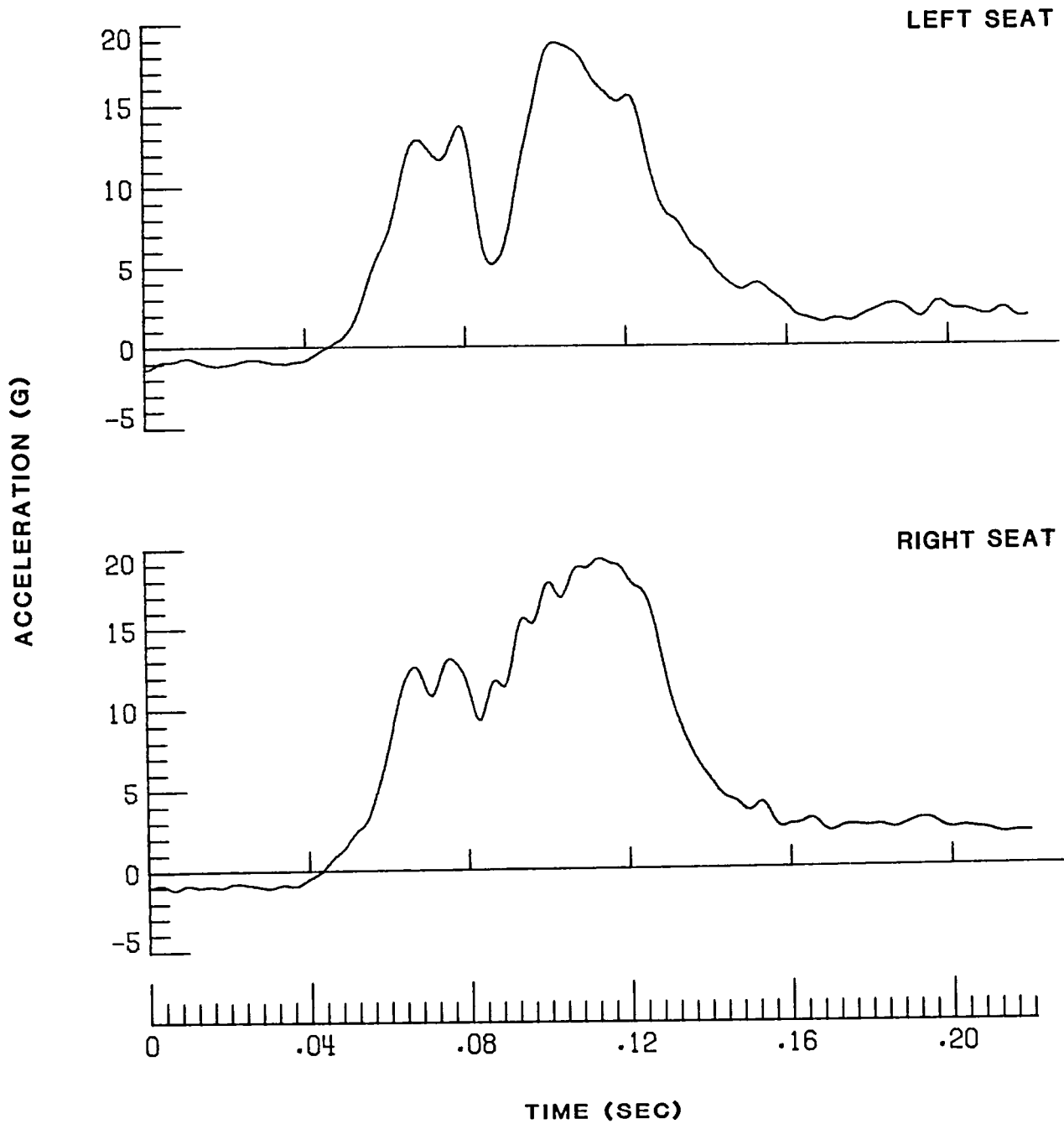
LEFT SEAT PAN
NASA TEST NO. 1



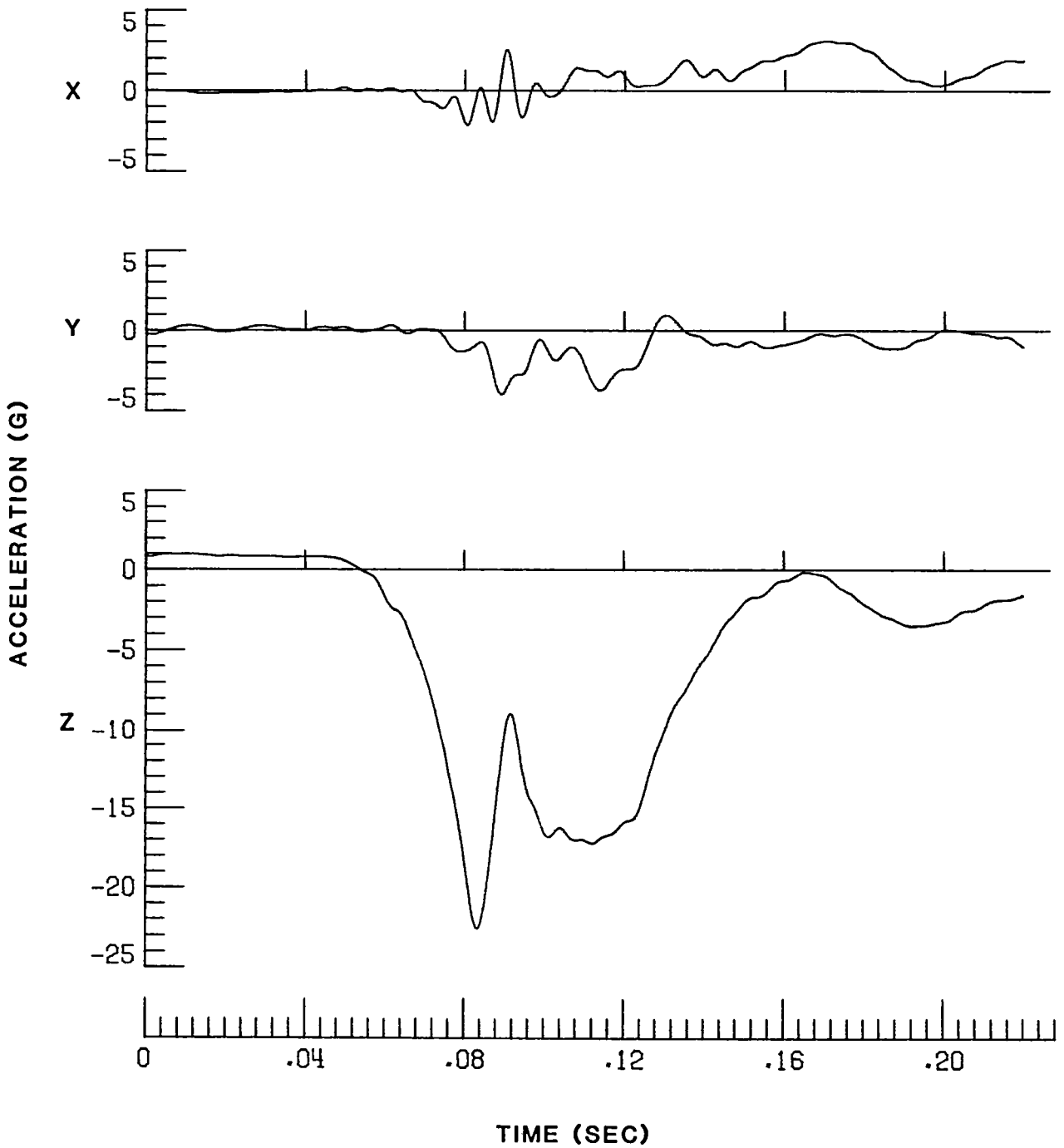
RIGHT SEAT PAN
NASA TEST NO. 1



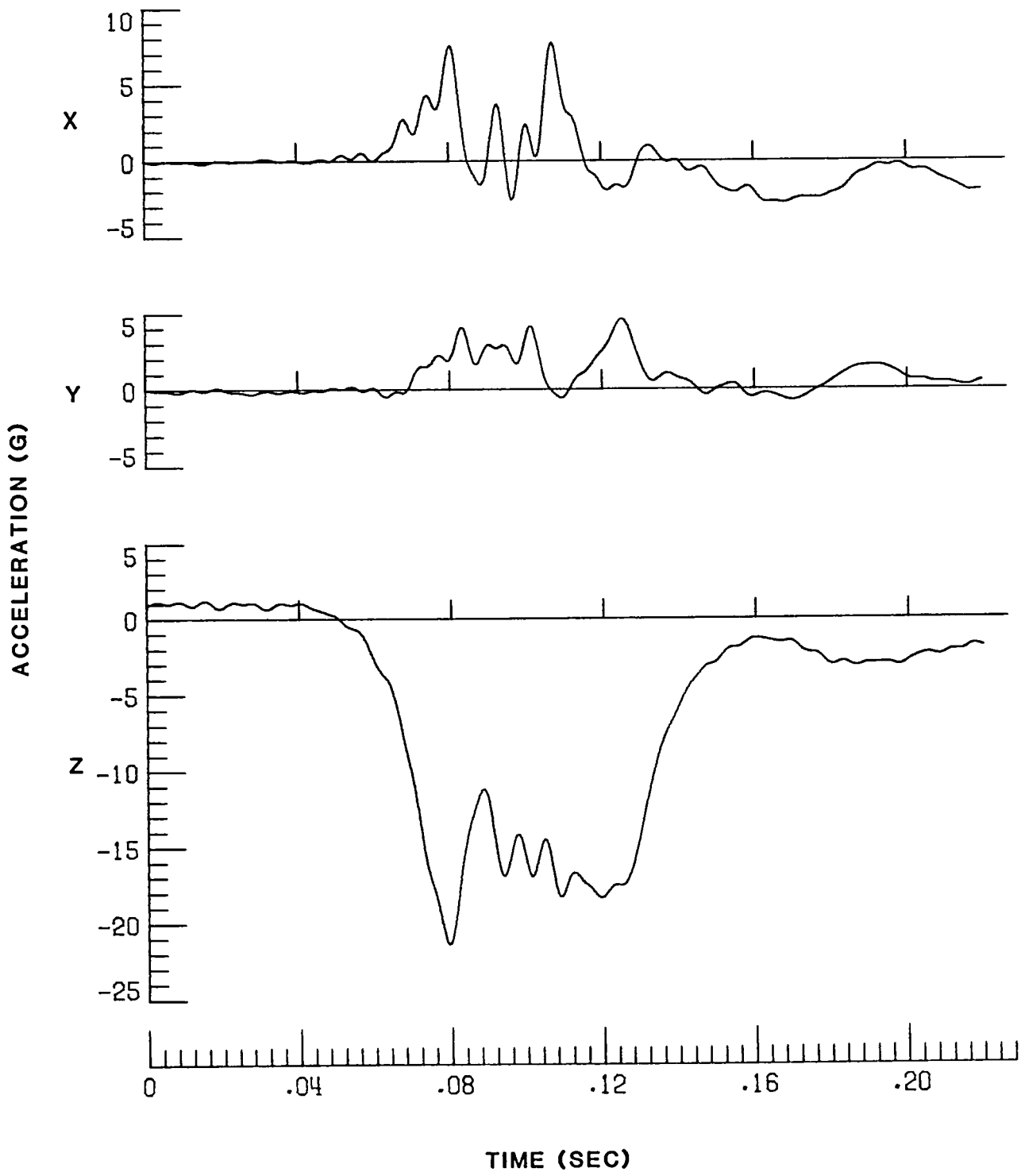
CAPSULE C.G.
NASA TEST NO. 1



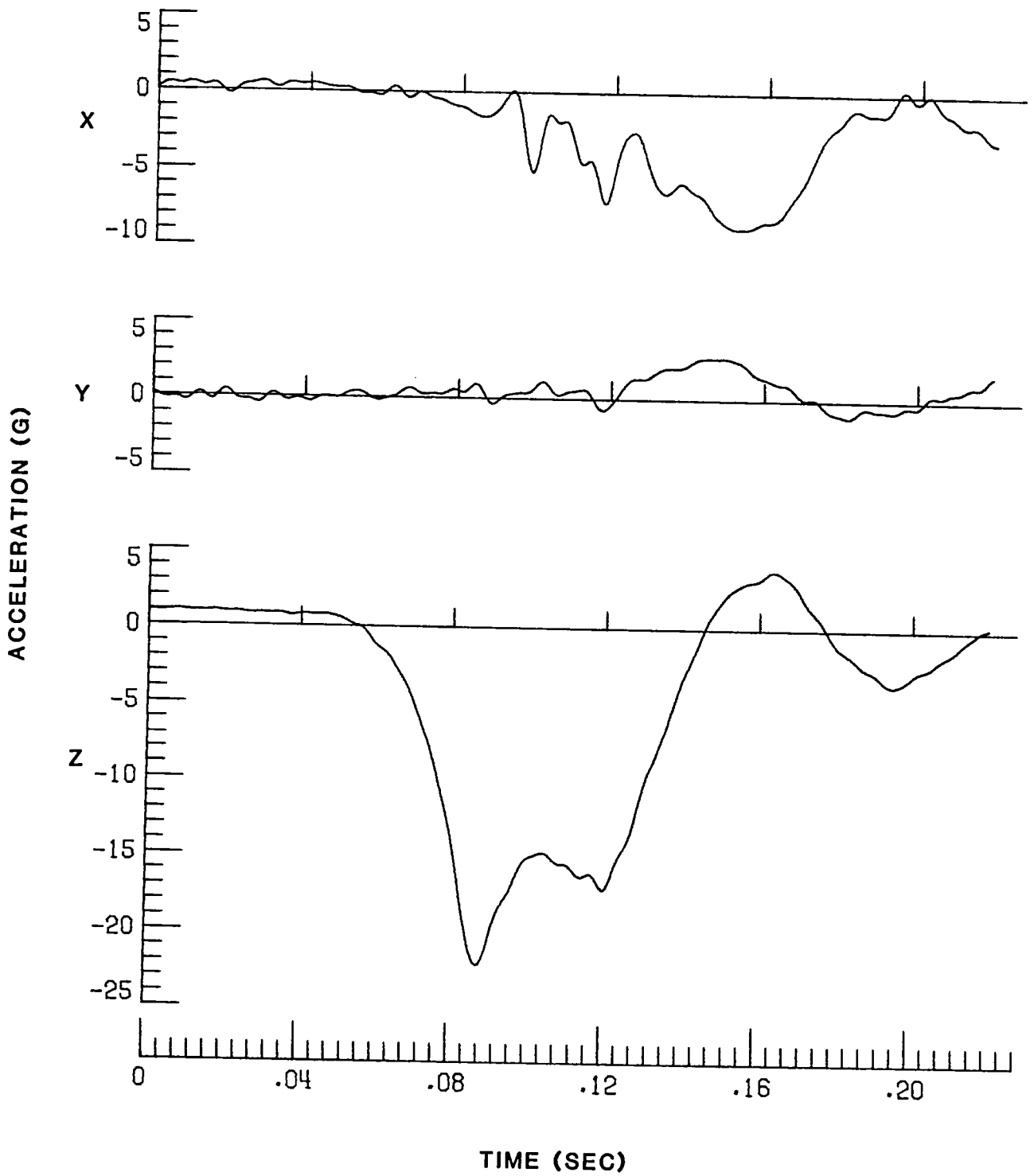
SEAT PAN ALONG BACK TANGENT LINE
NASA TEST NO. 1



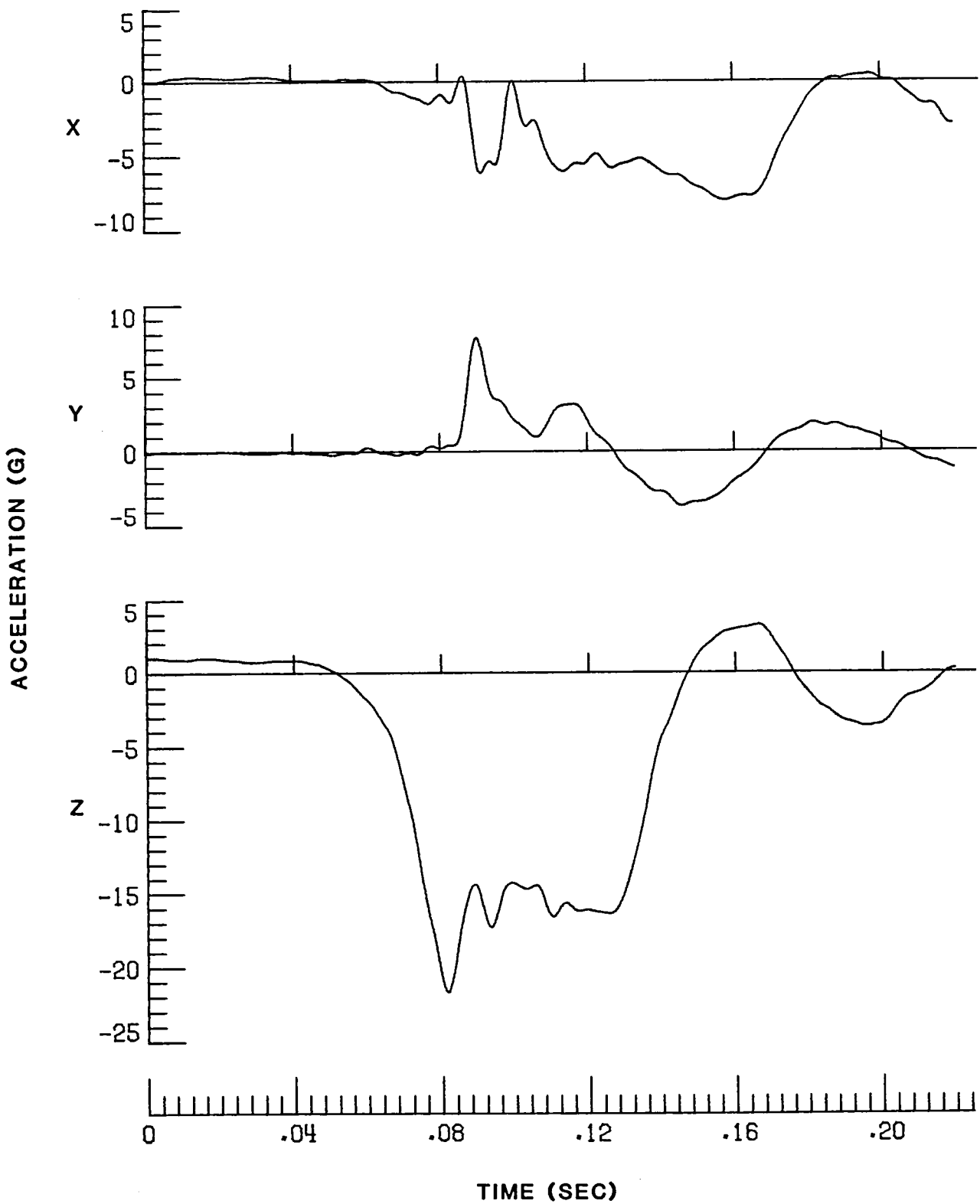
LEFT DUMMY PELVIS
NASA TEST NO. 1



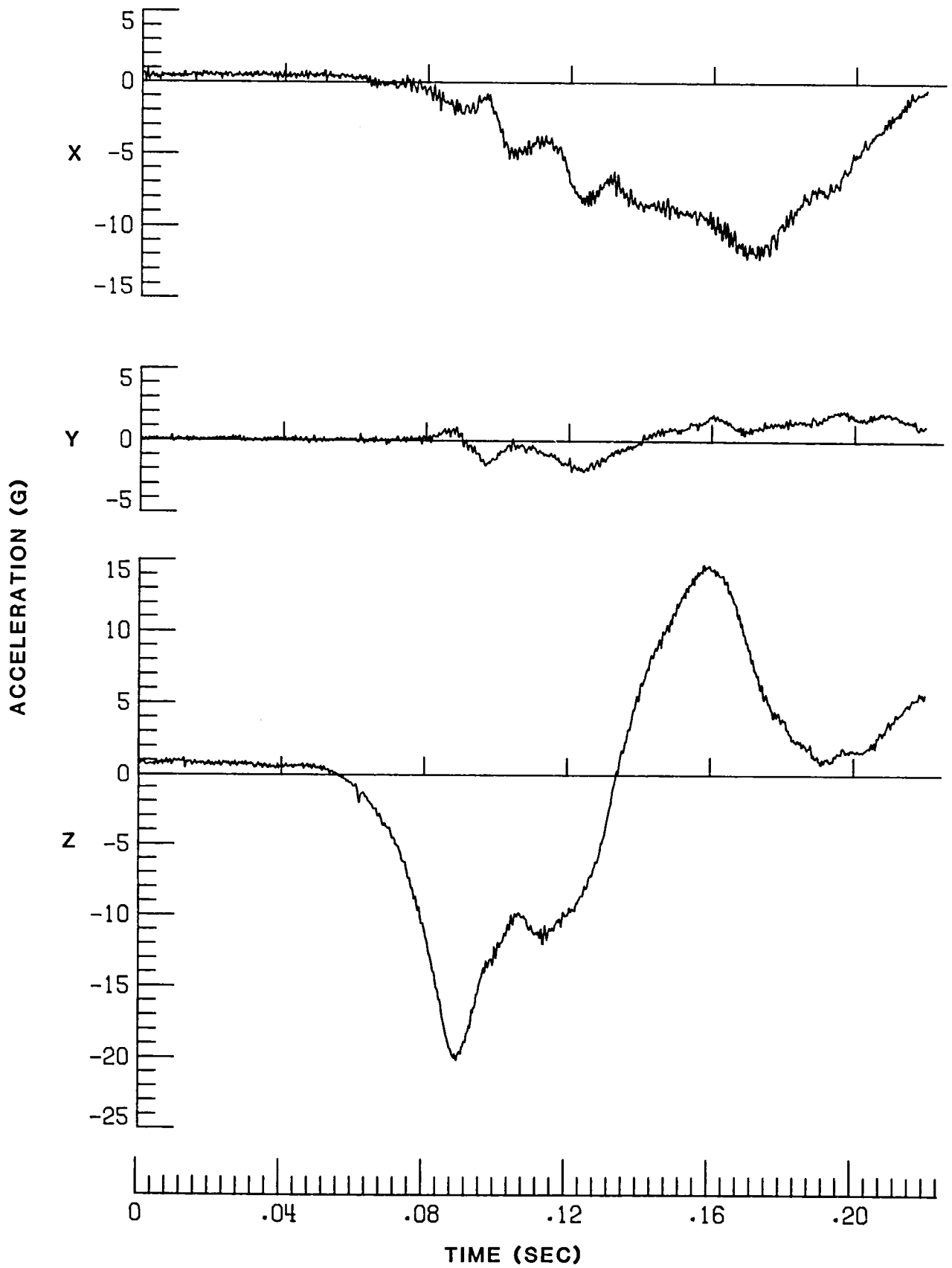
RIGHT DUMMY PELVIS
NASA TEST NO. 1



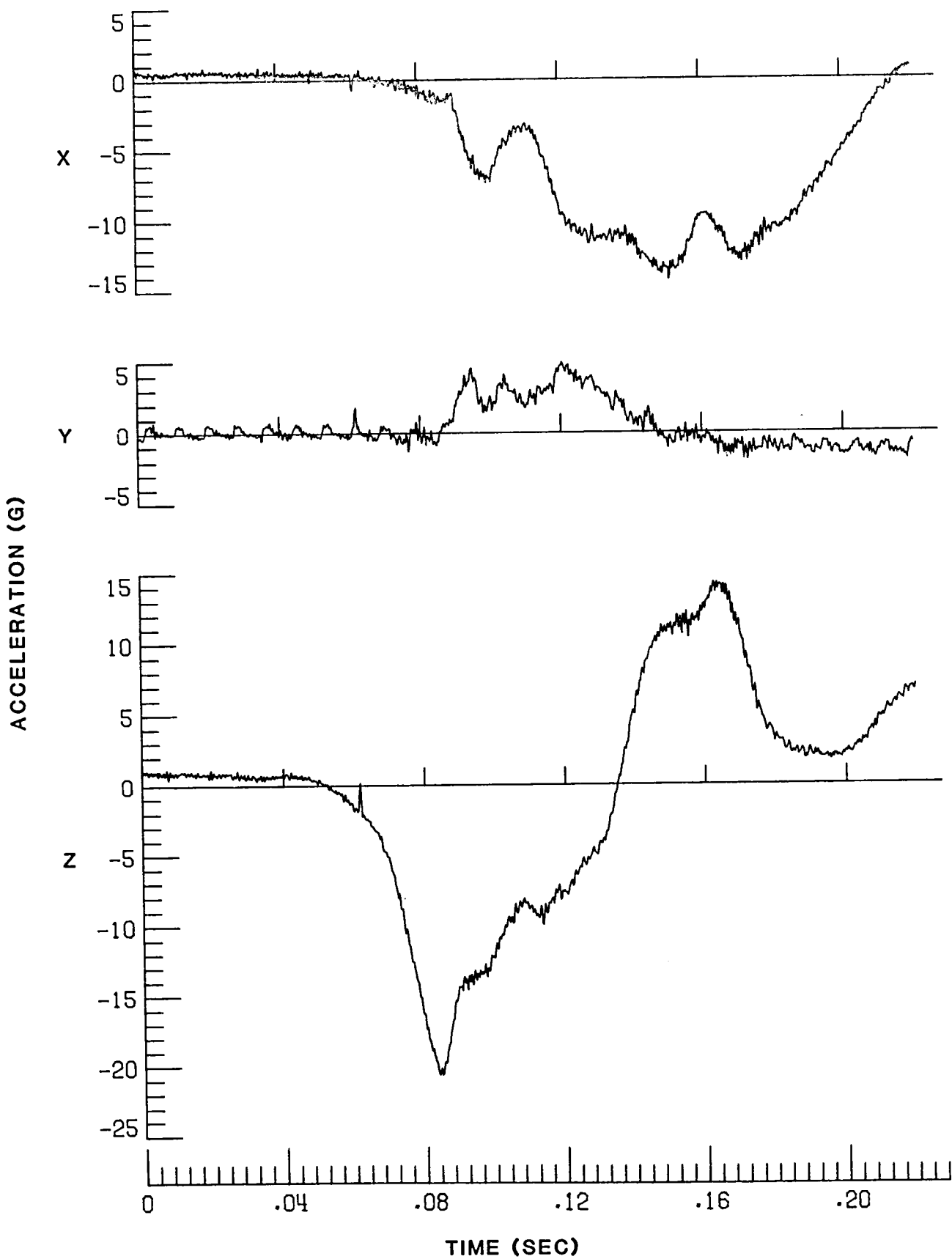
LEFT DUMMY CHEST
NASA TEST NO. 1



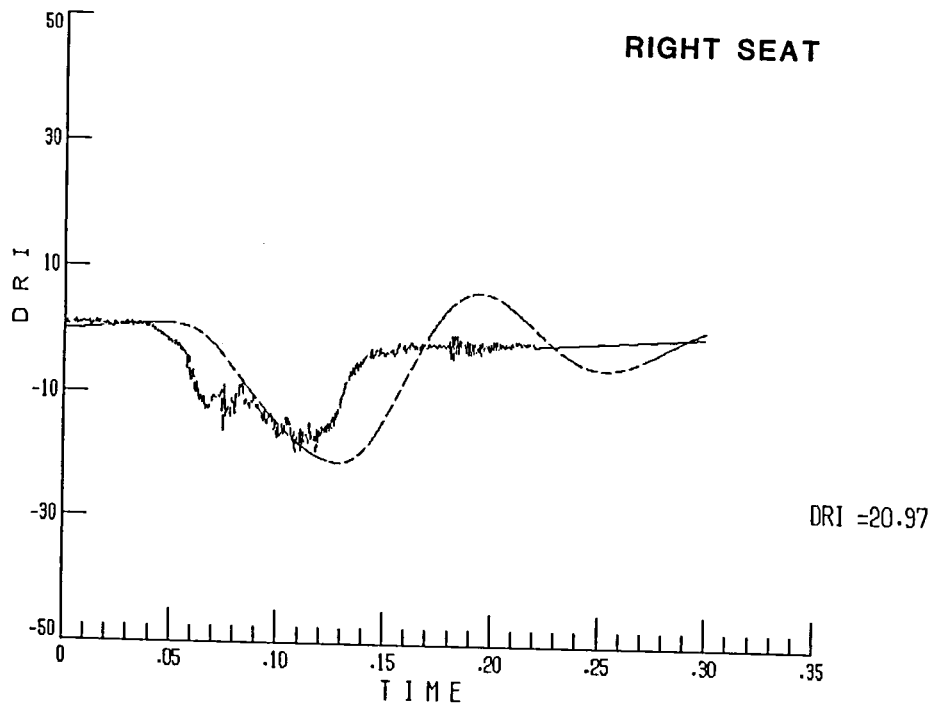
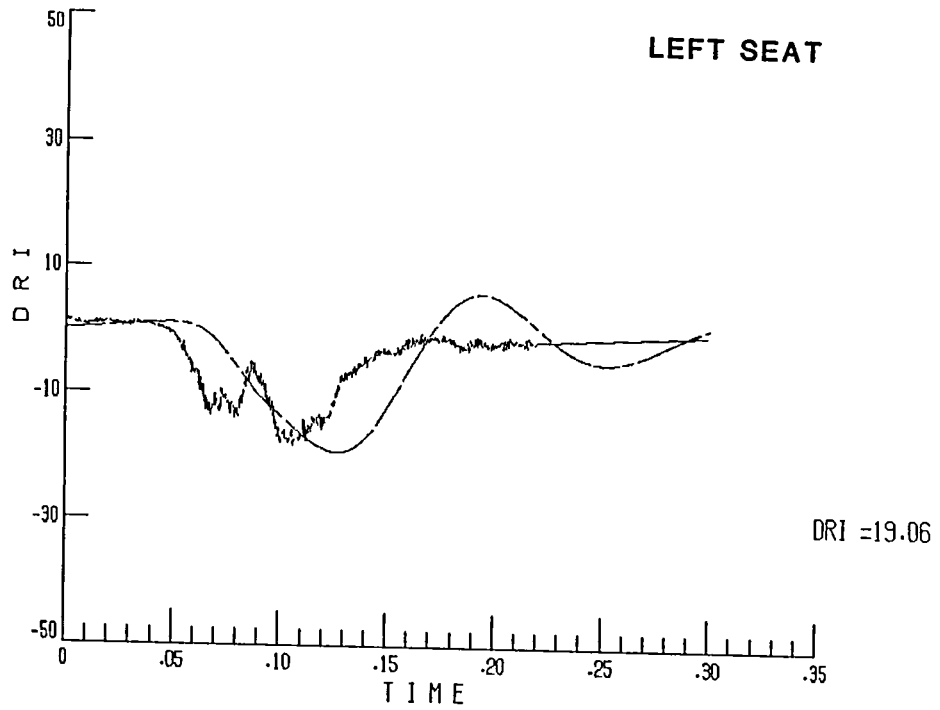
RIGHT DUMMY CHEST
NASA TEST NO. 1



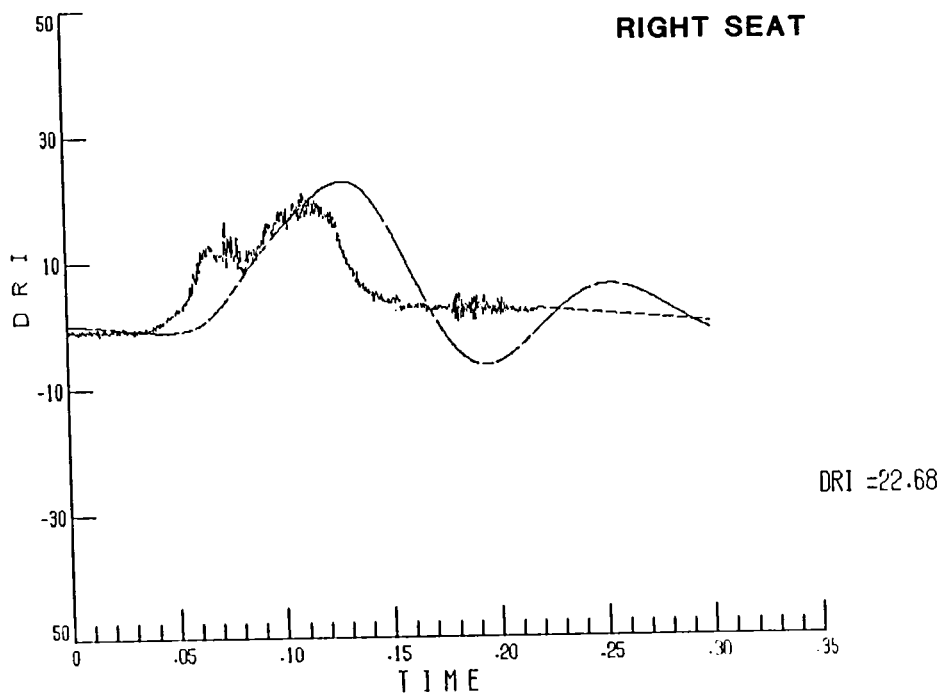
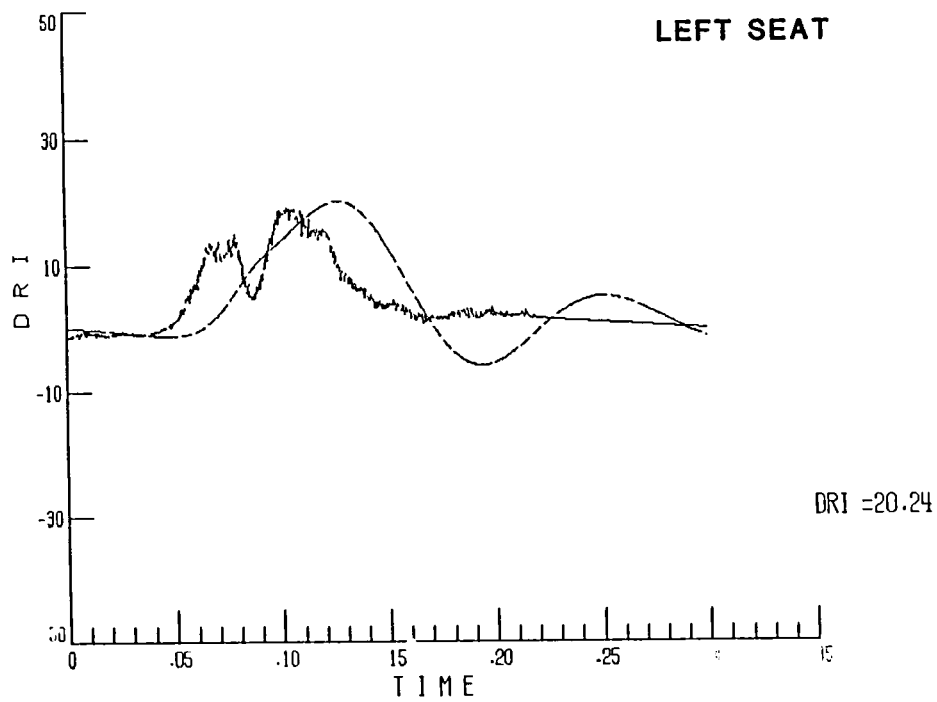
LEFT DUMMY HEAD
NASA TEST NO. 1



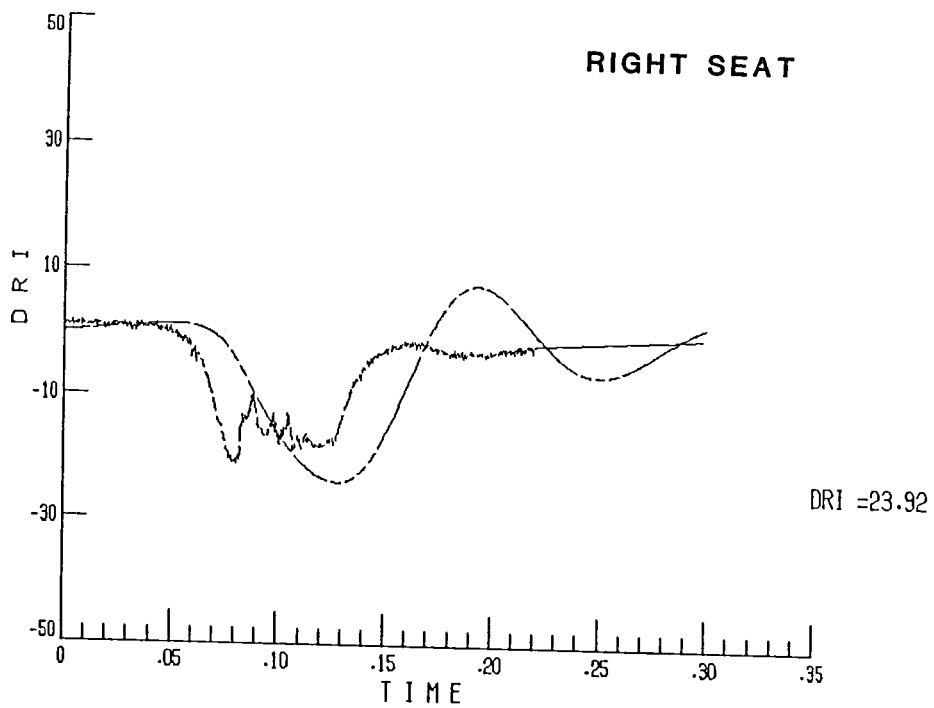
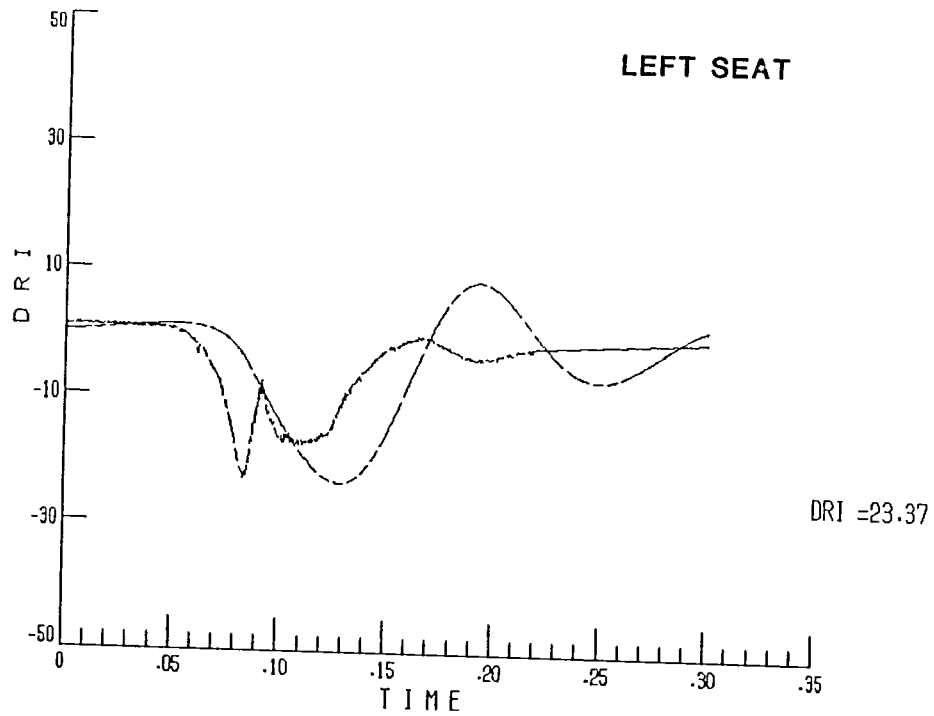
RIGHT DUMMY HEAD
 NASA TEST NO. 1



**DYNAMIC RESPONSE INDEX
SEAT PAN Z-AXIS
NASA TEST NO. 1**



**DYNAMIC RESPONSE INDEX
BACK TANGENT LINE
NASA TEST NO. 1**



DYNAMIC RESPONSE INDEX
DUMMY PELVIS Z-AXIS
NASA TEST NO. 1

3.0 NASA TEST NO. 2

HORIZONTAL VELOCITY: 34 ft/sec

VERTICAL VELOCITY: 32 ft/sec

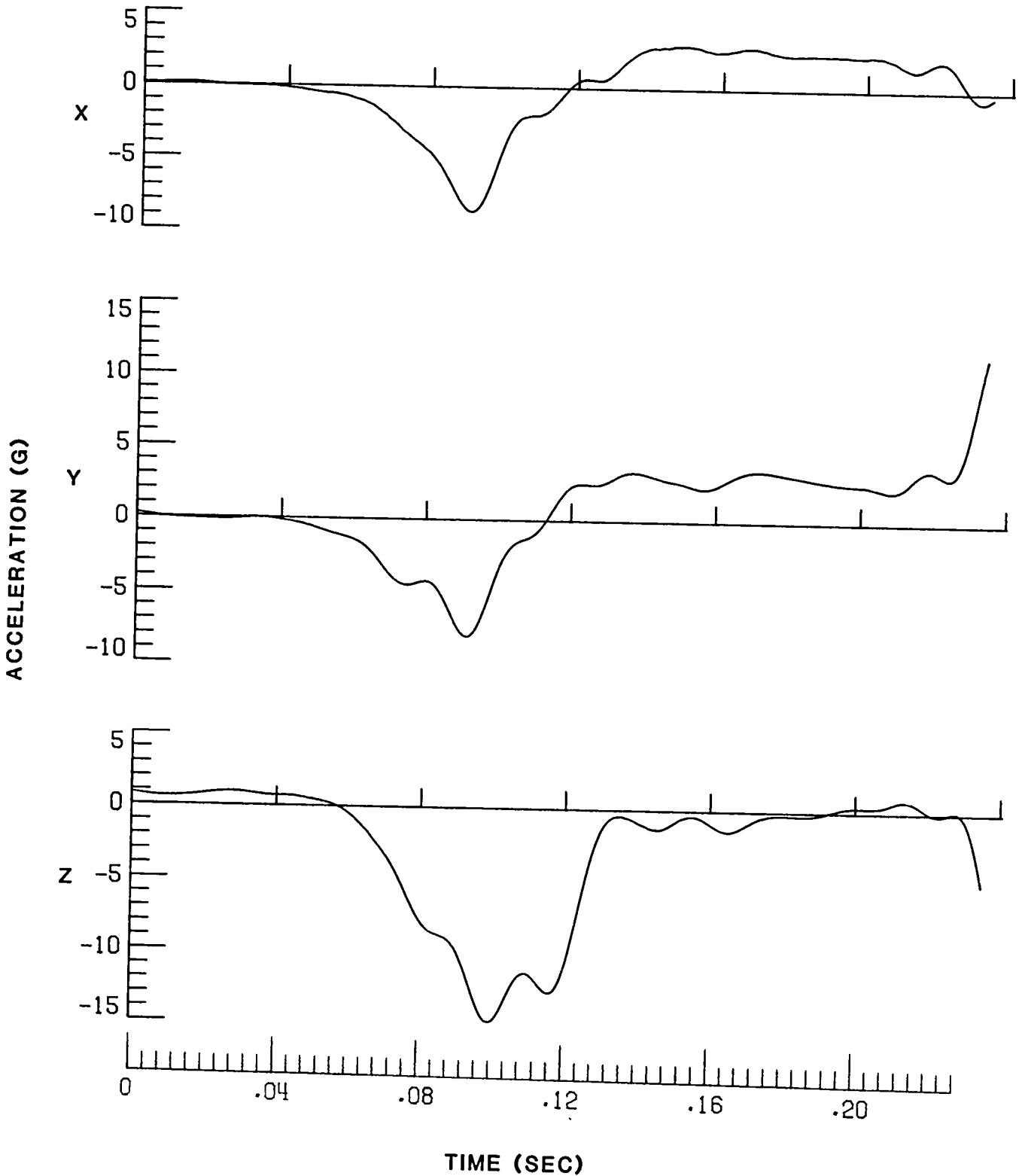
CREW MODULE PITCH: 0°

CREW MODULE ROLL: 15°

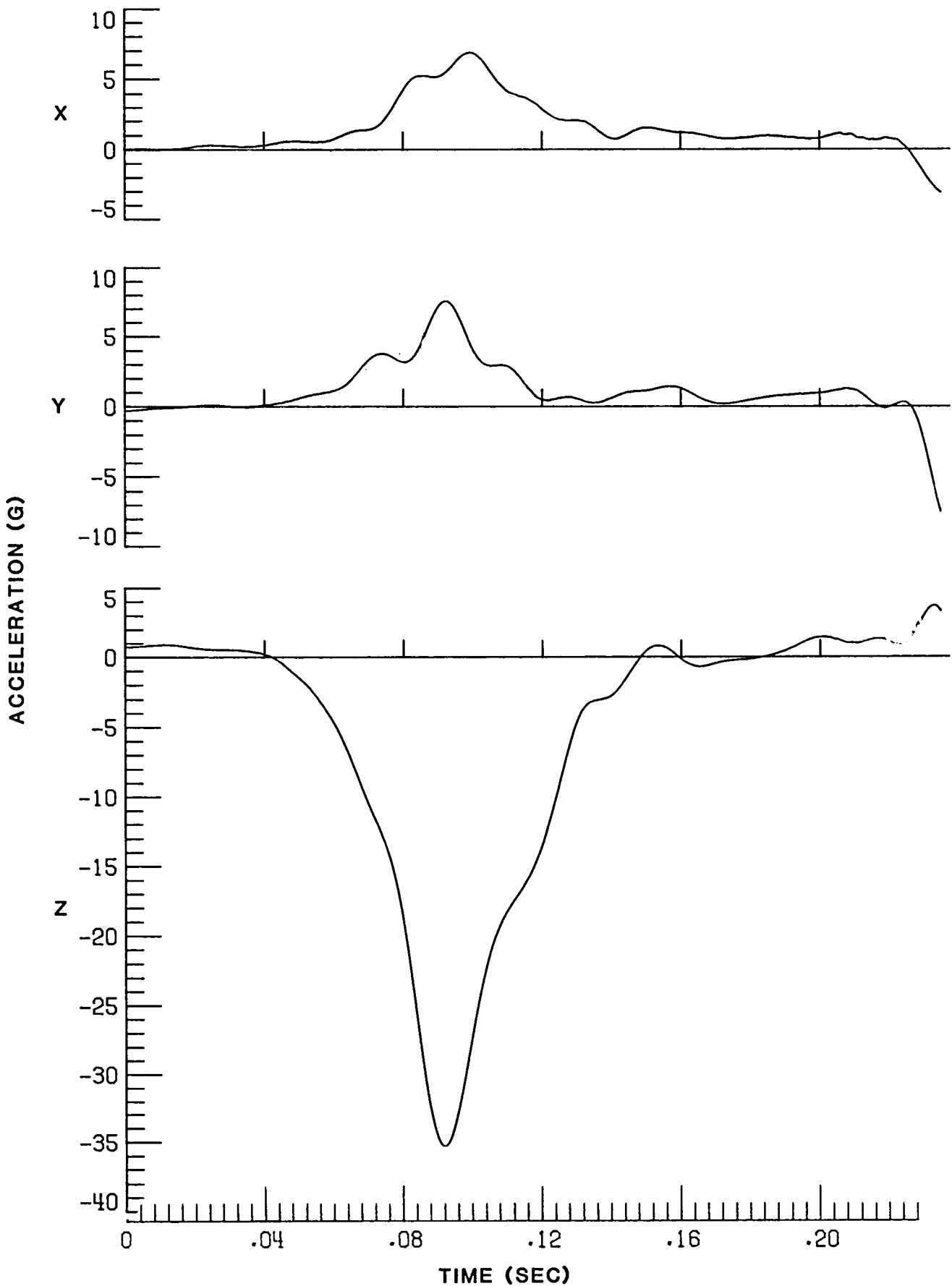
CREW MODULE YAW: 90°

LEFT SEAT: Energy Absorbing

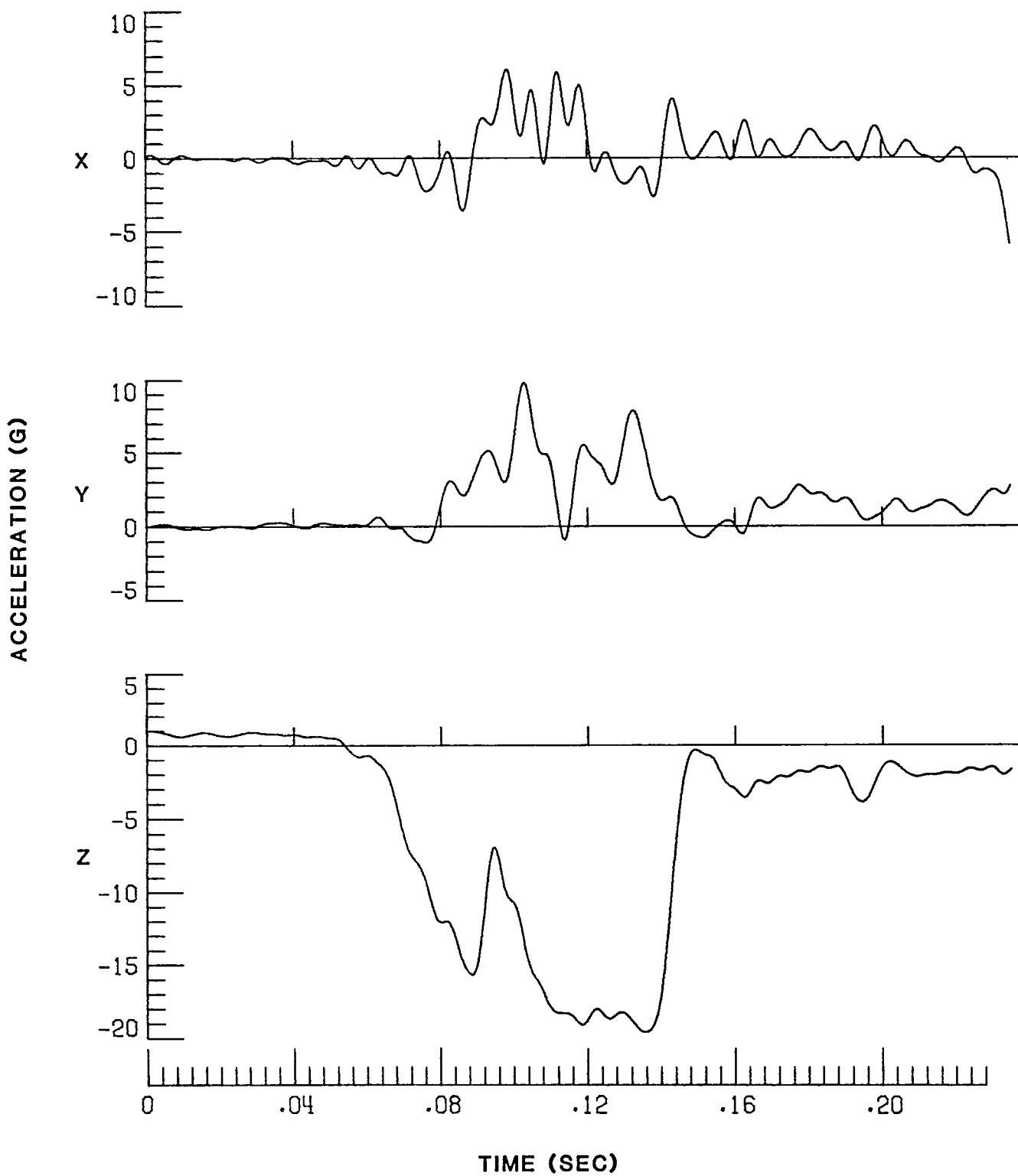
RIGHT SEAT: Energy Absorbing



LEFT BULKHEAD
NASA TEST NO. 2

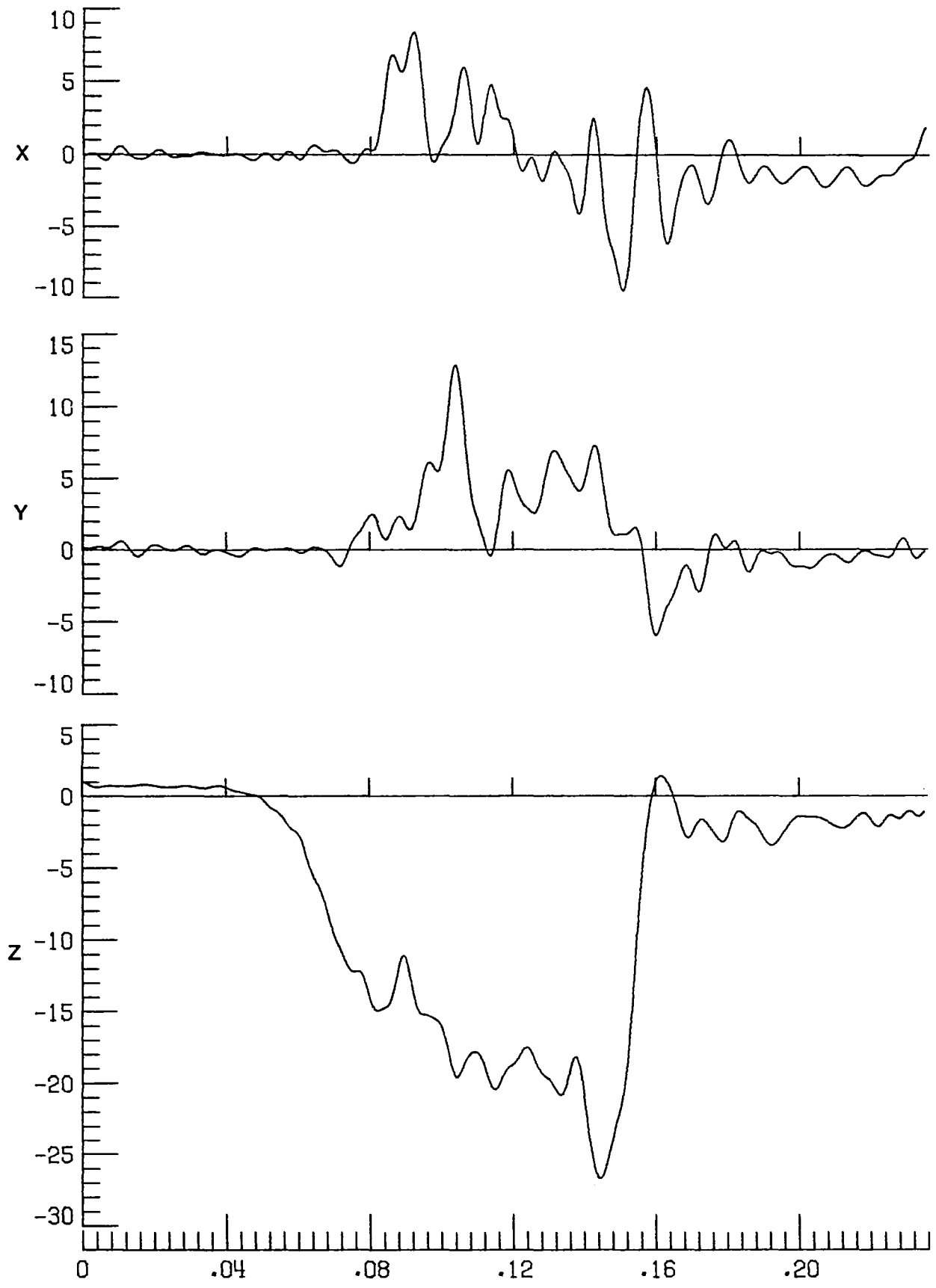


RIGHT BULKHEAD
NASA TEST NO. 2

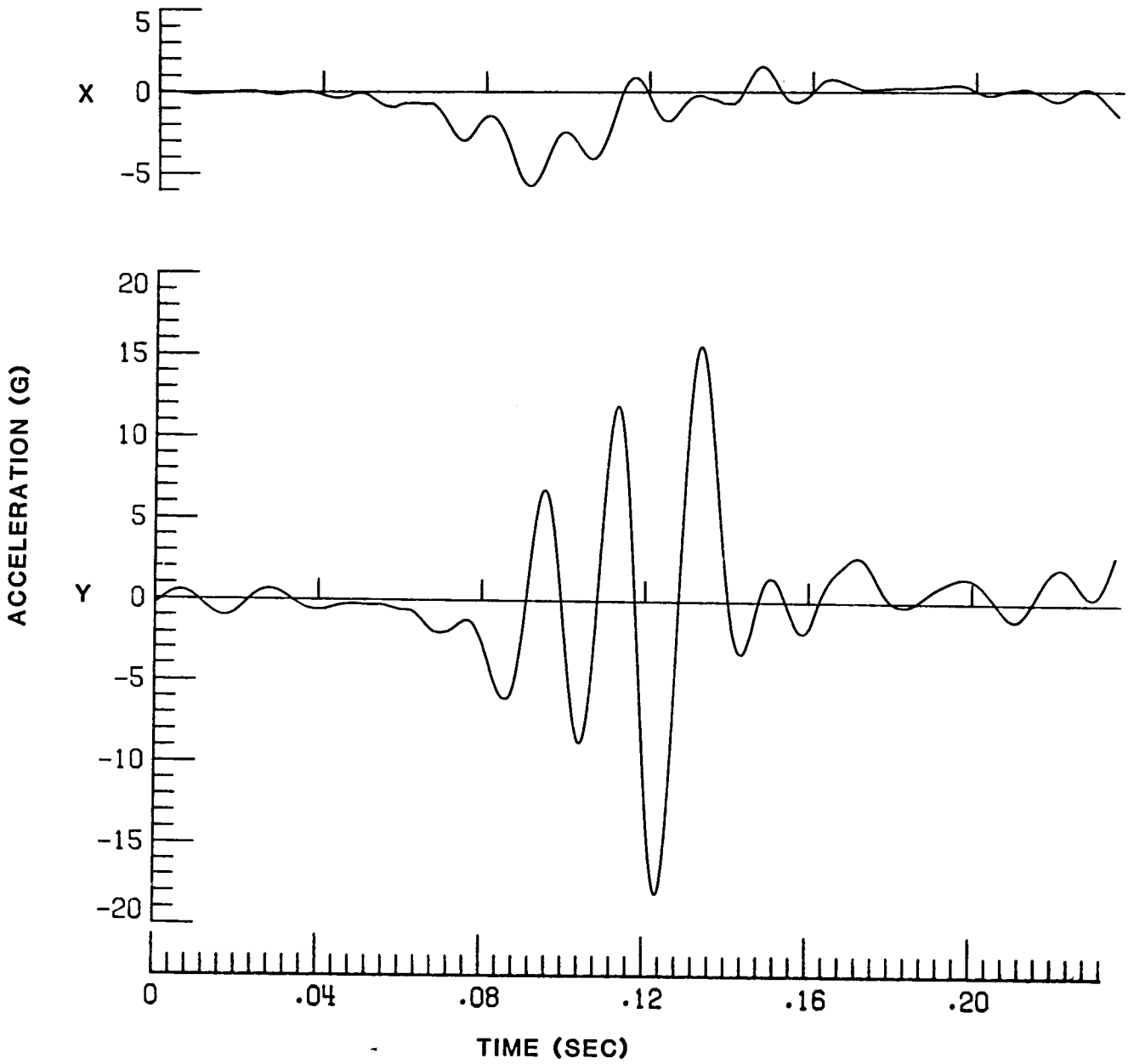


LEFT SEAT PAN
NASA TEST NO. 2

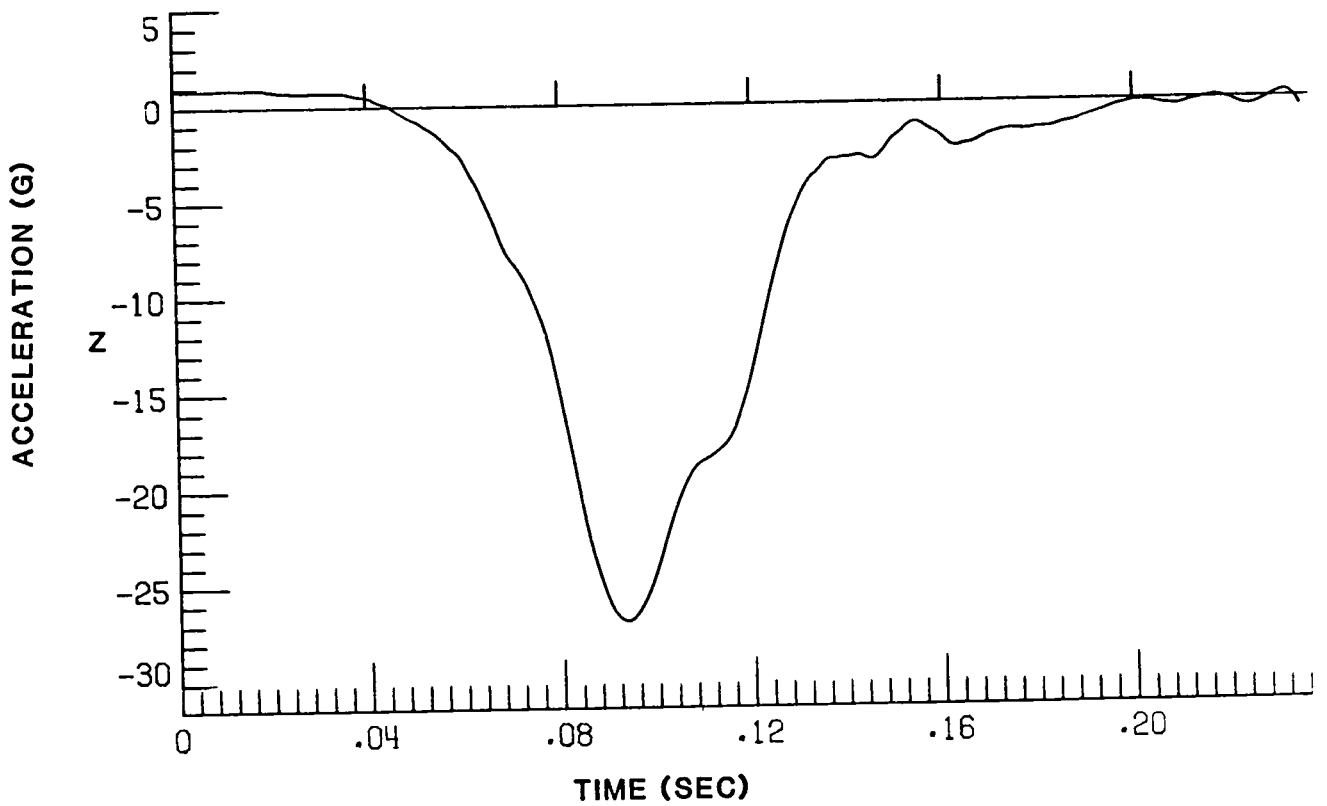
ACCELERATION (G)



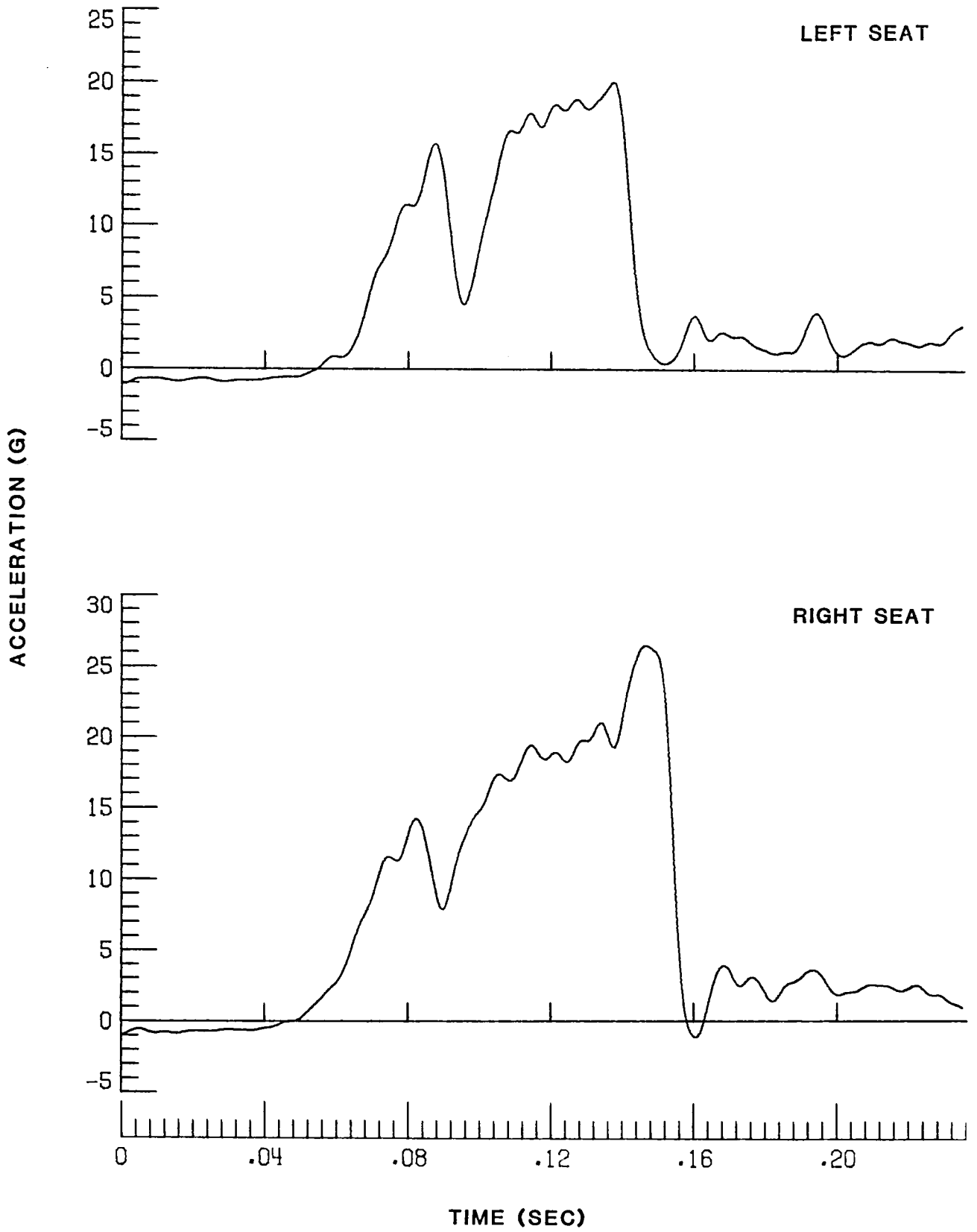
RIGHT SEAT PAN
NASA TEST NO. 2



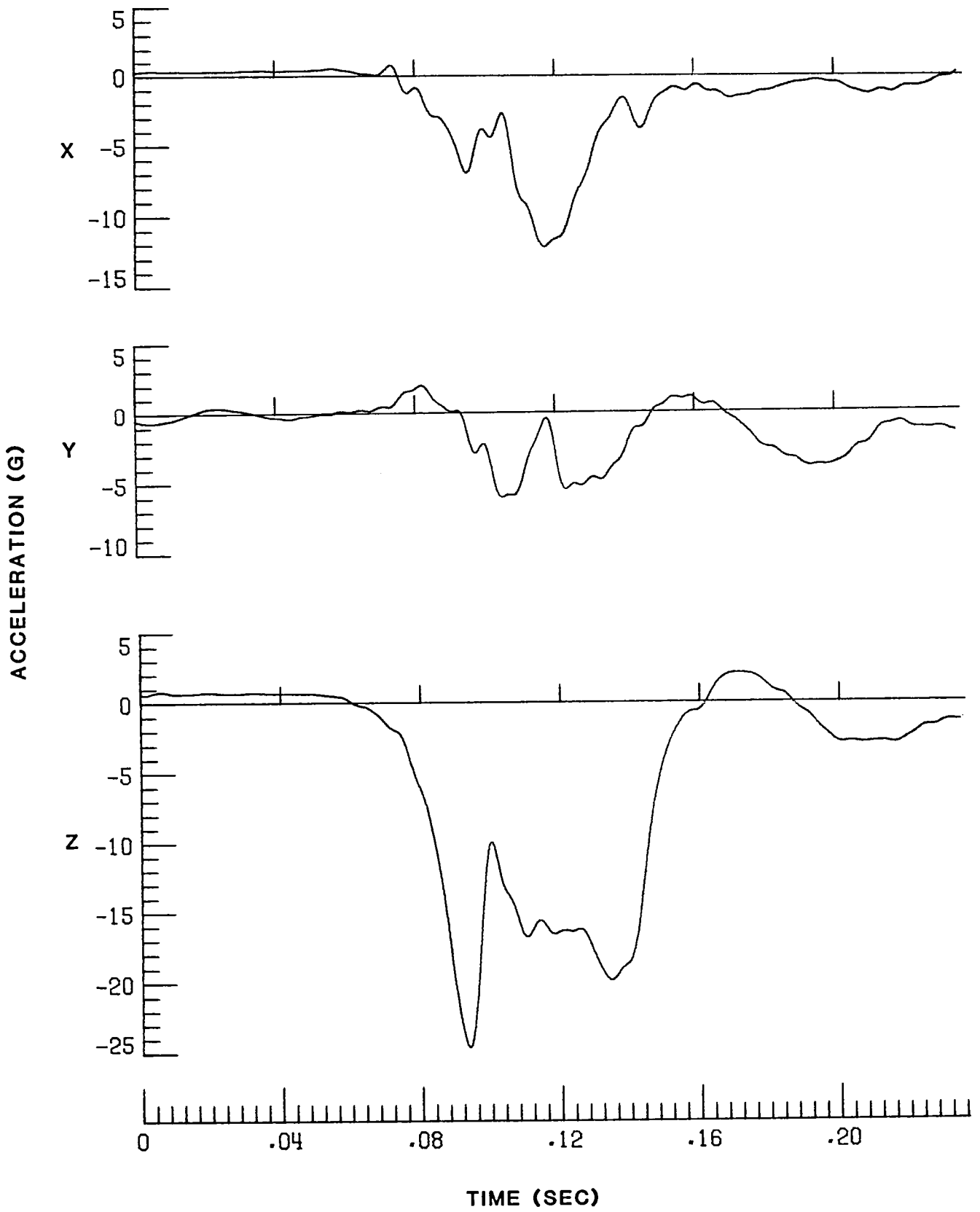
CAPSULE C.G.
NASA TEST NO. 2



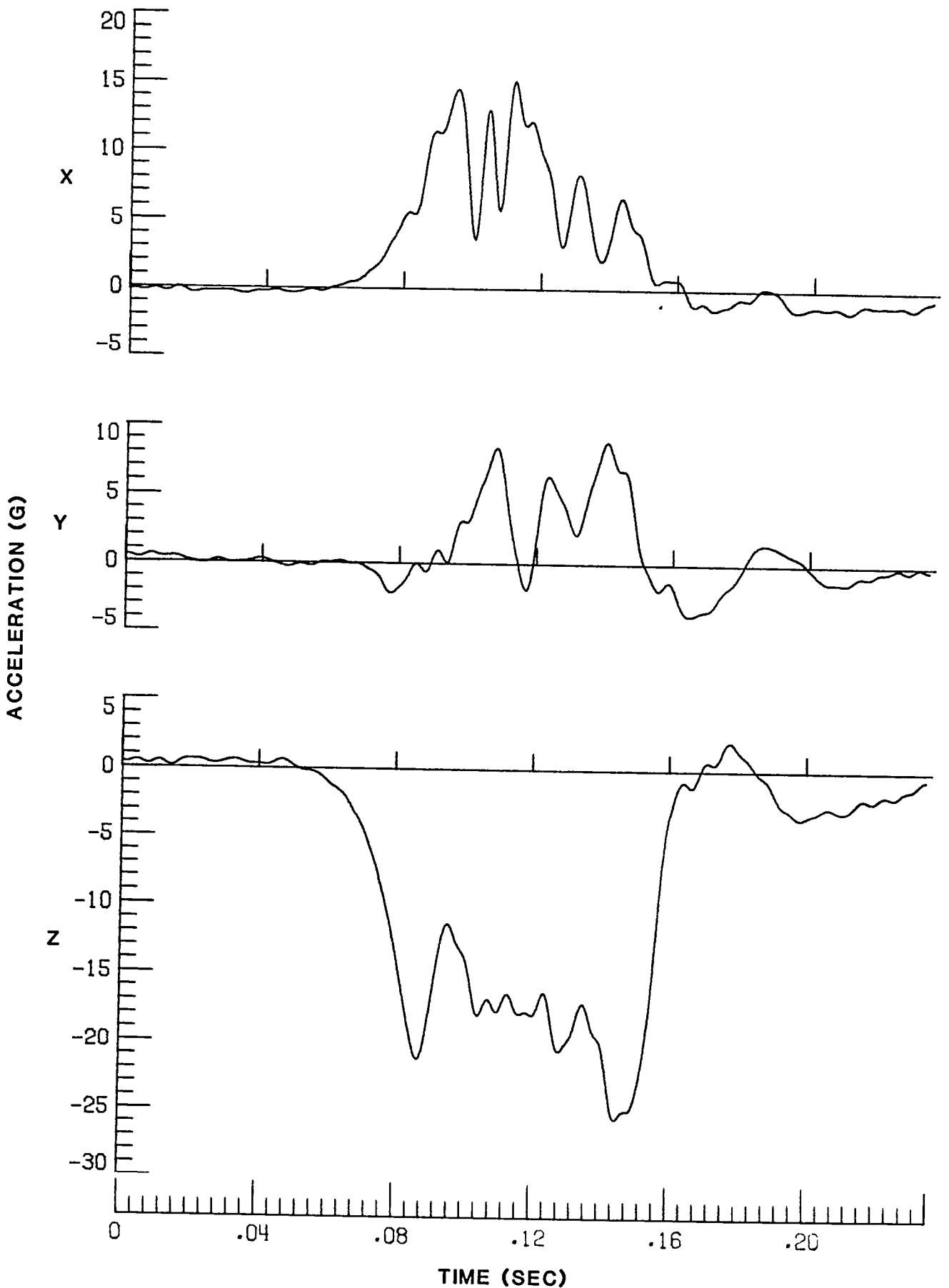
CAPSULE C.G.
NASA TEST NO. 2



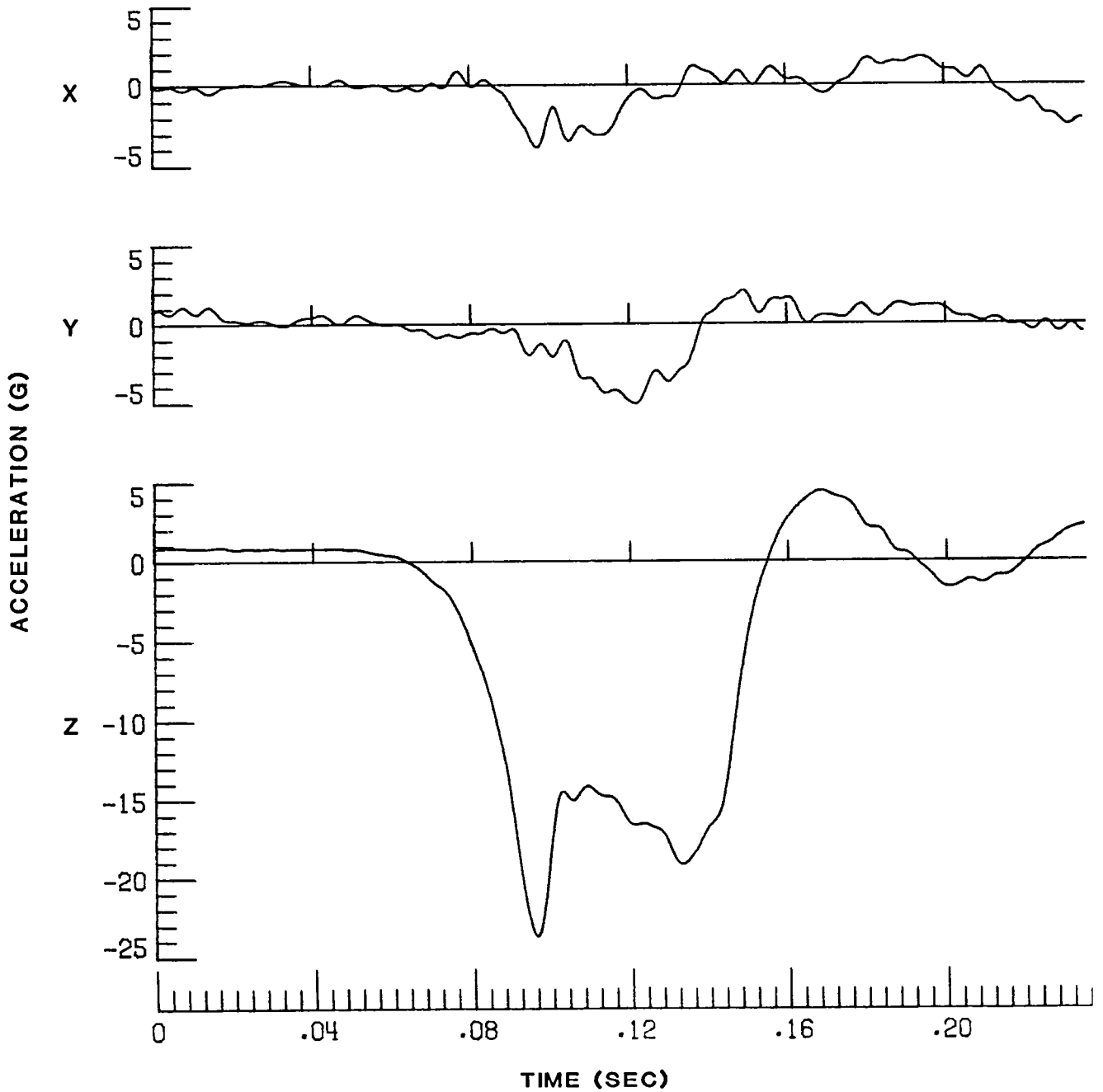
SEAT PAN ALONG BACK TANGENT LINE
NASA TEST NO. 2



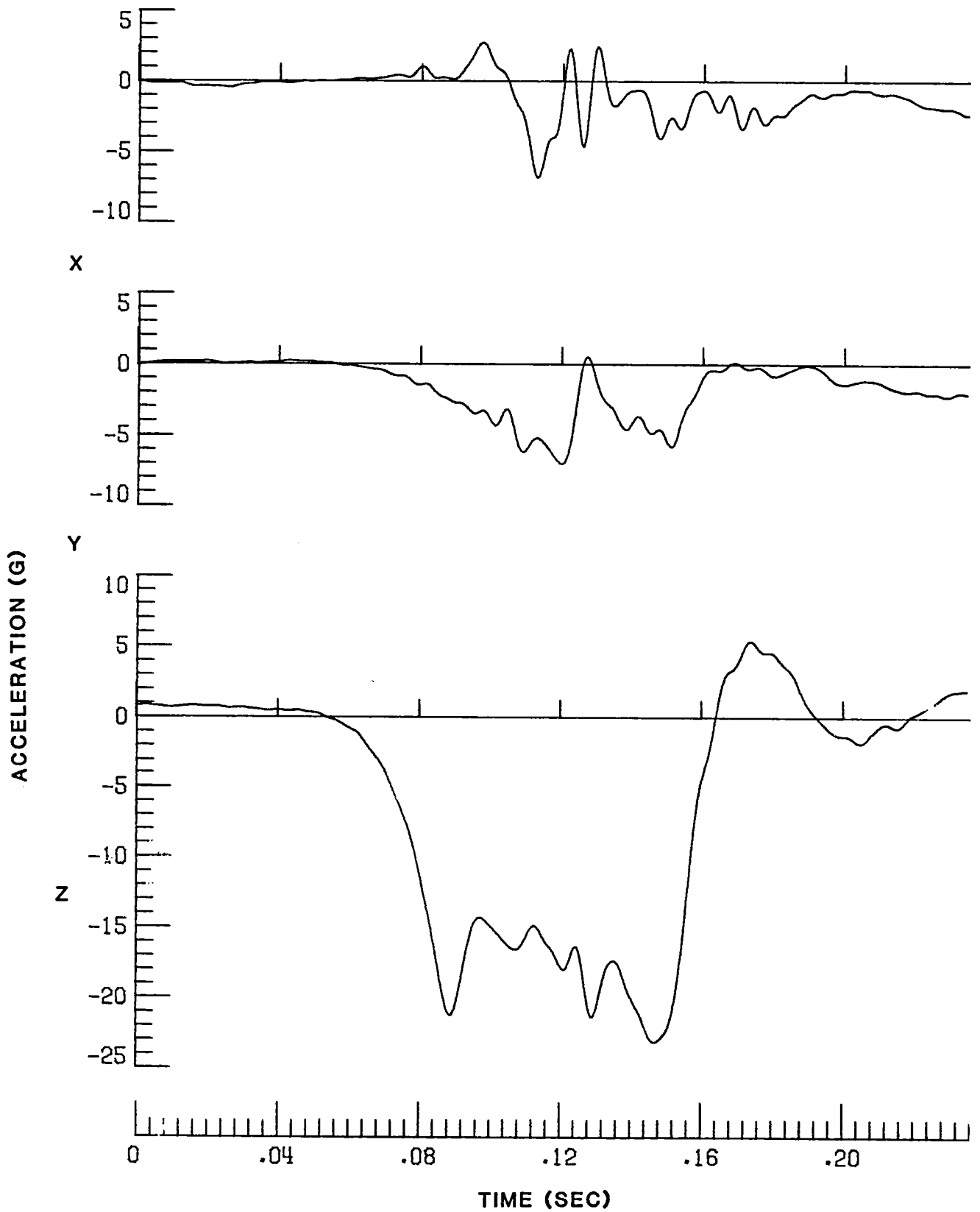
LEFT DUMMY PELVIS
NASA TEST NO. 2



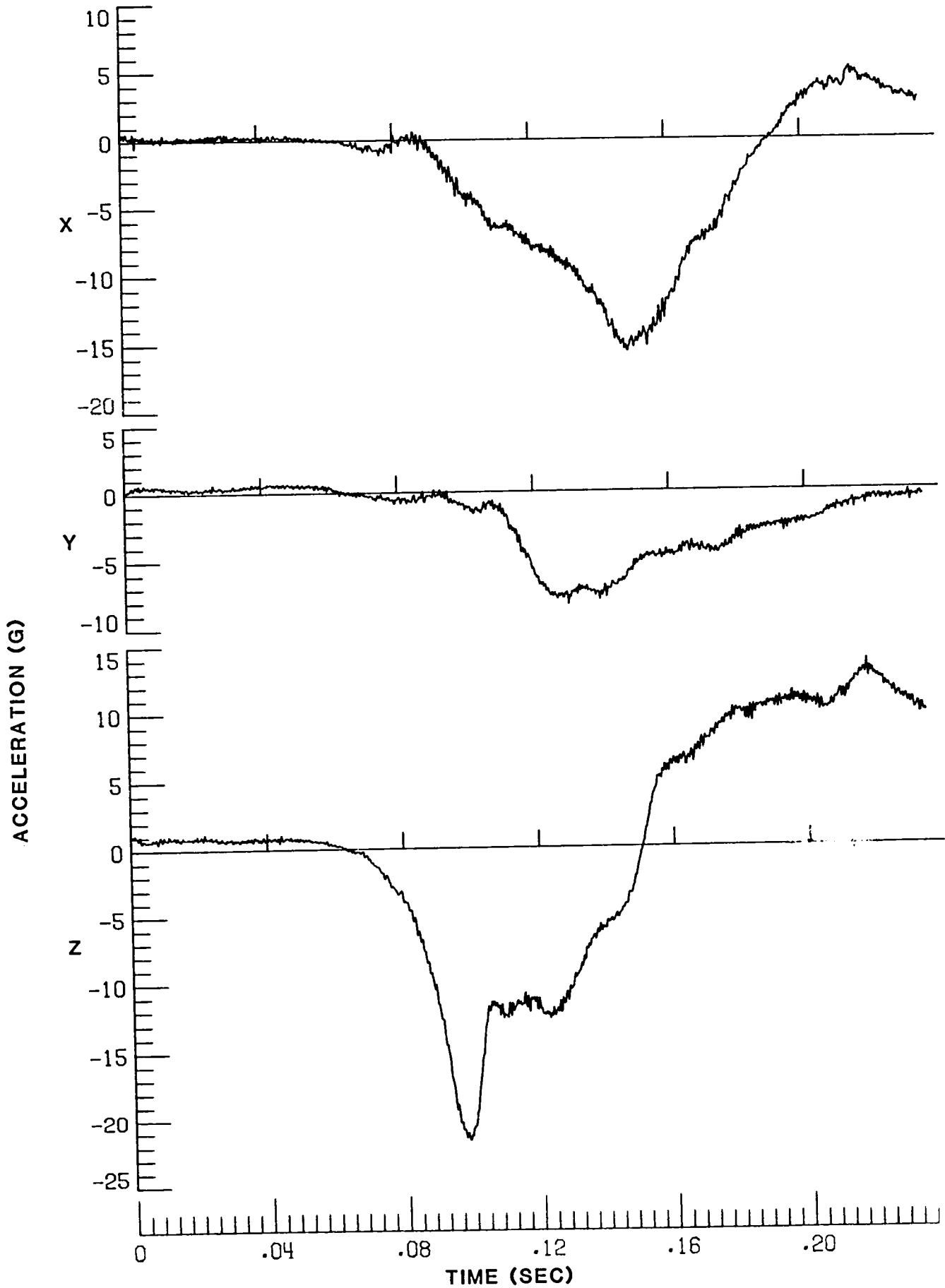
RIGHT DUMMY PELVIS
 NASA TEST NO. 2



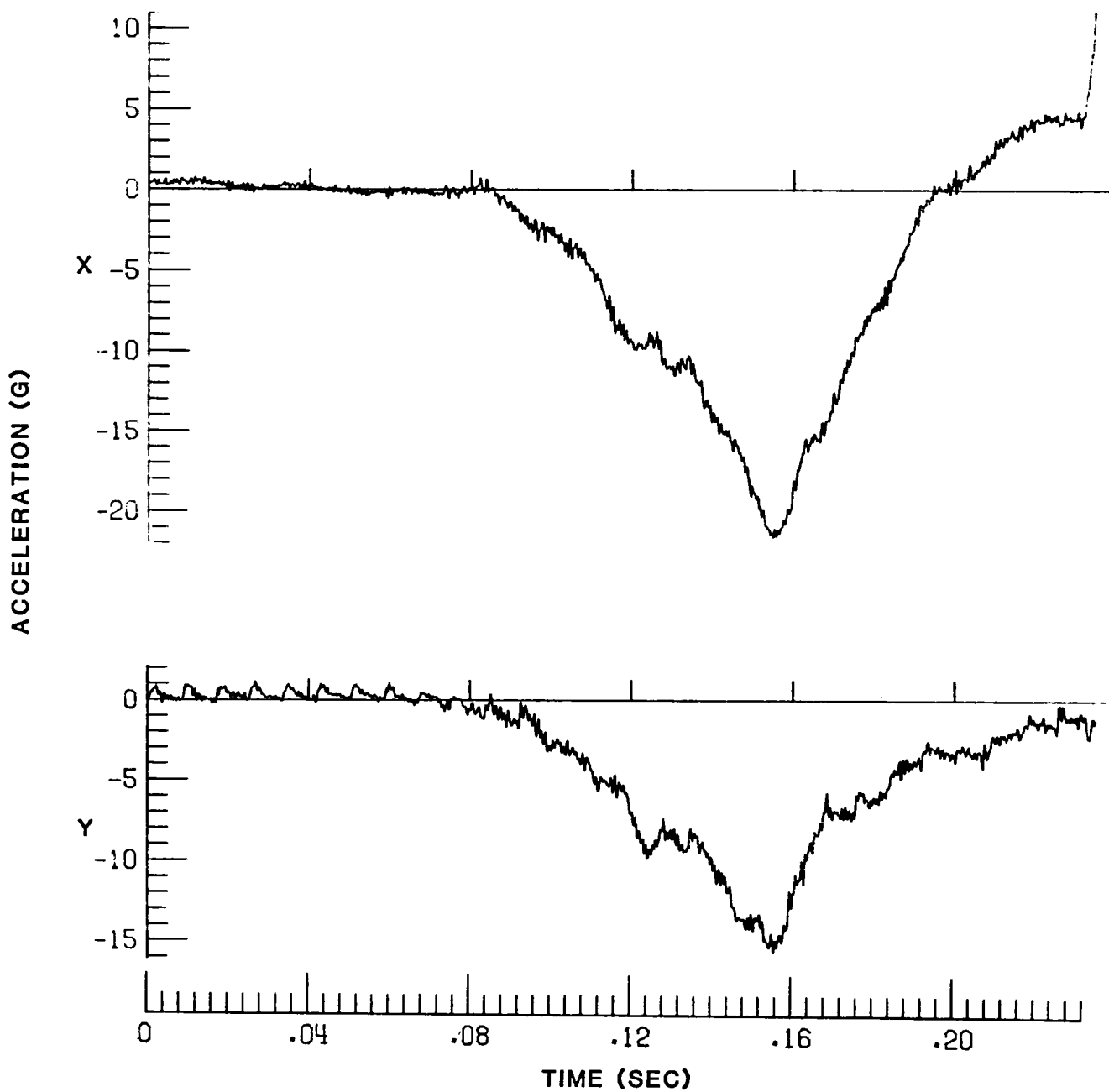
LEFT DUMMY CHEST
NASA TEST NO. 2



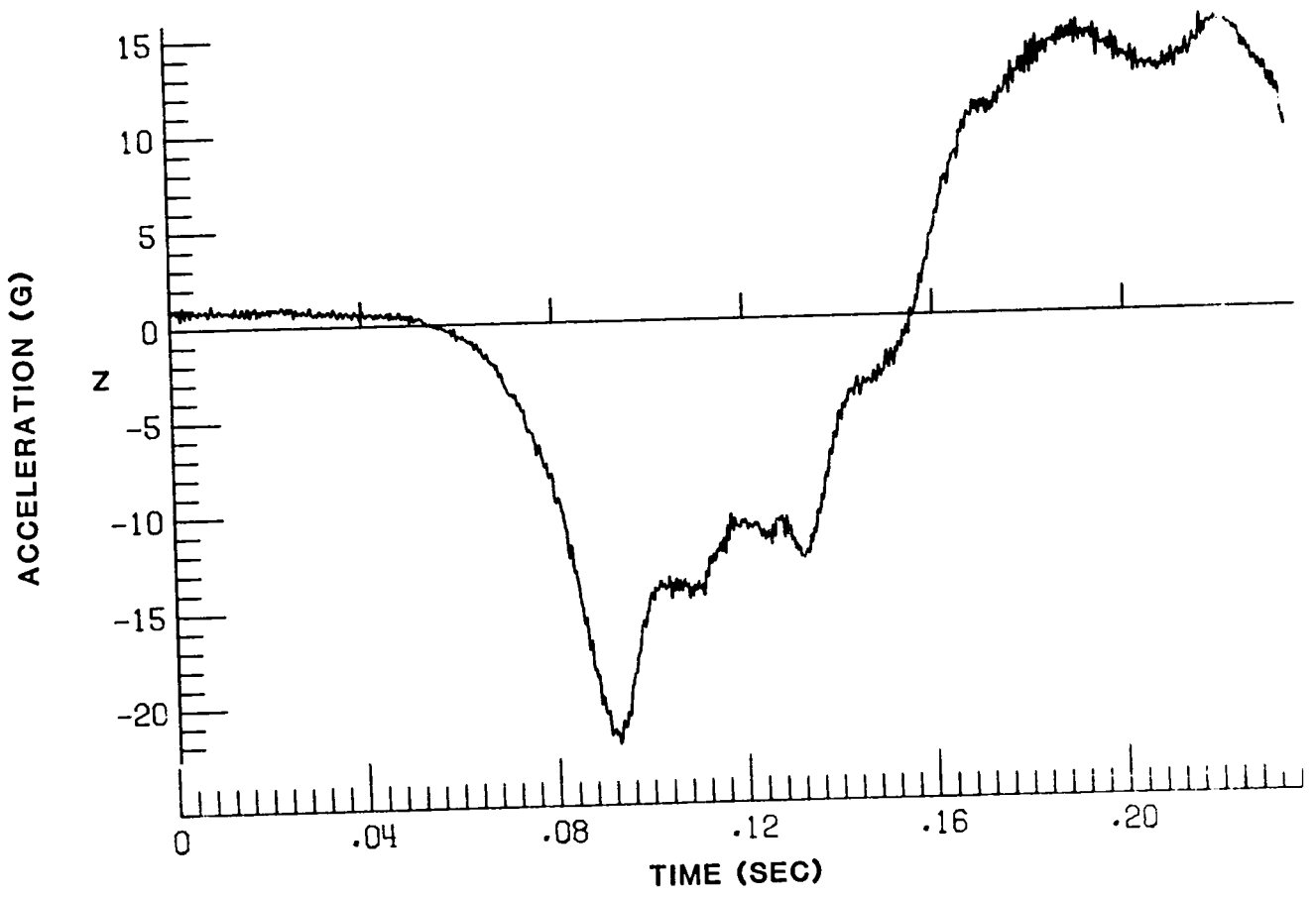
RIGHT DUMMY CHEST
 NASA TEST NO. 2



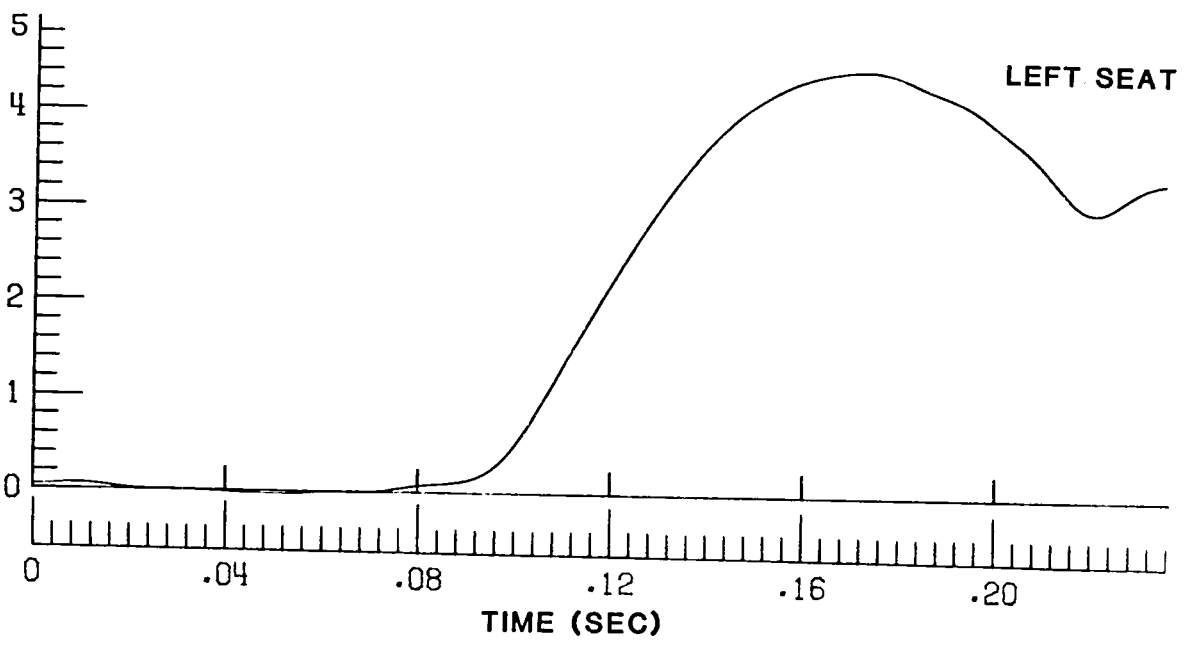
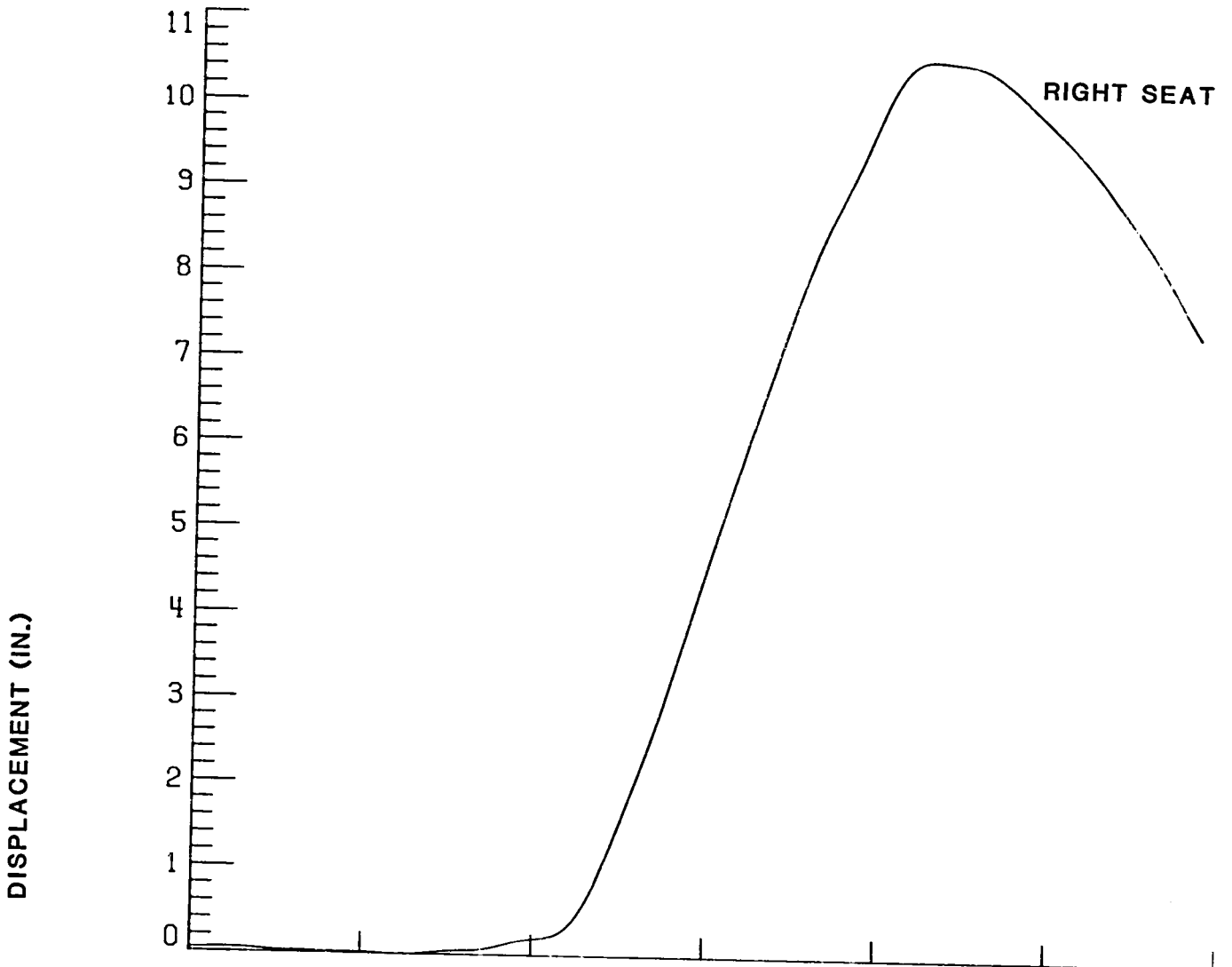
LEFT DUMMY HEAD
NASA TEST NO. 2



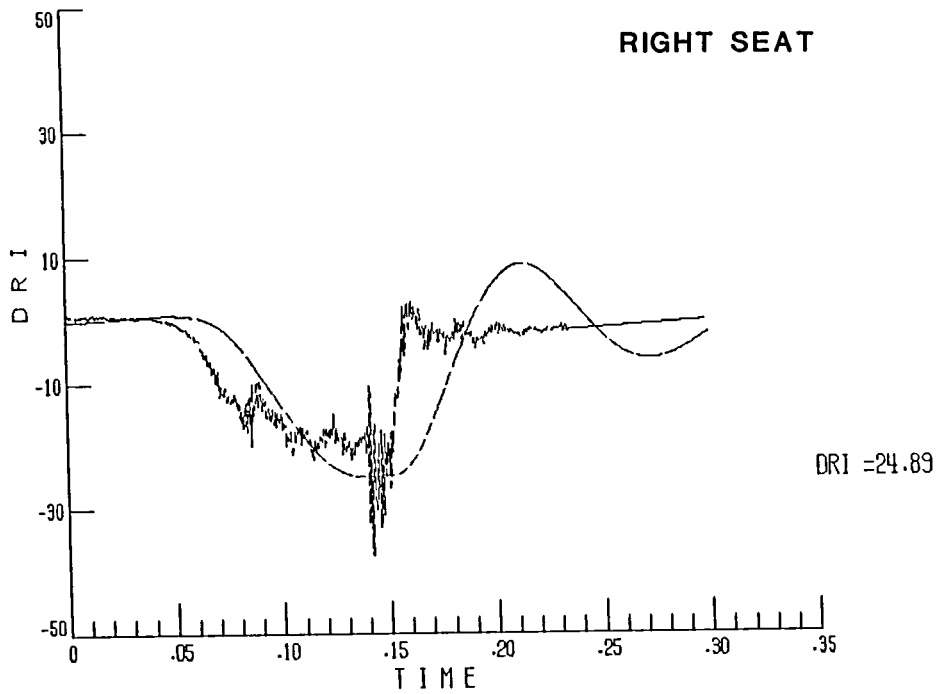
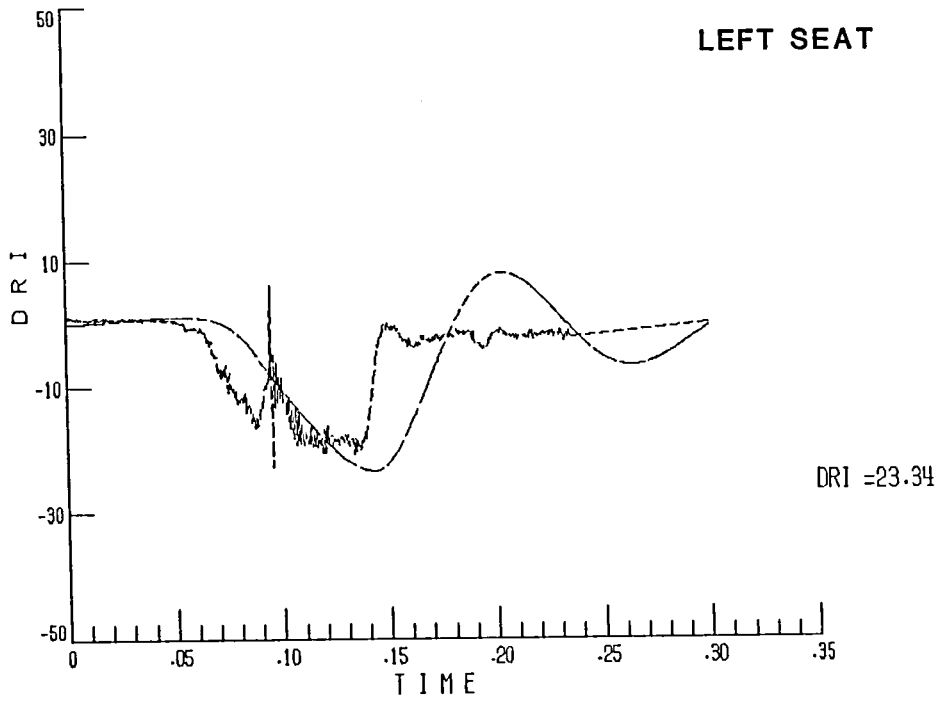
RIGHT DUMMY HEAD
NASA TEST NO. 2



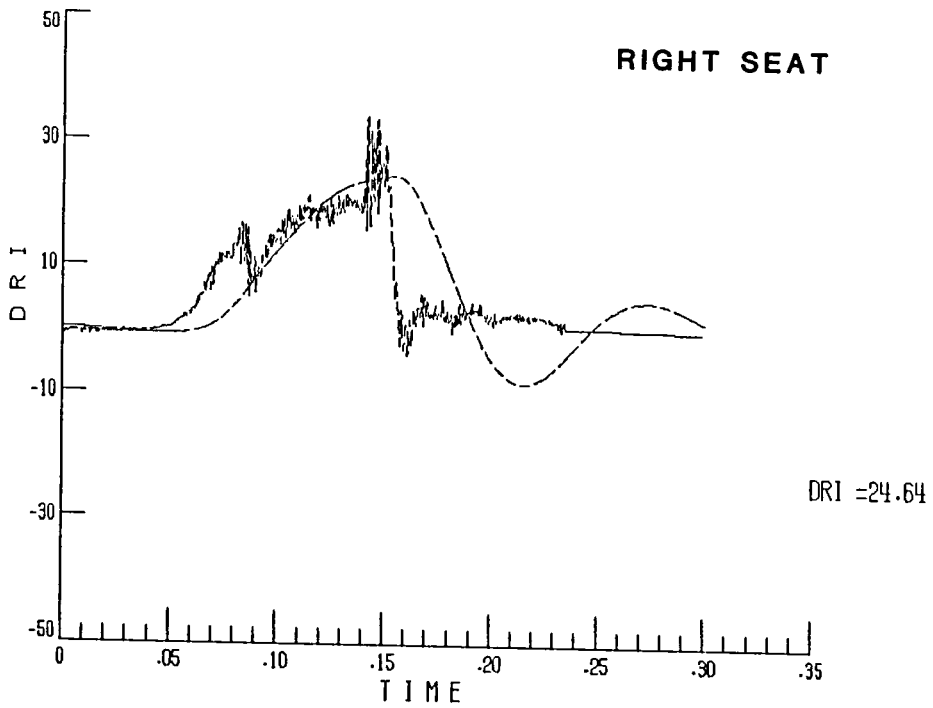
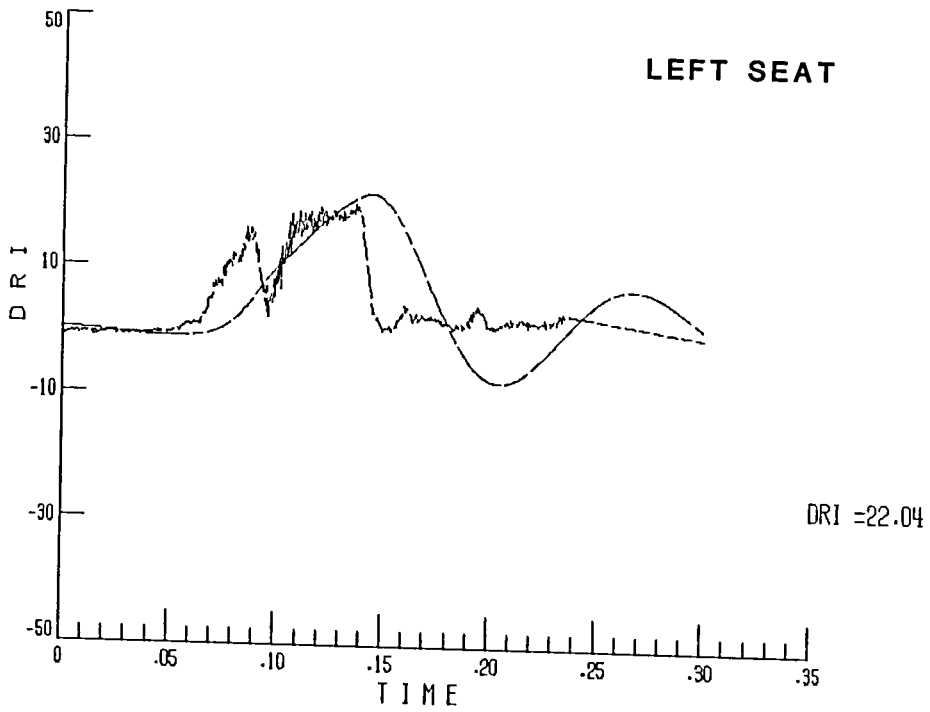
RIGHT DUMMY HEAD
NASA TEST NO. 2



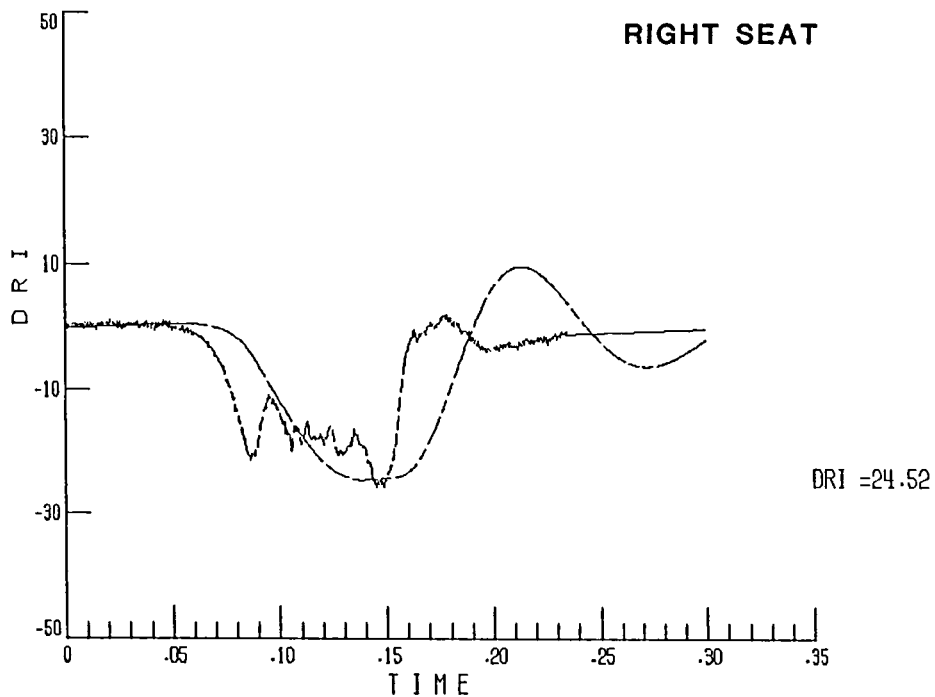
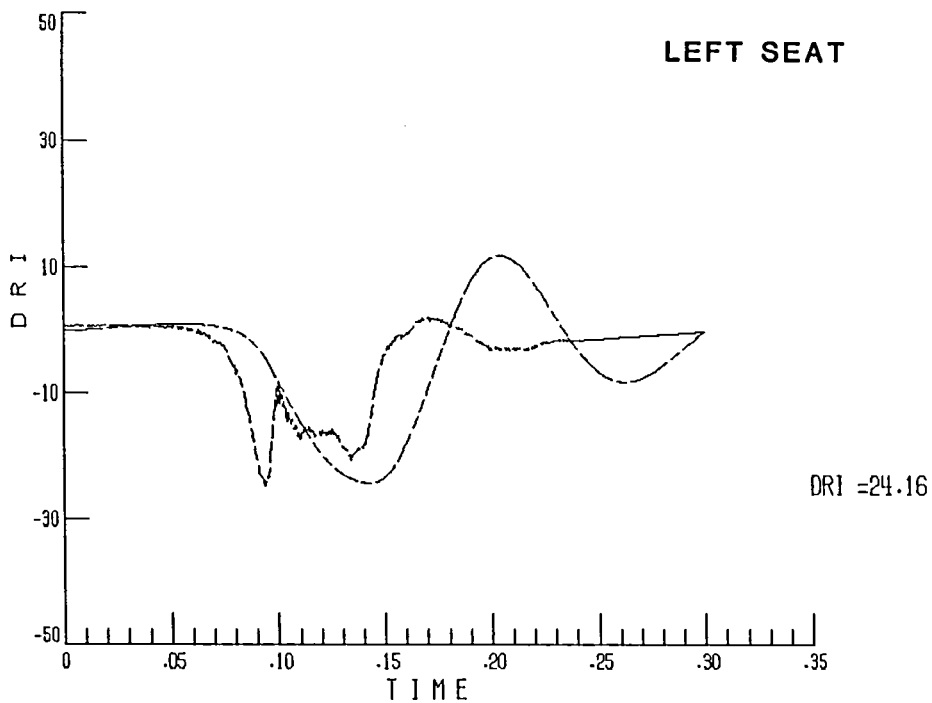
SEAT STROKE
NASA TEST NO. 2
34



**DYNAMIC RESPONSE INDEX
SEAT PAN Z-AXIS
NASA TEST NO. 2
35**



DYNAMIC RESPONSE INDEX
BACK TANGENT LINE
NASA TEST NO. 2



DYNAMIC RESPONSE INDEX
DUMMY PELVIS Z-AXIS
NASA TEST NO. 2

4.0 NASA TEST NO. 3

HORIZONTAL VELOCITY: 34 ft/sec

VERTICAL VELOCITY: 32 ft/sec

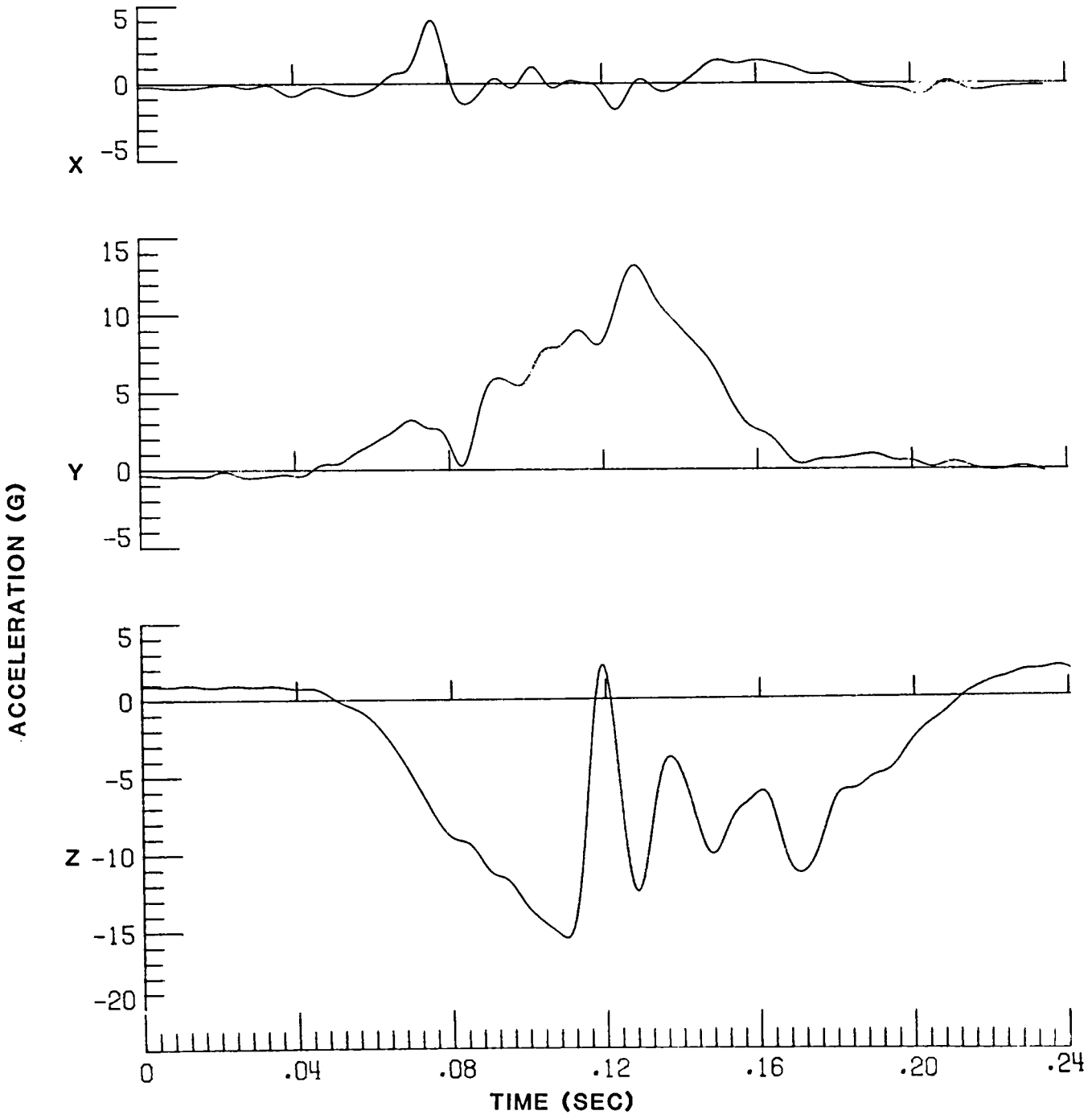
CREW MODULE PITCH: 17⁰

CREW MODULE ROLL: 0⁰

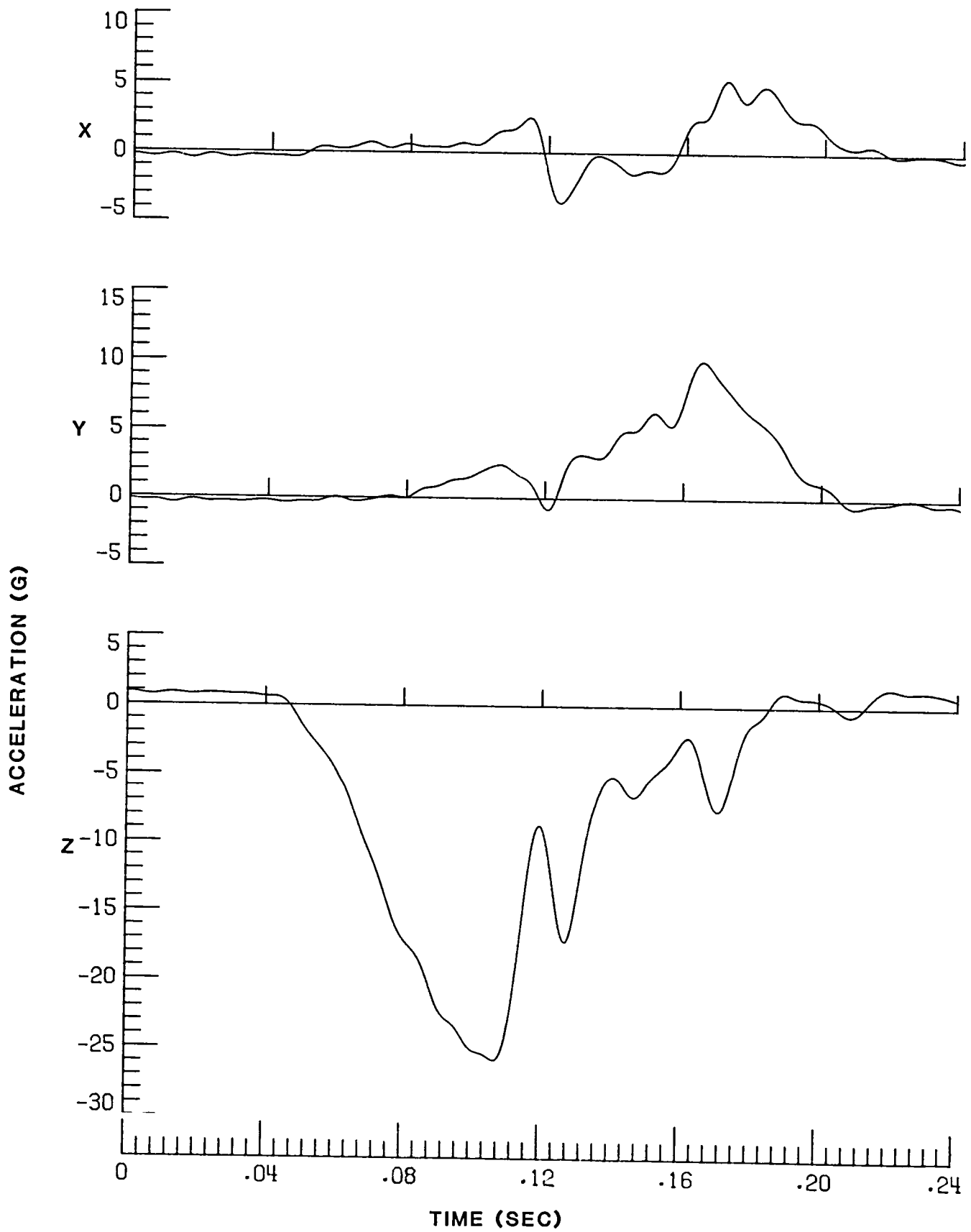
CREW MODULE YAW: 90⁰

LEFT SEAT: Energy Absorbing

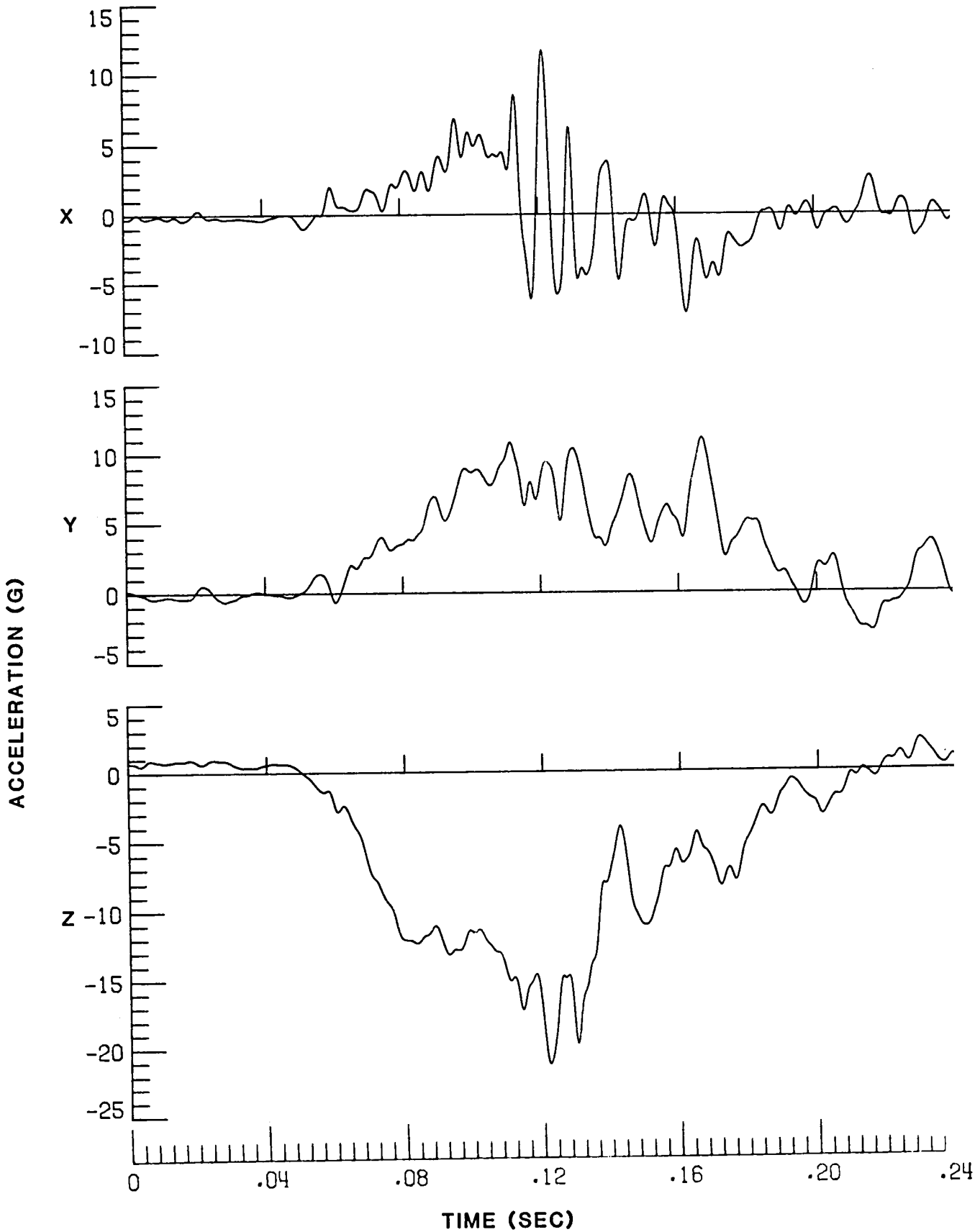
RIGHT SEAT: Energy Absorbing



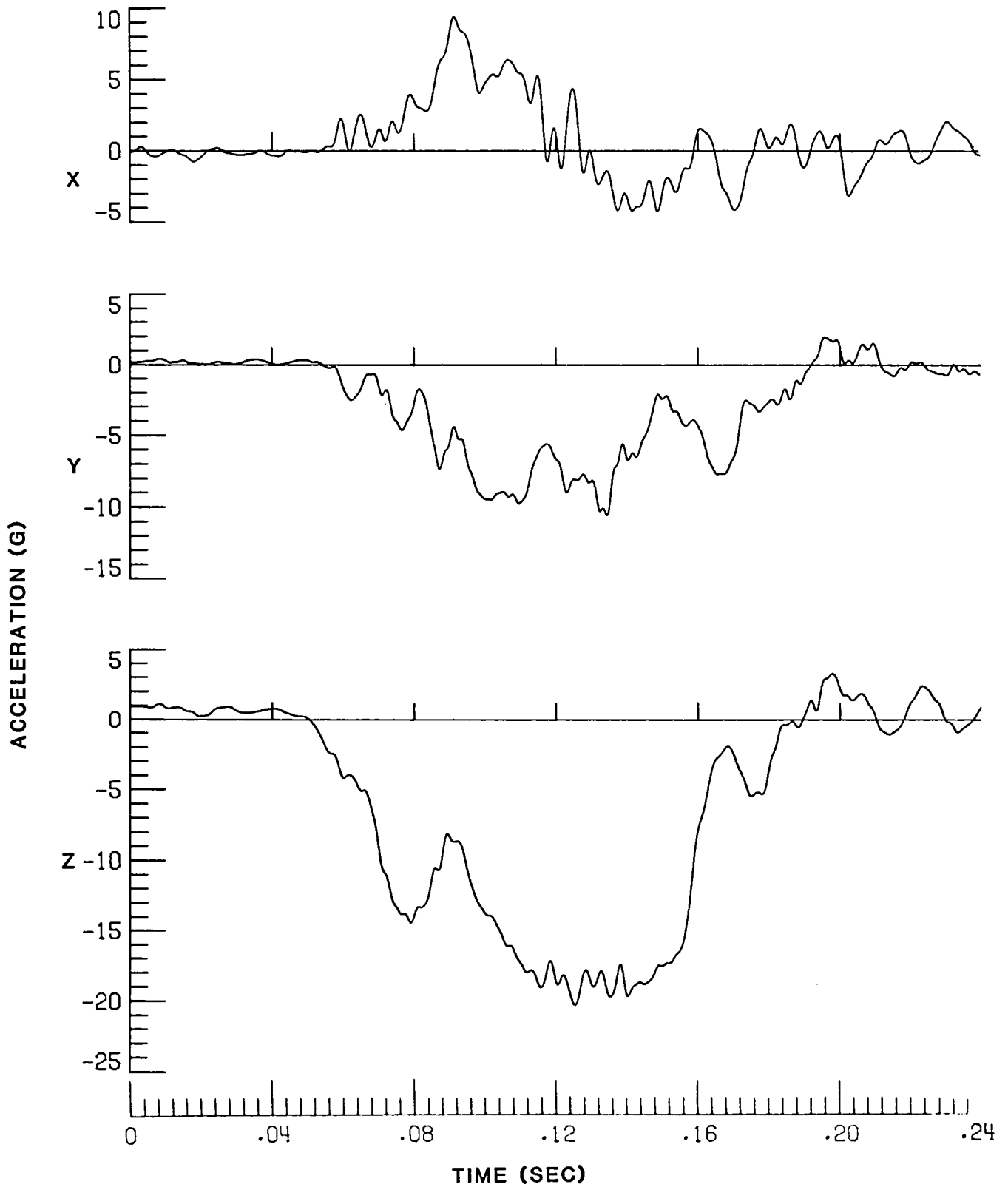
LEFT BULKHEAD
NASA TEST NO. 3



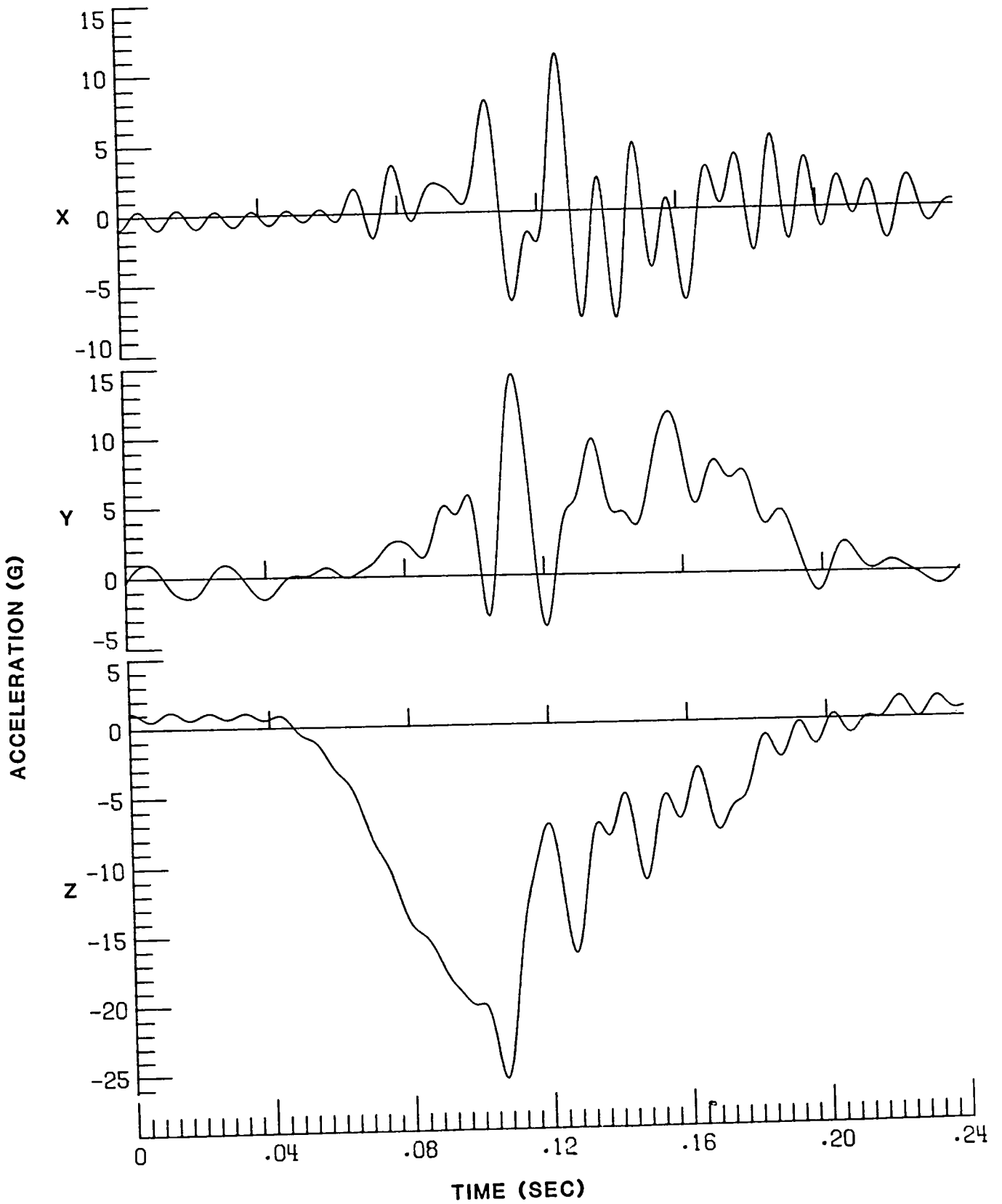
RIGHT BULKHEAD
 NASA TEST NO. 3



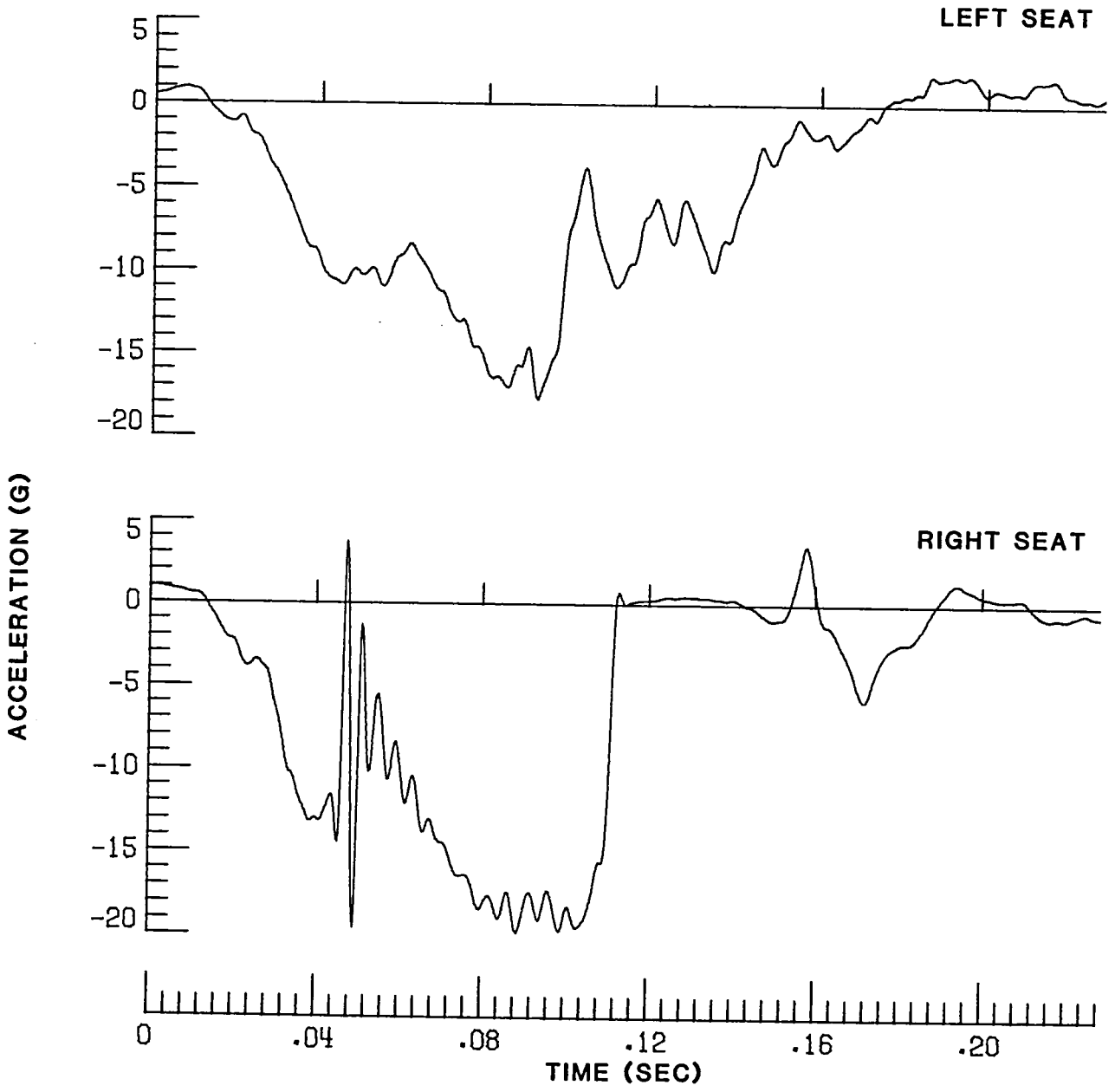
LEFT SEAT PAN
NASA TEST NO. 3



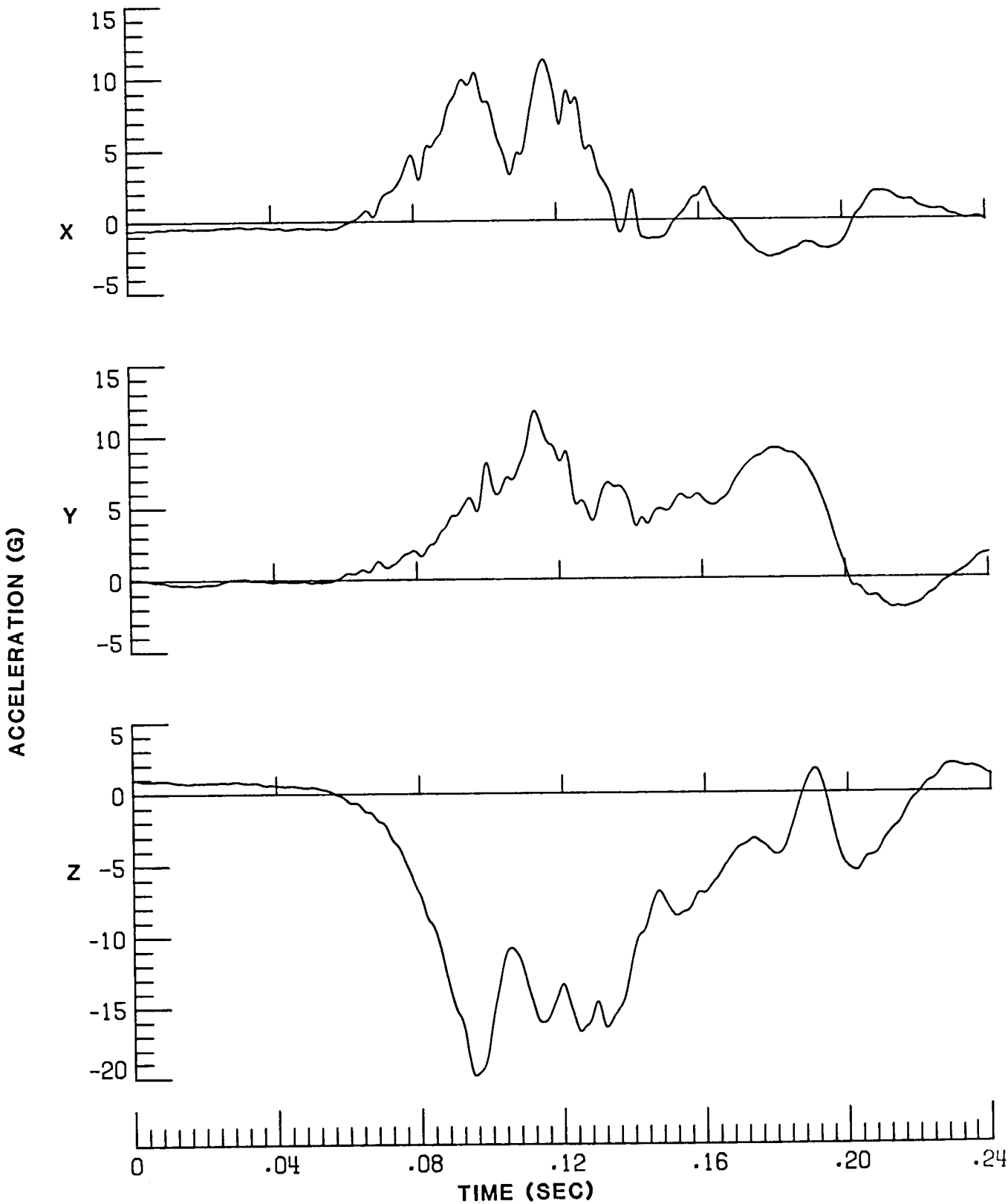
RIGHT SEAT PAN
NASA TEST NO. 3



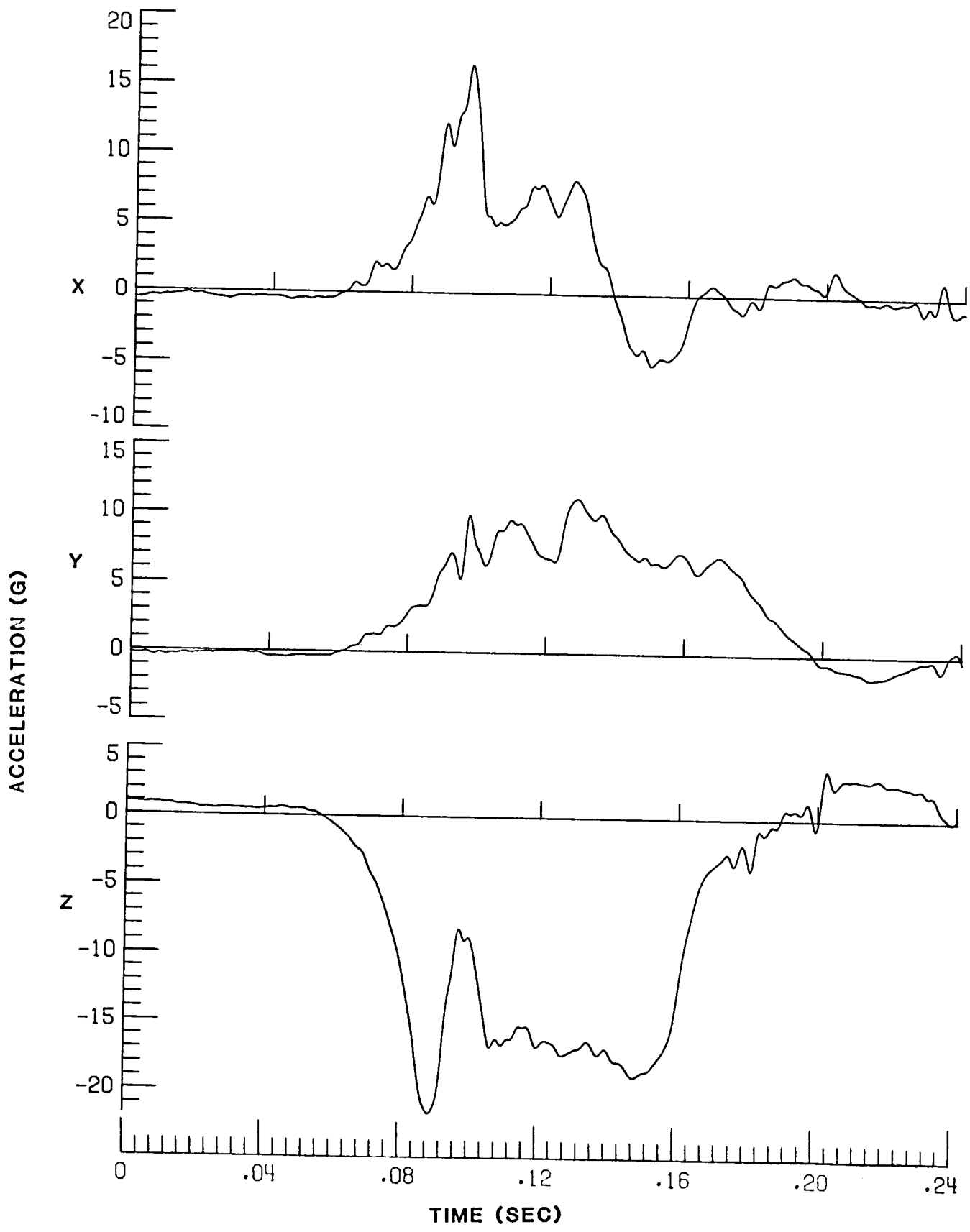
CAPSULE C.G.
NASA TEST NO. 3



SEAT PAN ALONG BACK TANGENT LINE
 NASA TEST NO. 3

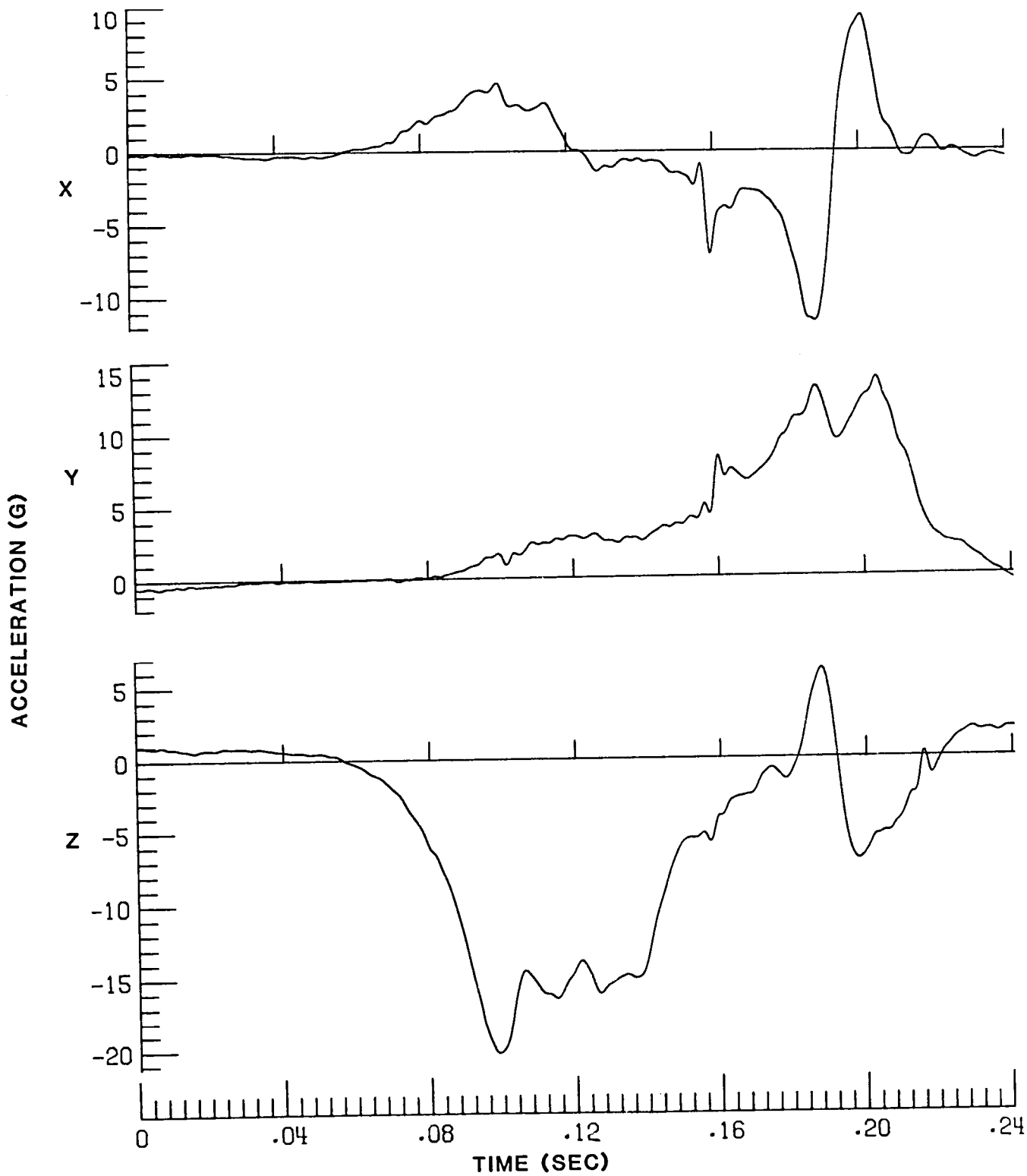


LEFT DUMMY PELVIS
NASA TEST NO. 3

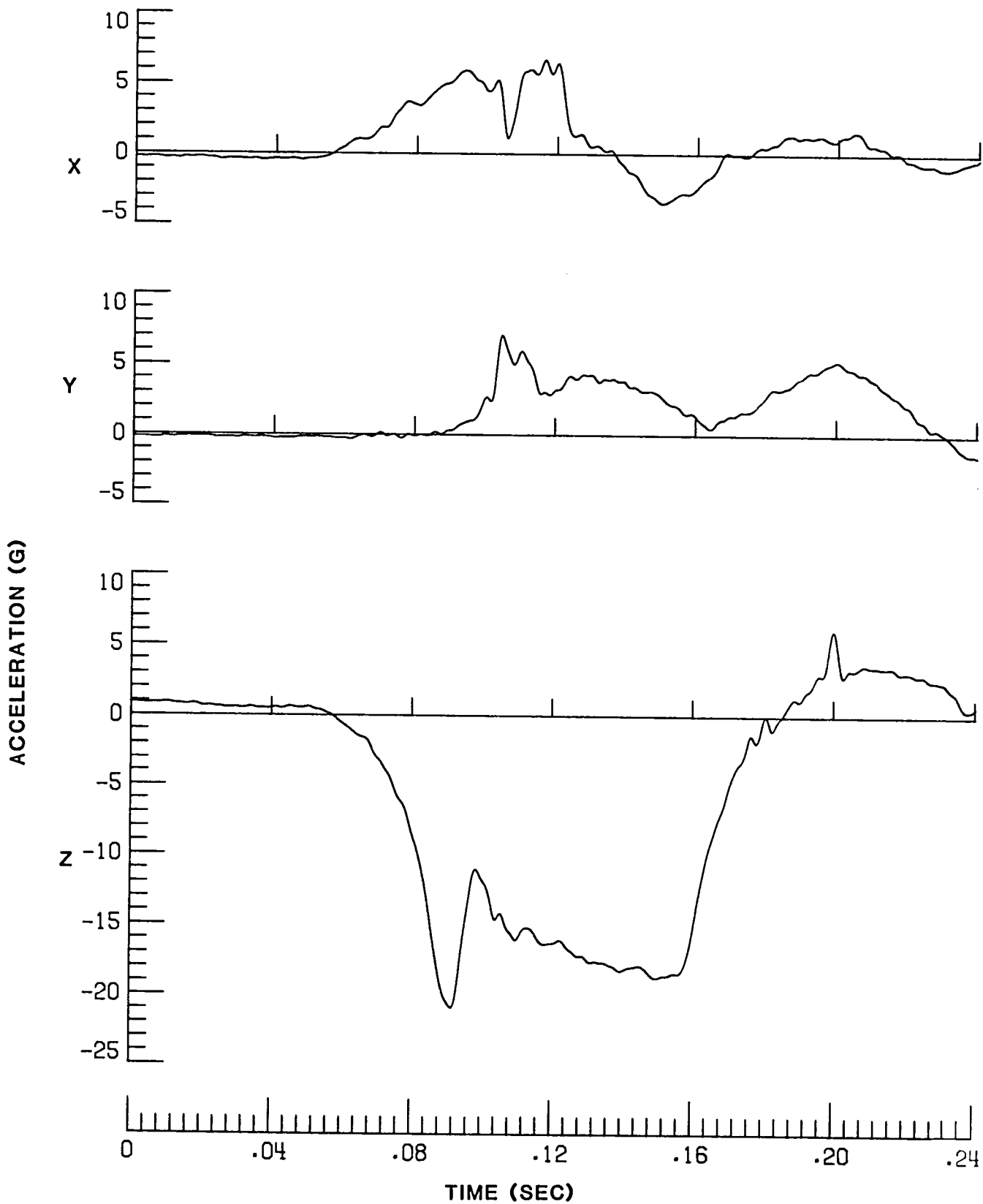


RIGHT DUMMY PELVIS

NASA TEST NO. 3

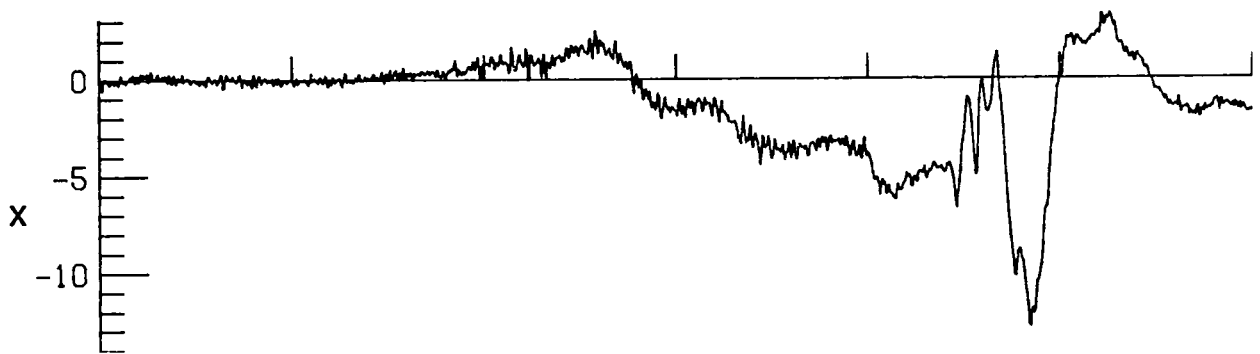


LEFT DUMMY CHEST
 NASA TEST NO. 3

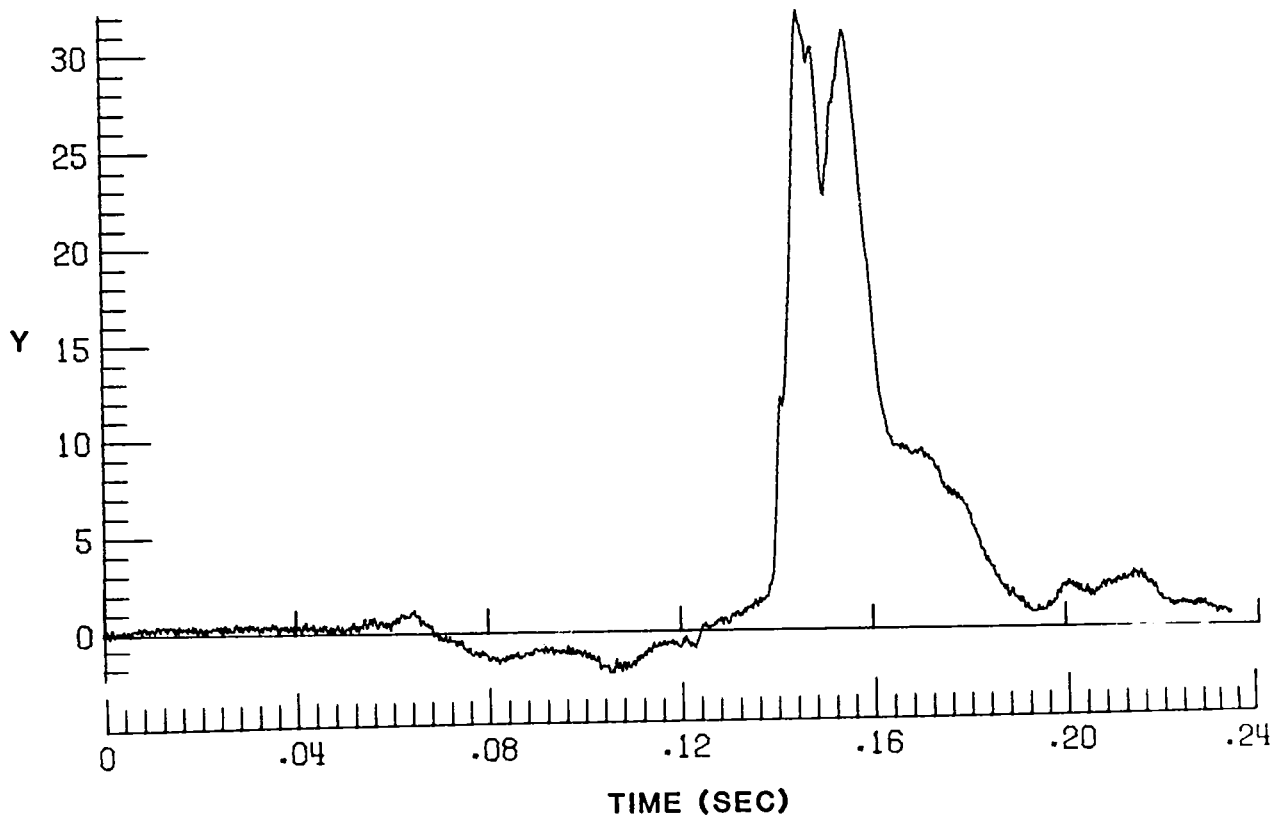


RIGHT DUMMY CHEST

NASA TEST NO. 3

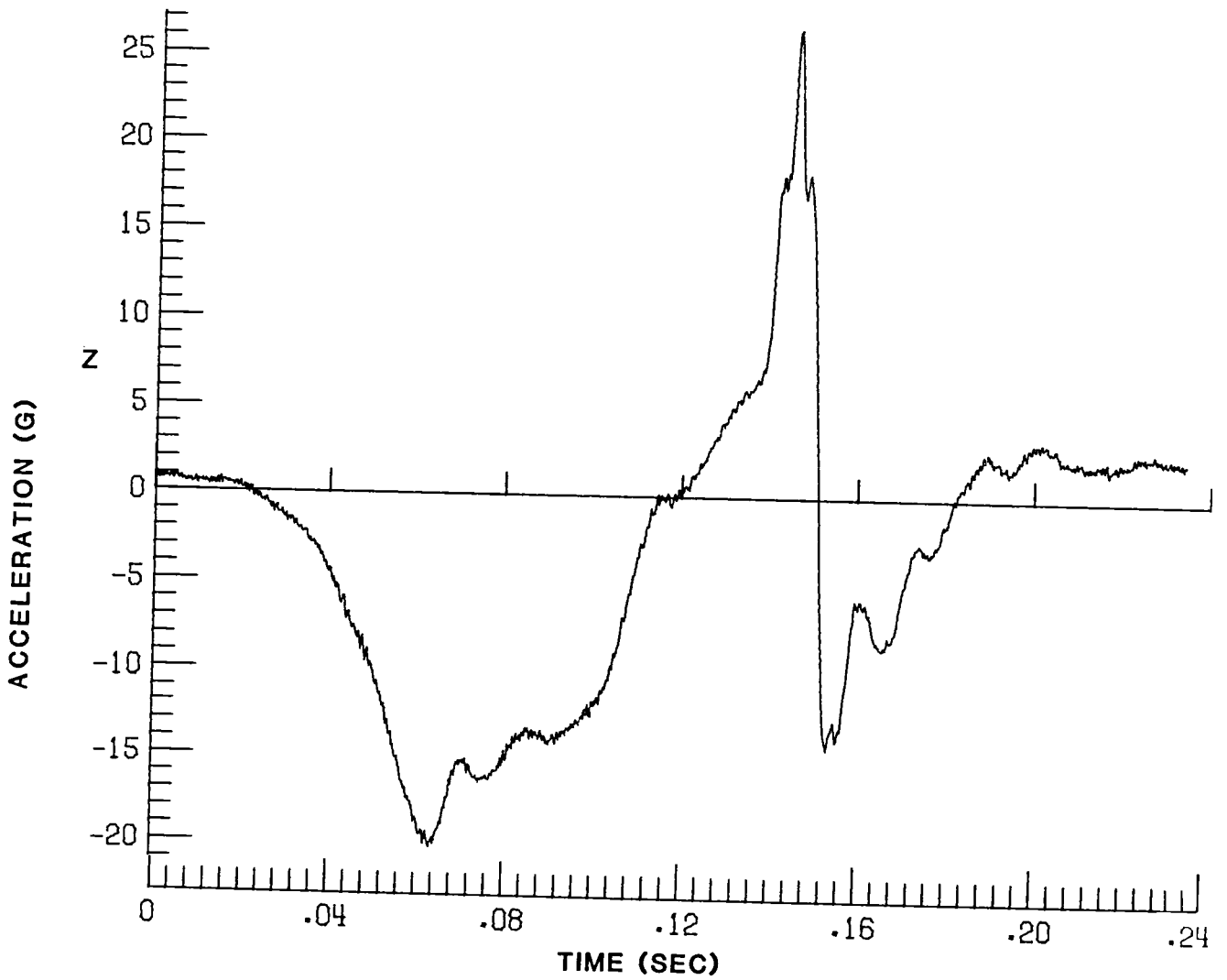


ACCELERATION (G)

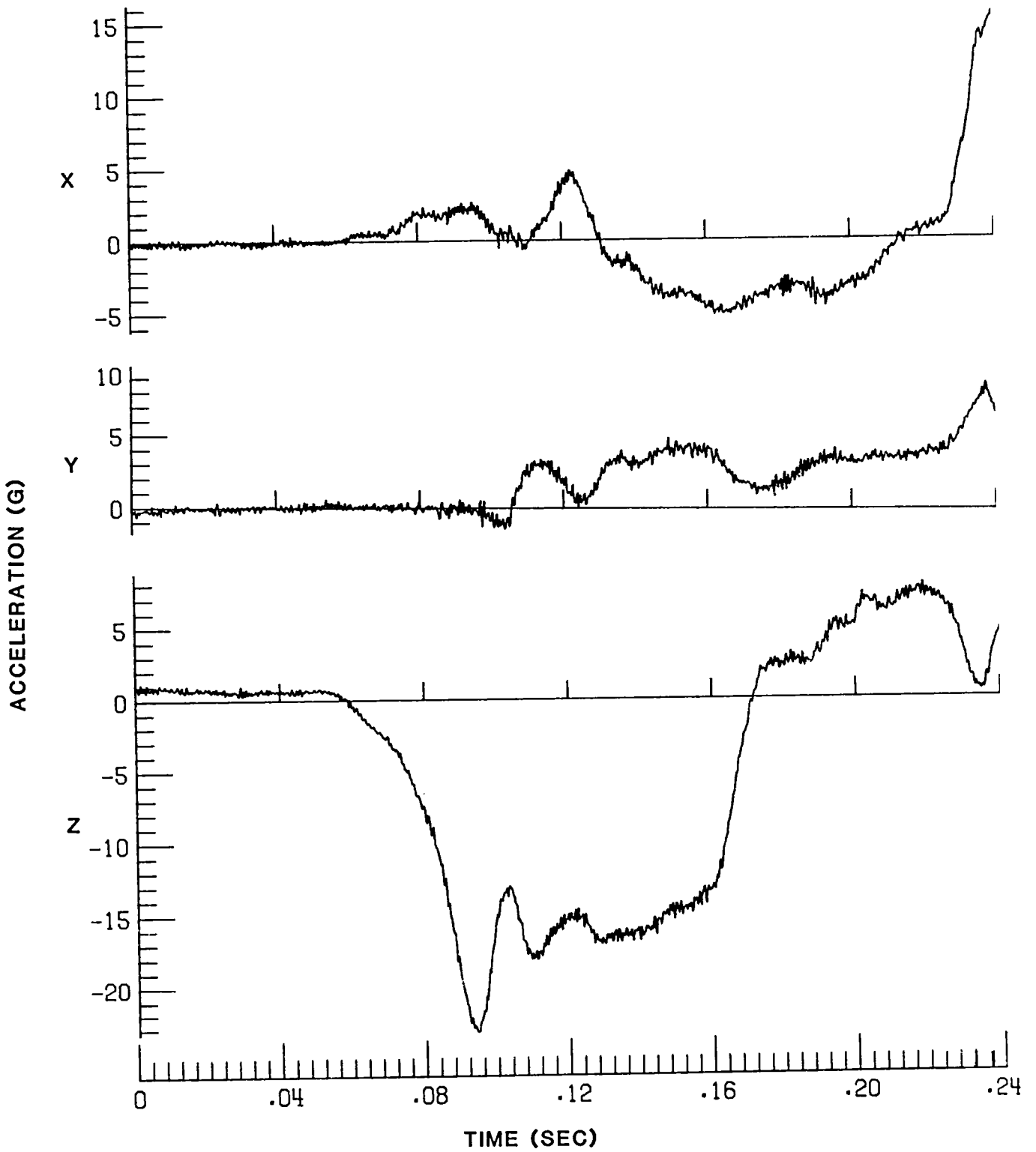


LEFT DUMMY HEAD

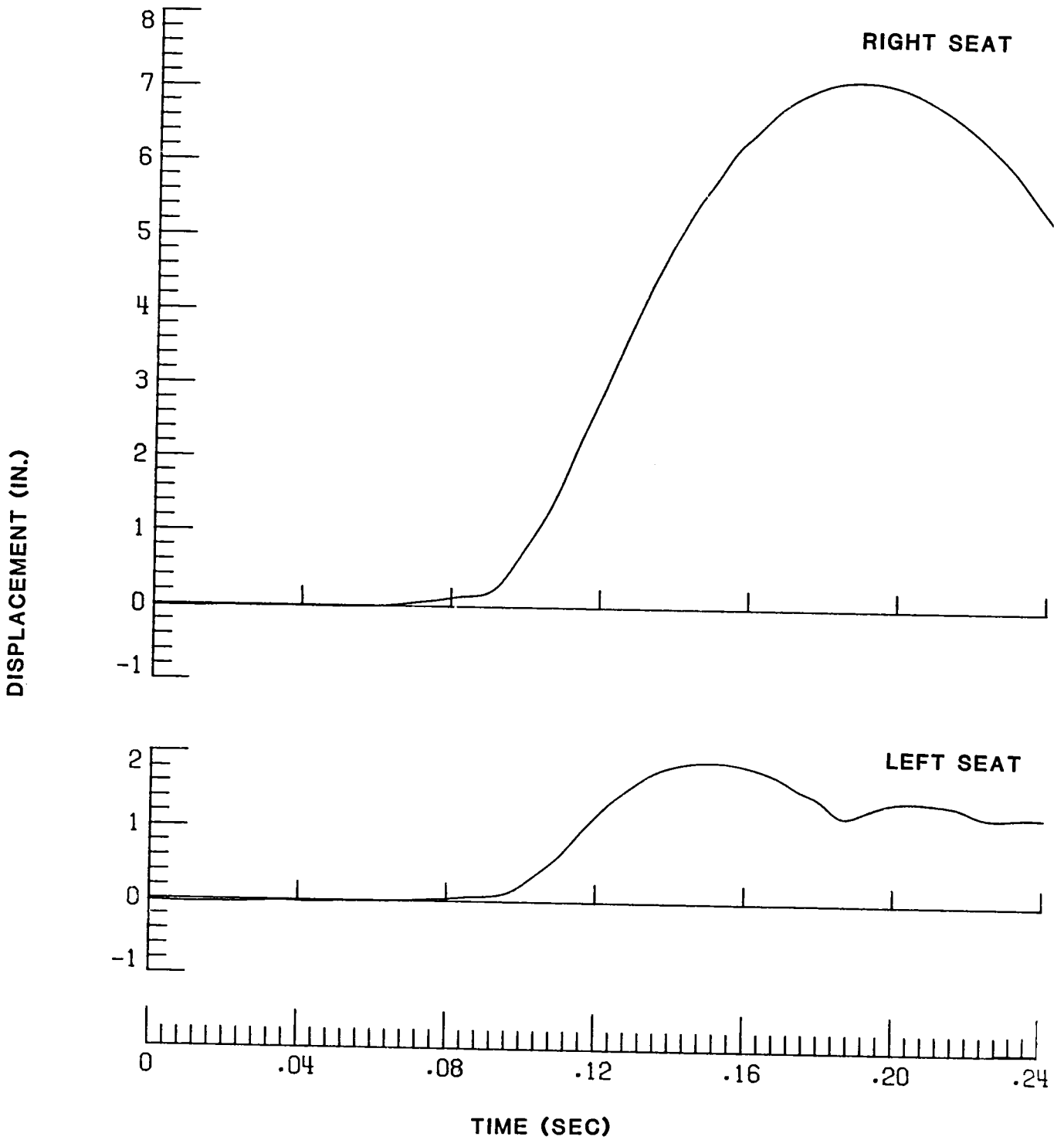
NASA TEST NO. 3



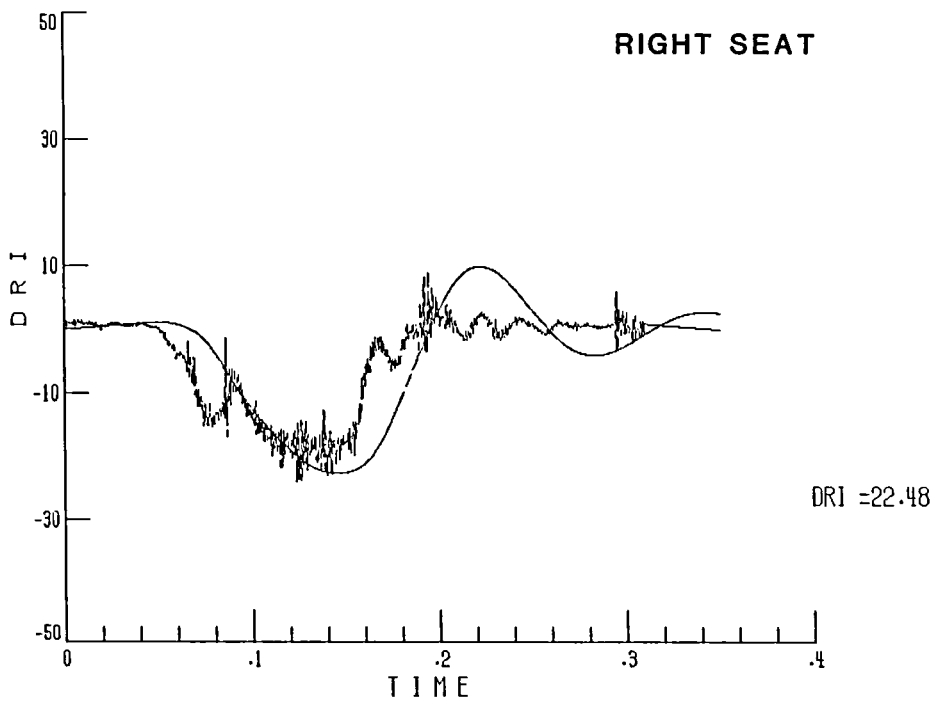
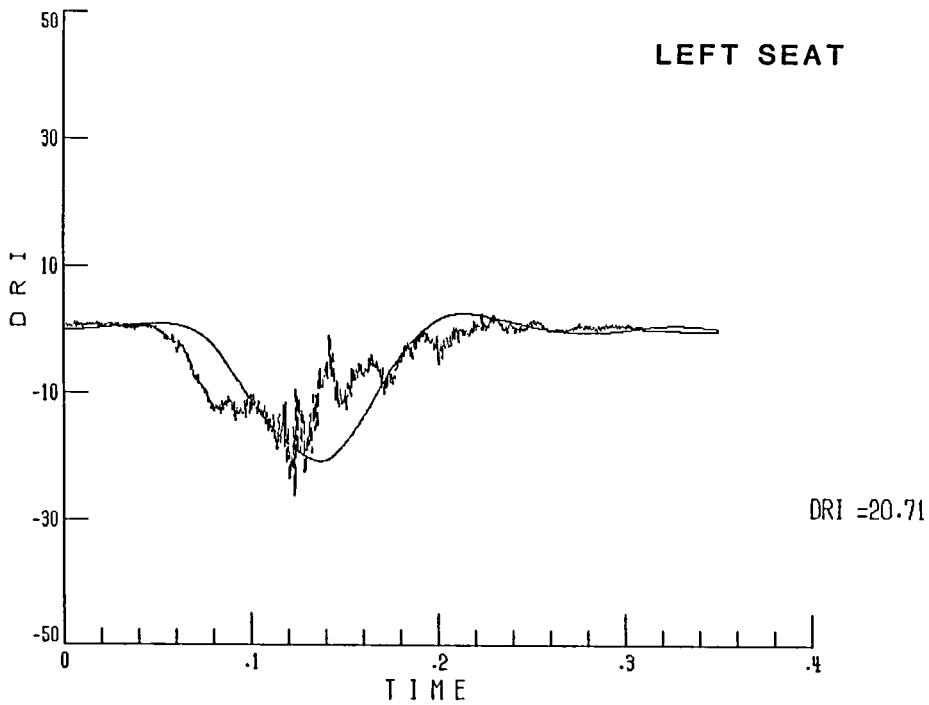
LEFT DUMMY HEAD
NASA TEST NO. 3



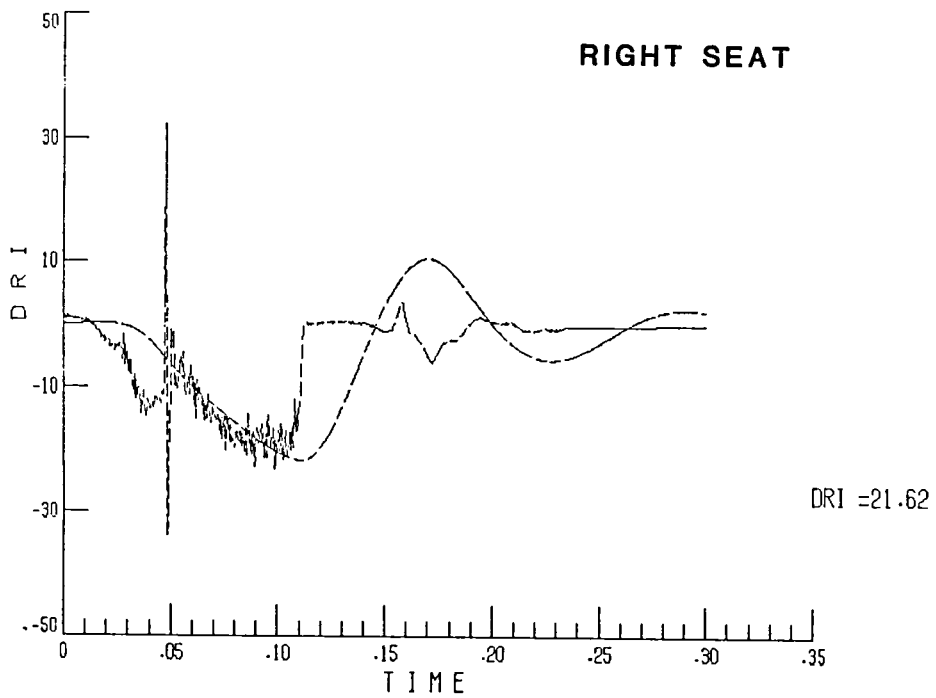
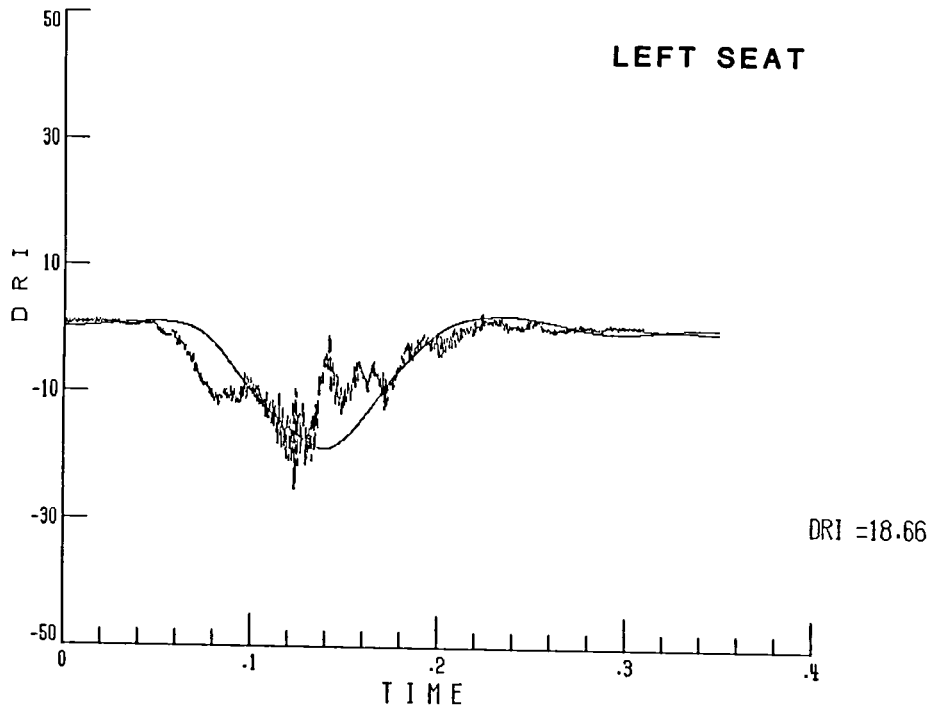
RIGHT DUMMY HEAD
NASA TEST NO. 3



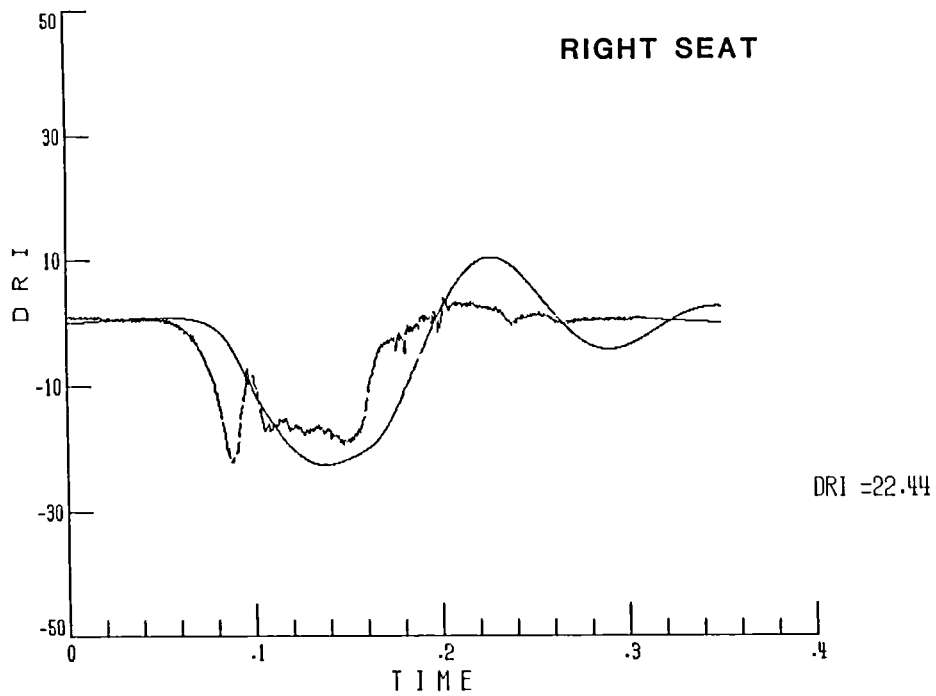
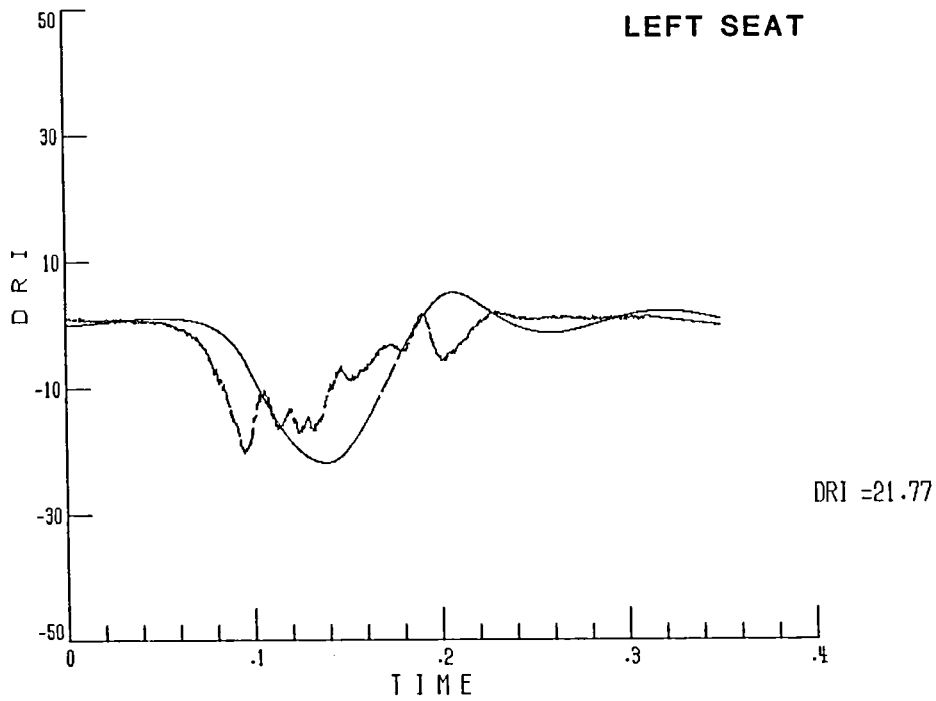
SEAT STROKE
NASA TEST NO. 3



**DYNAMIC RESPONSE INDEX
SEAT PAN Z-AXIS
NASA TEST NO. 3**



**DYNAMIC RESPONSE INDEX
BACK TANGENT LINE
NASA TEST NO. 3**



**DYNAMIC RESPONSE INDEX
DUMMY PELVIS Z-AXIS
NASA TEST NO. 3**

5.0 NASA TEST NO. 4

HORIZONTAL VELOCITY: 34 ft/sec

VERTICAL VELOCITY: 32 ft/sec

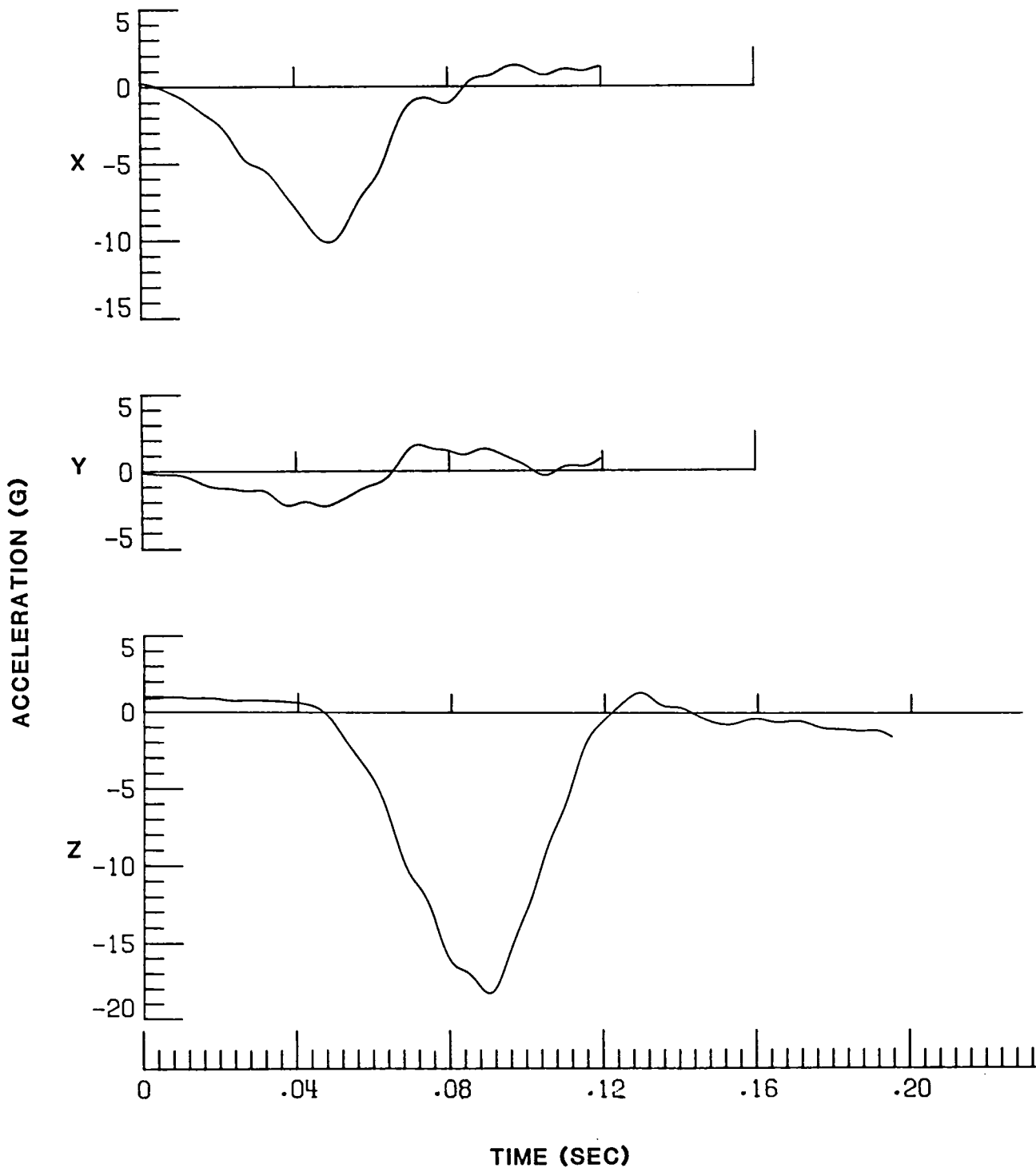
CREW MODULE PITCH: - 13⁰

CREW MODULE ROLL: 0⁰

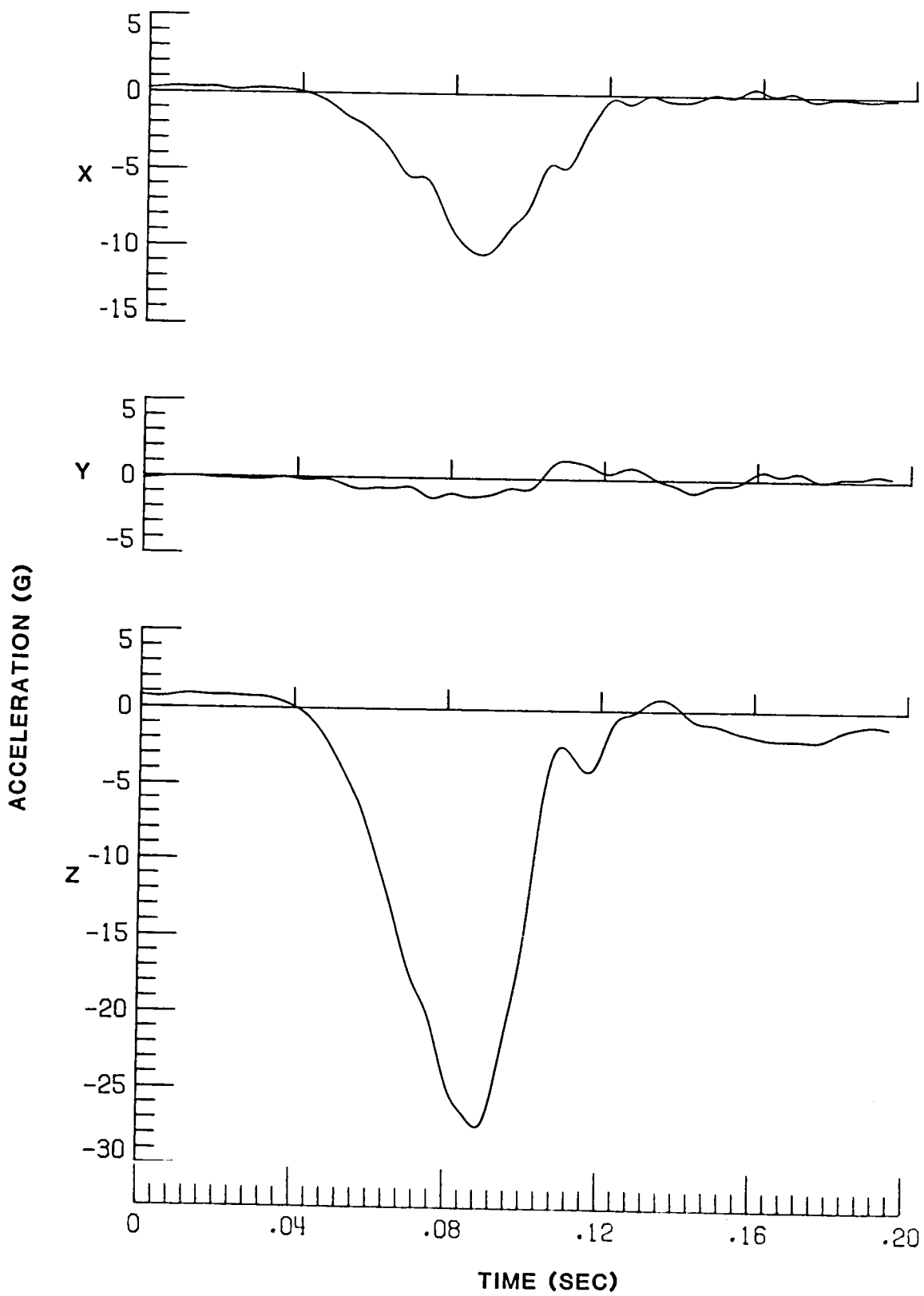
CREW MODULE YAW: 75⁰

LEFT SEAT: Energy Absorbing

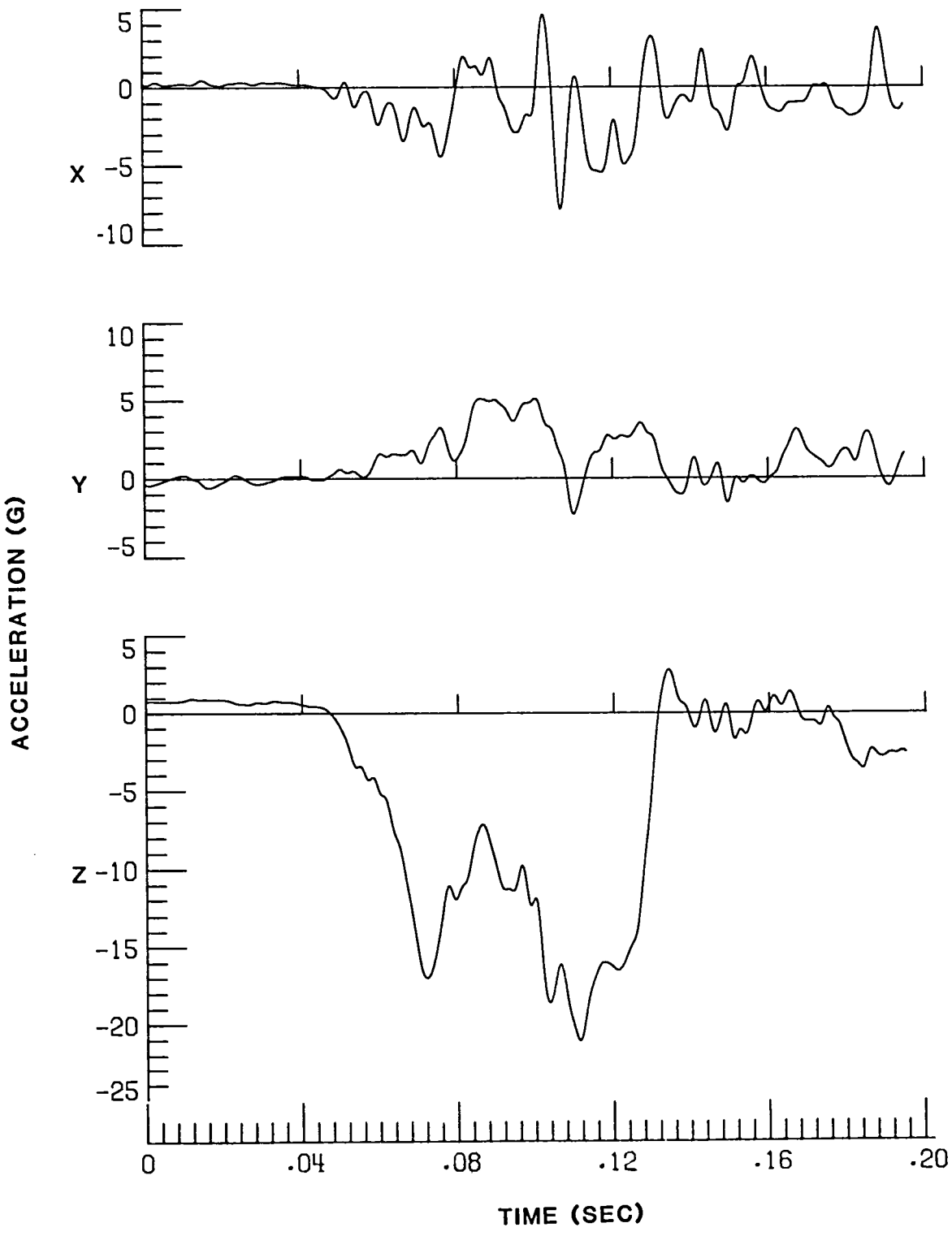
RIGHT SEAT: Energy Absorbing



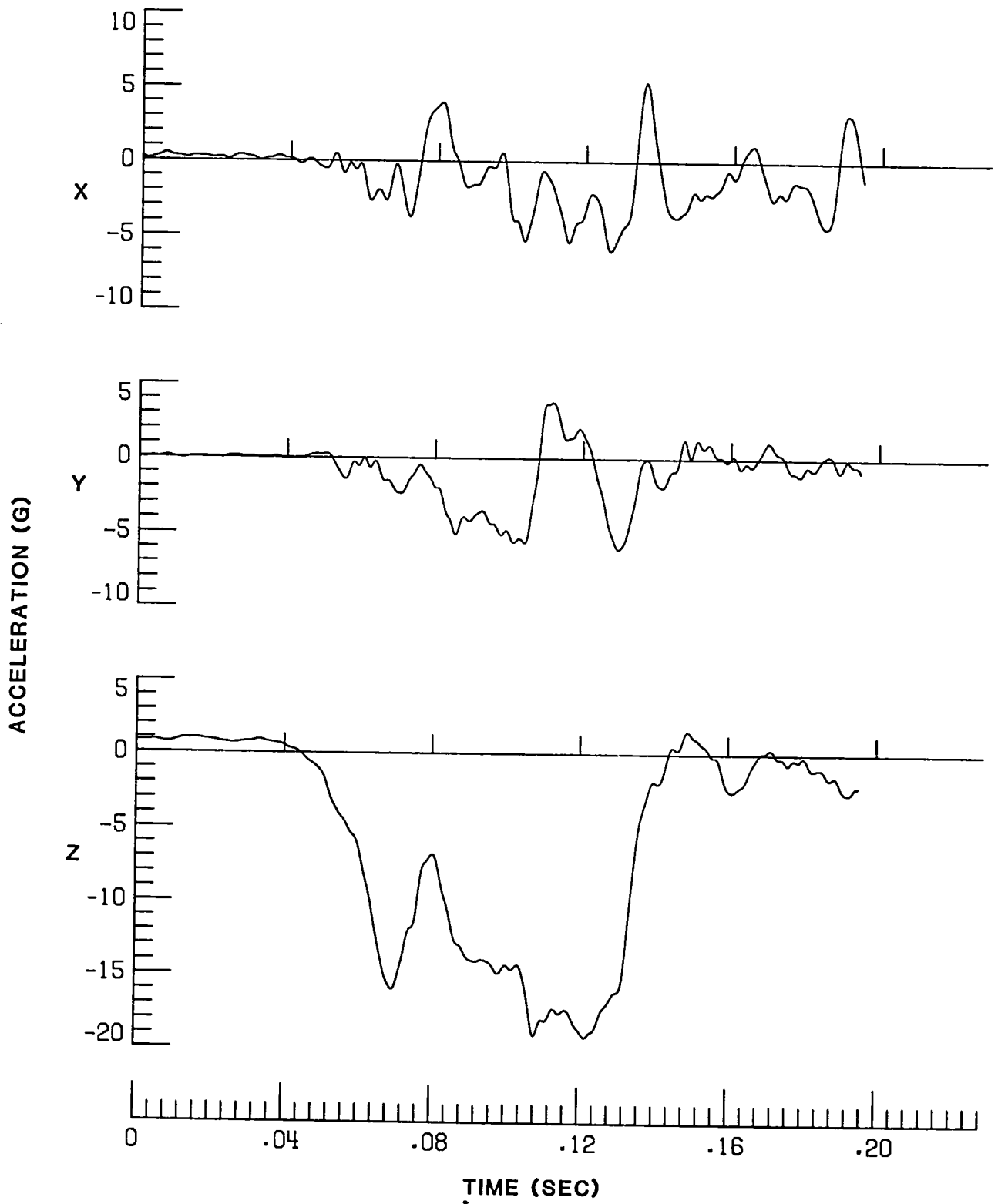
LEFT BULKHEAD
NASA TEST NO. 4



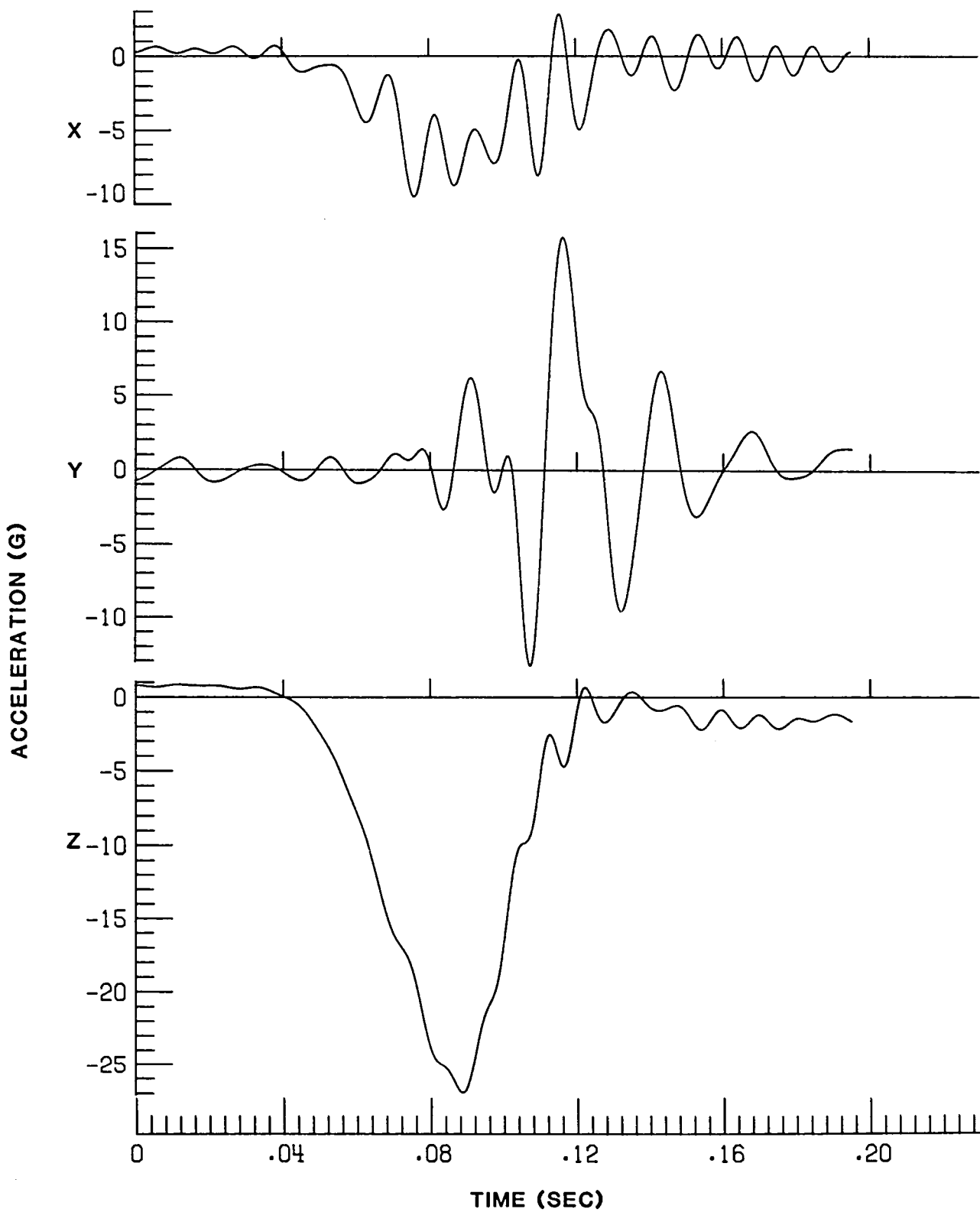
RIGHT BULKHEAD
NASA TEST NO. 4



LEFT SEAT PAN
NASA TEST NO. 4

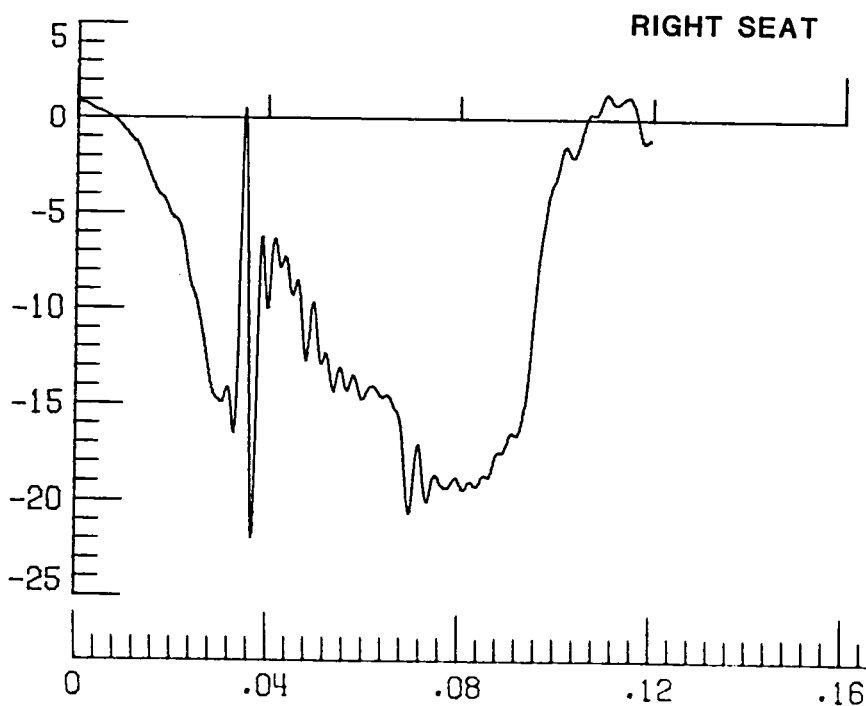
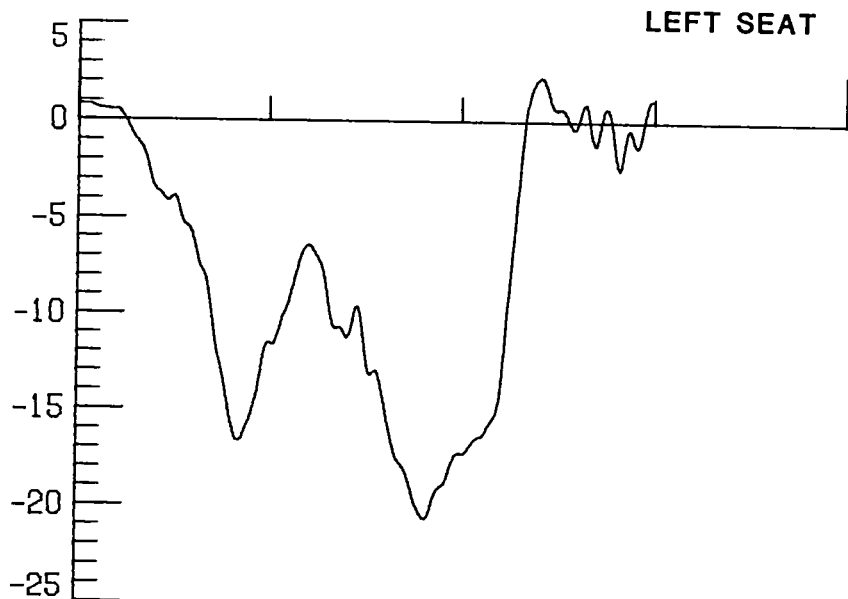


RIGHT SEAT PAN
NASA TEST NO. 4
60



CAPSULE C.G.
NASA TEST NO. 4

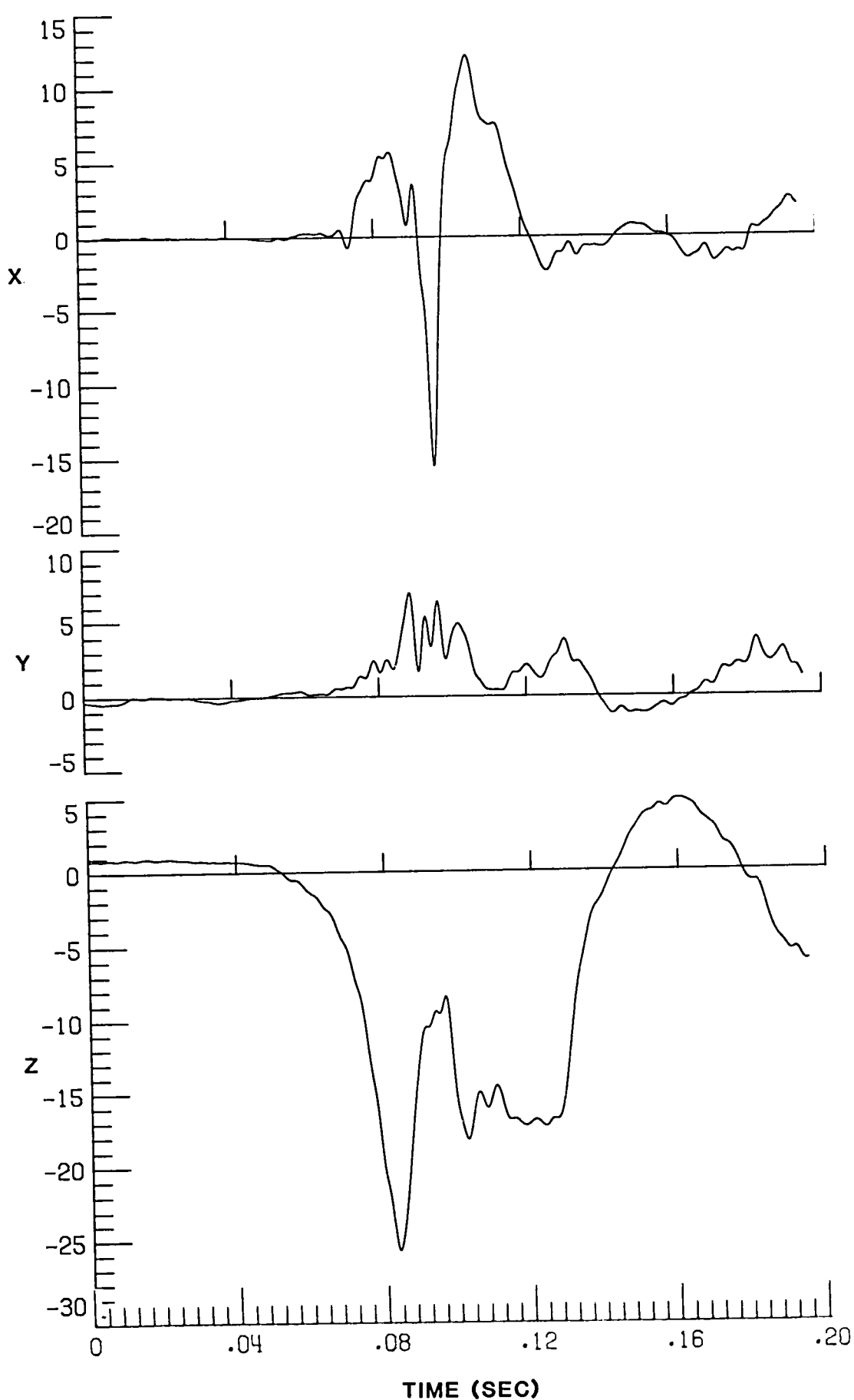
ACCELERATION (G)



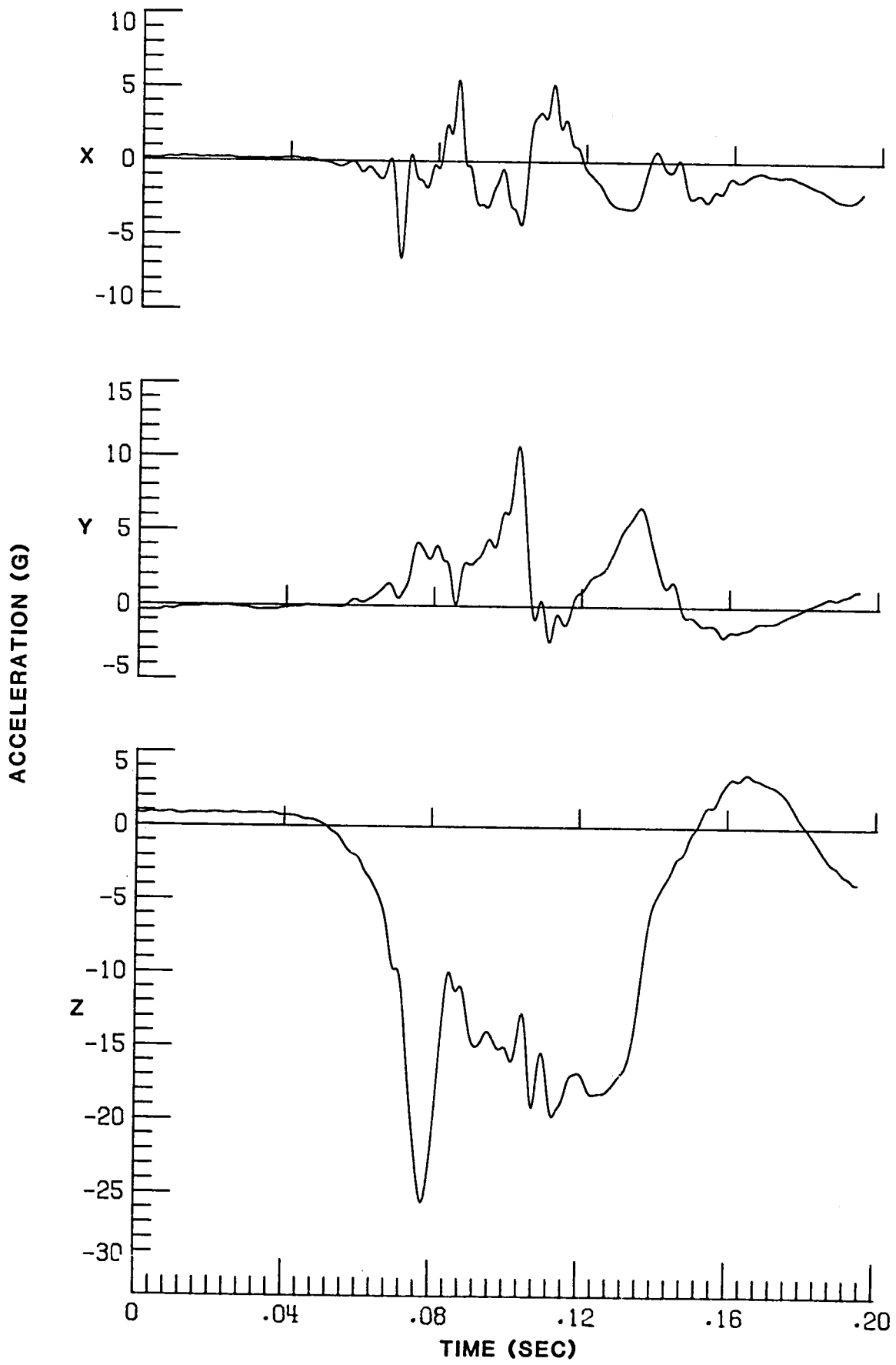
TIME (SEC)

SEAT PAN ALONG BACK TANGENT LINE
NASA TEST NO. 4

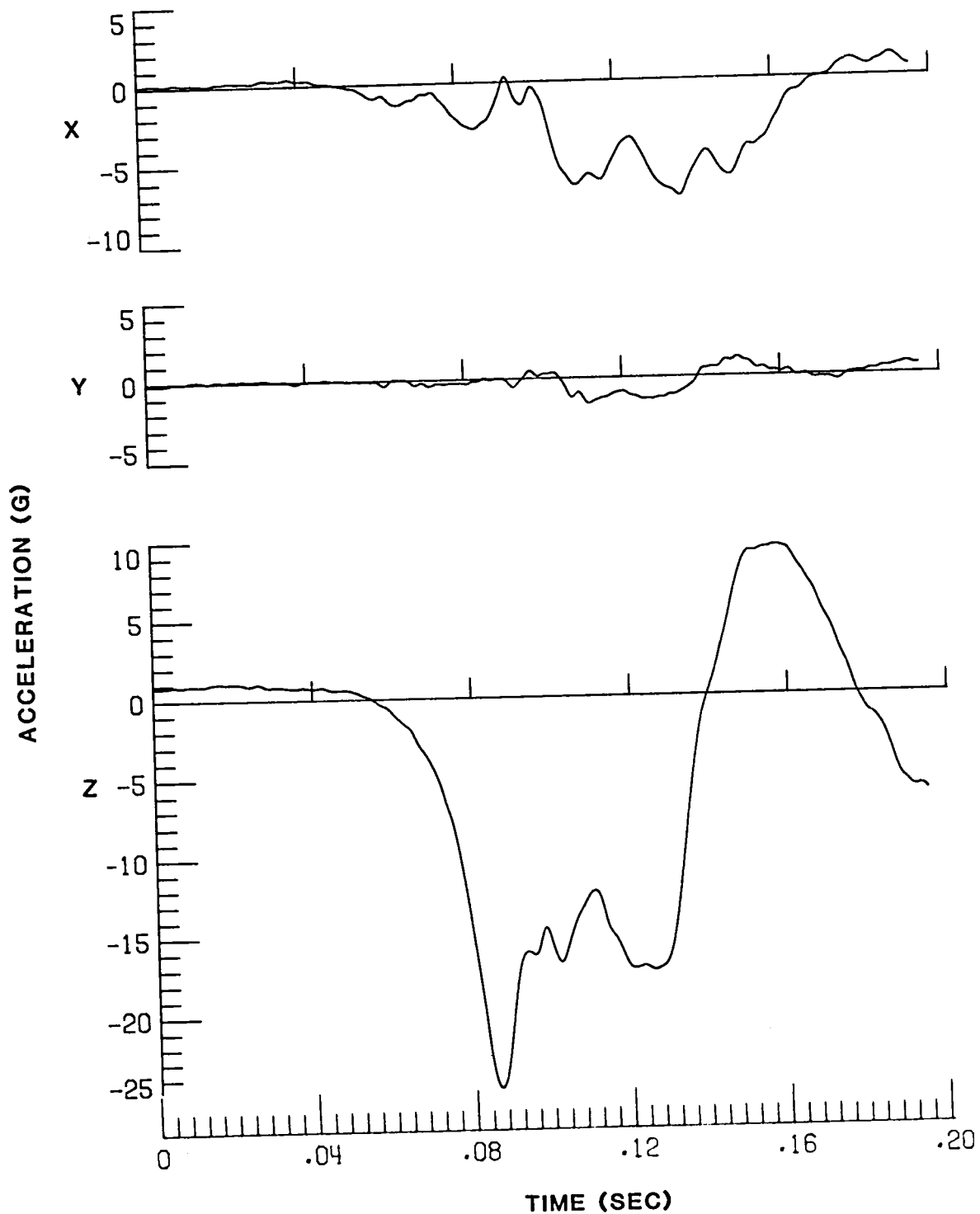
ACCELERATION (G)



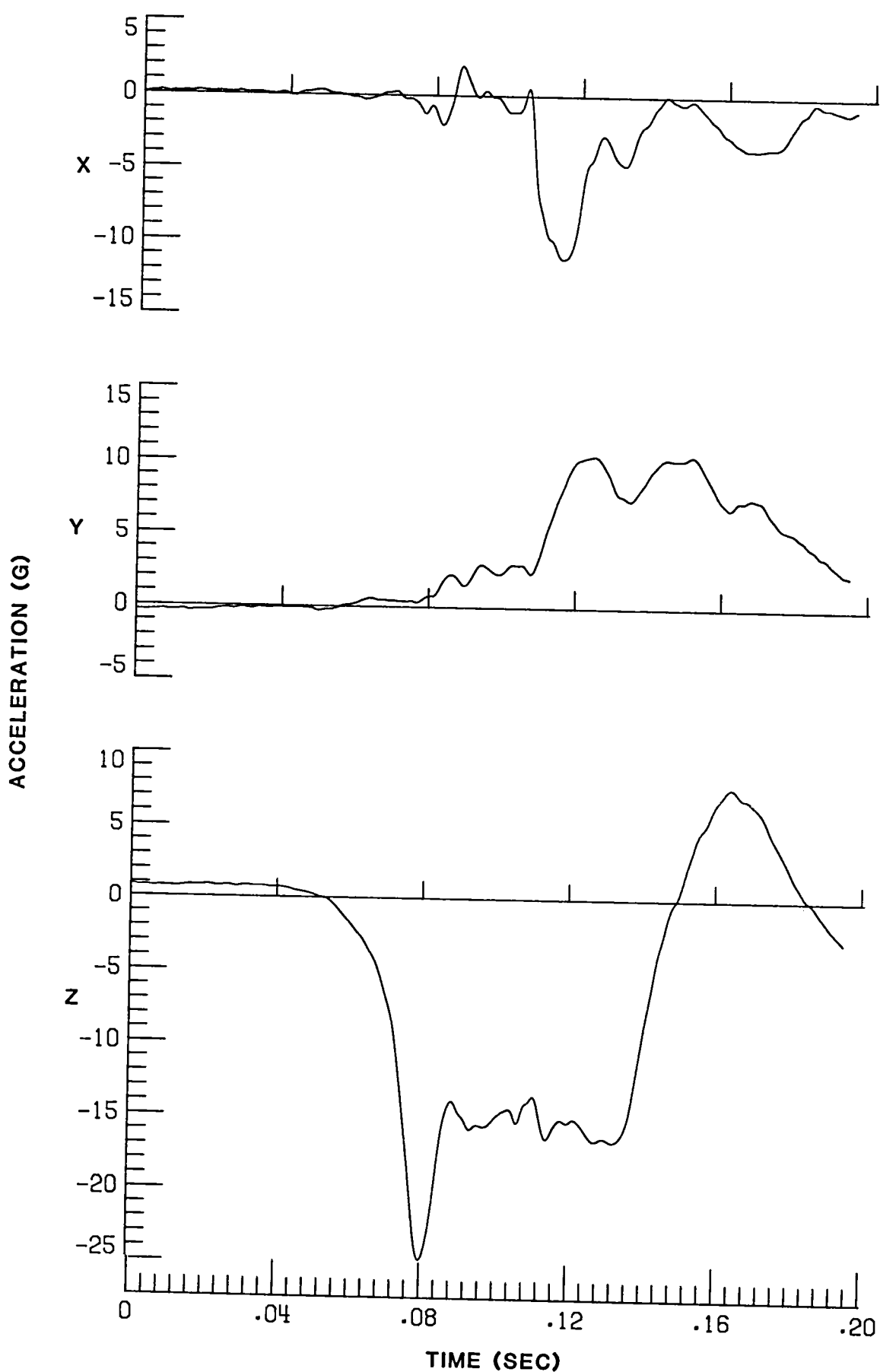
LEFT DUMMY PELVIS
NASA TEST NO. 4



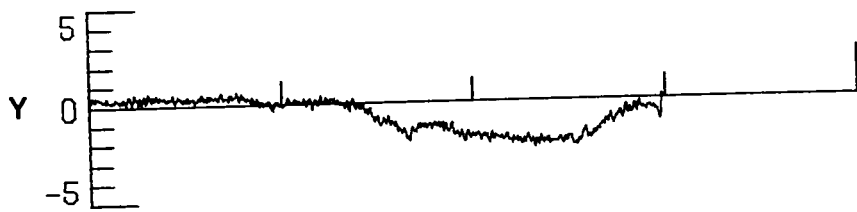
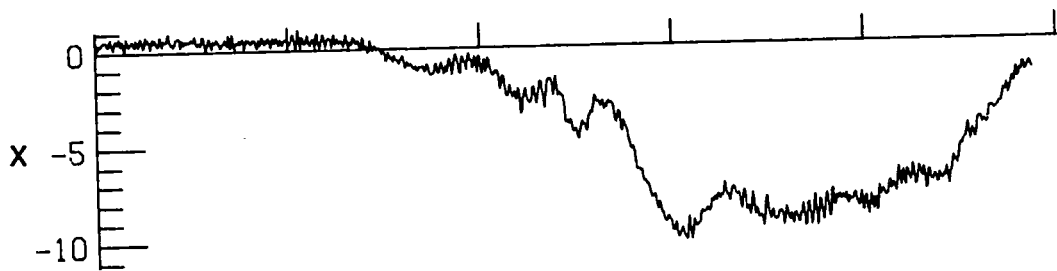
RIGHT DUMMY PELVIS
 NASA TEST NO. 4



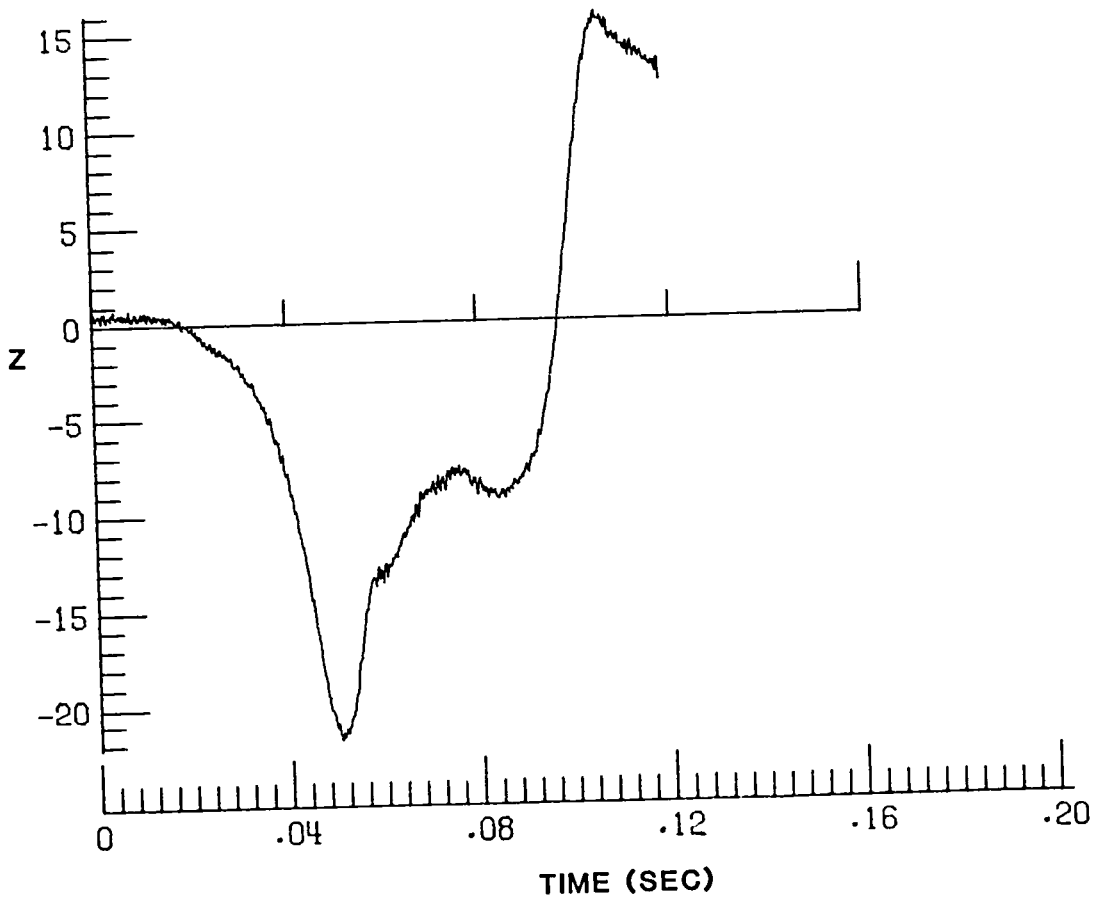
LEFT DUMMY CHEST
NASA TEST NO. 4



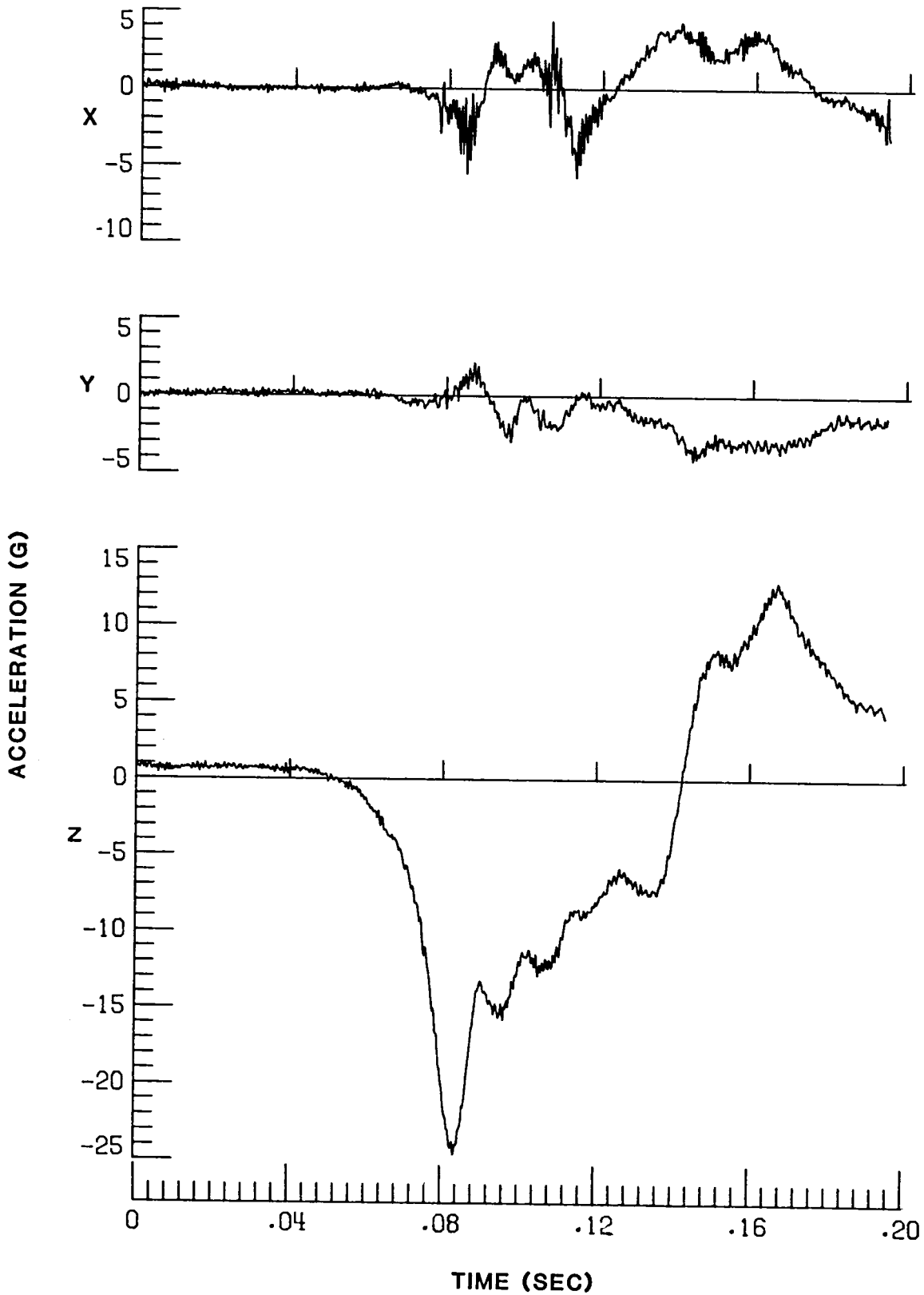
RIGHT DUMMY CHEST
NASA TEST NO. 4



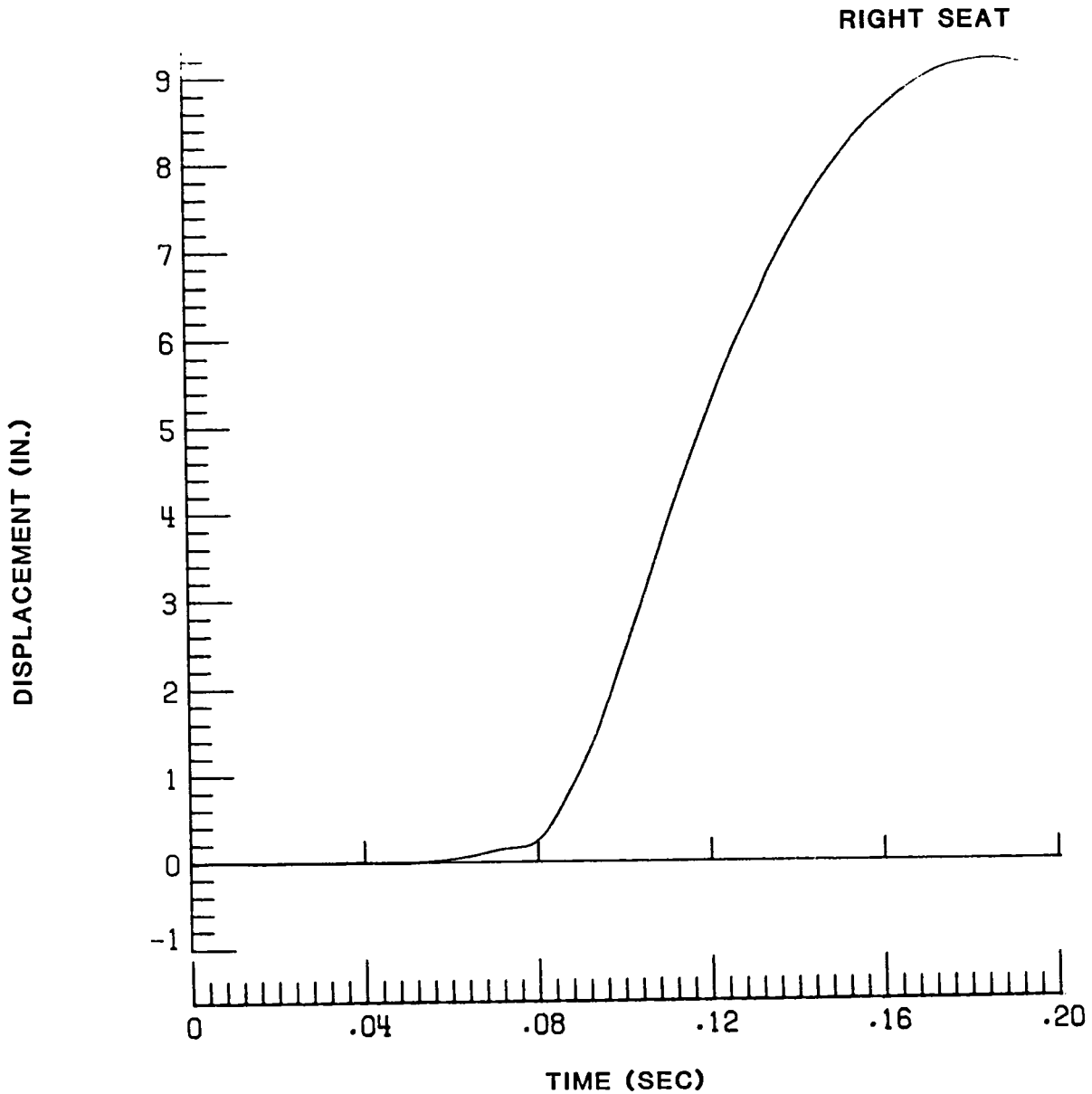
ACCELERATION (G)



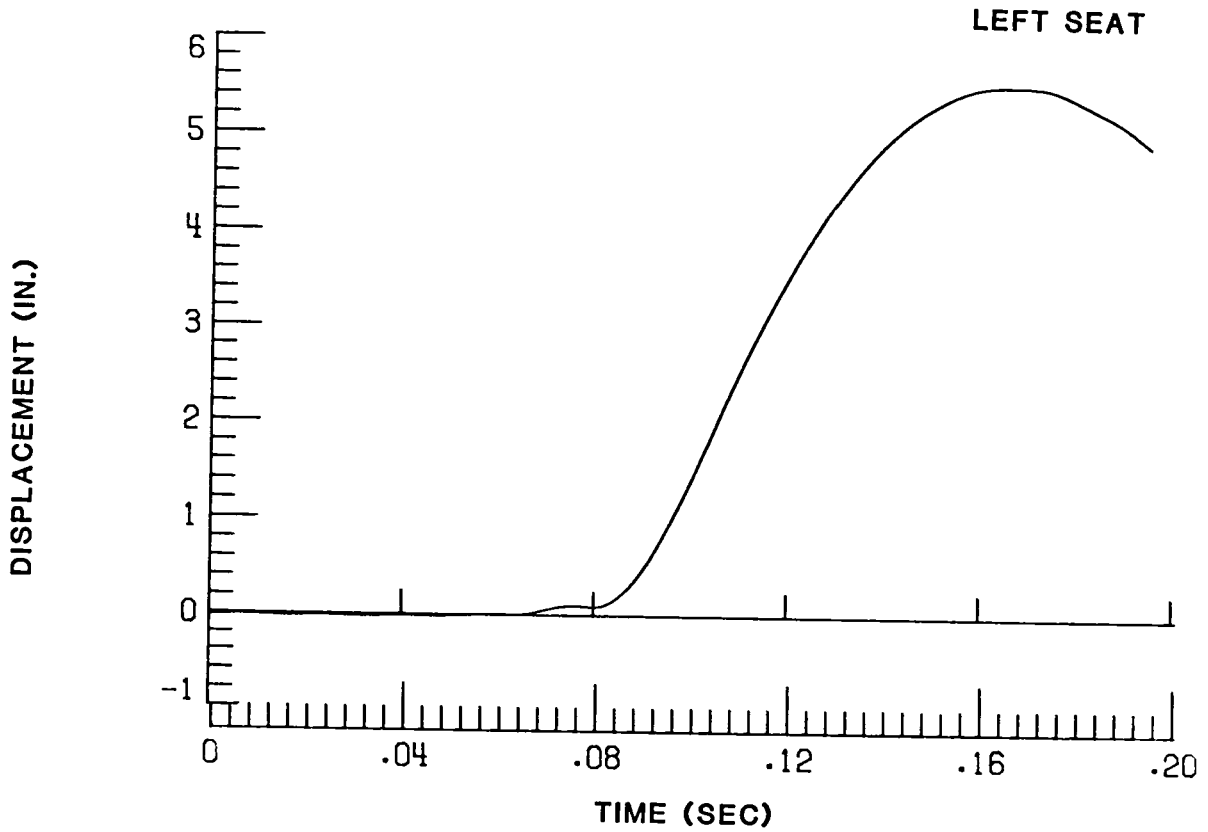
LEFT DUMMY HEAD
NASA TEST NO. 4



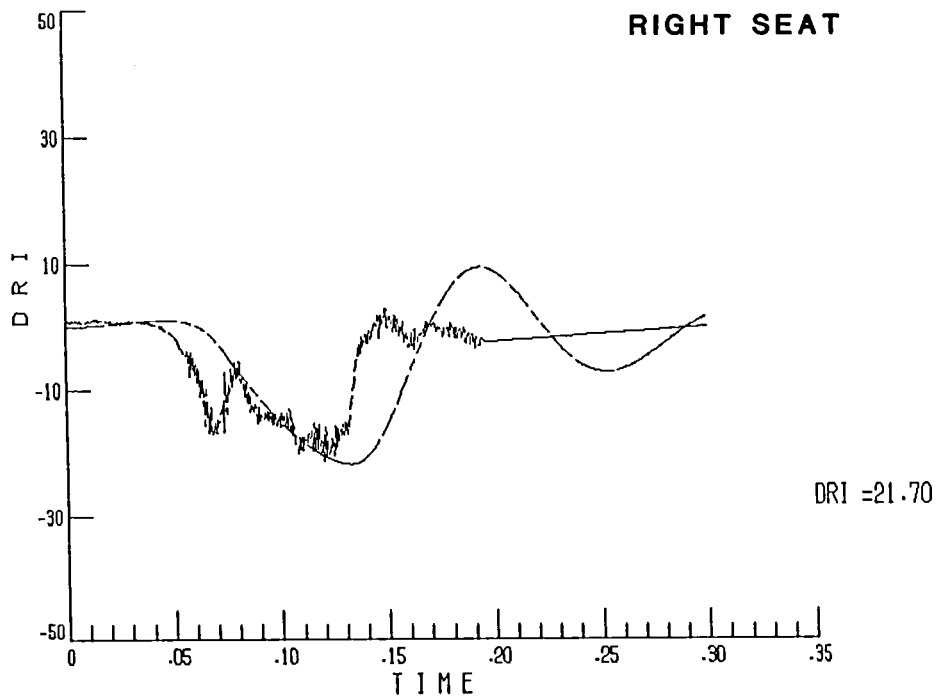
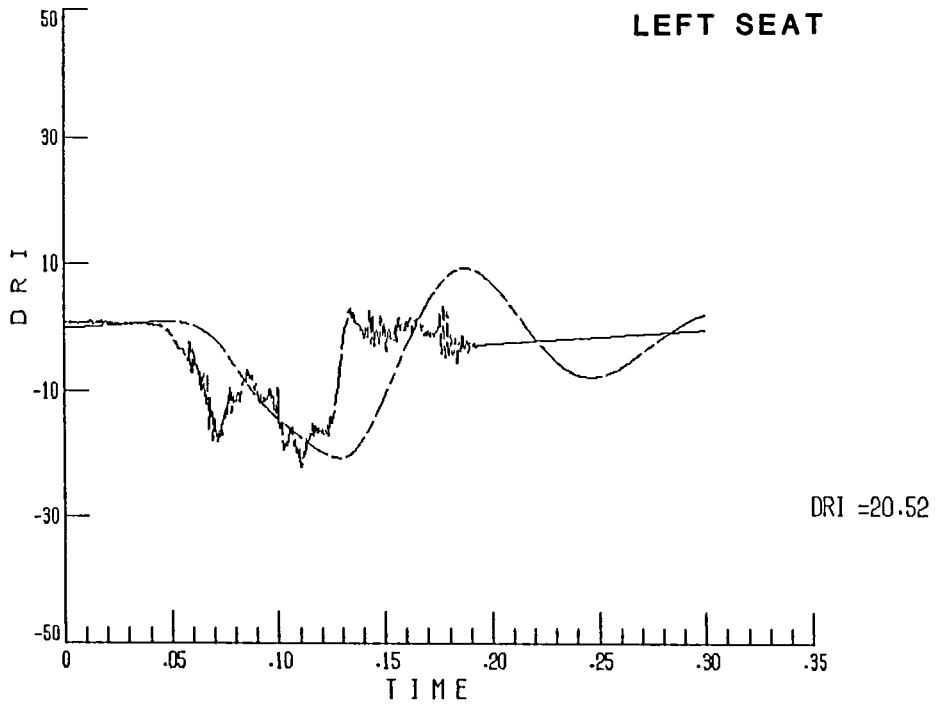
RIGHT DUMMY HEAD
NASA TEST NO. 4



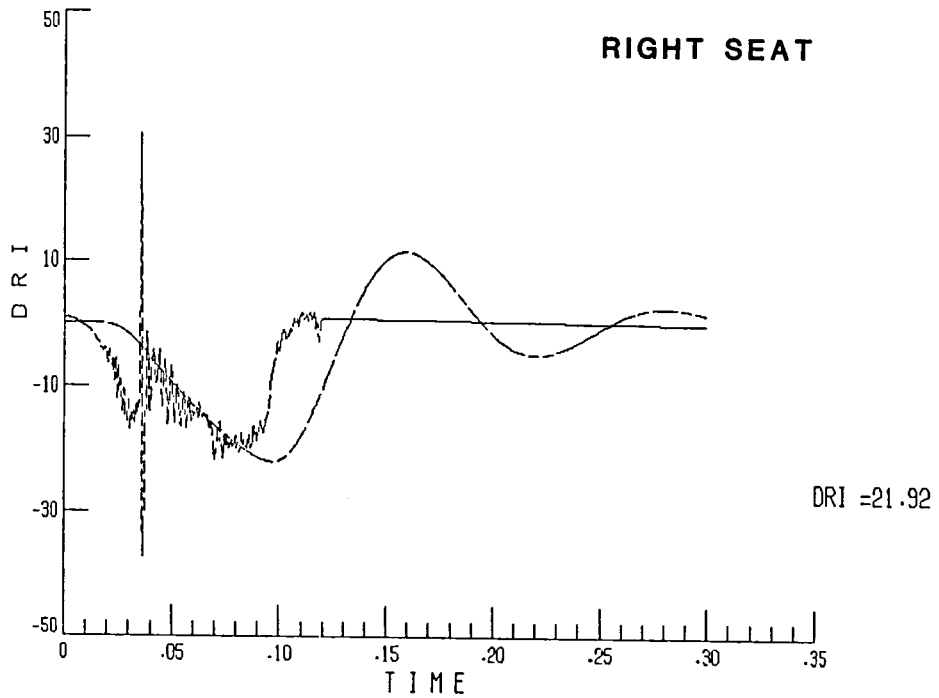
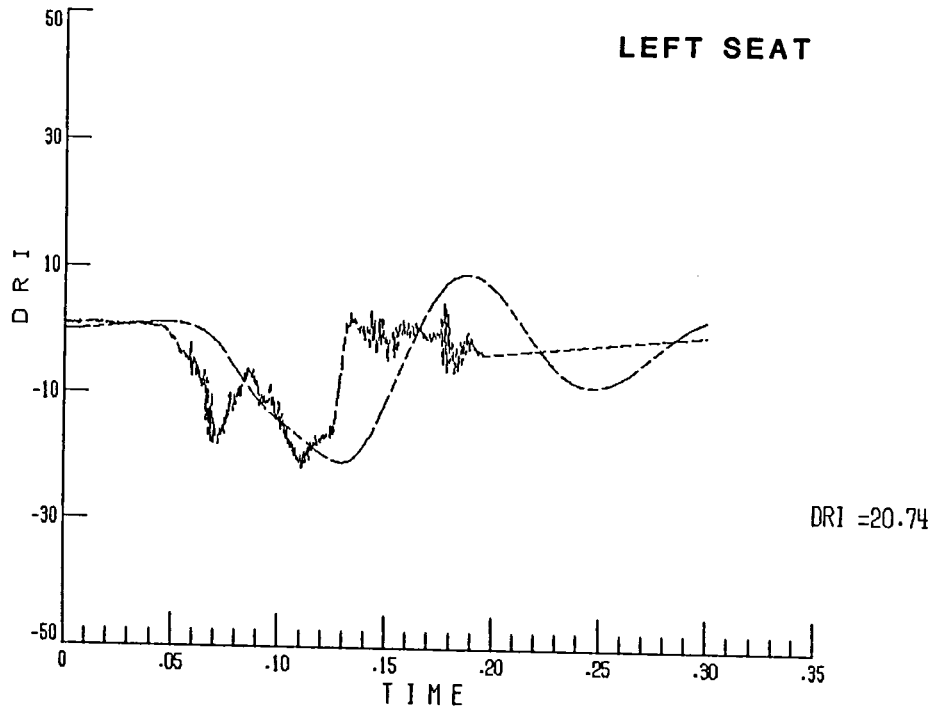
SEAT STROKE
NASA TEST NO. 4



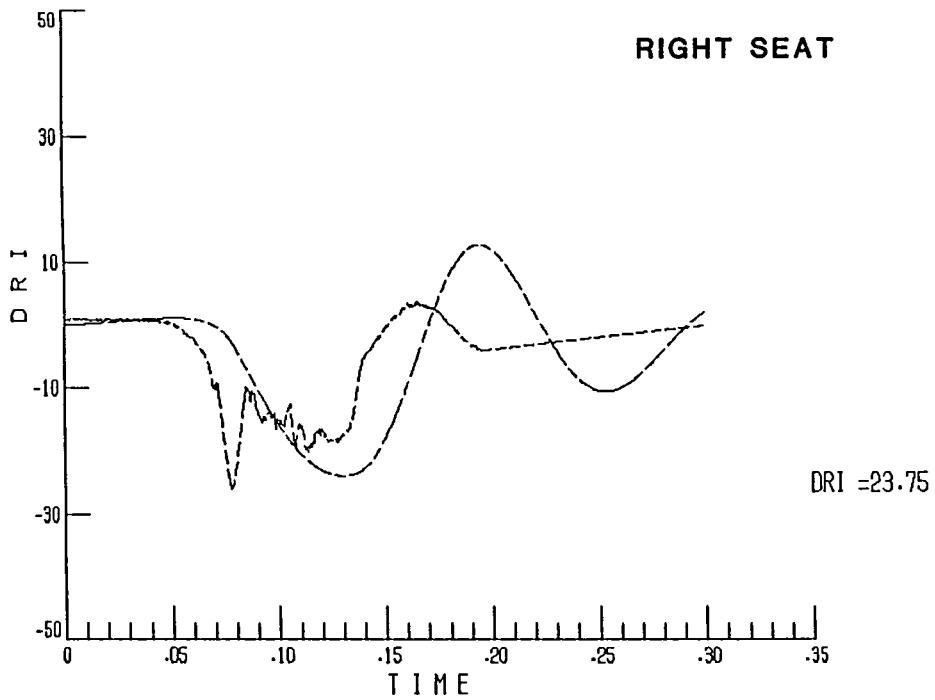
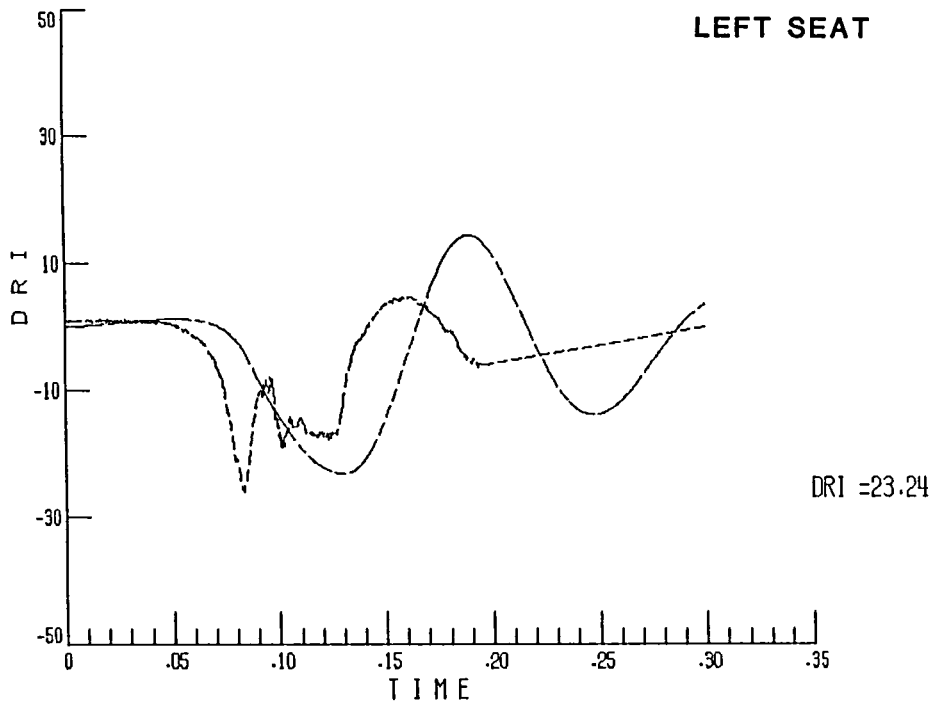
**SEAT STROKE
NASA TEST NO. 4**



**DYNAMIC RESPONSE INDEX
SEAT PAN Z-AXIS
NASA TEST NO. 4**



**DYNAMIC RESPONSE INDEX
BACK TANGENT LINE
NASA TEST NO. 4**



**DYNAMIC RESPONSE INDEX
DUMMY PELVIS Z-AXIS
NASA TEST NO. 4**

6.0 NASA TEST NO. 5

HORIZONTAL VELOCITY: 34 ft/sec

VERTICAL VELOCITY: 32 ft/sec

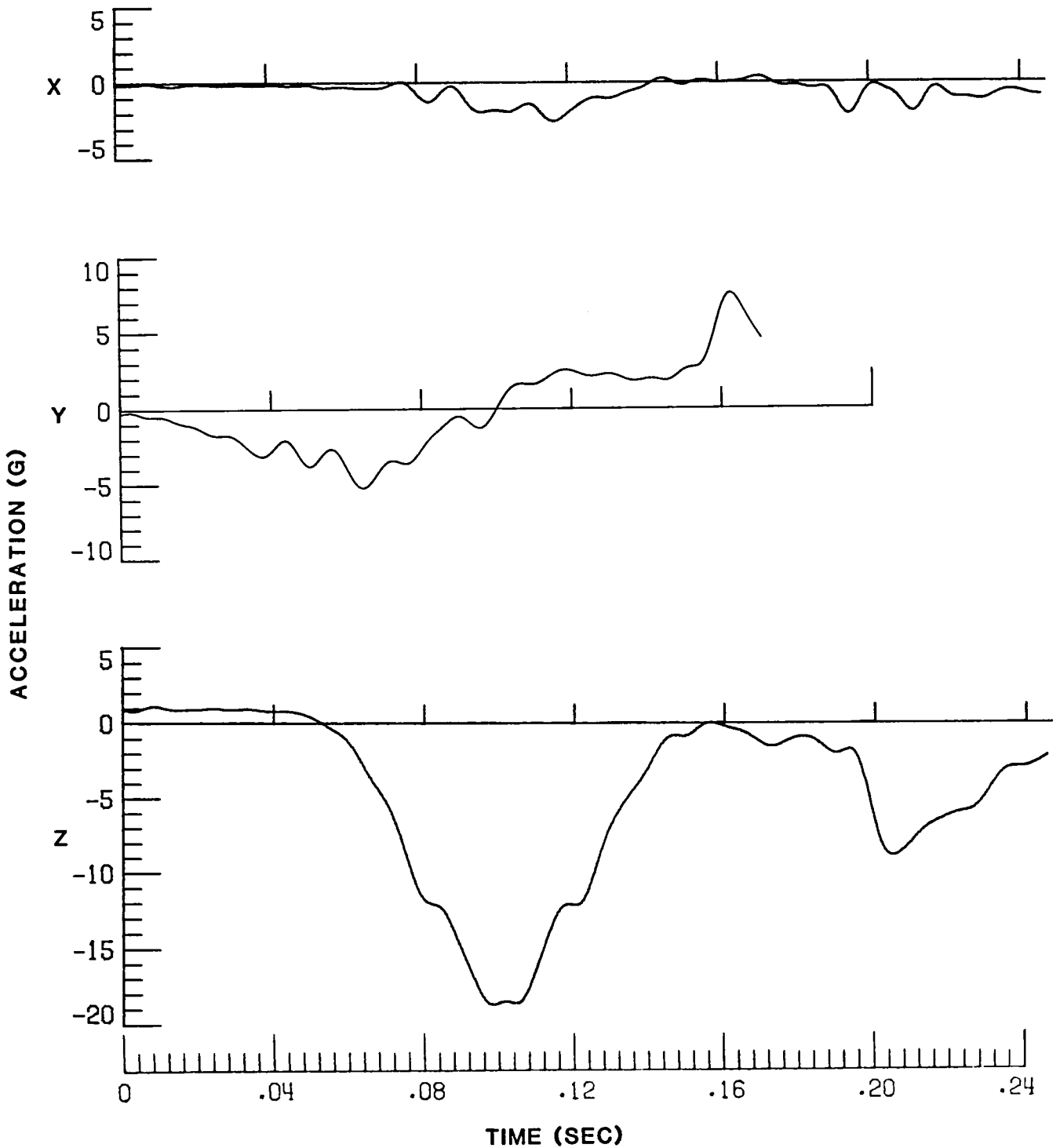
CREW MODULE PITCH: 17°

CREW MODULE ROLL: 0°

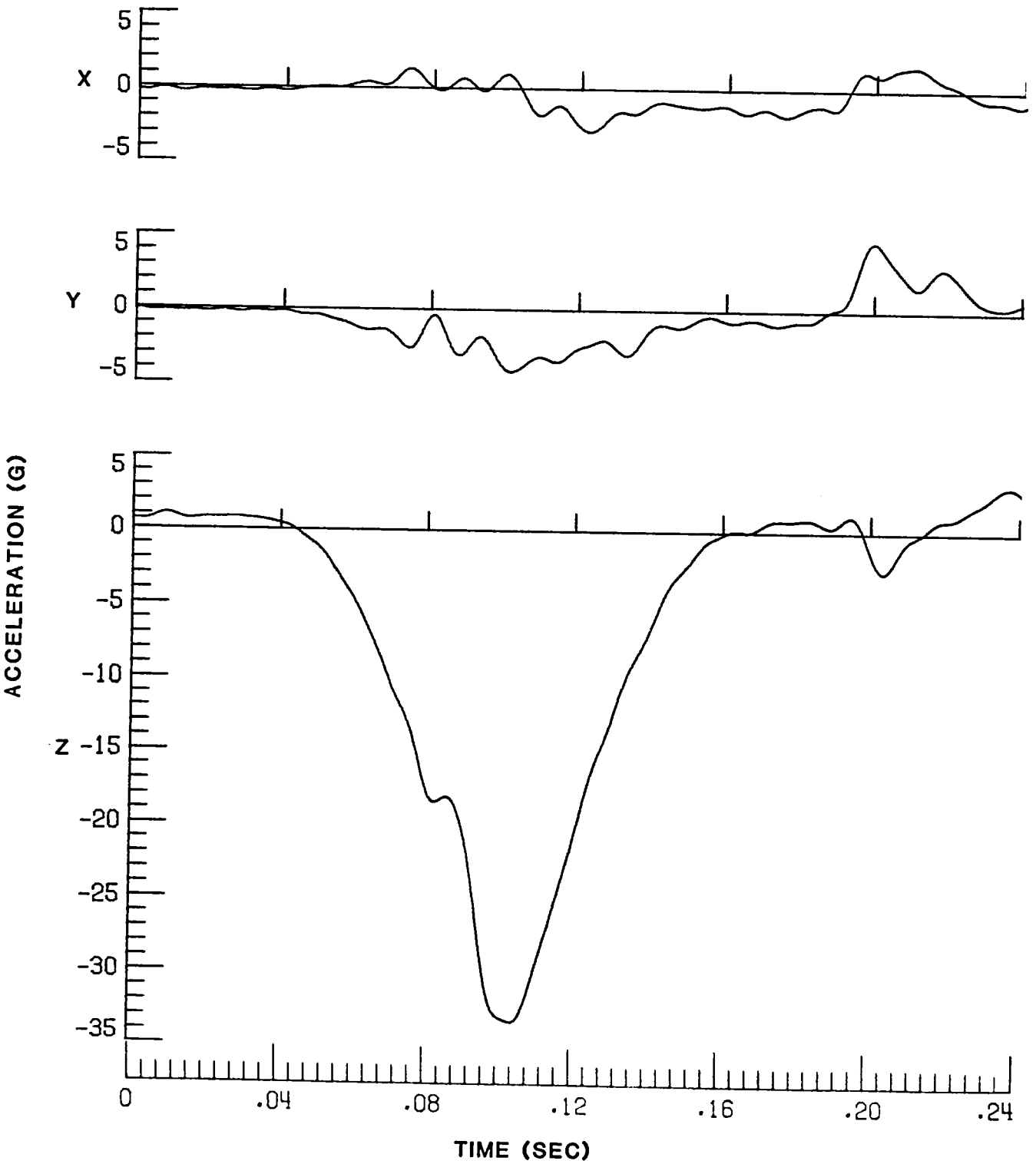
CREW MODULE YAW: 45°

LEFT SEAT: Energy Absorbing

RIGHT SEAT: Energy Absorbing

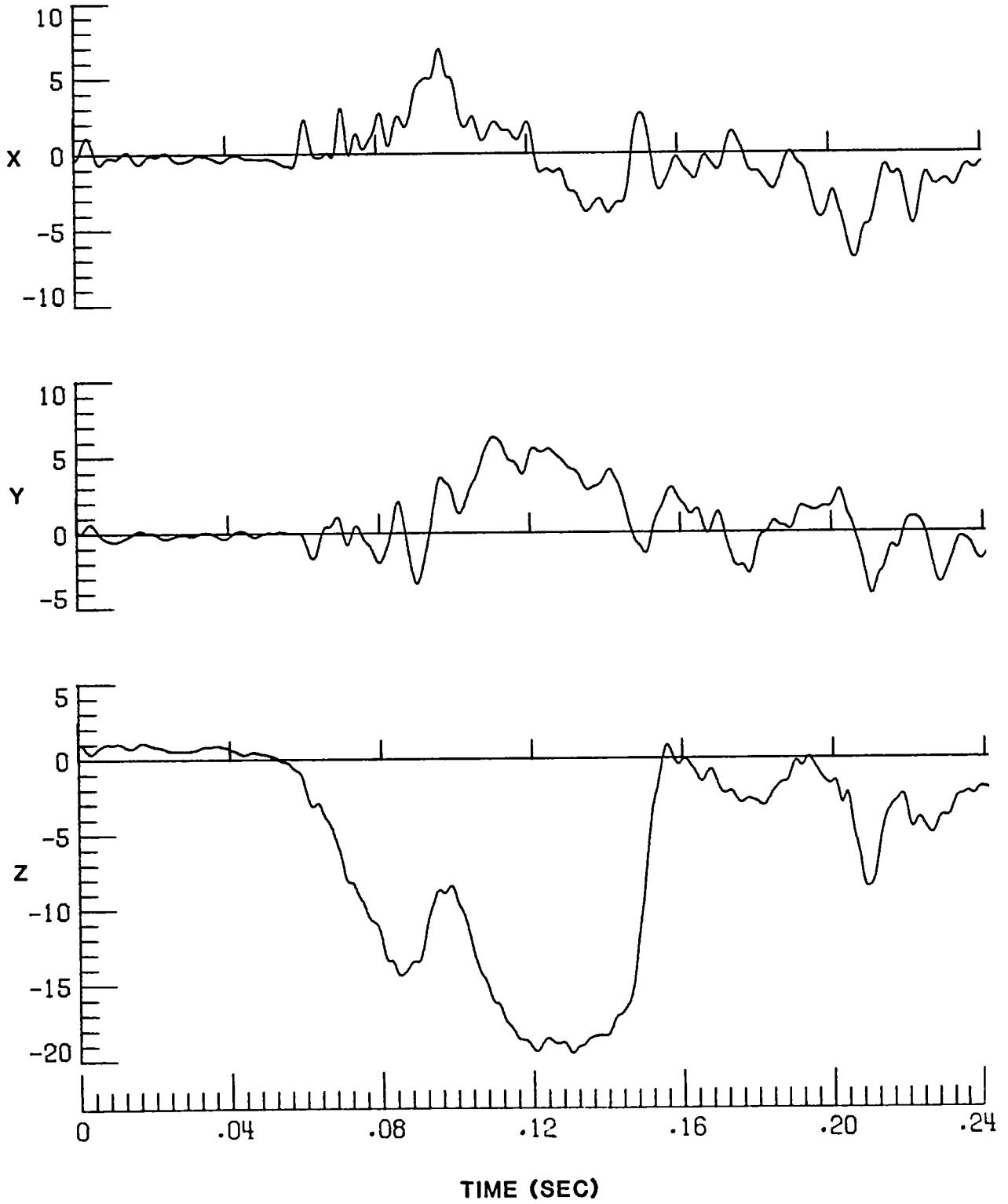


LEFT BULKHEAD
NASA TEST NO. 5

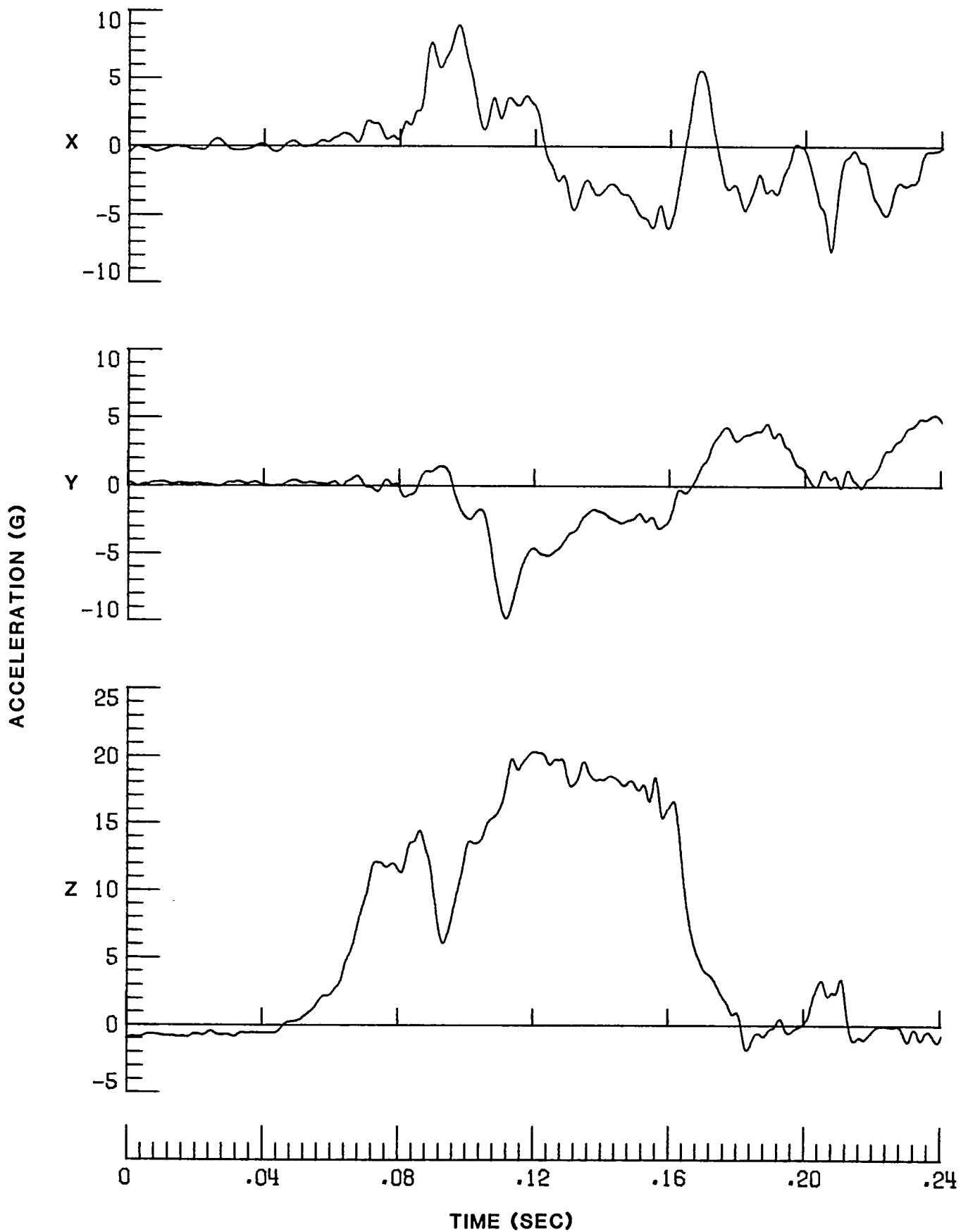


RIGHT BULKHEAD
NASA TEST NO. 5

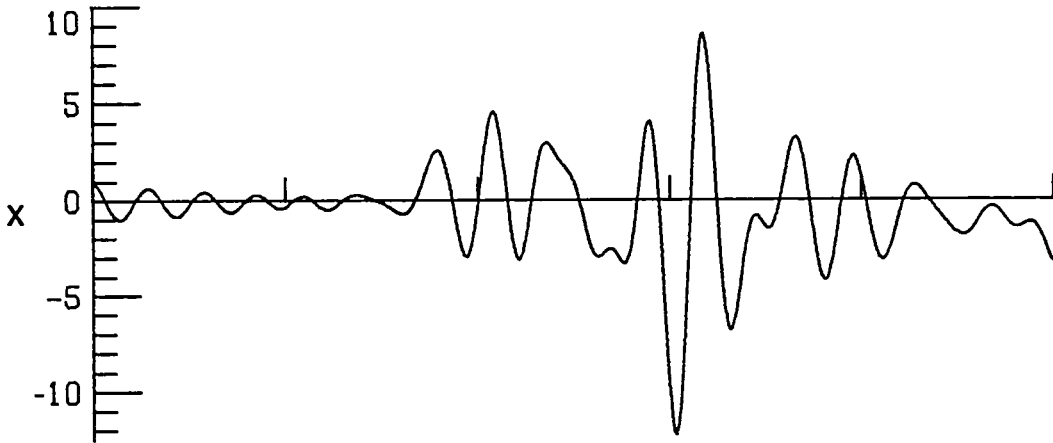
ACCELERATION (G)



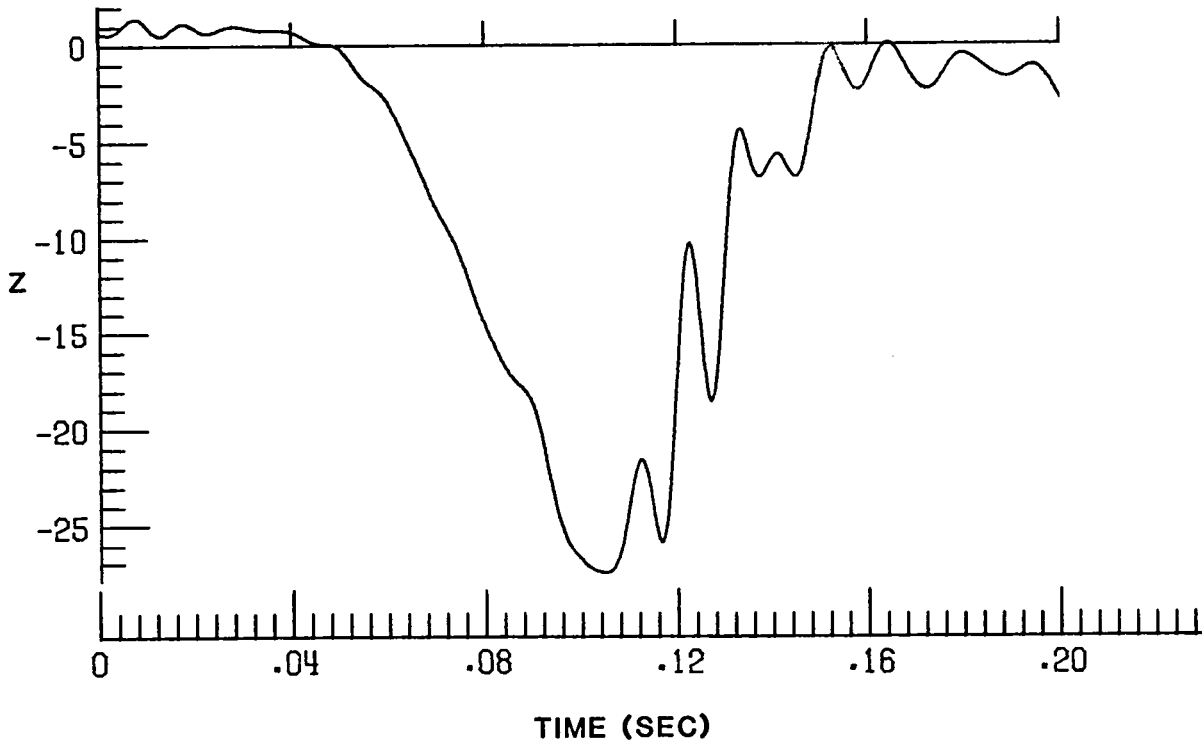
LEFT SEAT PAN
NASA TEST NO. 5



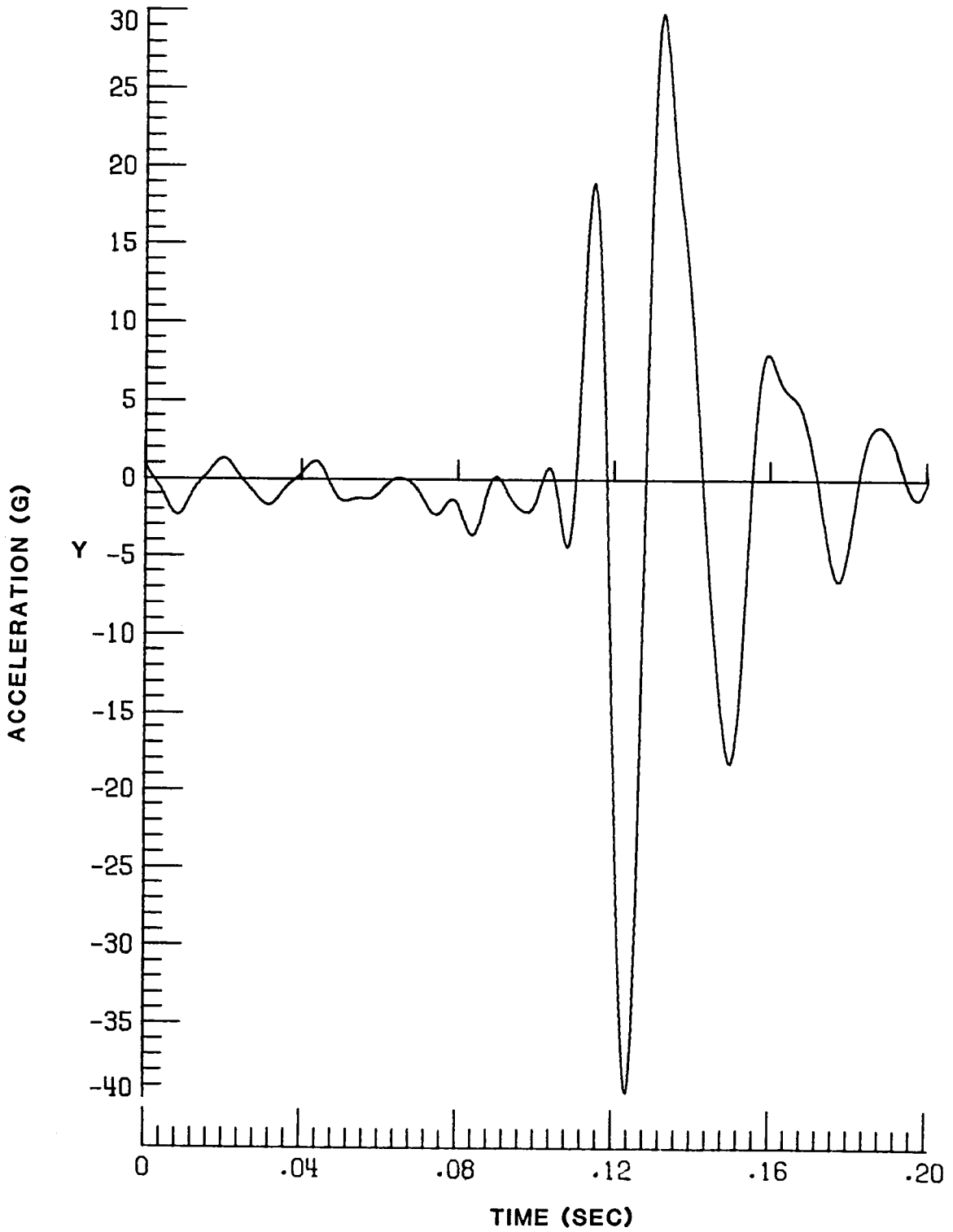
RIGHT SEAT PAN
NASA TEST NO. 5



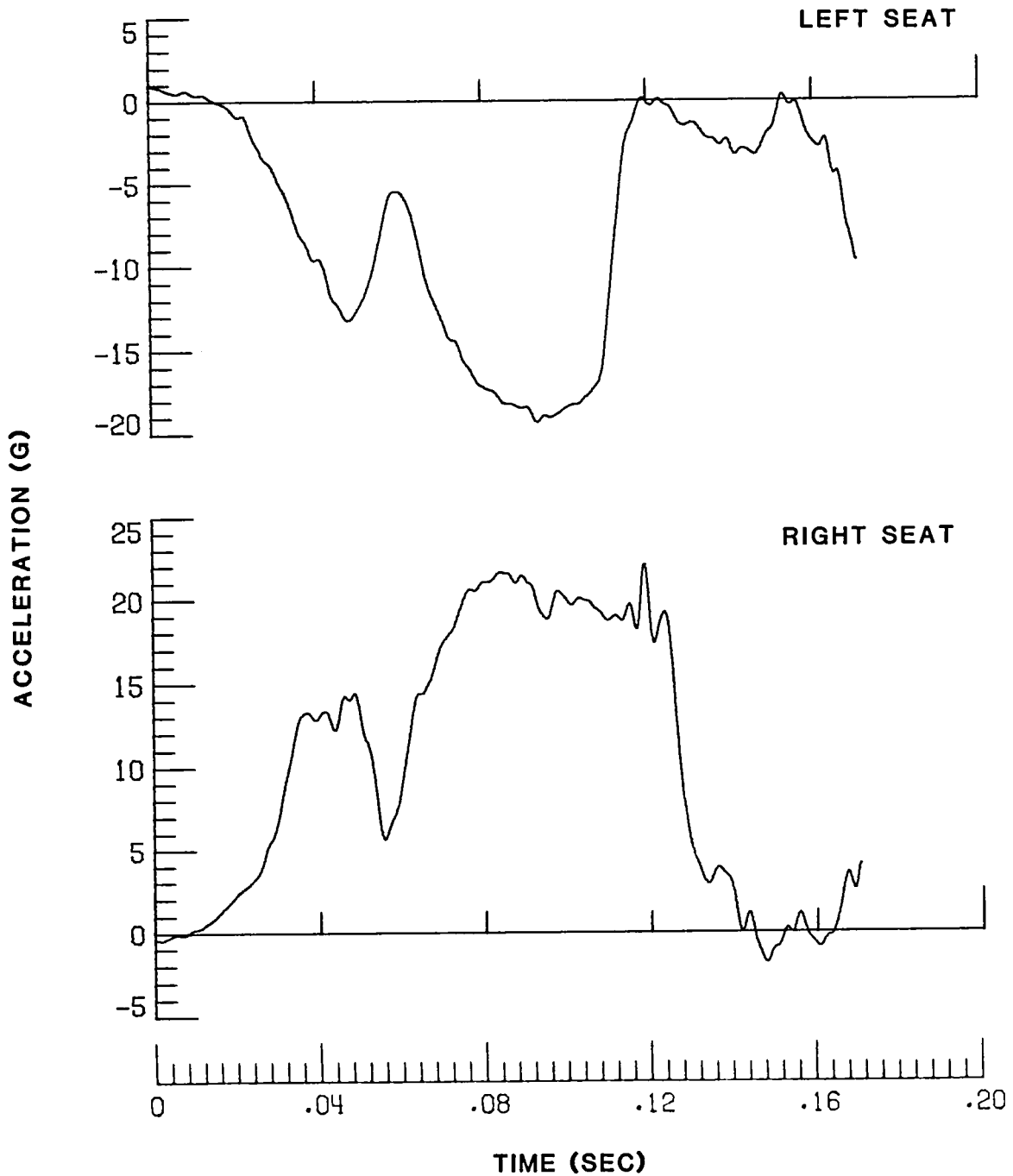
ACCELERATION (G)



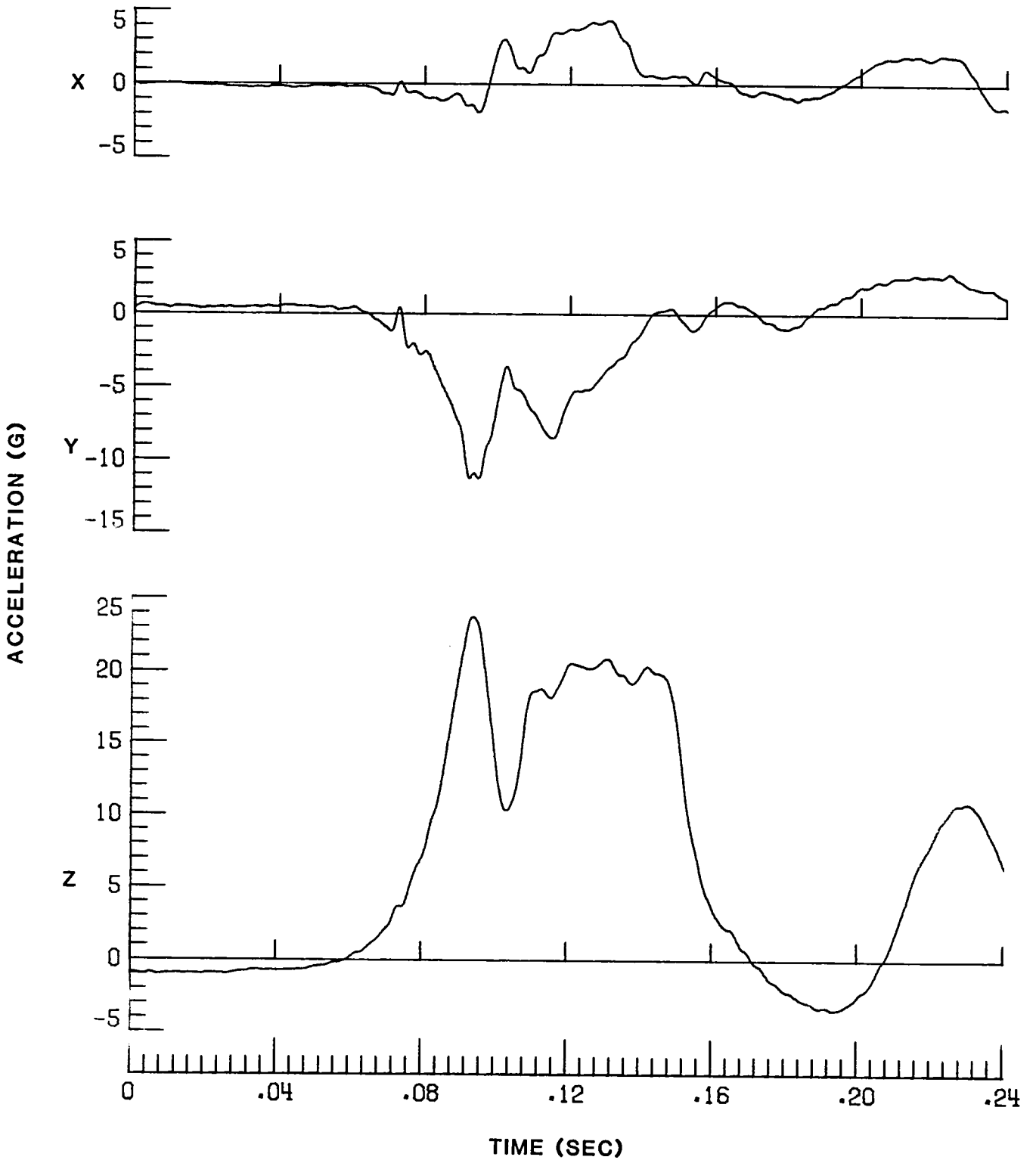
CAPSULE C.G.
NASA TEST NO. 5



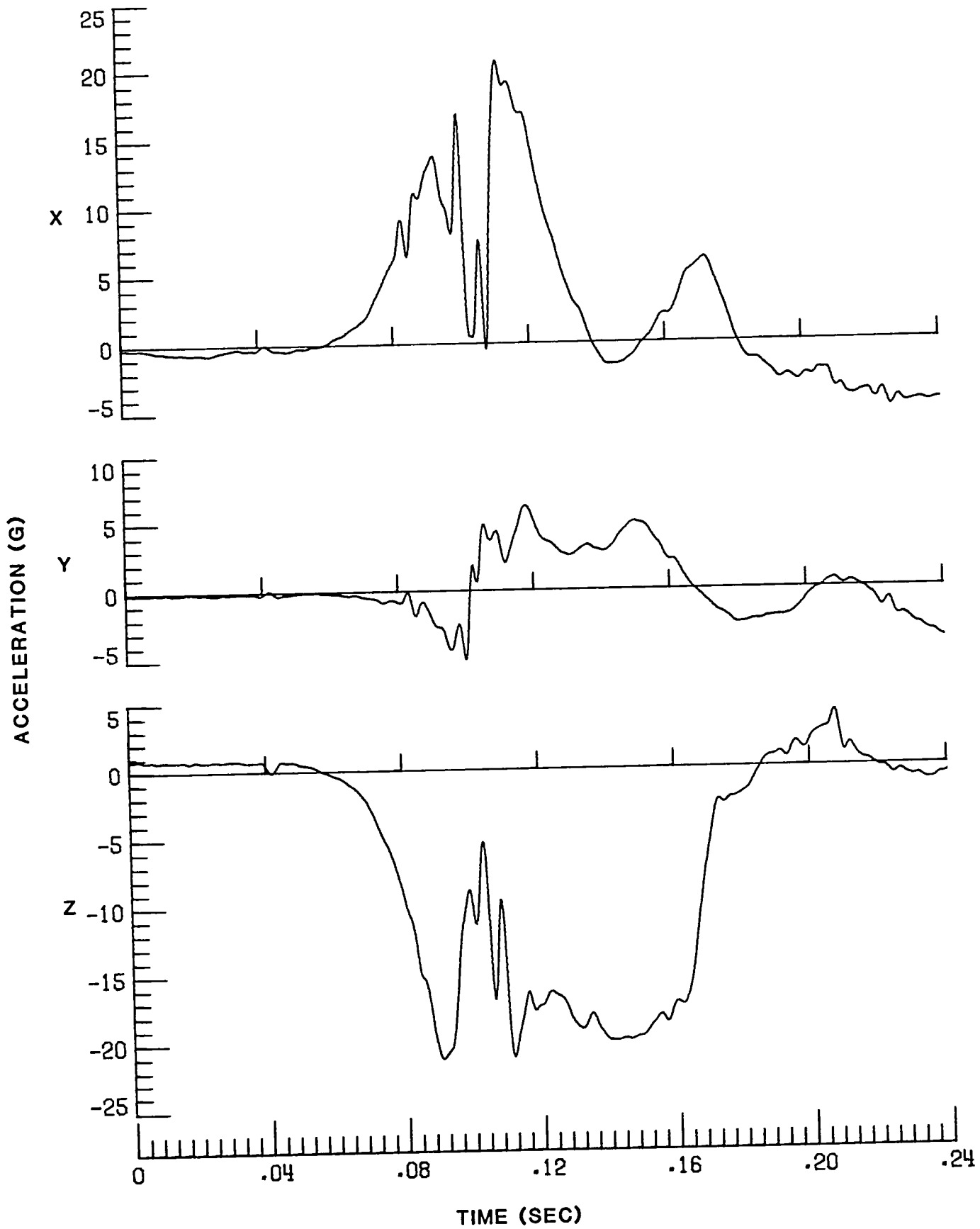
CAPSULE C.G.
NASA TEST NO. 5



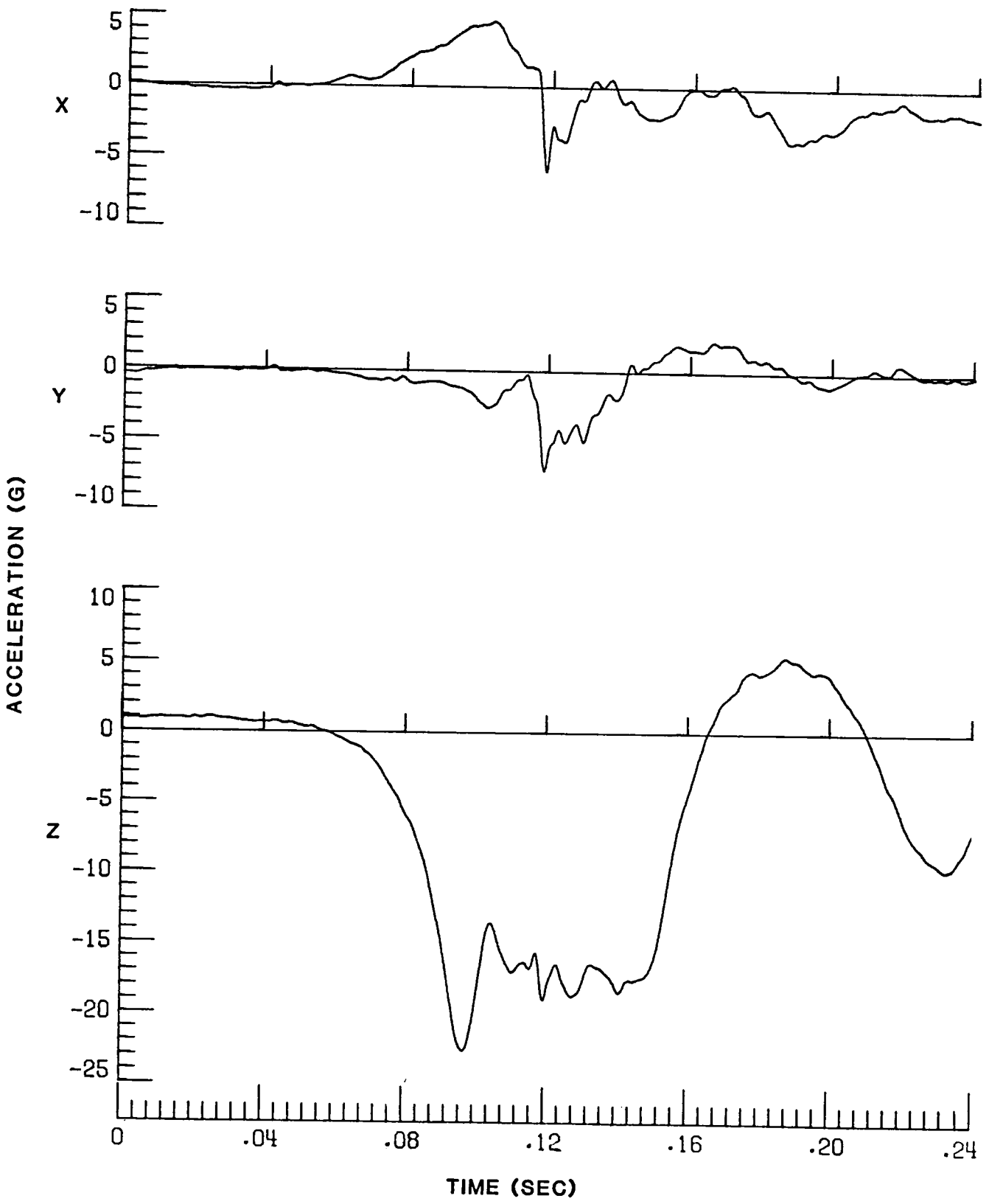
SEAT PAN ALONG BACK TANGENT LINE
NASA TEST NO. 5



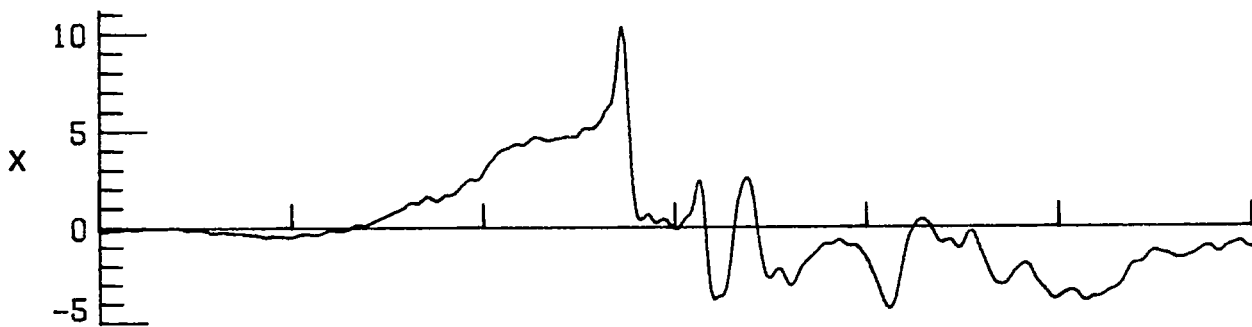
LEFT DUMMY PELVIS
NASA TEST NO. 5



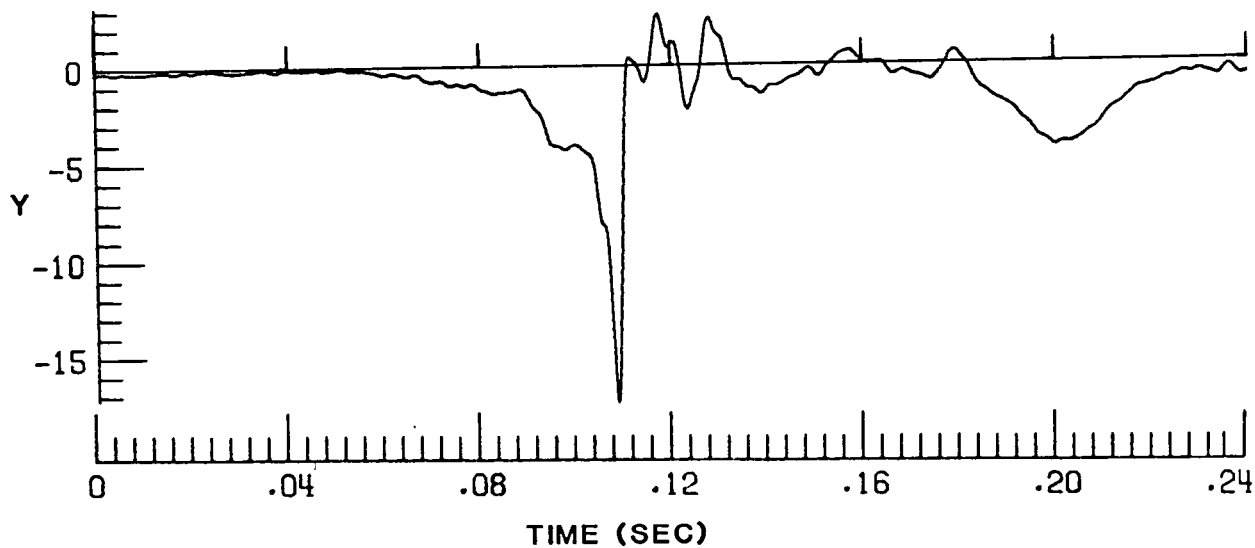
RIGHT DUMMY PELVIS
 NASA TEST NO. 5



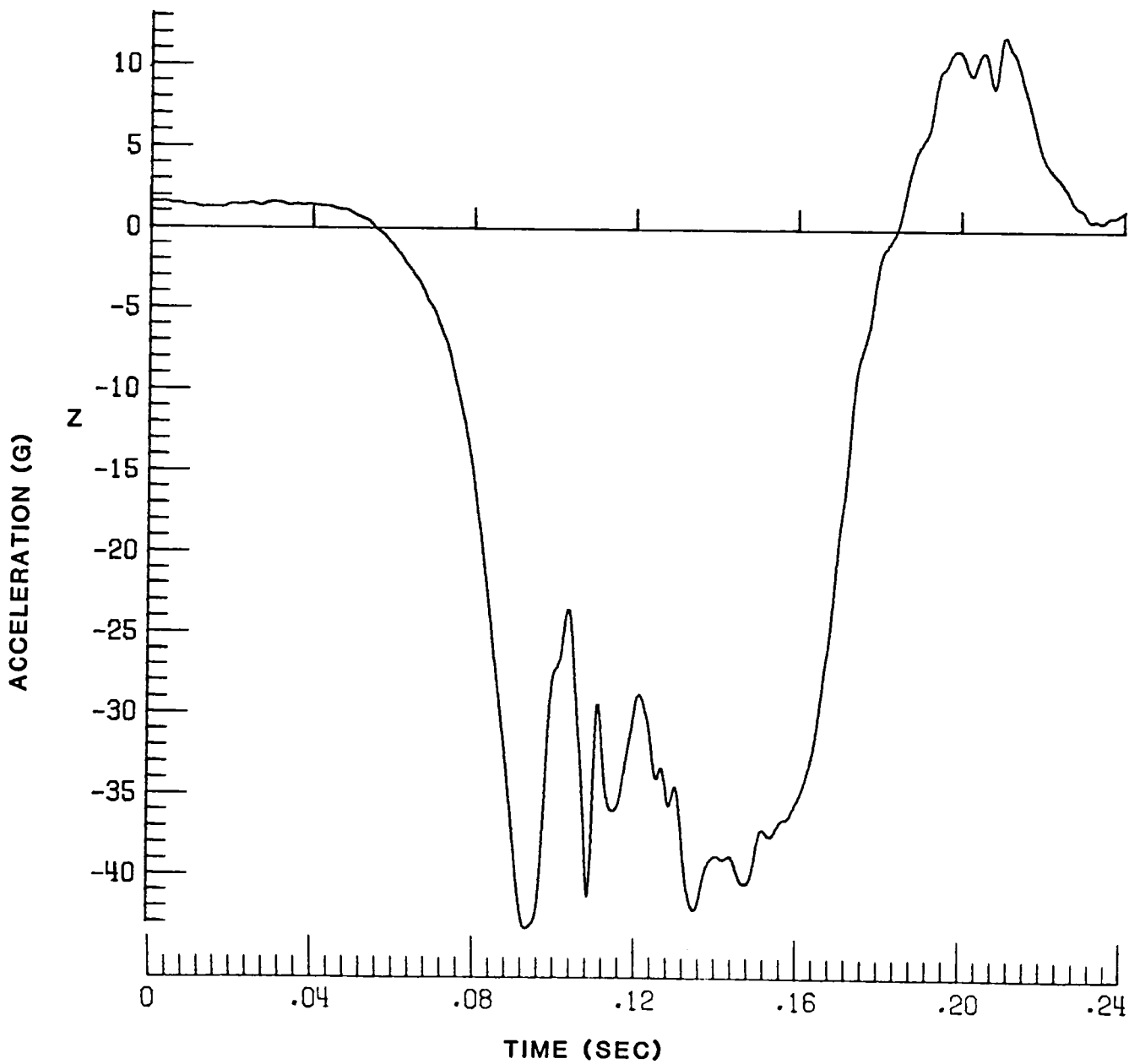
LEFT DUMMY CHEST
NASA TEST NO. 5



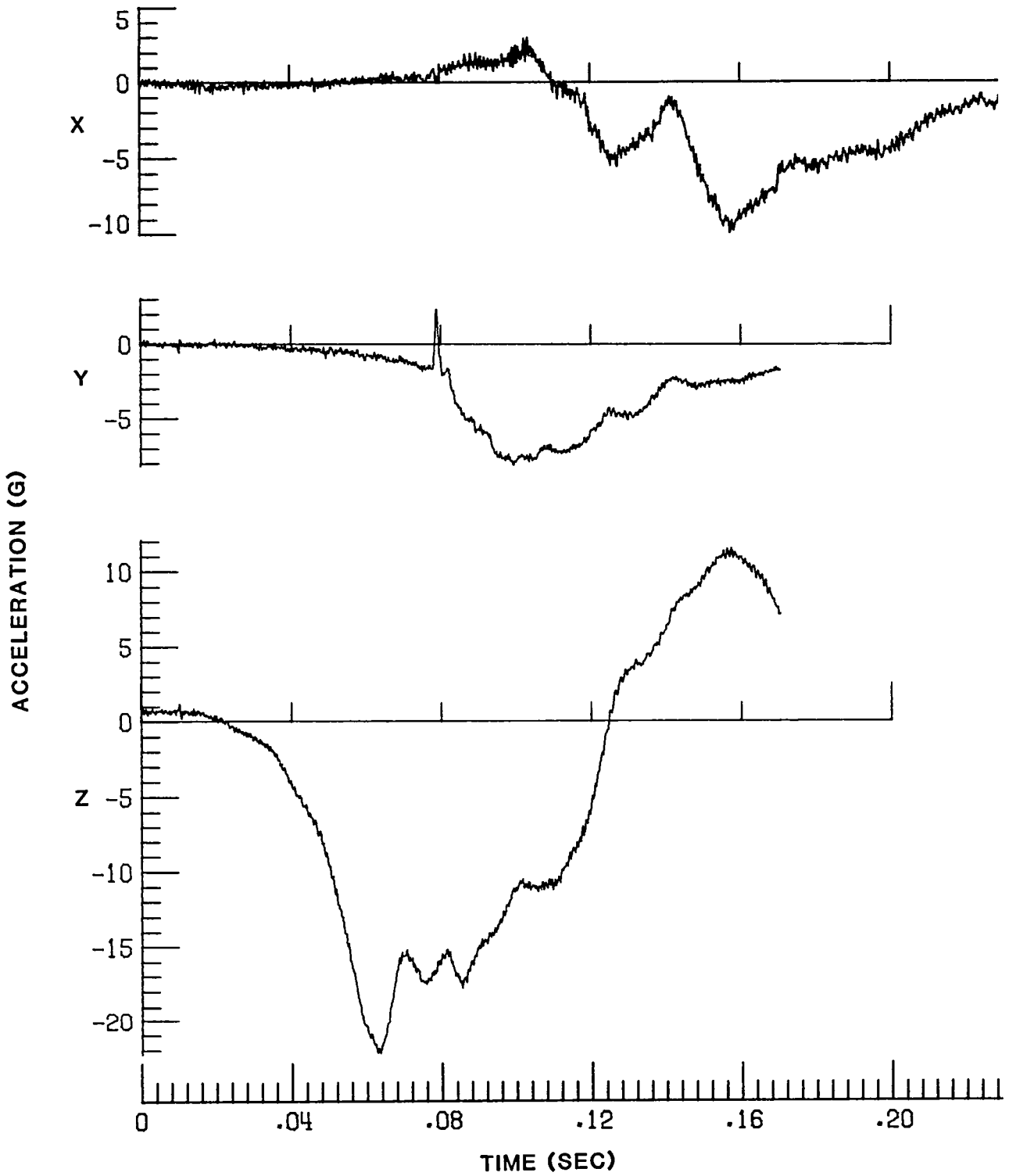
ACCELERATION (G)



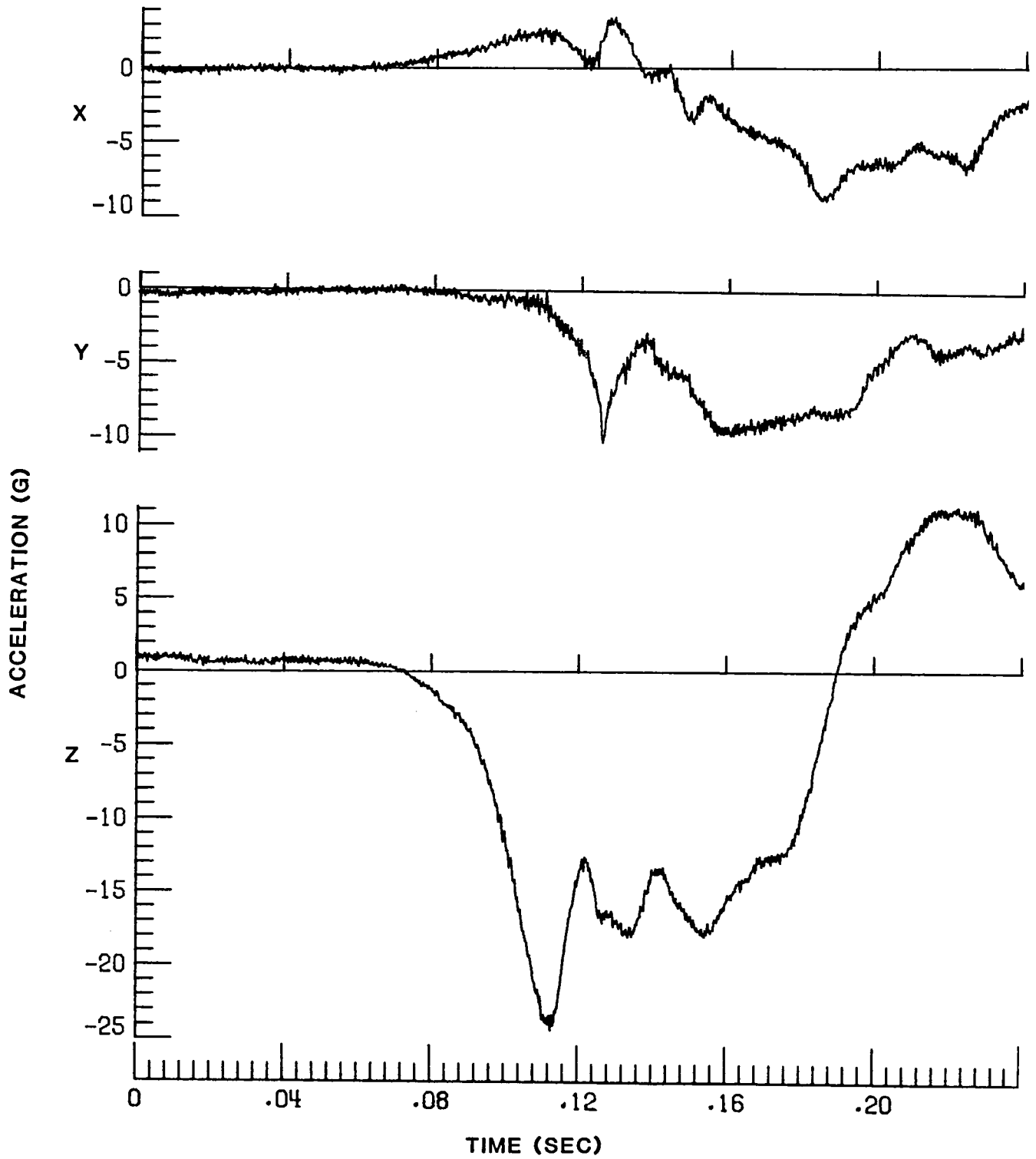
RIGHT DUMMY CHEST
NASA TEST NO. 5



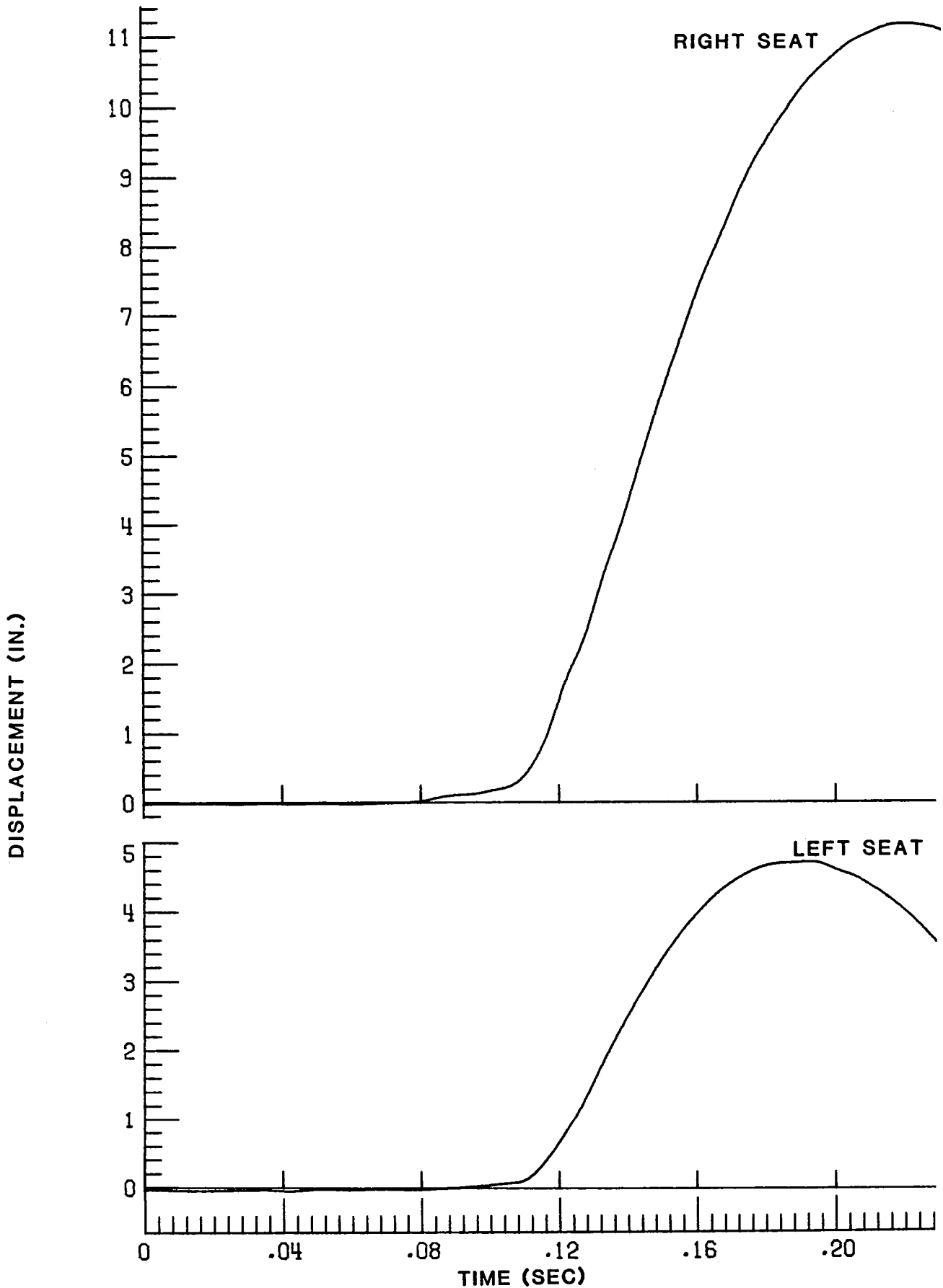
RIGHT DUMMY CHEST
NASA TEST NO. 5



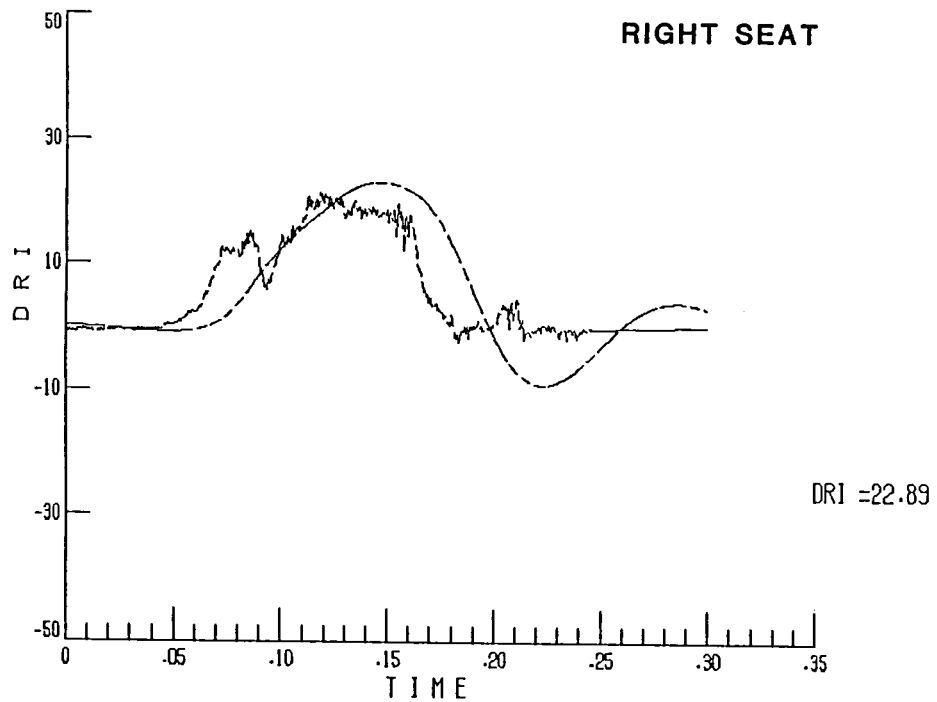
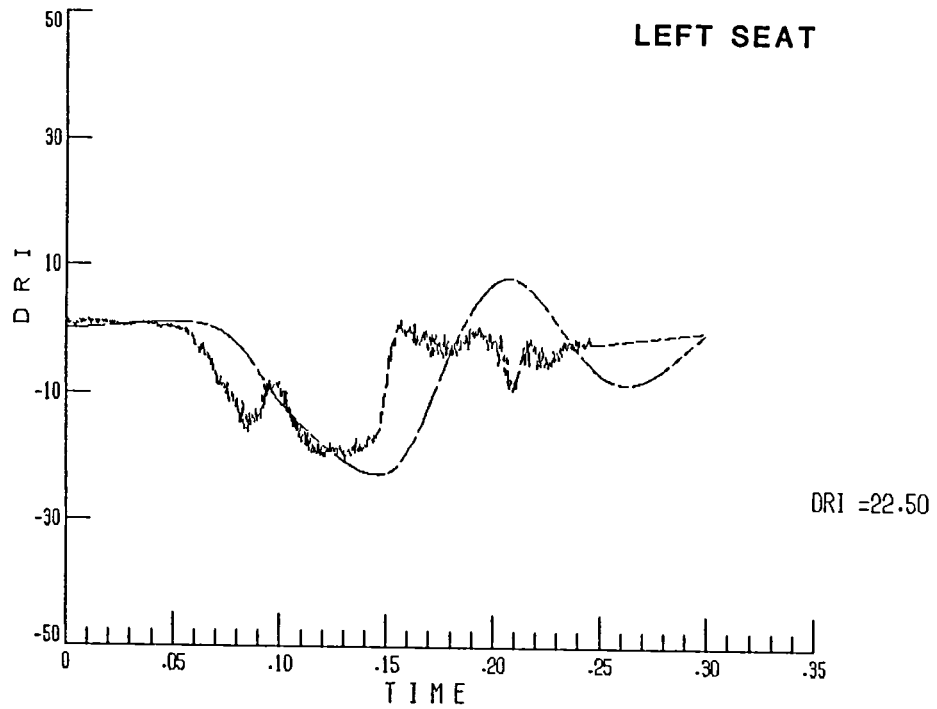
LEFT DUMMY HEAD
NASA TEST NO. 5



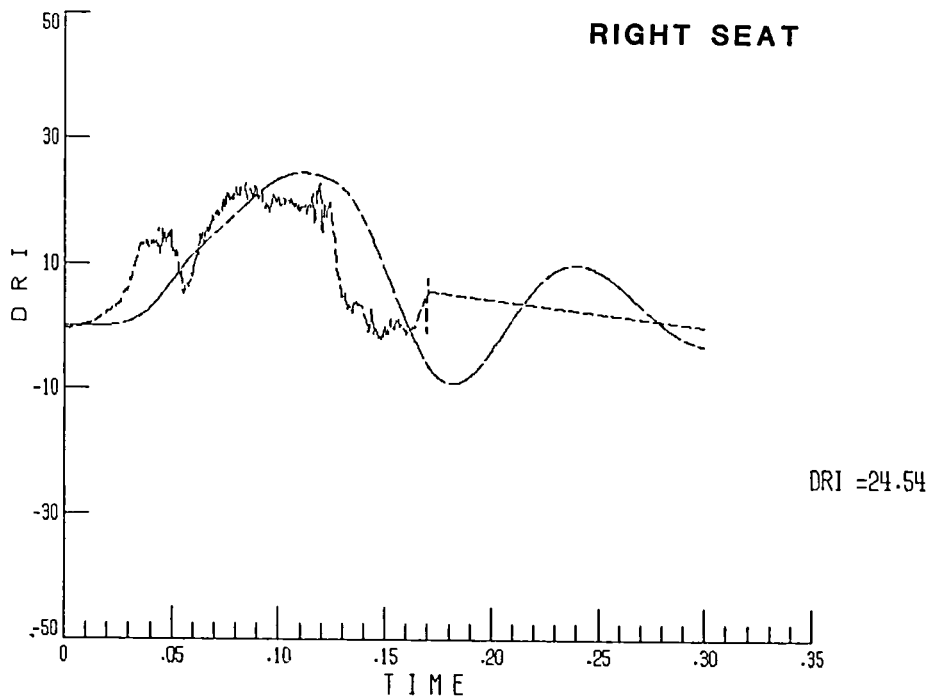
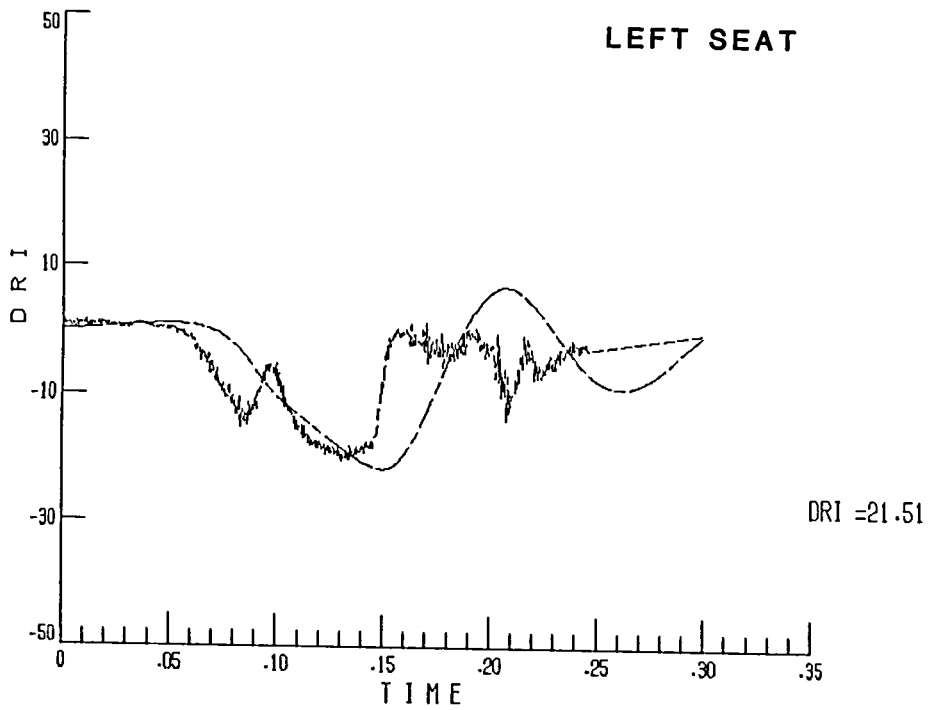
RIGHT DUMMY HEAD
NASA TEST NO. 5
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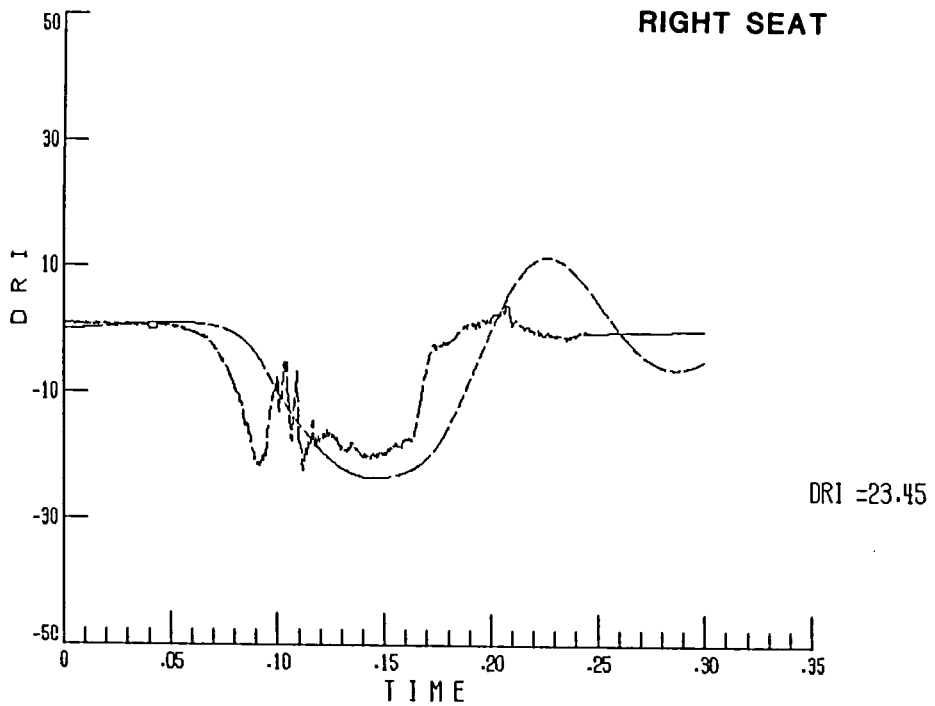
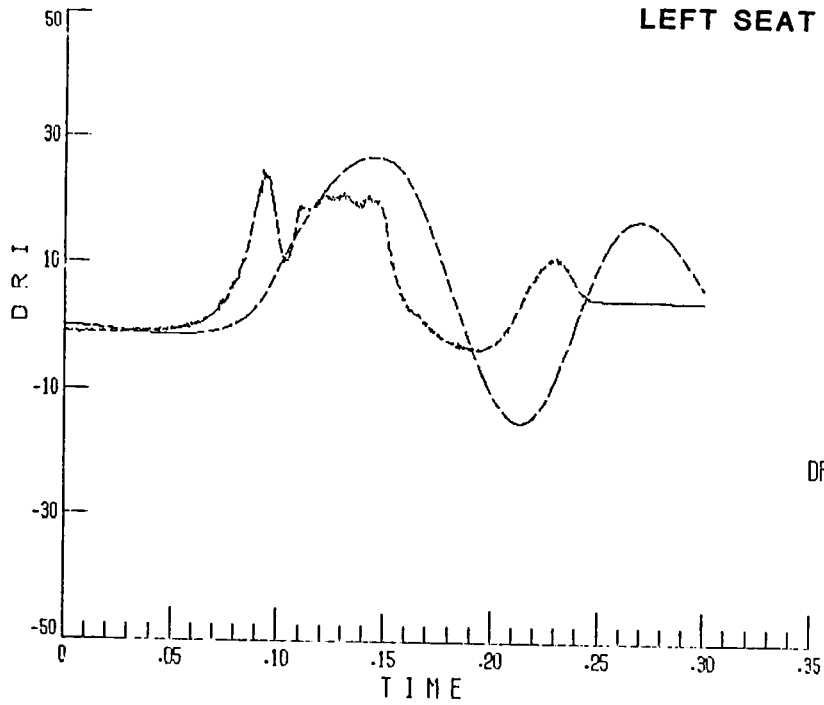
SEAT STROKE
NASA TEST NO. 5



**DYNAMIC RESPONSE INDEX
SEAT PAN Z-AXIS
NASA TEST NO. 5**



DYNAMIC RESPONSE INDEX
BACK TANGENT LINE
NASA TEST NO. 5
 91



**DYNAMIC RESPONSE INDEX
DUMMY PELVIS Z-AXIS
NASA TEST NO. 5**

7.0 NASA TEST NO. 6

HORIZONTAL VELOCITY: 43 ft/sec

VERTICAL VELOCITY: 32 ft/sec

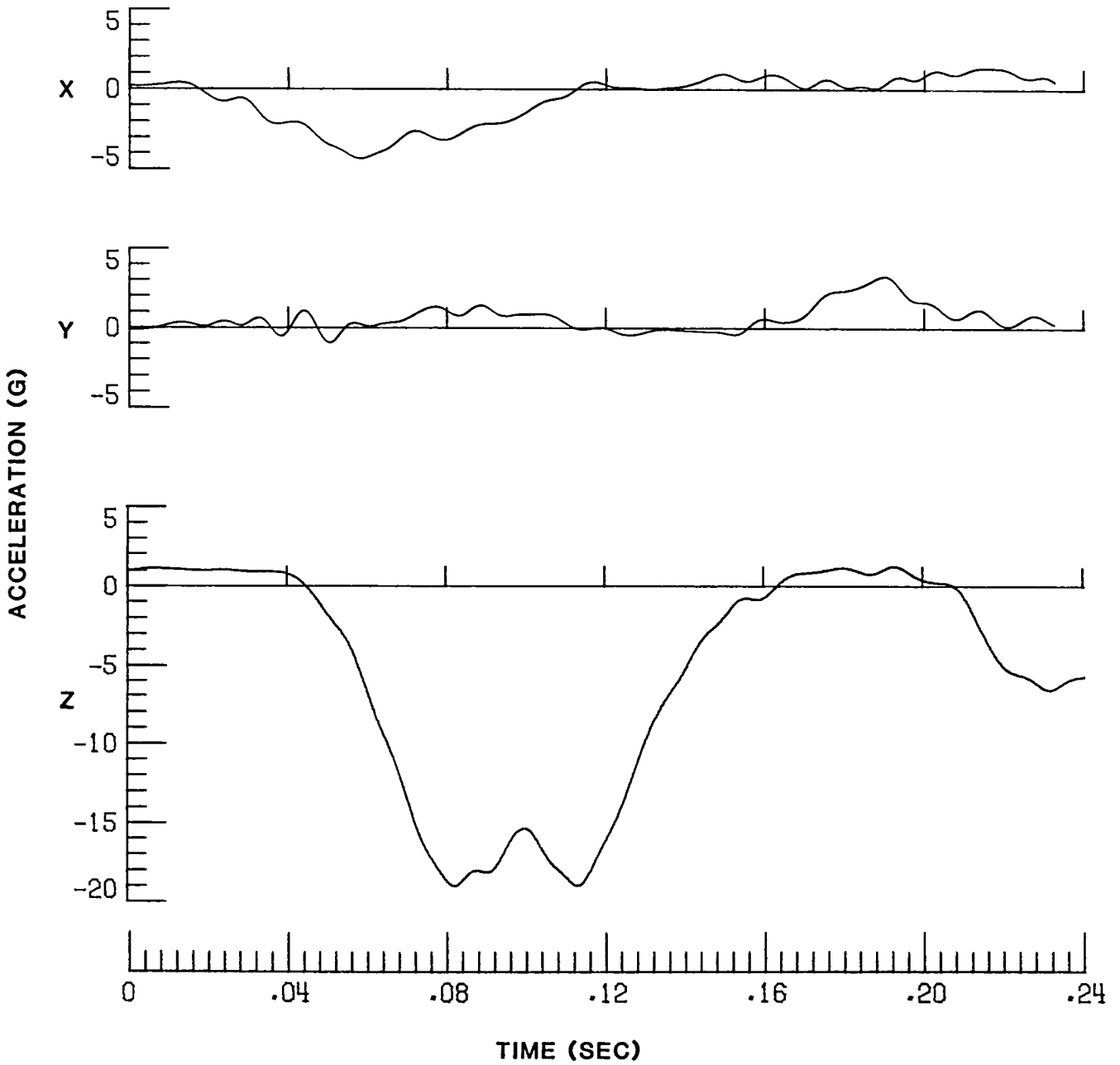
CREW MODULE PITCH: 2°

CREW MODULE ROLL: 0°

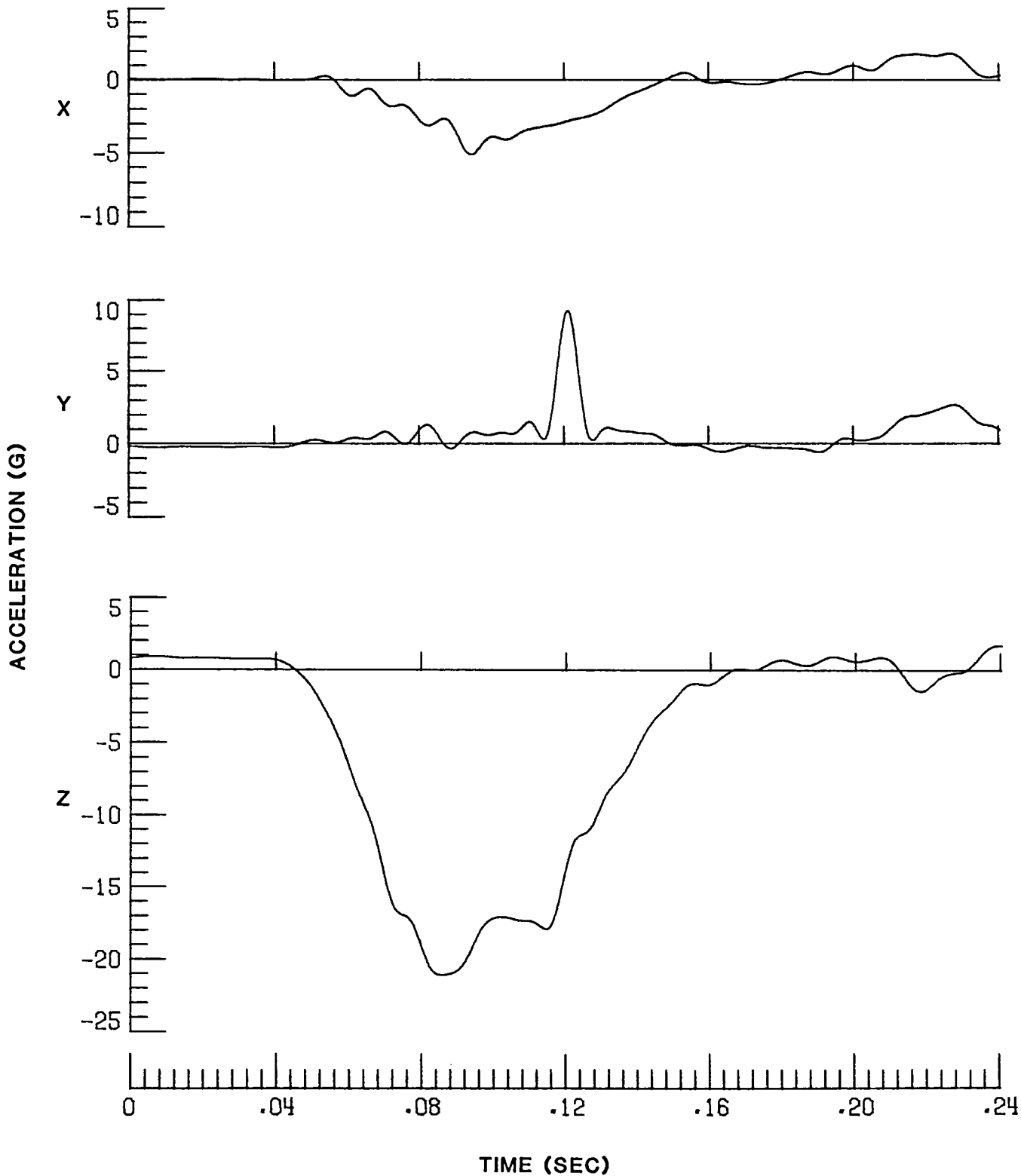
CREW MODULE YAW: 0°

LEFT SEAT: Energy Absorbing

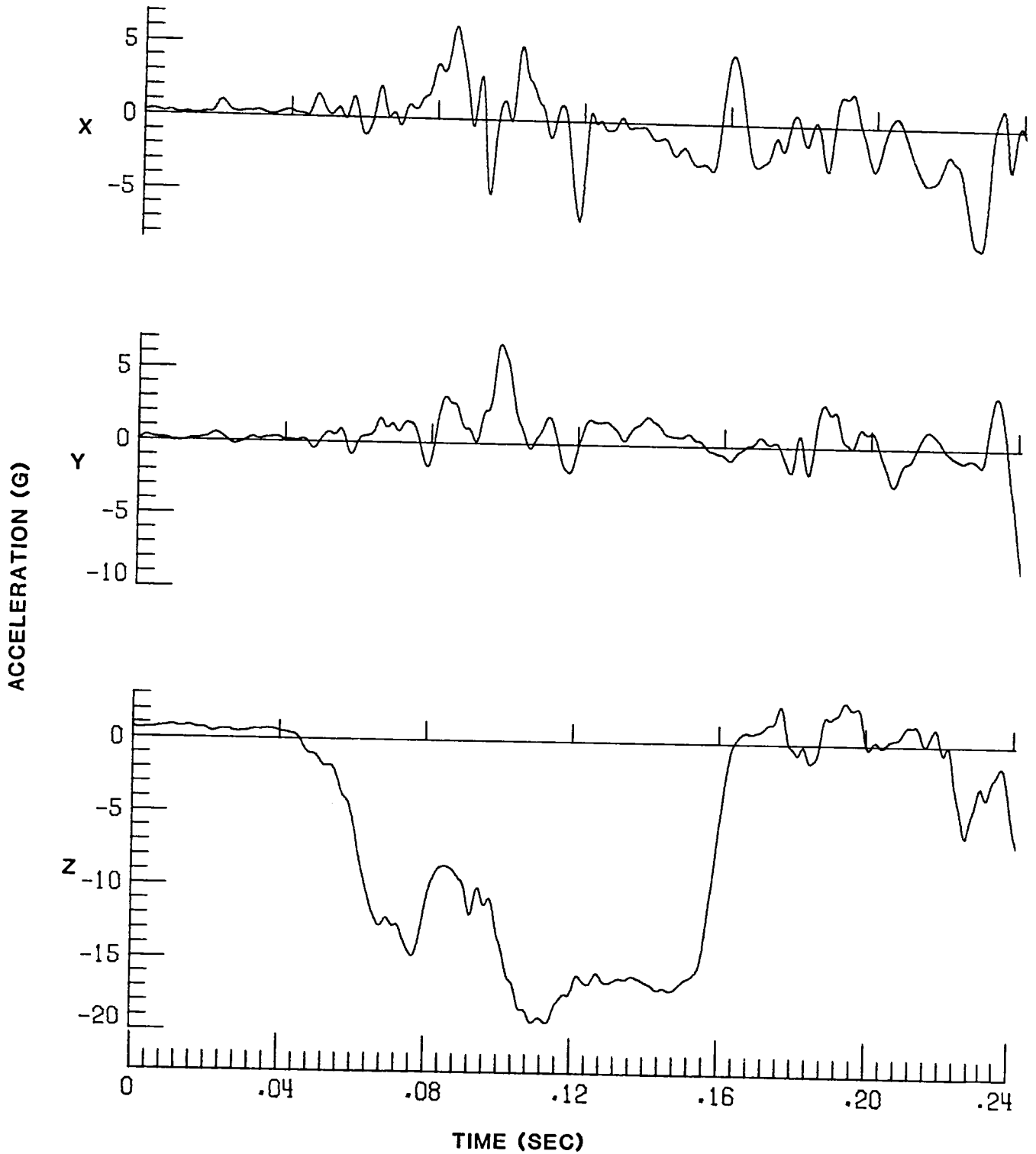
RIGHT SEAT: Energy Absorbing



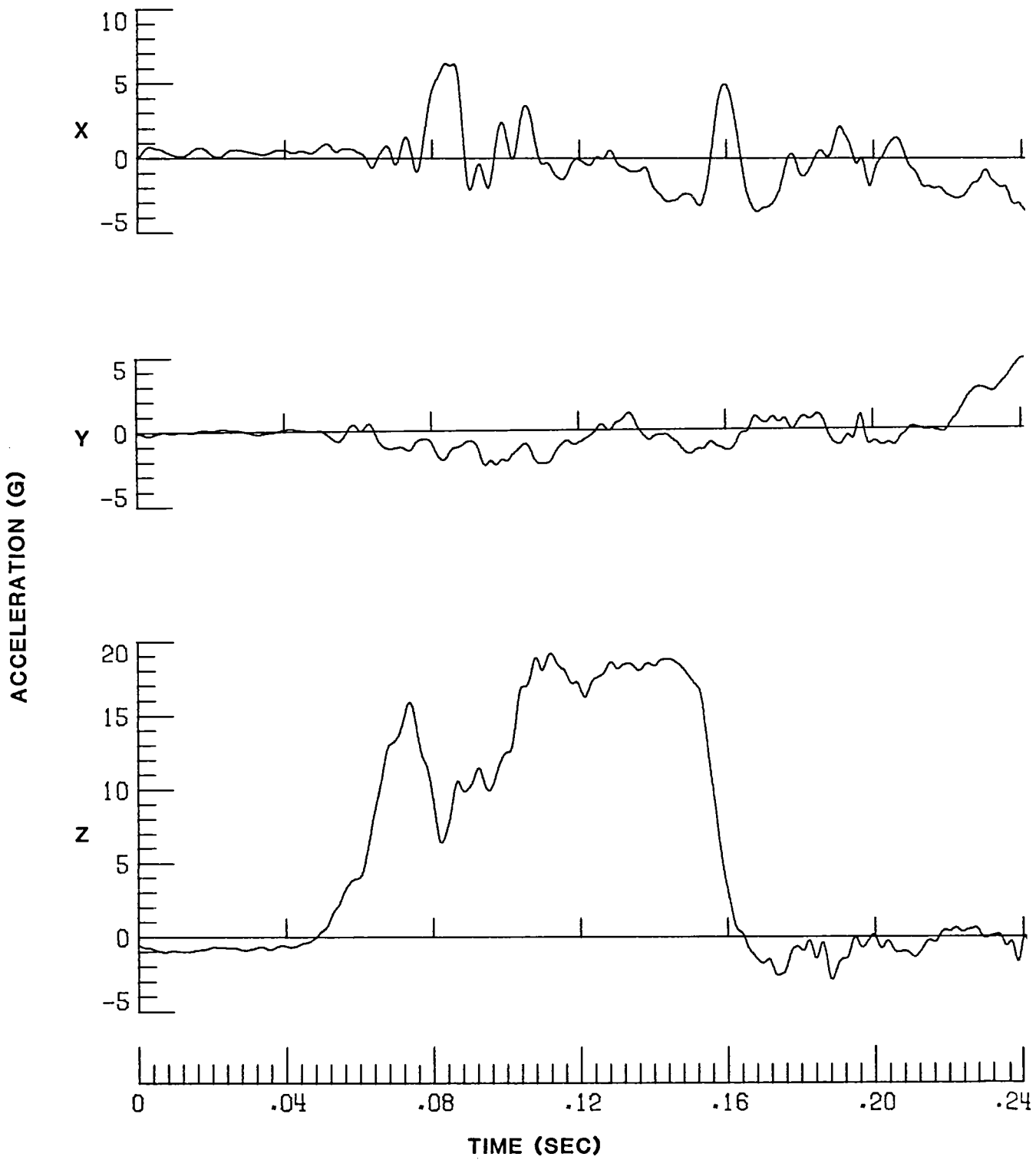
LEFT BULKHEAD
NASA TEST NO. 6



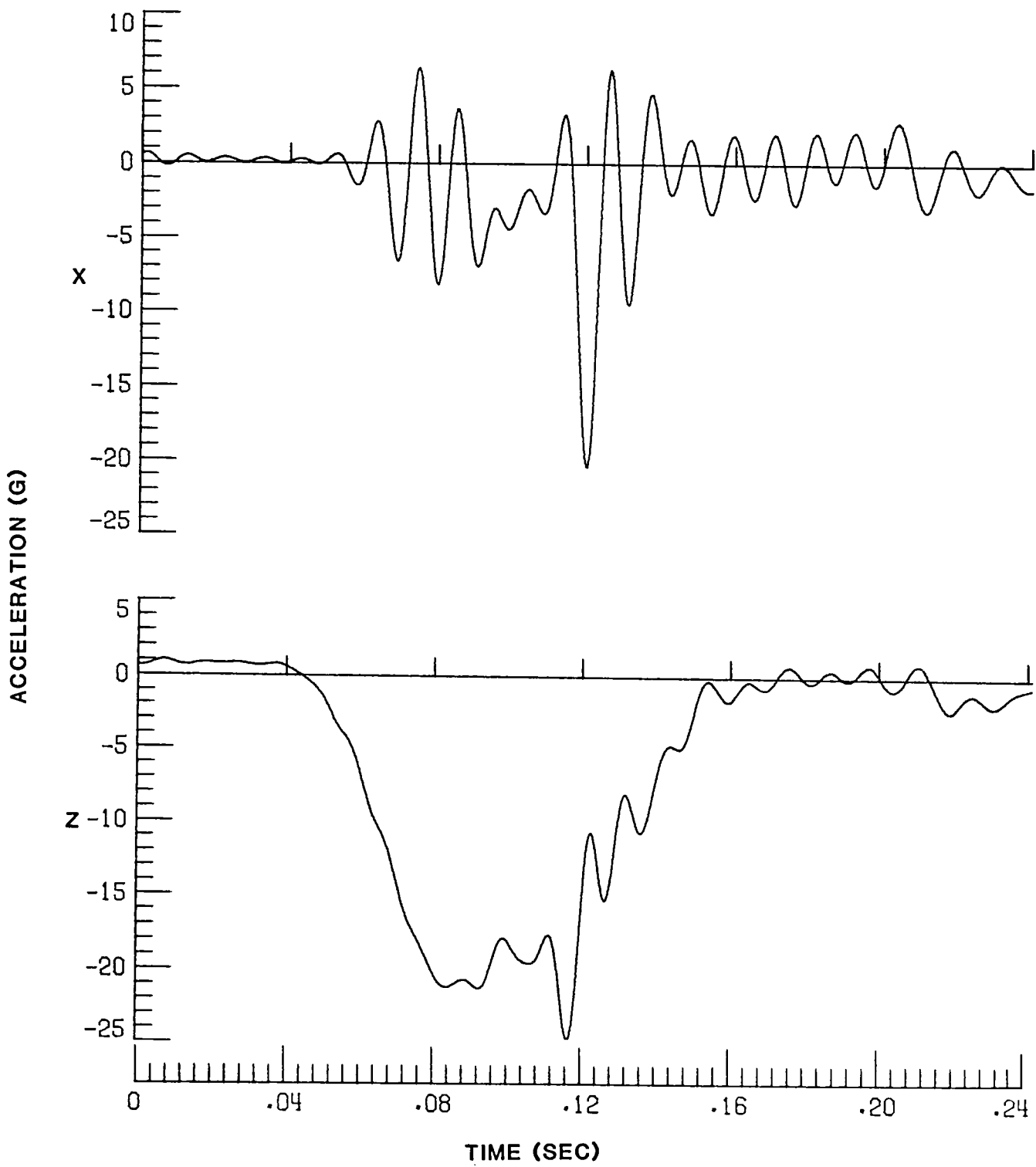
RIGHT BULKHEAD
NASA TEST NO. 6



LEFT SEAT PAN
 NASA TEST NO. 6



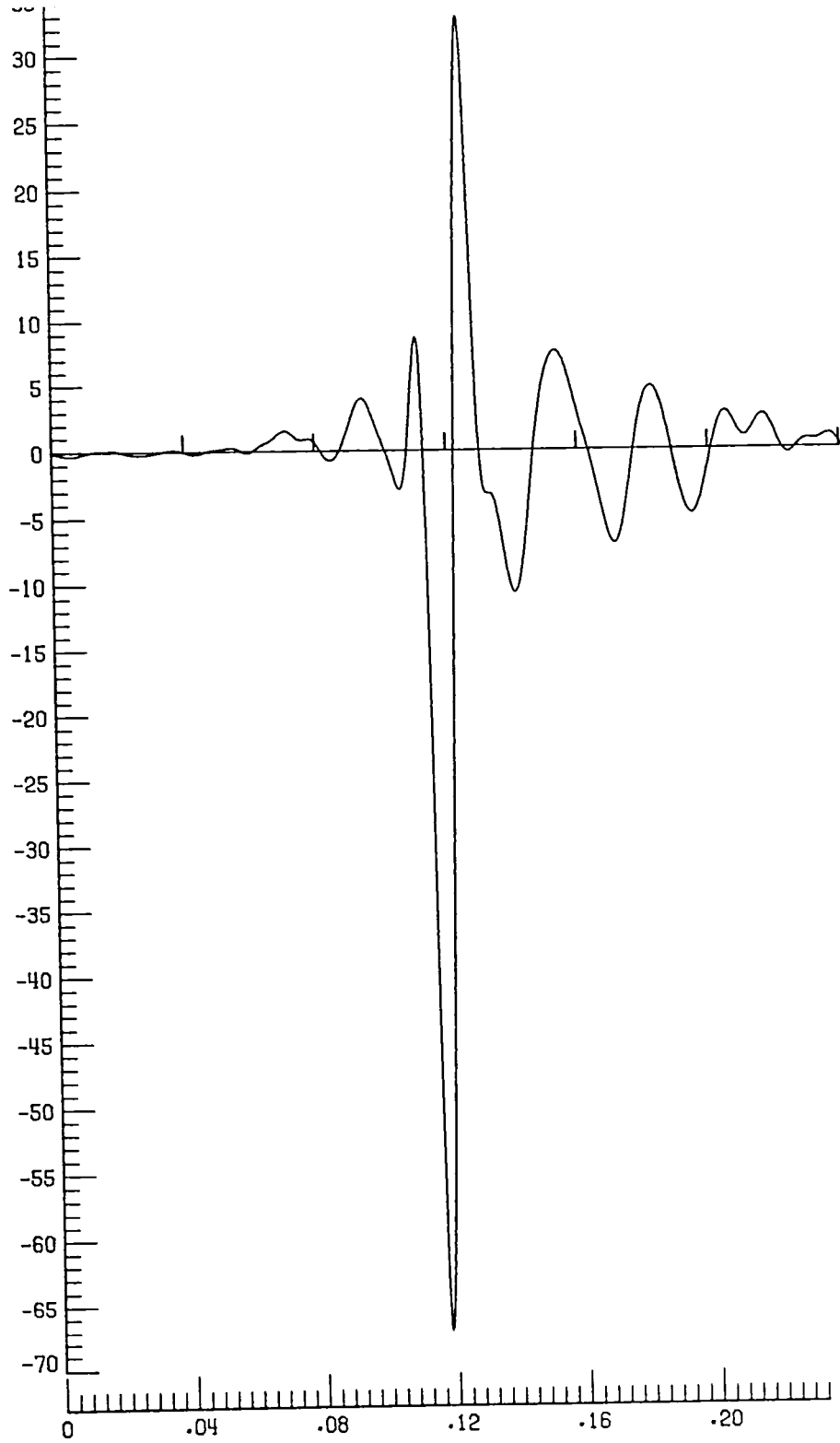
RIGHT SEAT PAN
NASA TEST NO. 6



CAPSULE C.G.
 NASA TEST NO. 6

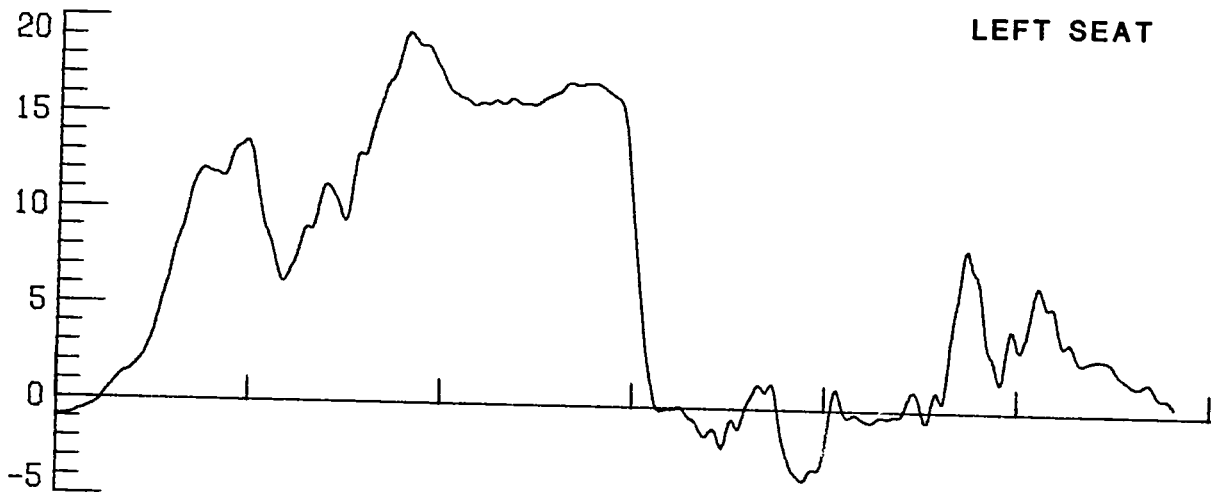
ACCELERATION (G)

Y

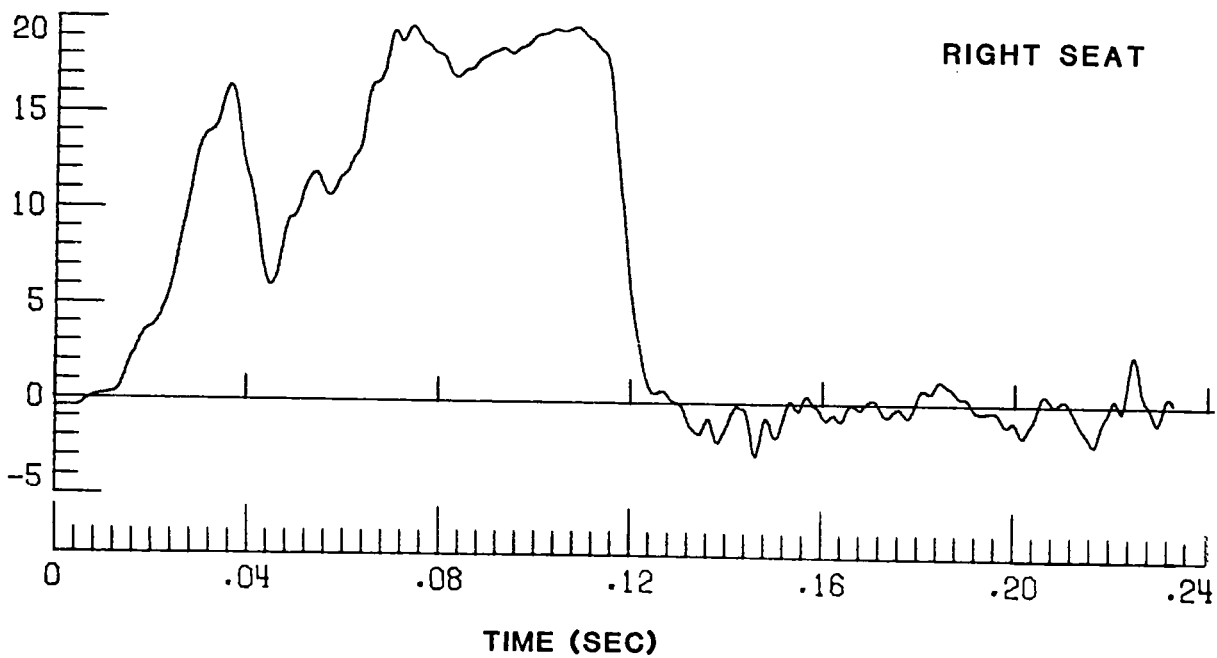


TIME (SEC)

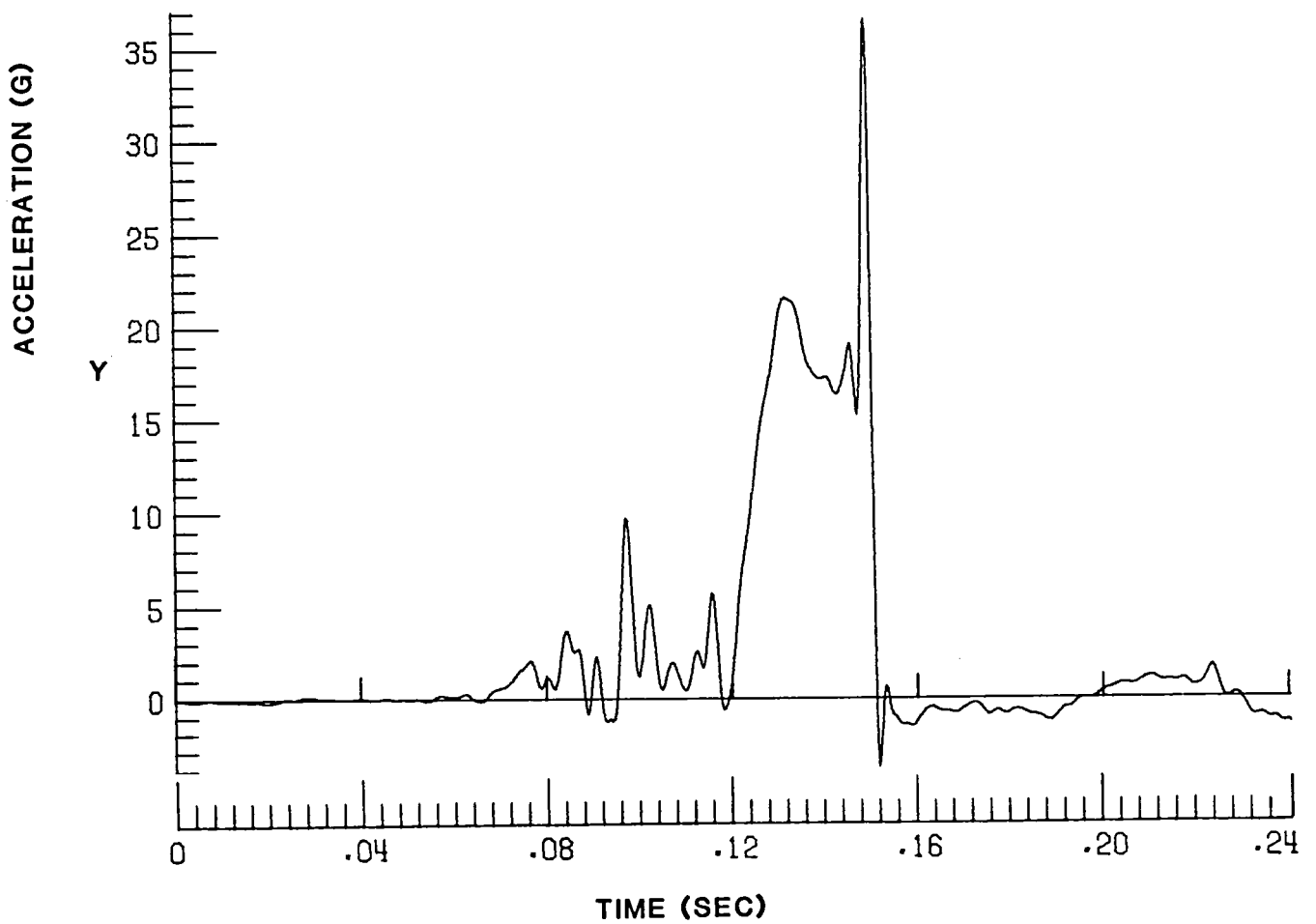
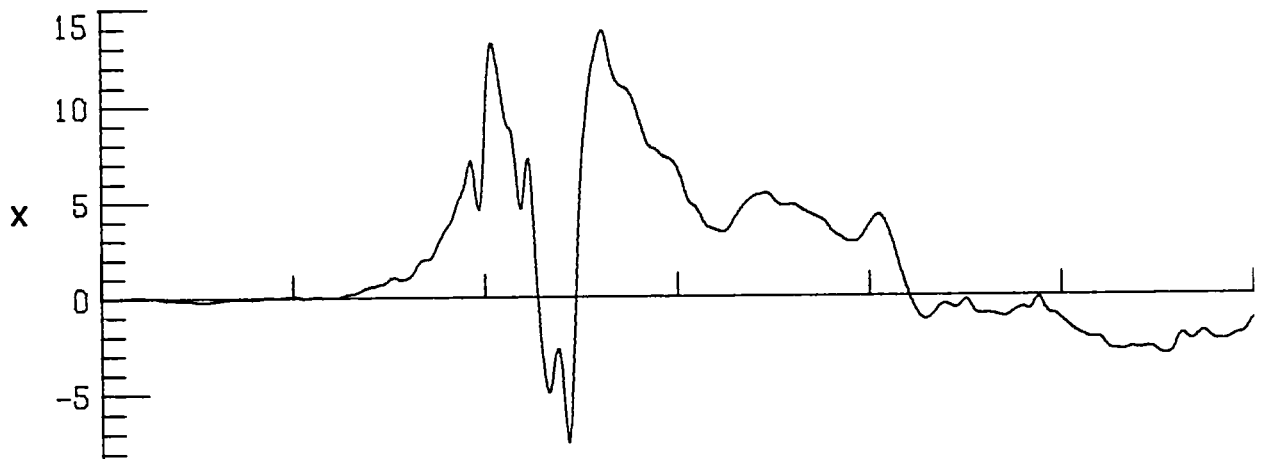
CAPSULE C.G.
NASA TEST NO. 6



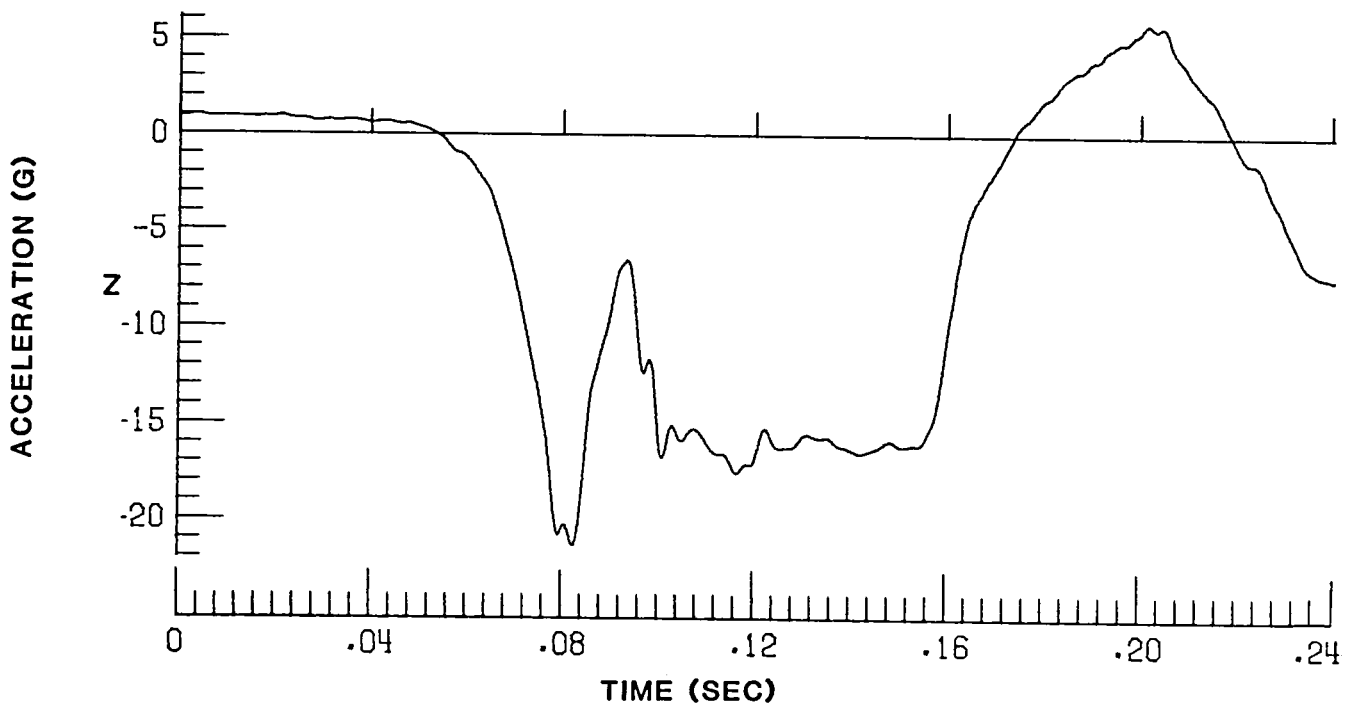
ACCELERATION (G)



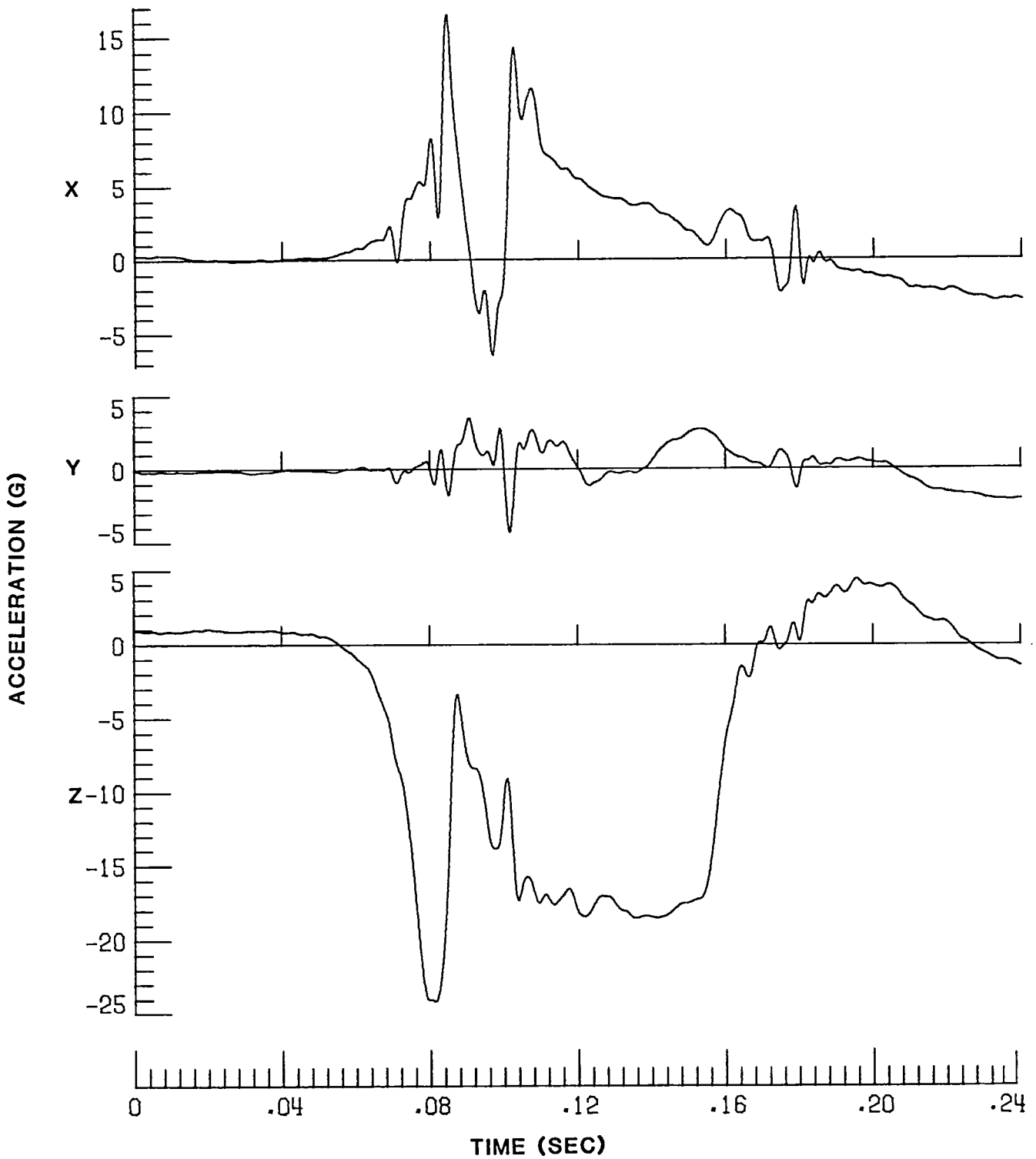
SEAT PAN ALONG BACK TANGENT LINE
 NASA TEST NO. 6
 100



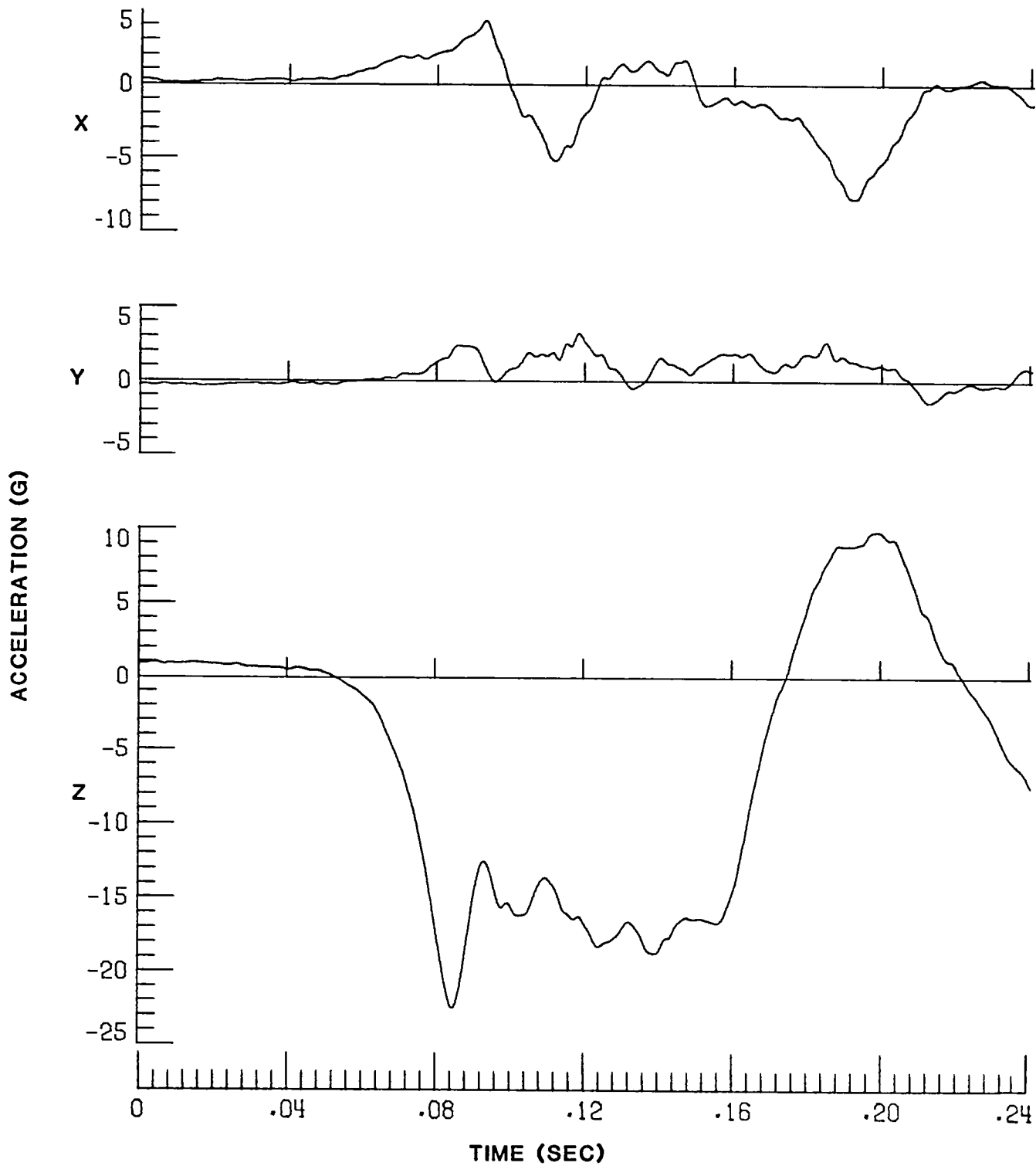
LEFT DUMMY PELVIS
NASA TEST NO. 6



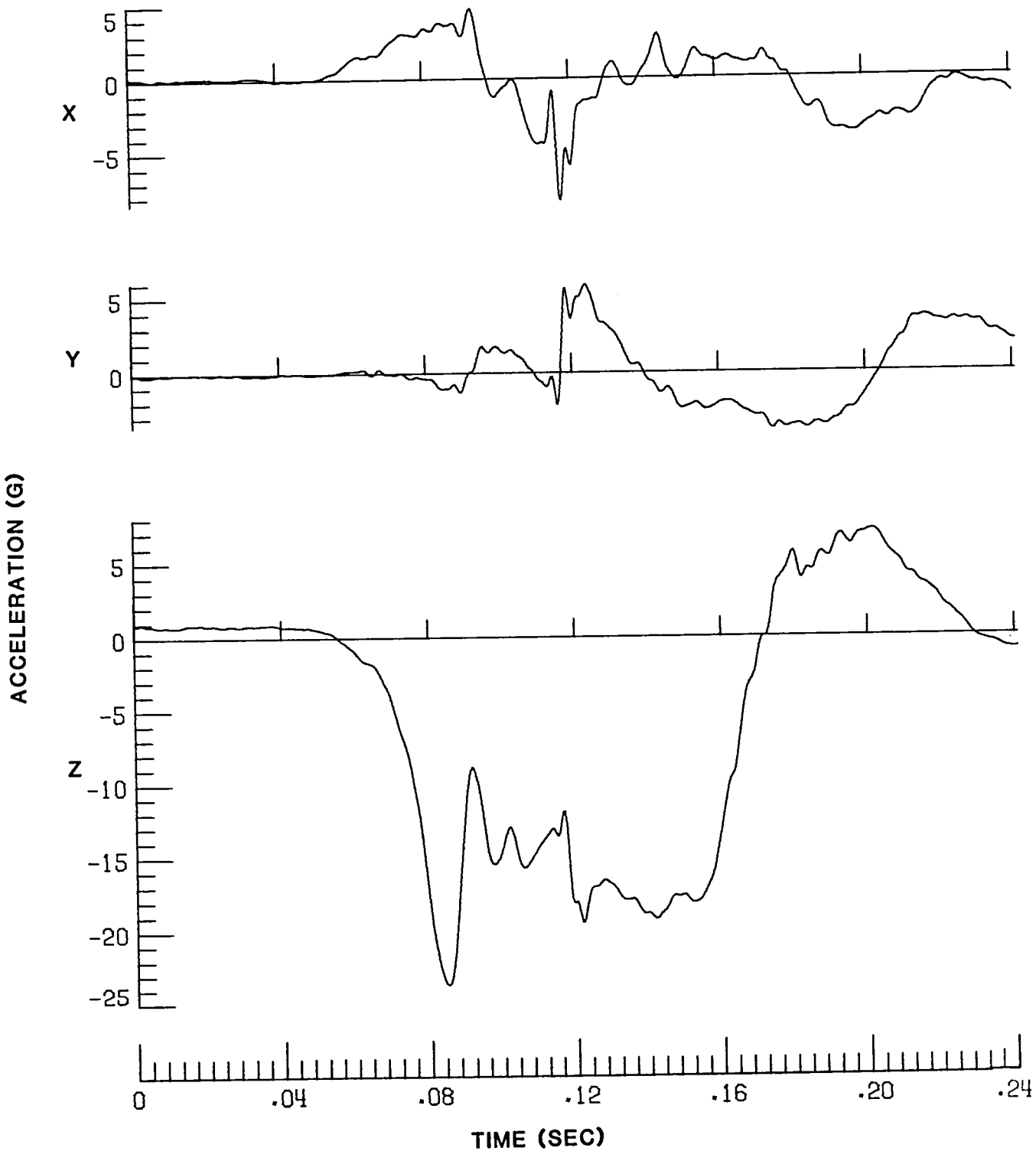
LEFT DUMMY PELVIS
NASA TEST NO. 6



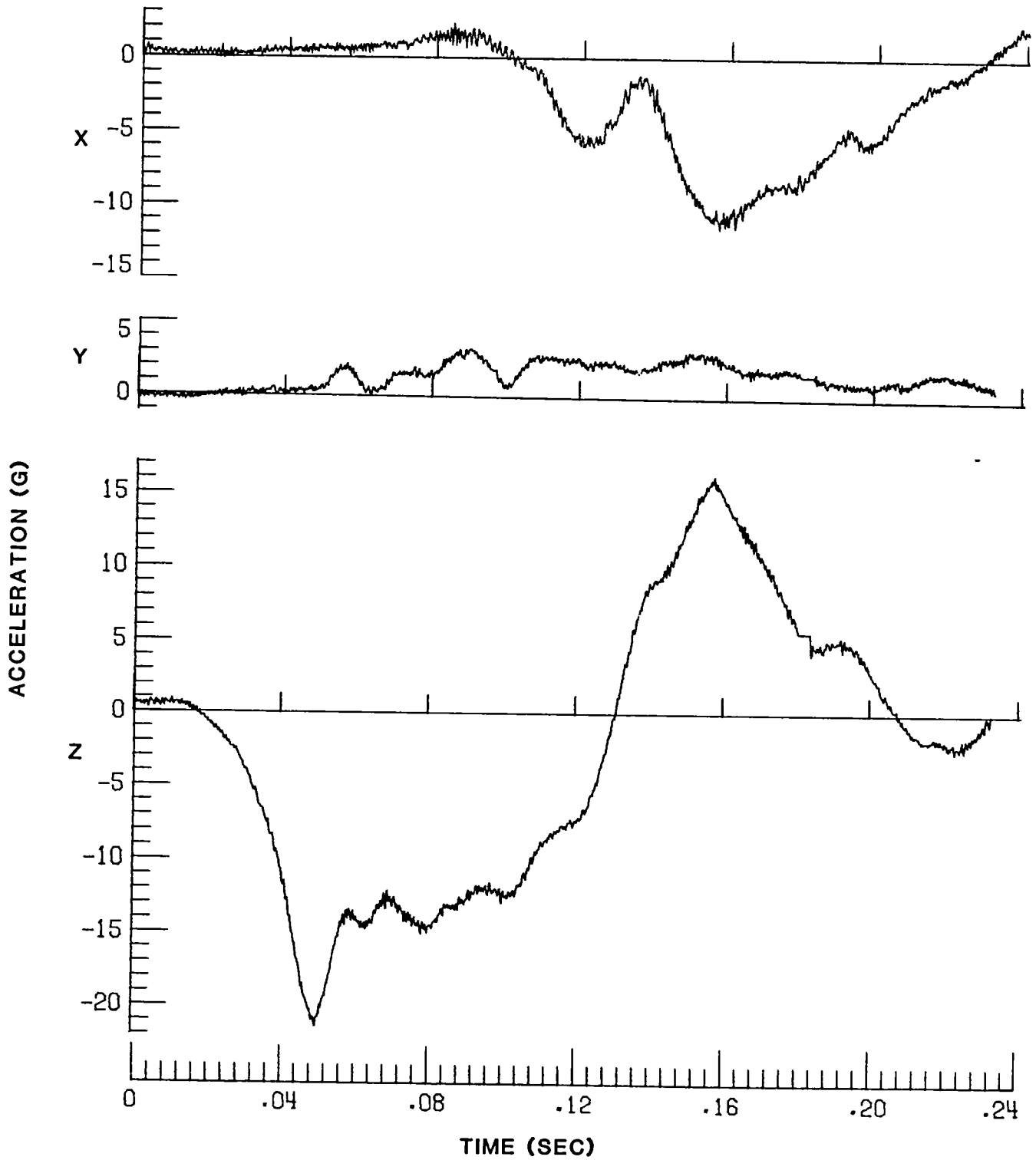
RIGHT DUMMY PELVIS
NASA TEST NO. 6



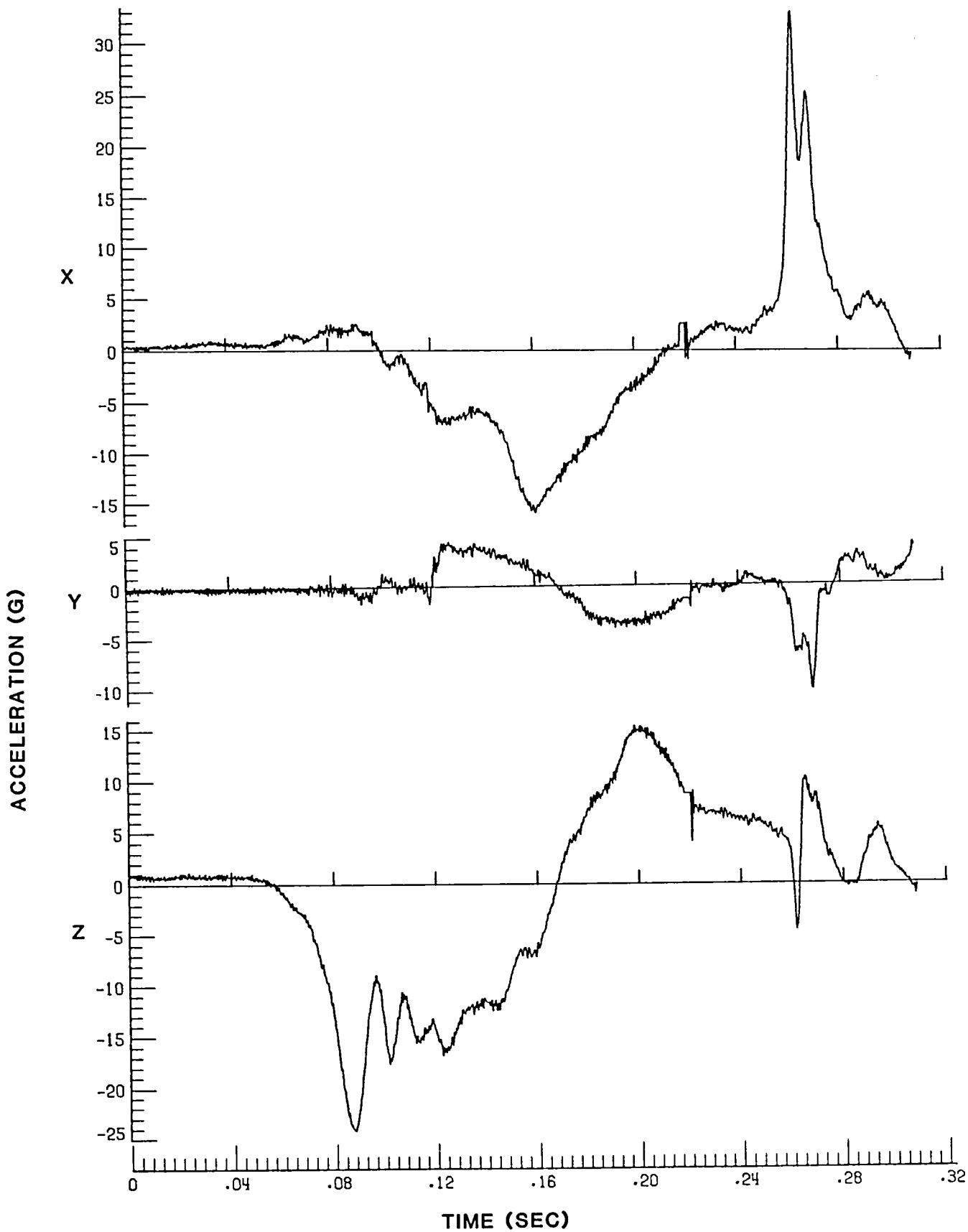
LEFT DUMMY CHEST
NASA TEST NO. 6



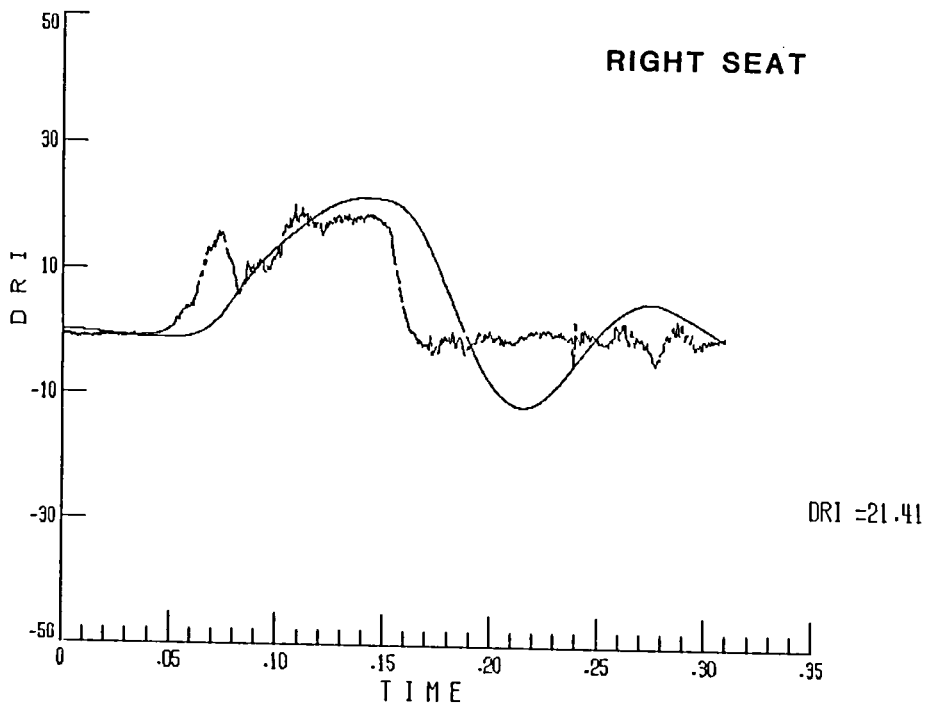
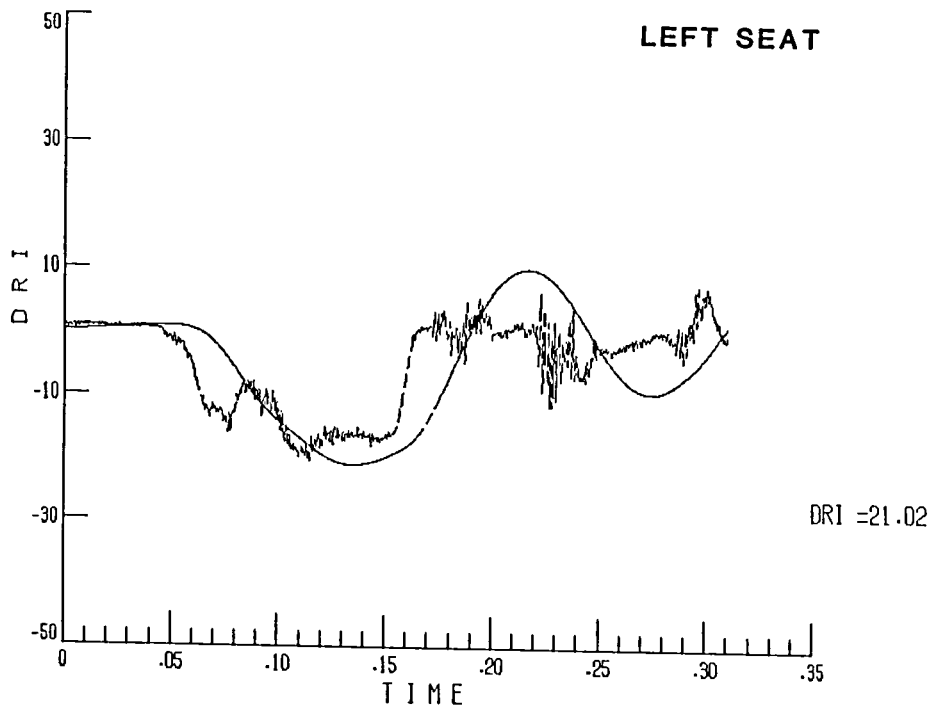
RIGHT DUMMY CHEST
NASA TEST NO. 6



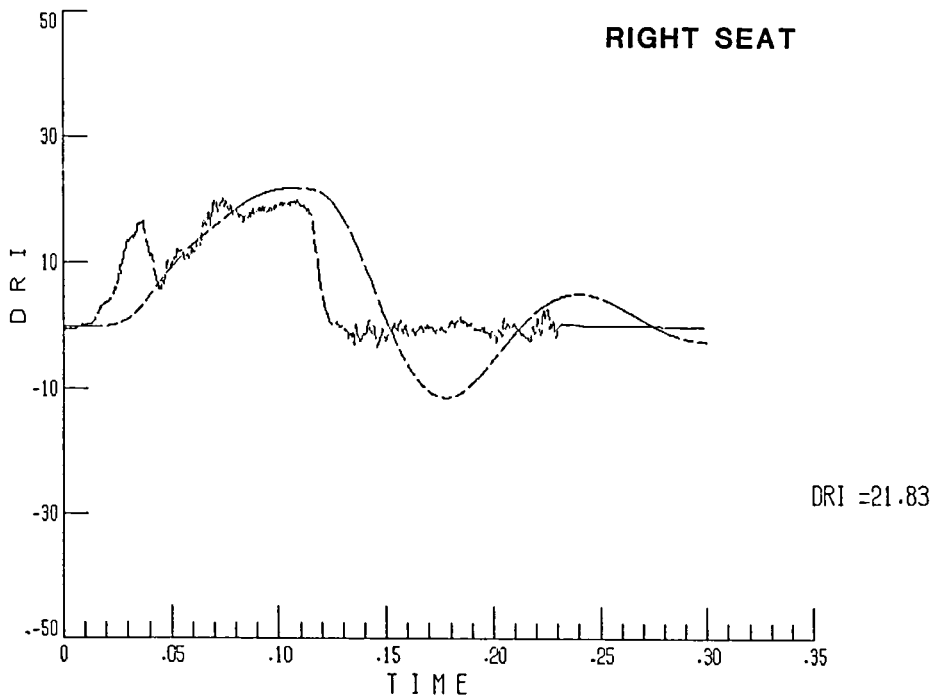
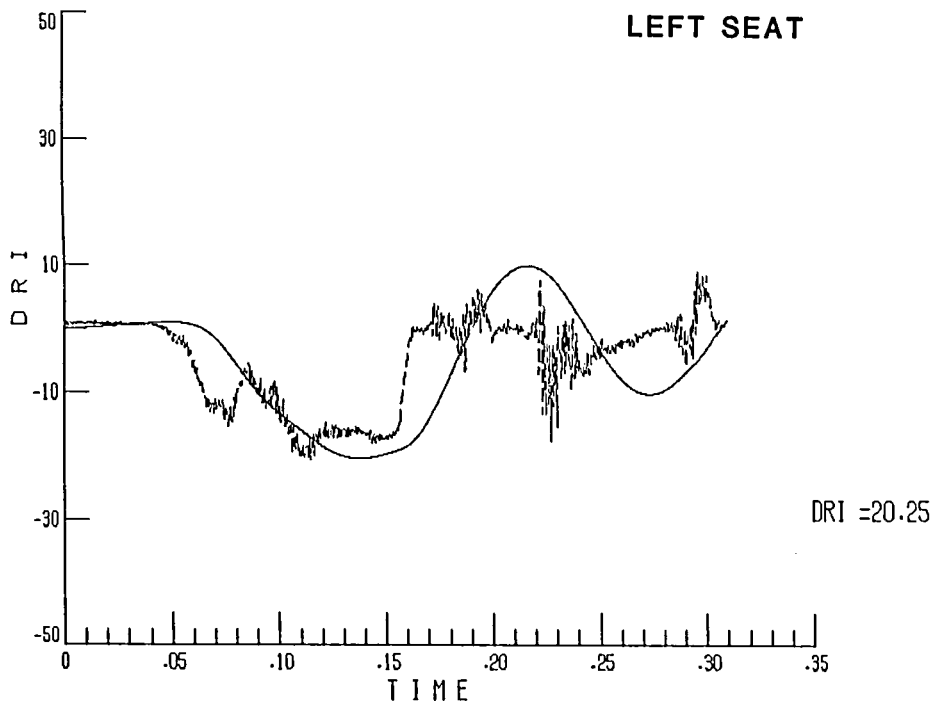
LEFT DUMMY HEAD
NASA TEST NO. 6



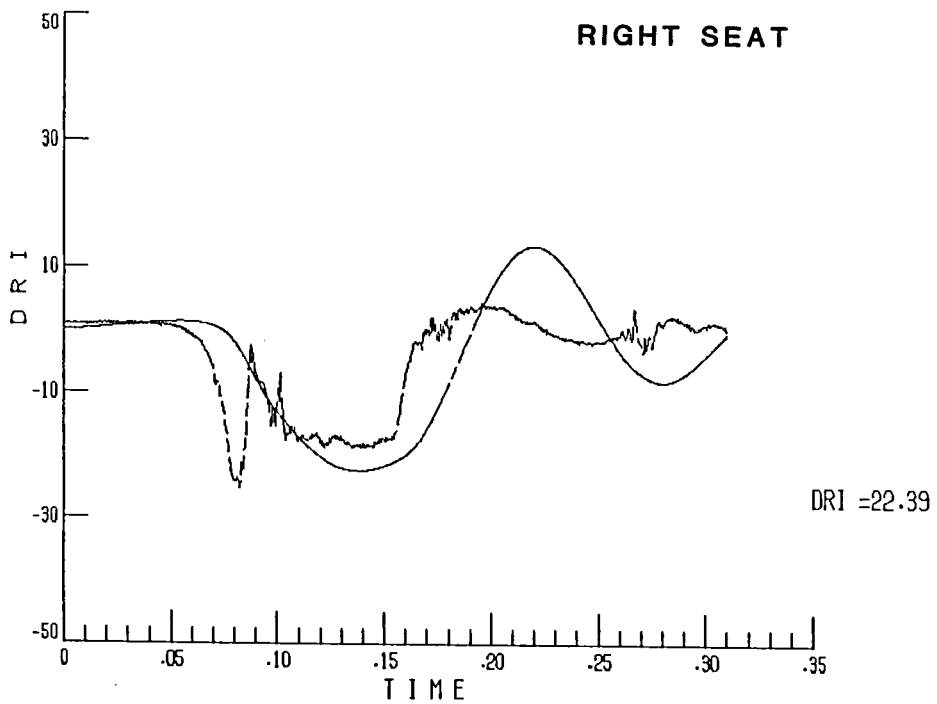
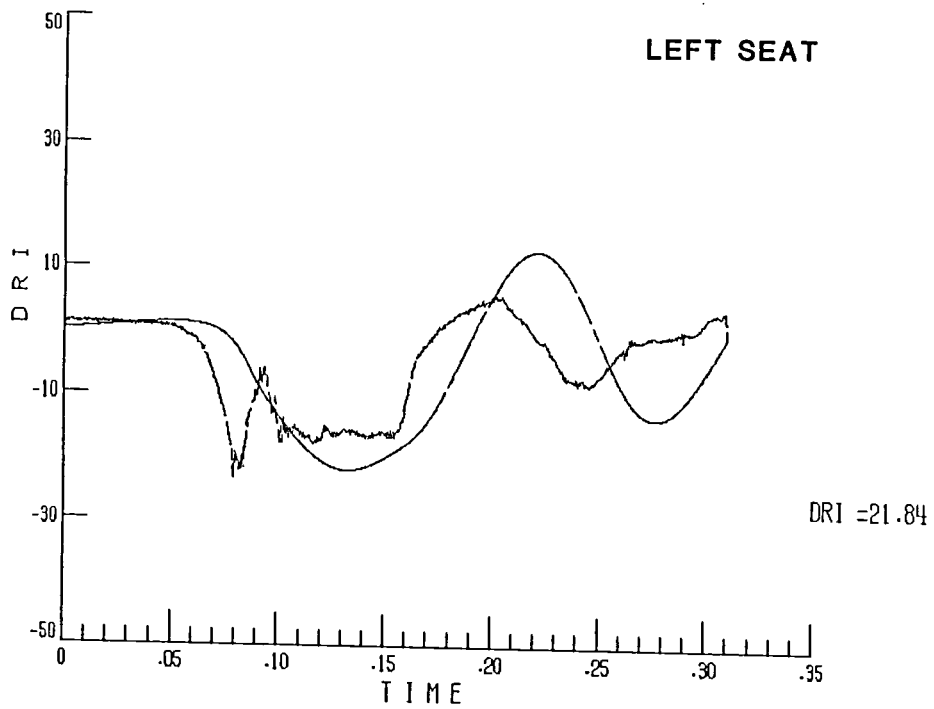
RIGHT DUMMY HEAD
NASA TEST NO. 6



DYNAMIC RESPONSE INDEX
SEAT PAN Z-AXIS
NASA TEST NO. 6
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**DYNAMIC RESPONSE INDEX
BACK TANGENT LINE
NASA TEST NO. 6**



DYNAMIC RESPONSE INDEX
DUMMY PELVIS Z-AXIS
NASA TEST NO. 6

8.0 NASA TEST NO. 7

HORIZONTAL VELOCITY: 43 ft/sec

VERTICAL VELOCITY: 32 ft/sec

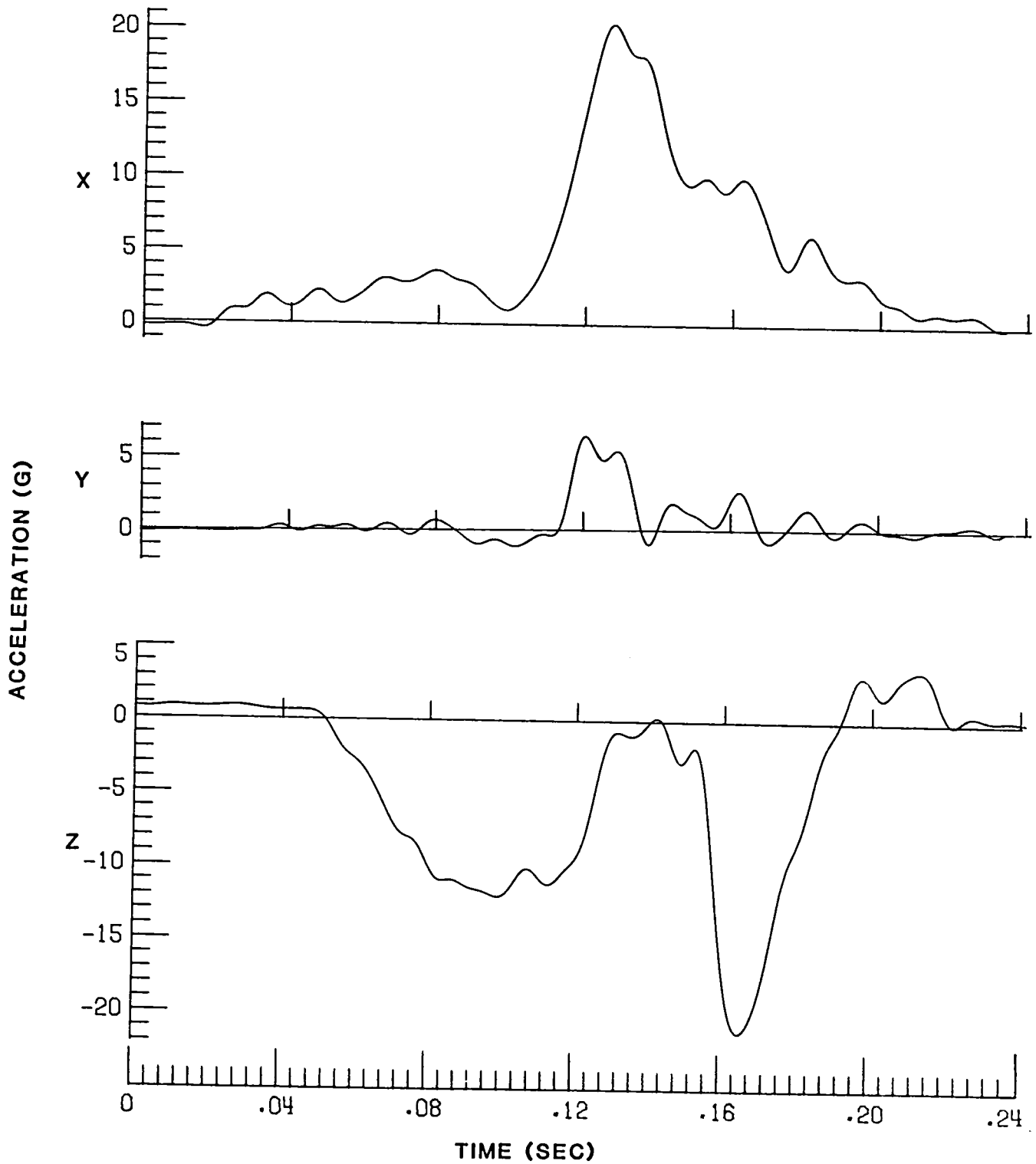
CREW MODULE PITCH: 7°

CREW MODULE ROLL: 0°

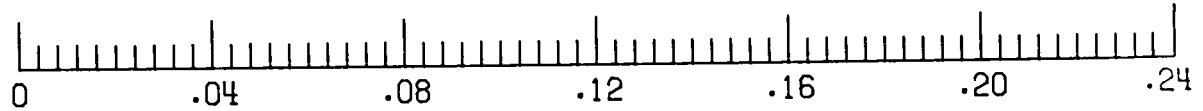
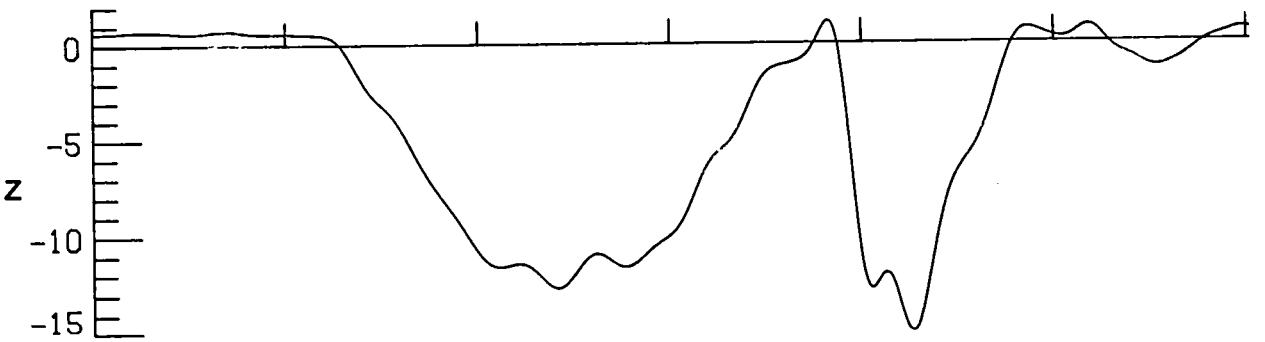
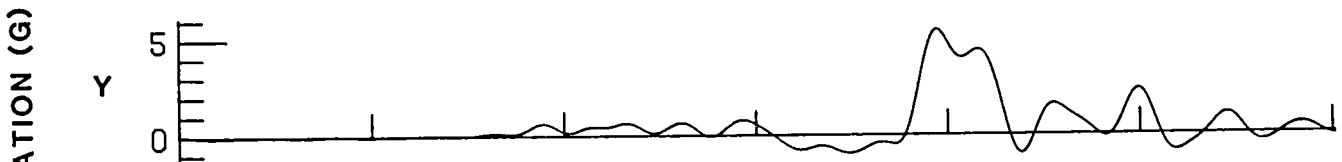
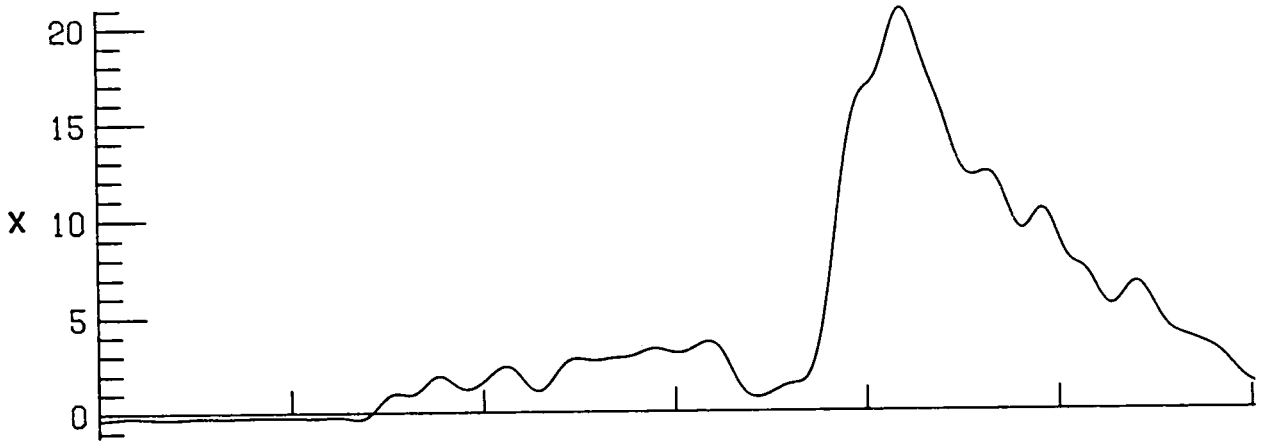
CREW MODULE YAW: 180°

LEFT SEAT: Energy Absorbing

RIGHT SEAT: Energy Absorbing

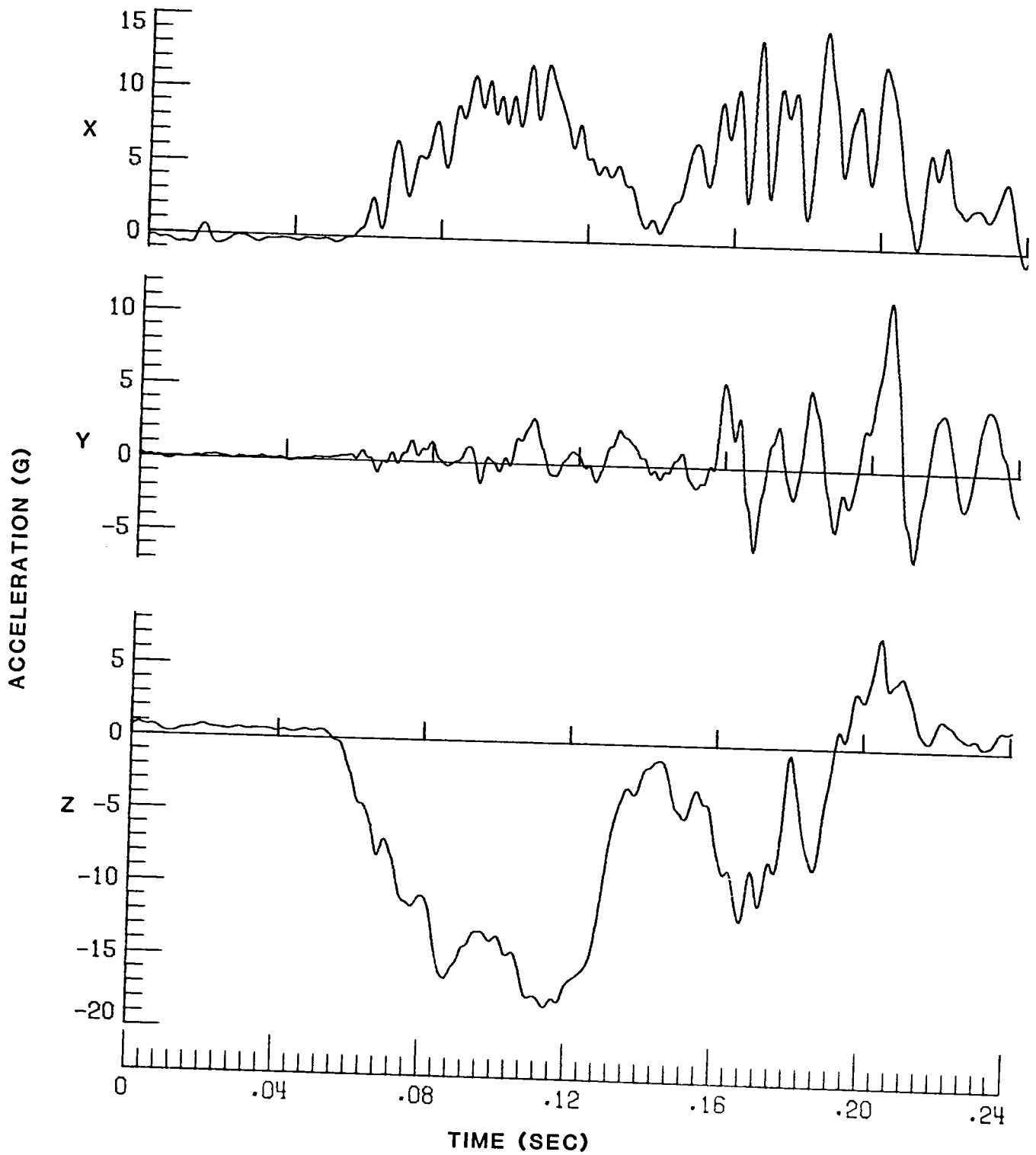


LEFT BULKHEAD
 NASA TEST NO. 7

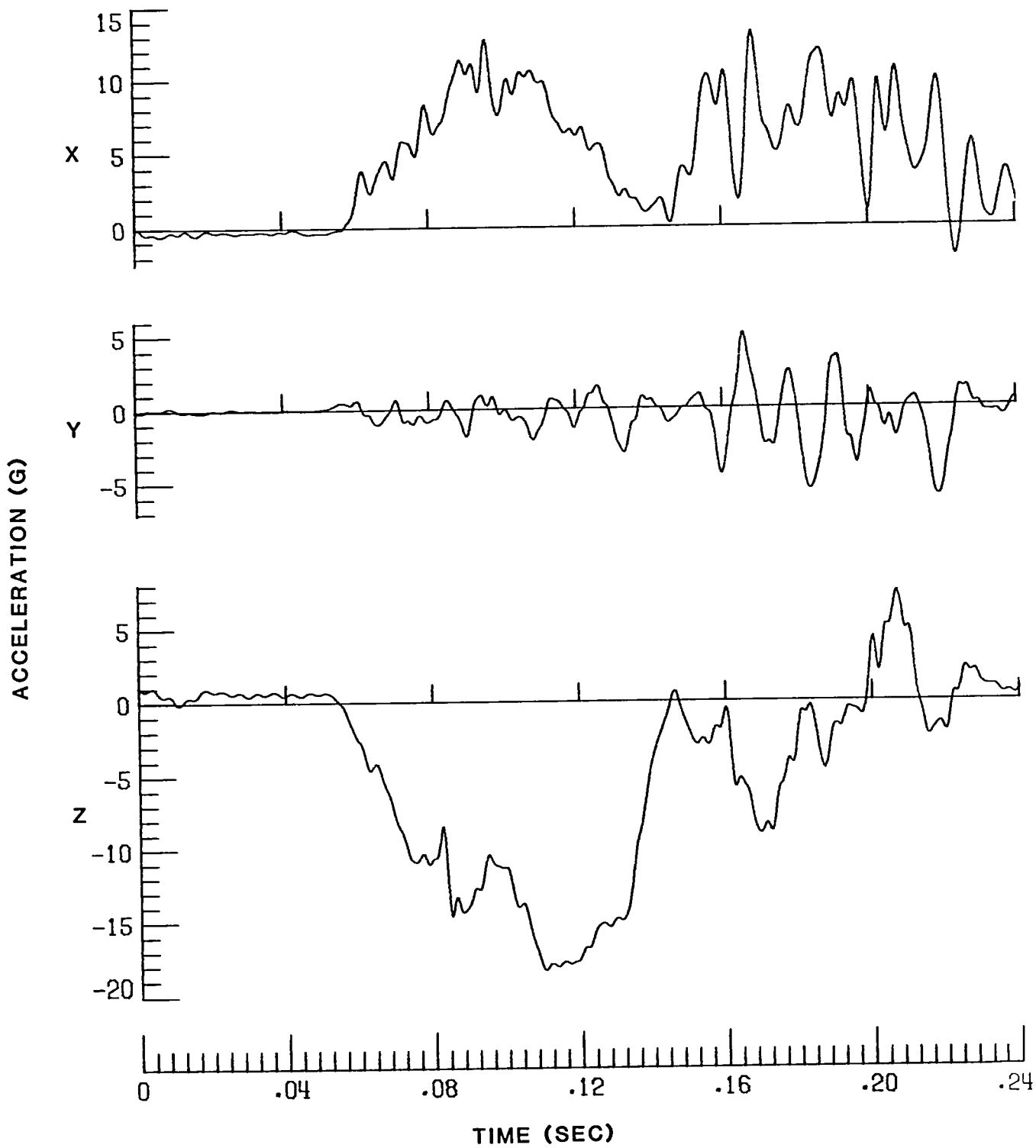


TIME (SEC)

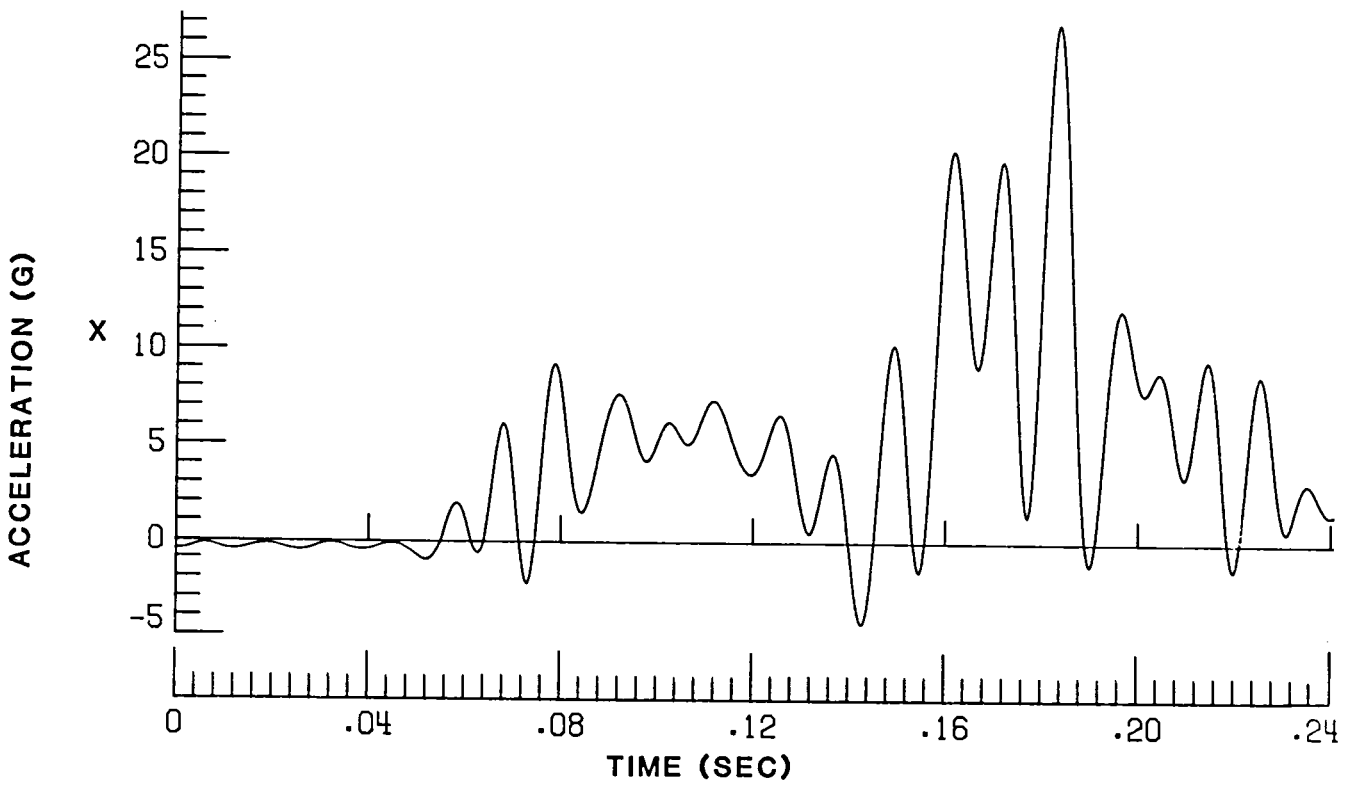
RIGHT BULKHEAD
NASA TEST NO. 7



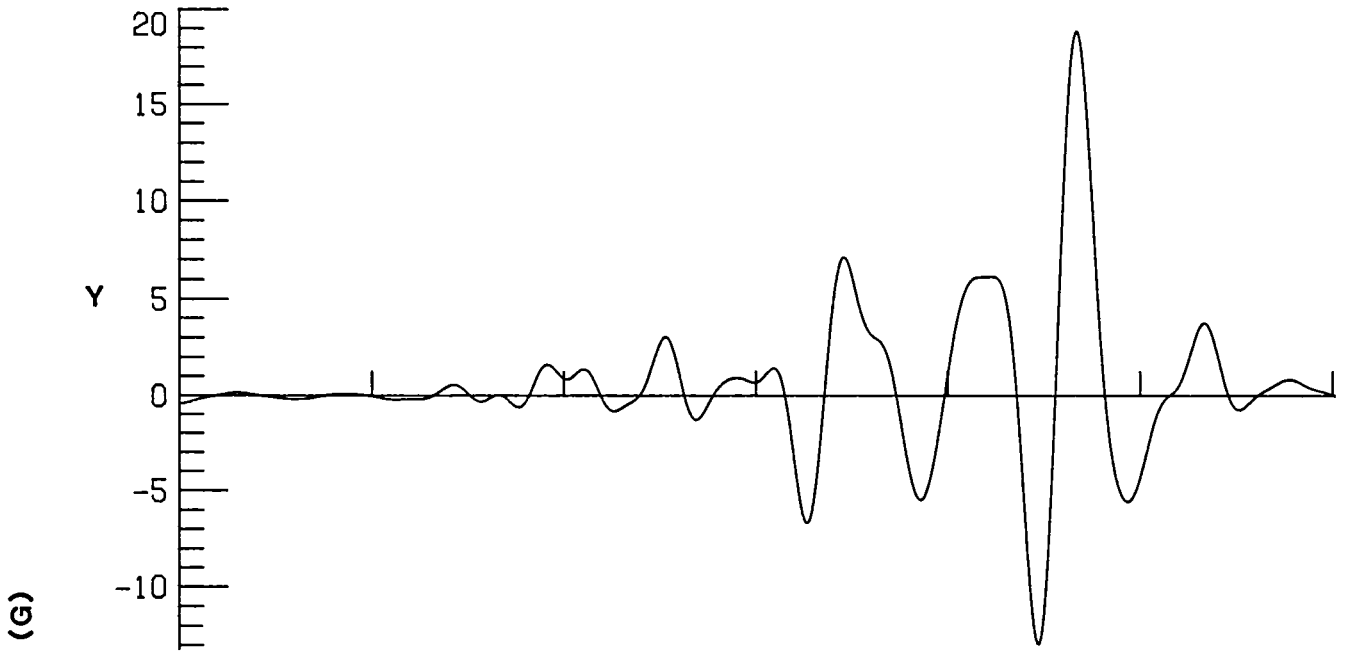
LEFT SEAT PAN
NASA TEST NO. 7



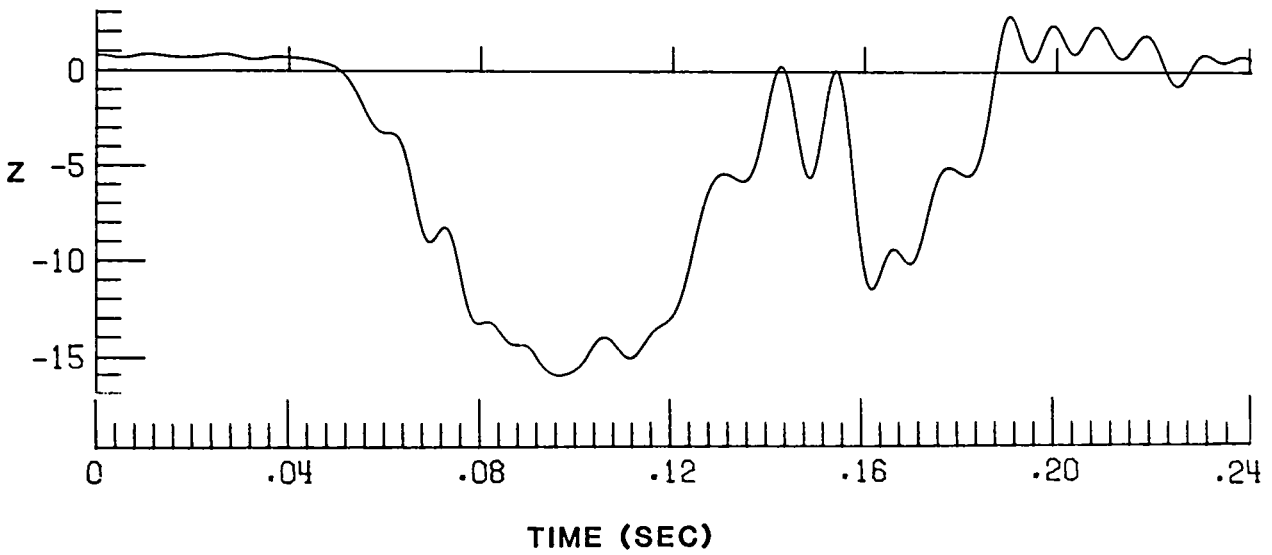
RIGHT SEAT PAN
NASA TEST NO. 7



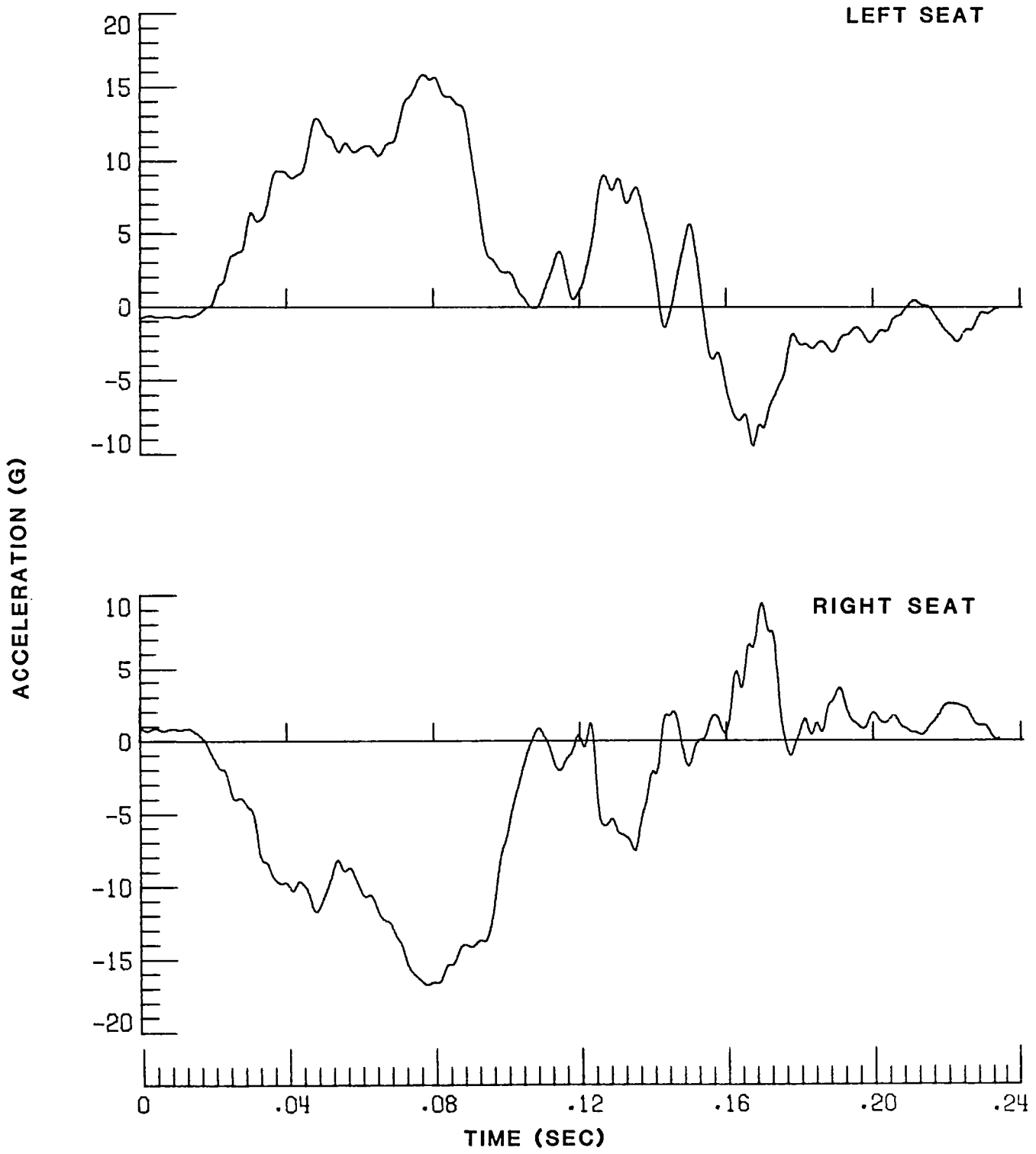
CAPSULE C.G.
NASA TEST NO. 7



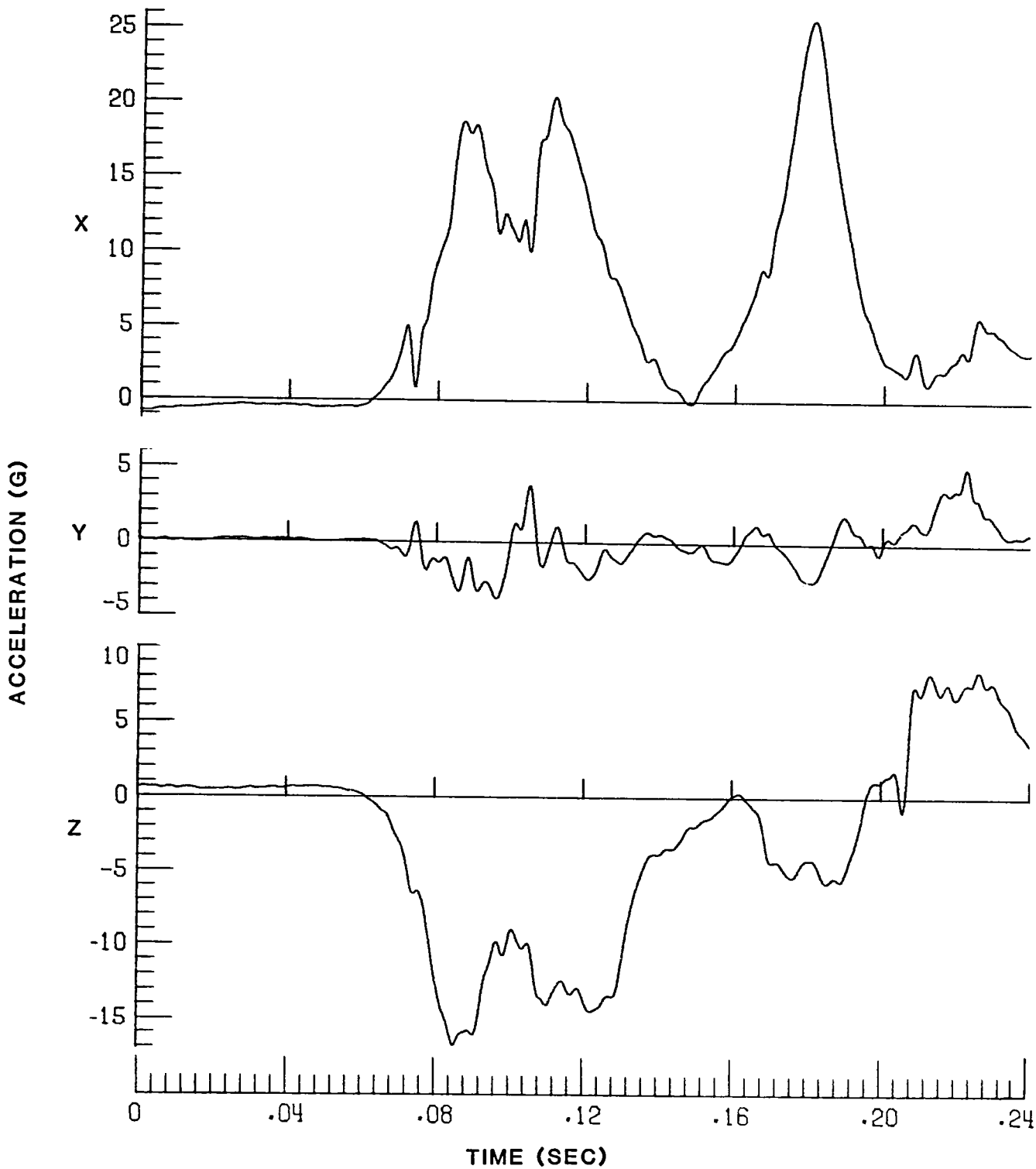
ACCELERATION (G)



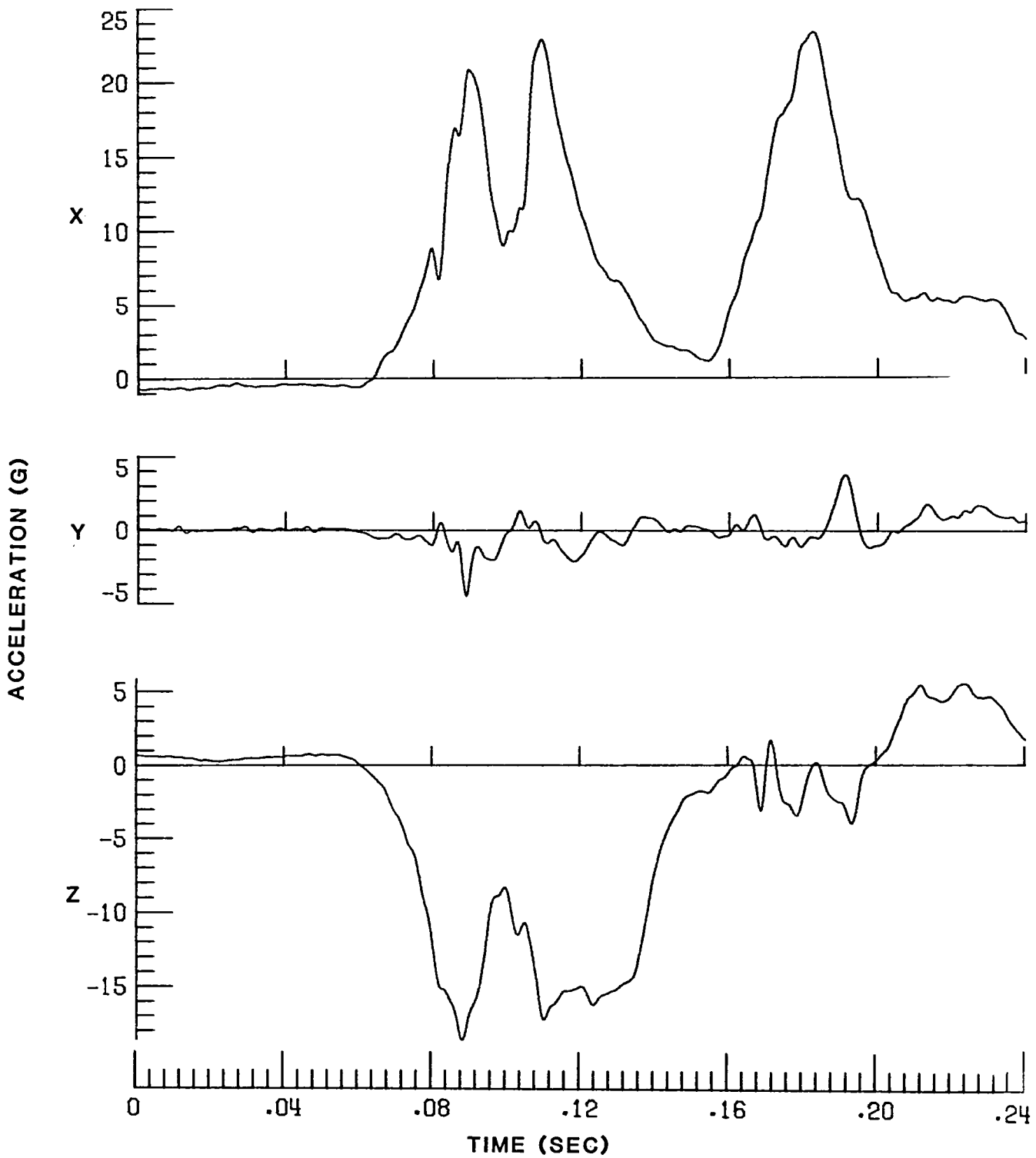
CAPSULE C.G.
NASA TEST NO. 7



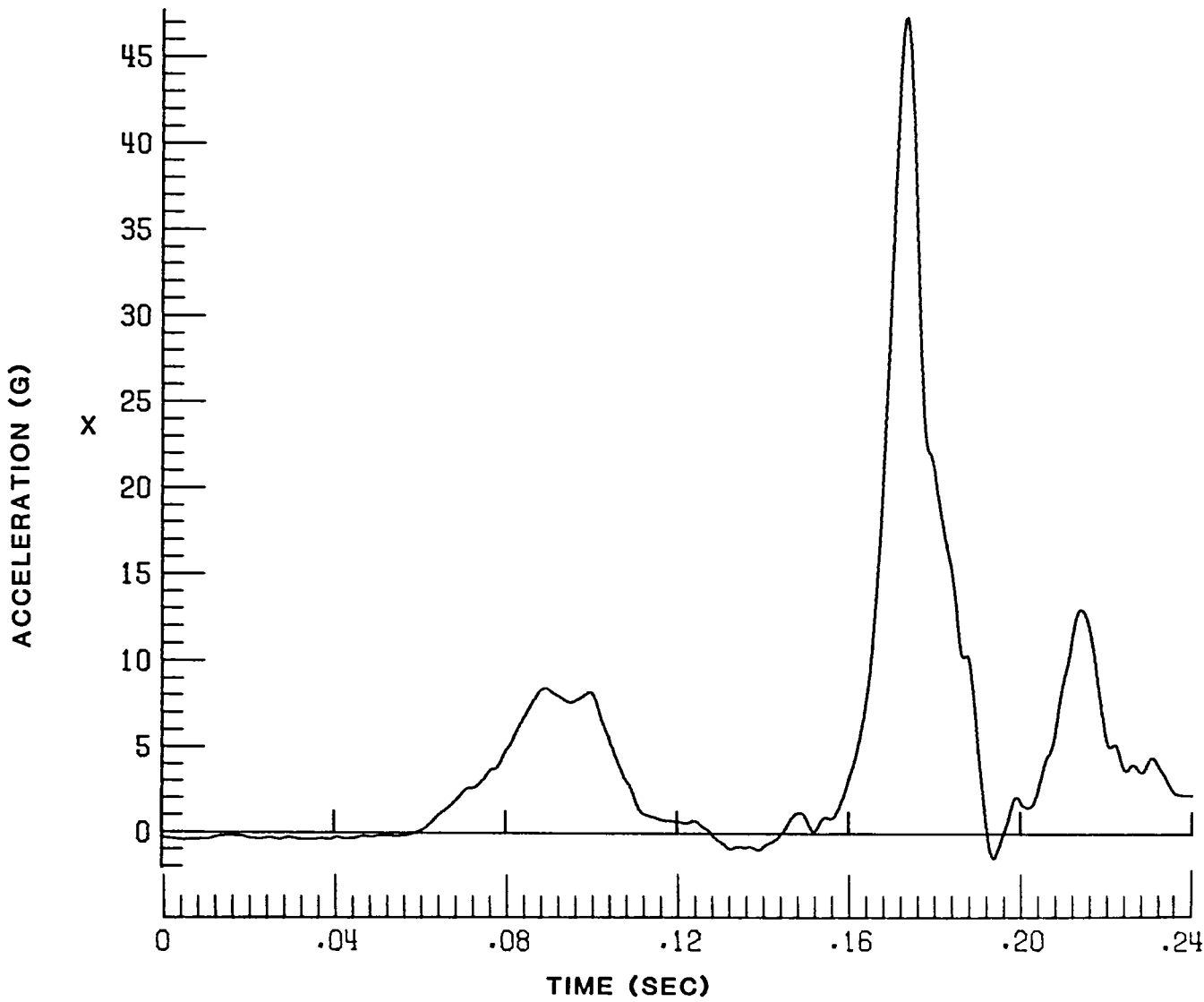
SEAT PAN ALONG BACK TANGENT LINE
NASA TEST NO. 7



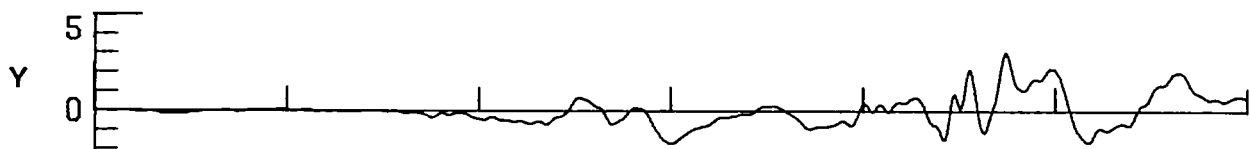
LEFT DUMMY PELVIS
NASA TEST NO. 7



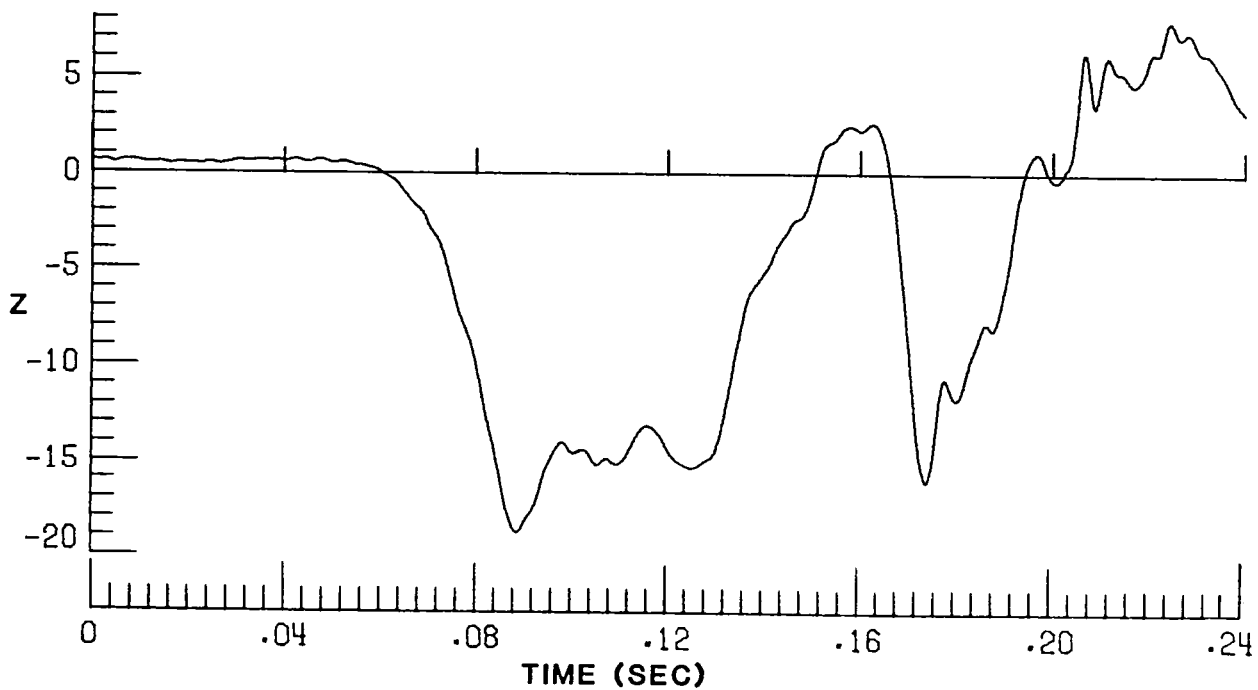
RIGHT DUMMY PELVIS
NASA TEST NO. 7



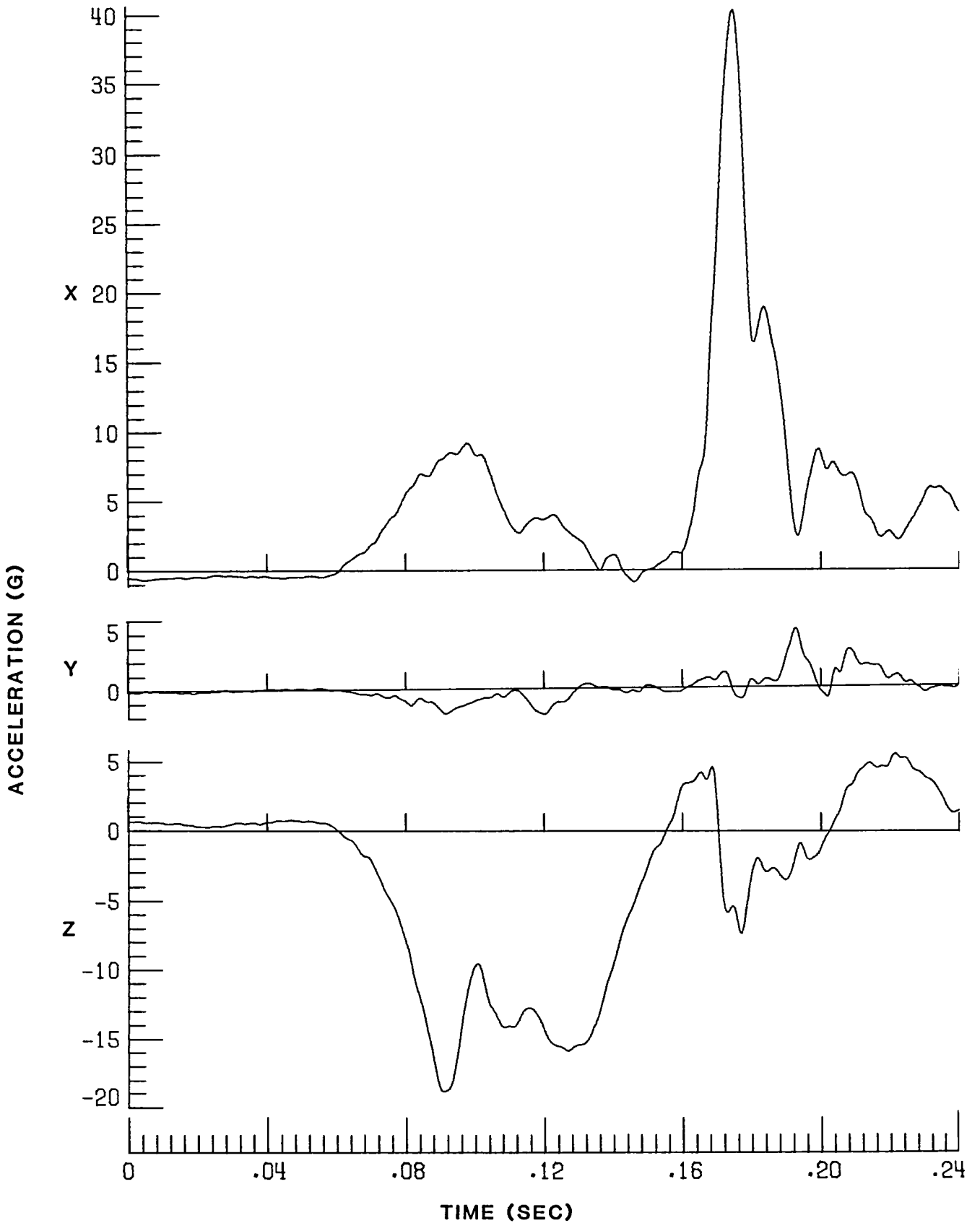
LEFT DUMMY CHEST
NASA TEST NO. 7



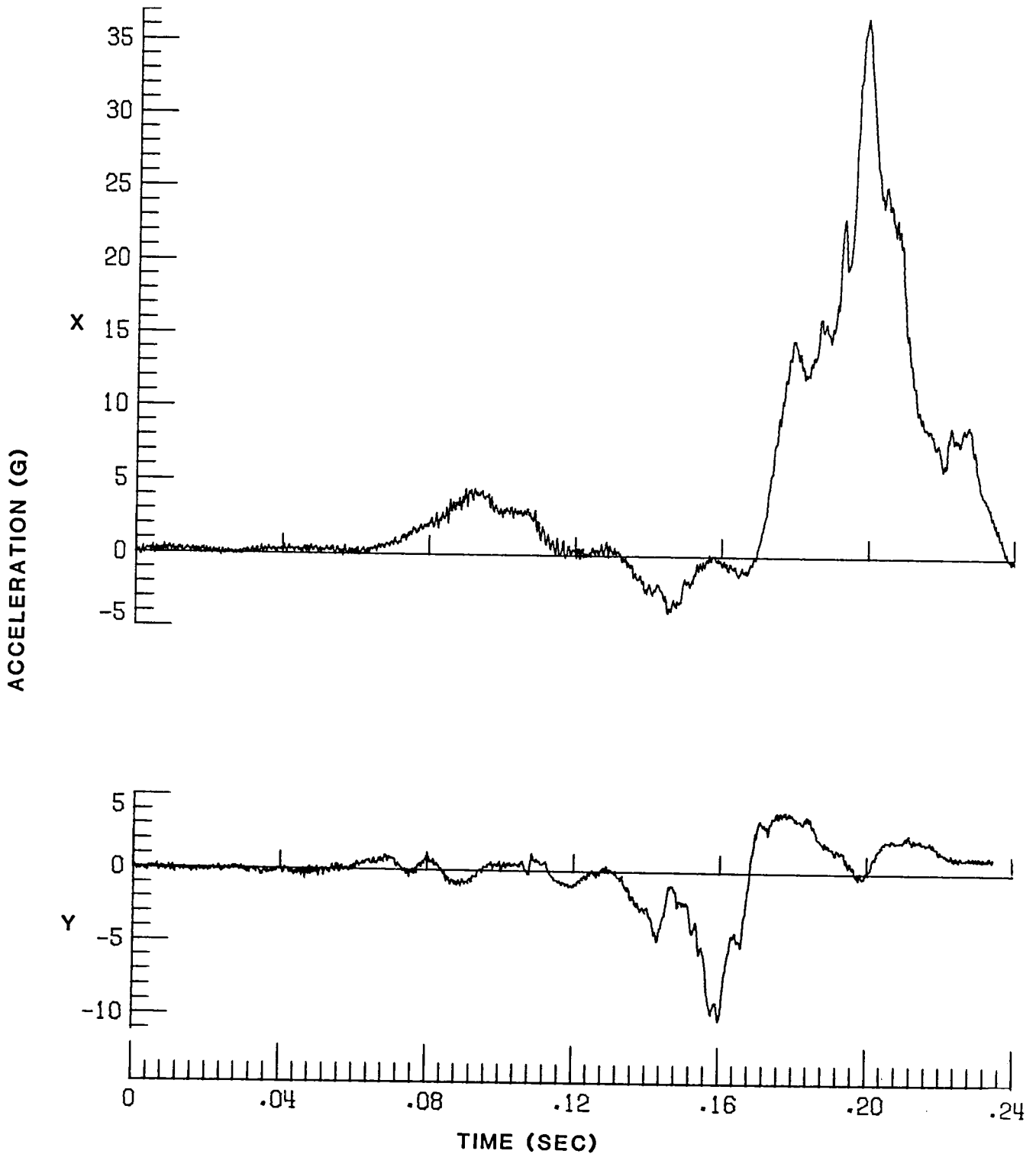
ACCELERATION (G)



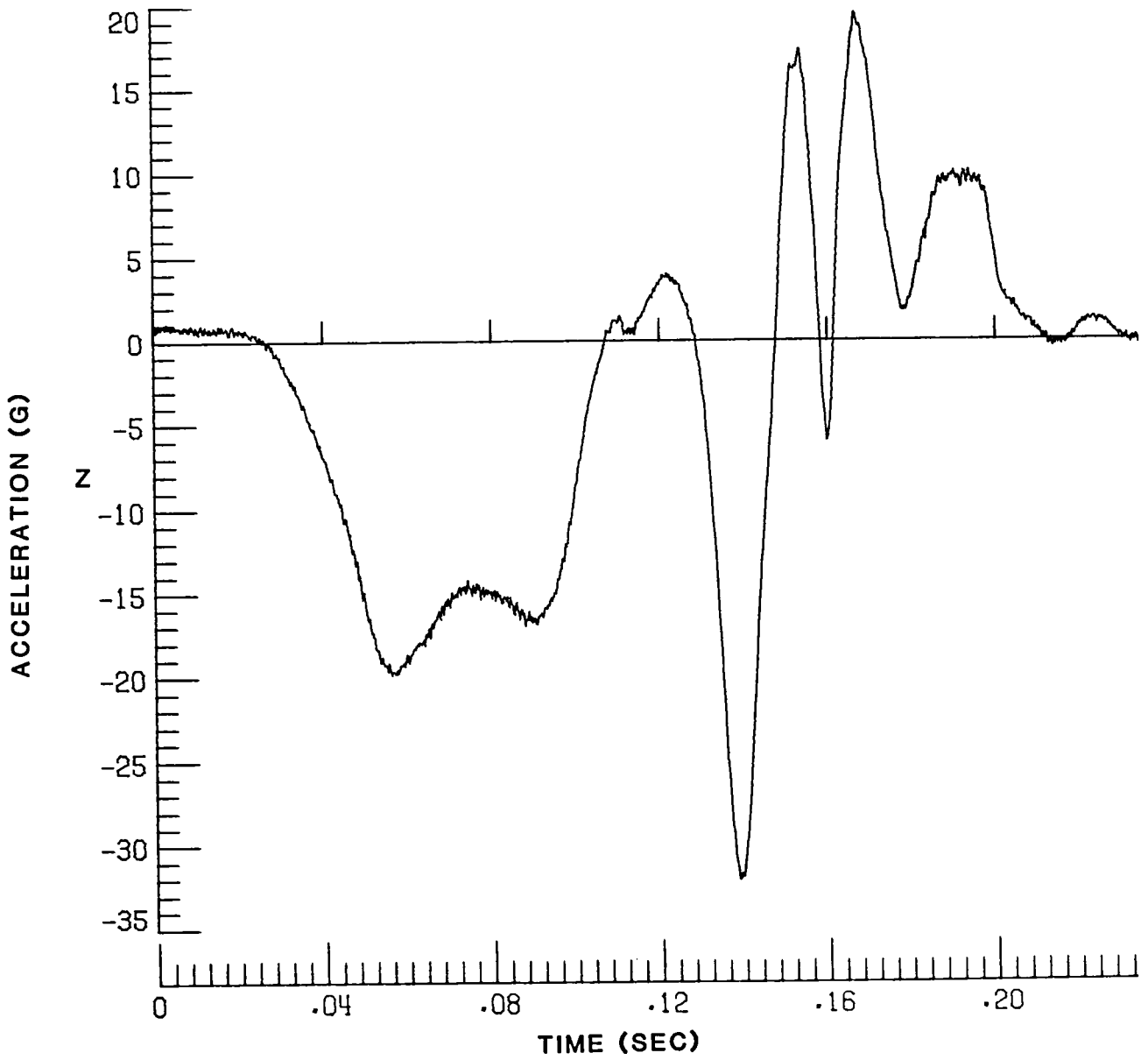
LEFT DUMMY CHEST
NASA TEST NO. 7



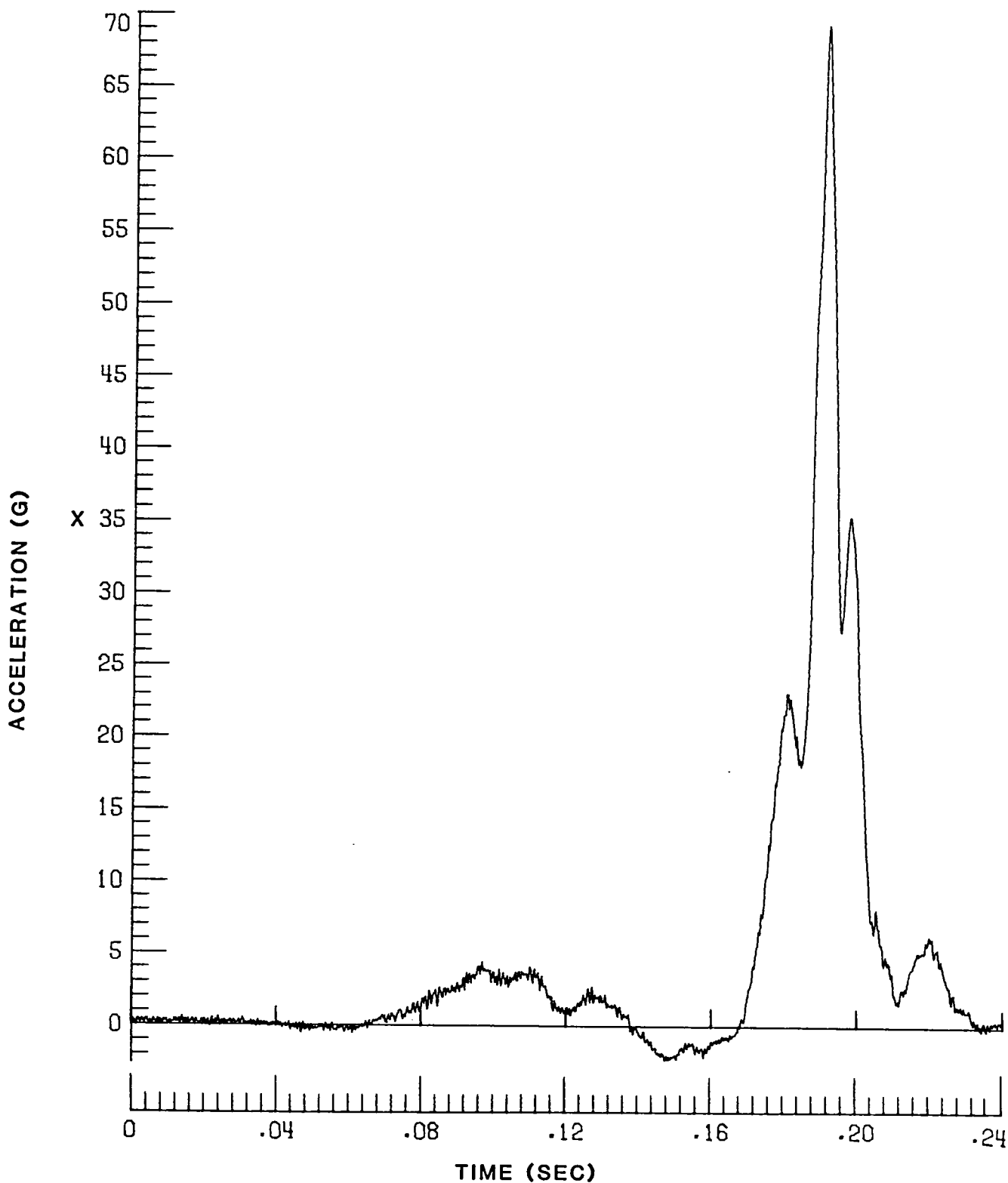
RIGHT DUMMY CHEST
NASA TEST NO. 7



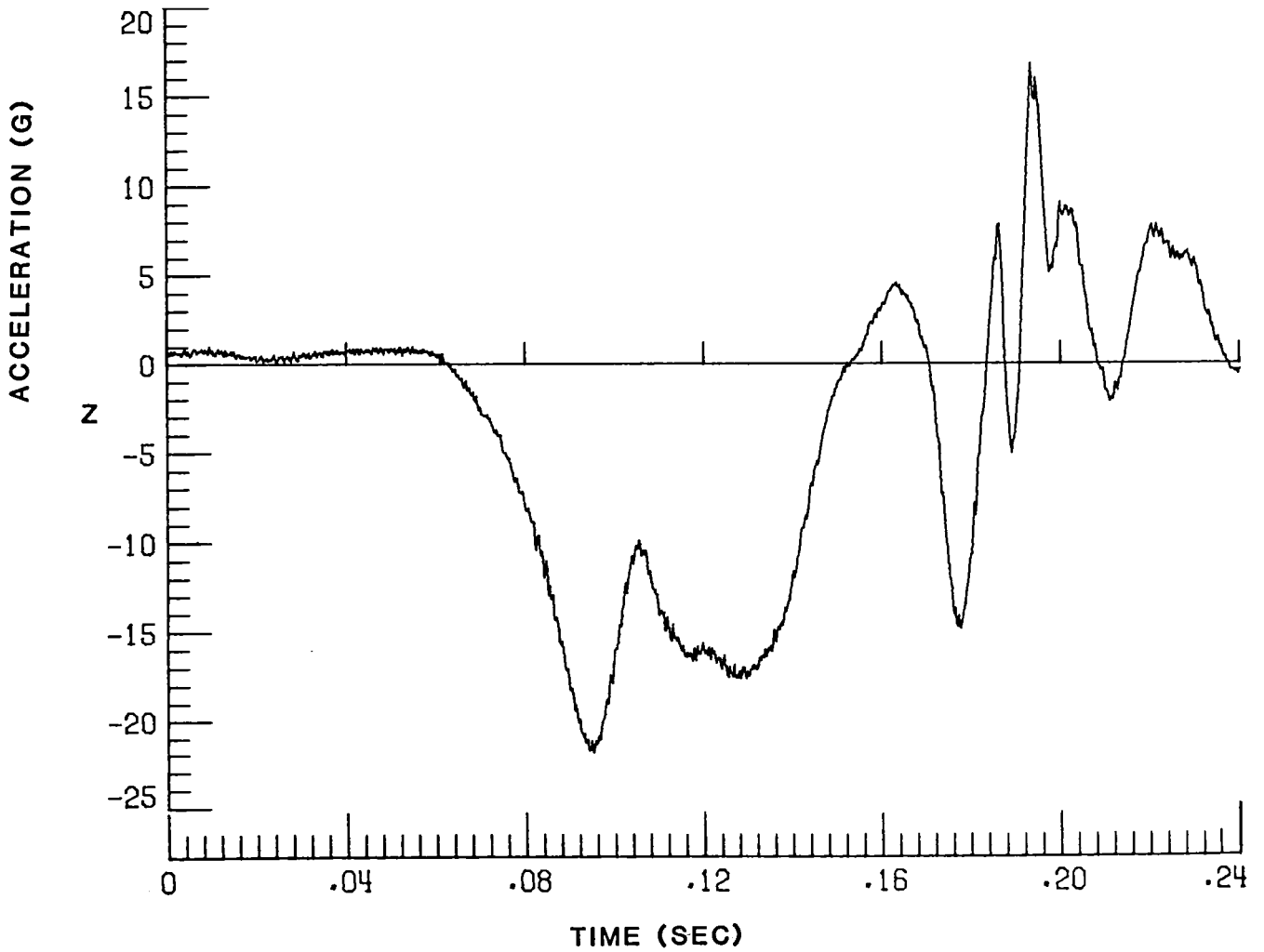
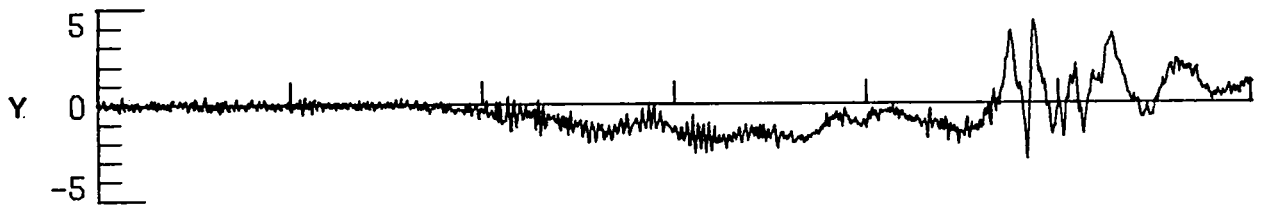
LEFT DUMMY HEAD
NASA TEST NO. 7



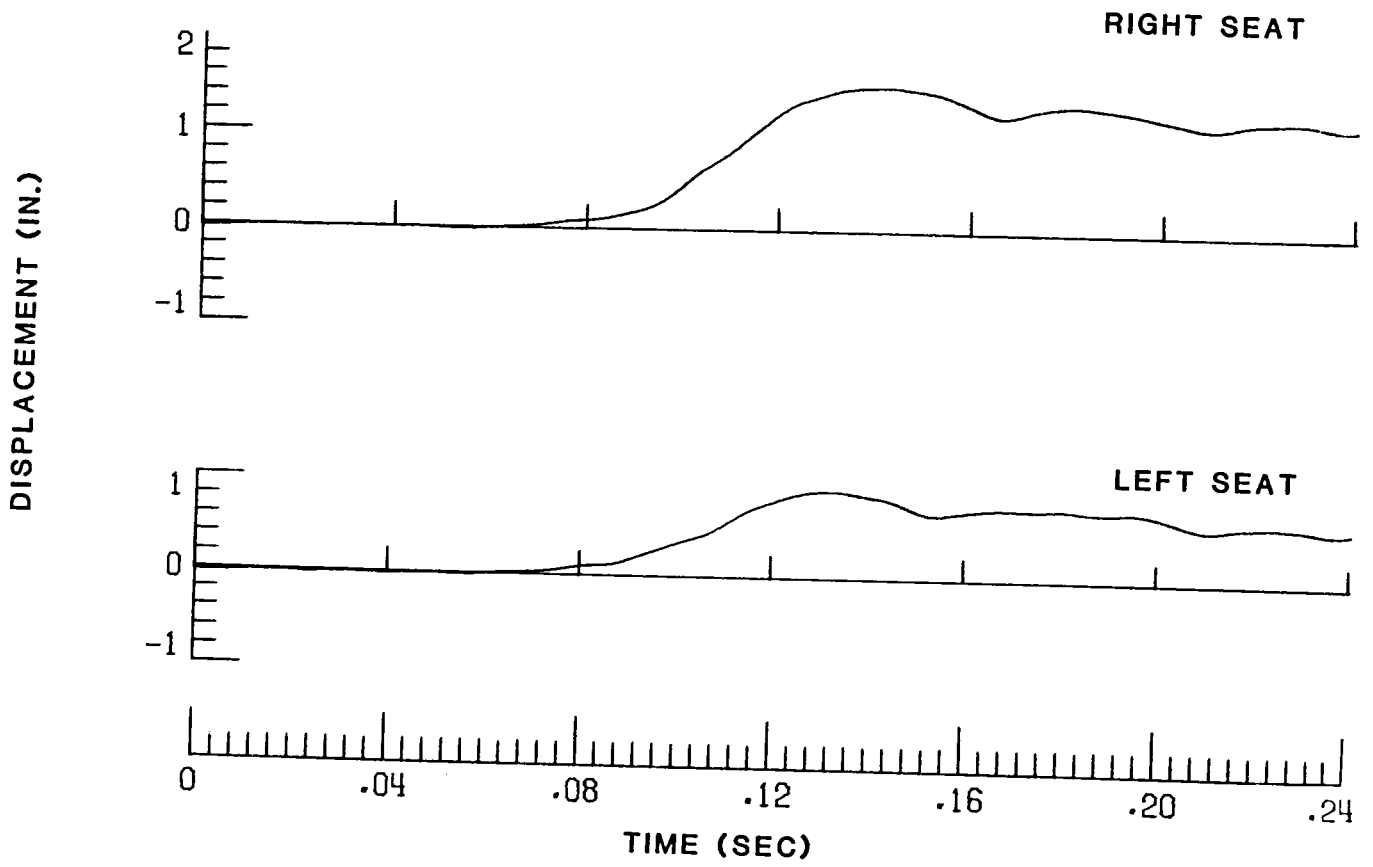
LEFT DUMMY HEAD
NASA TEST NO. 7



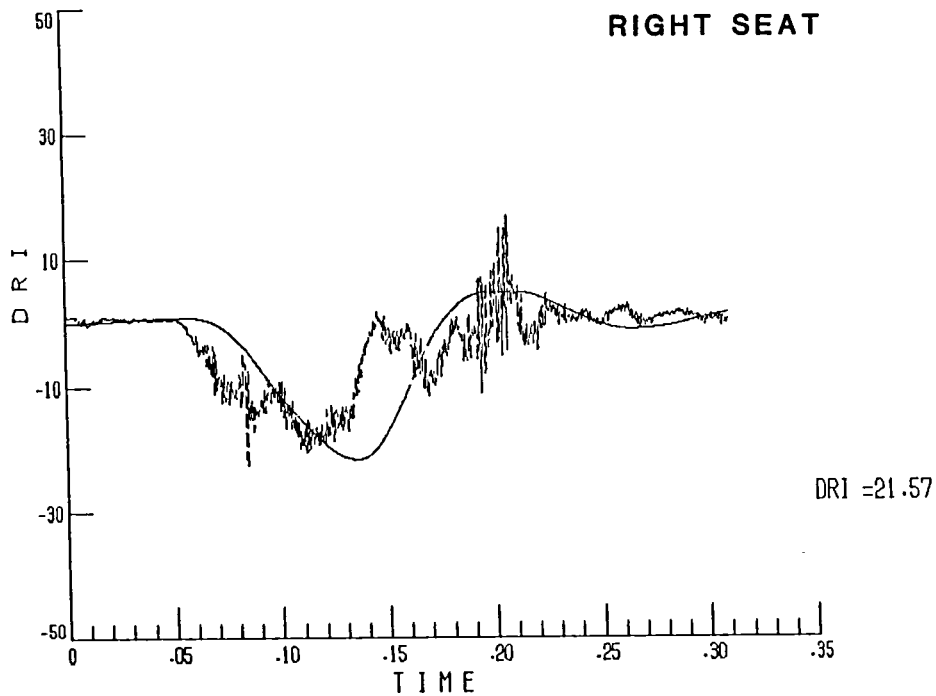
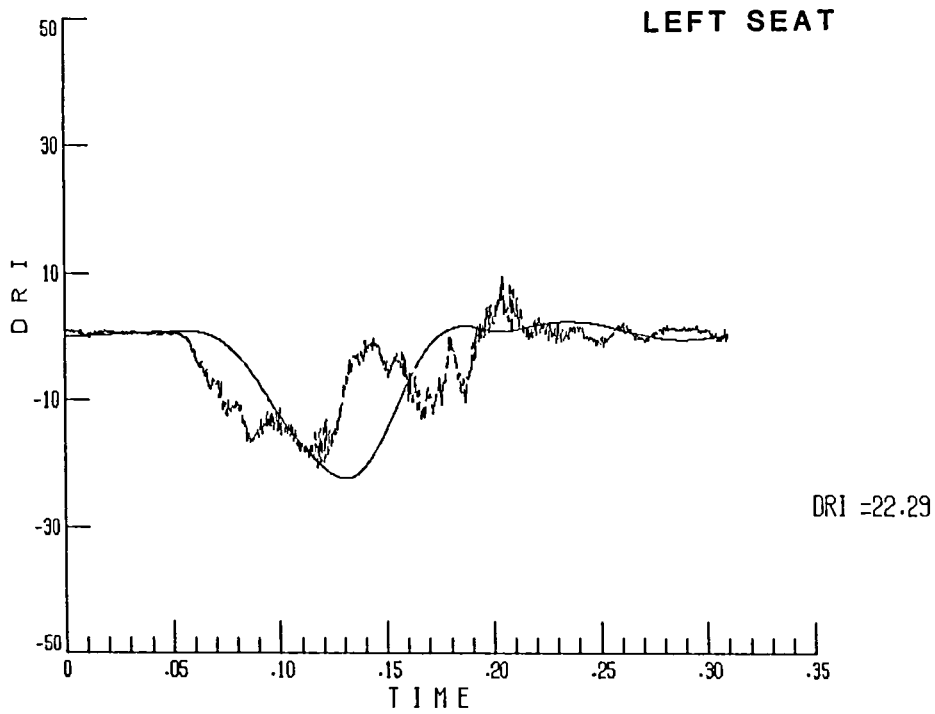
RIGHT DUMMY HEAD
NASA TEST NO. 7



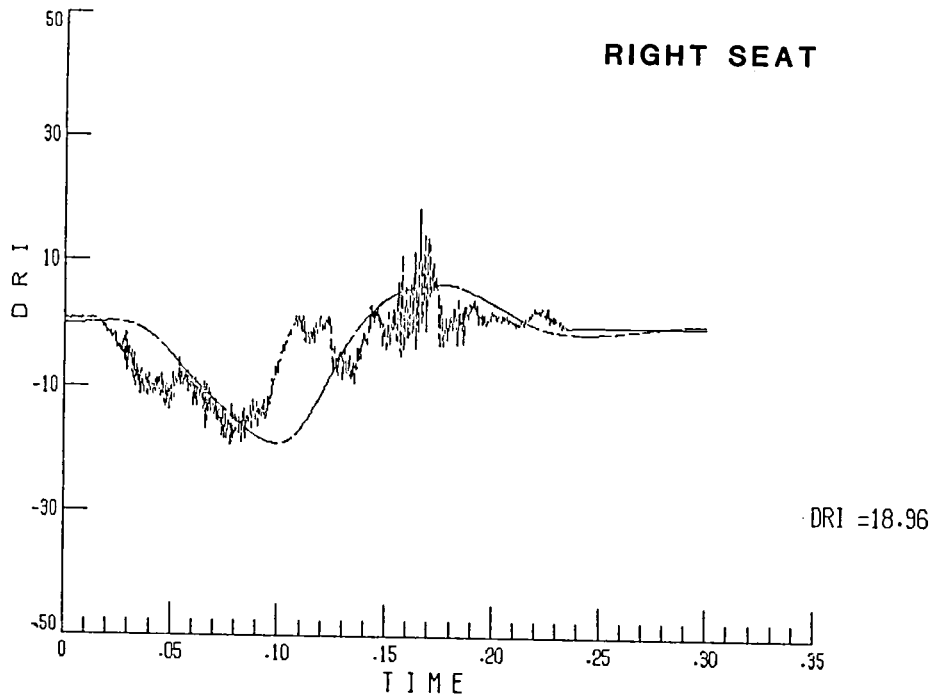
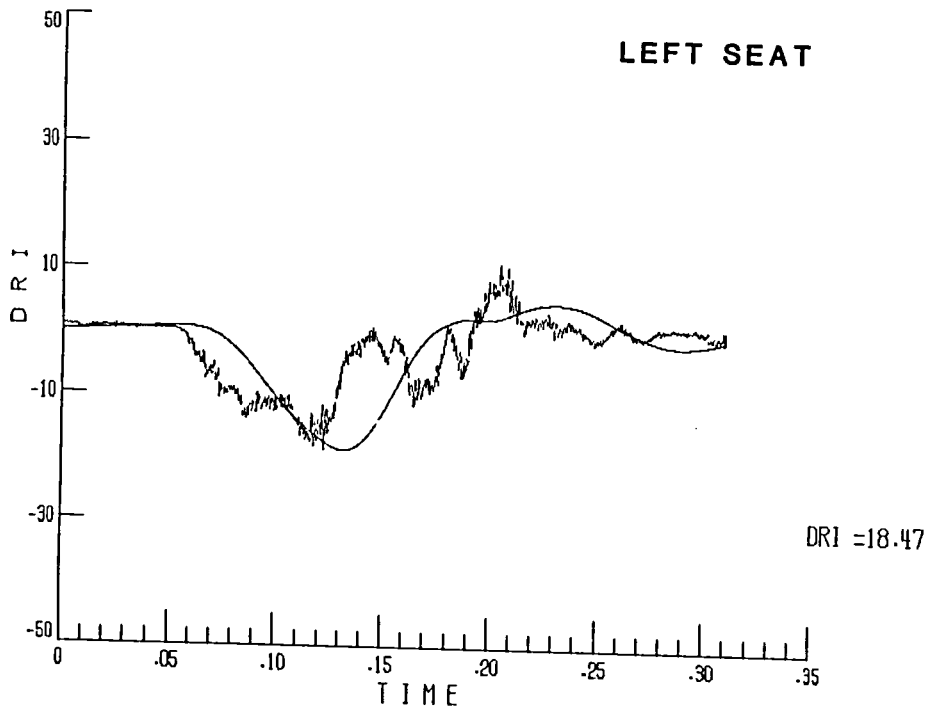
RIGHT DUMMY HEAD
NASA TEST NO. 7



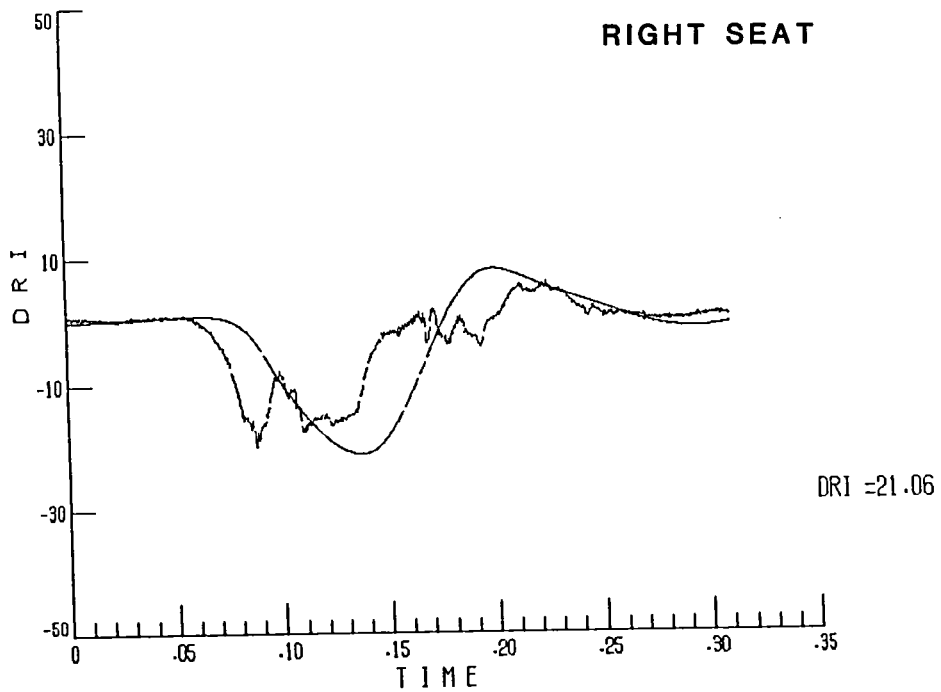
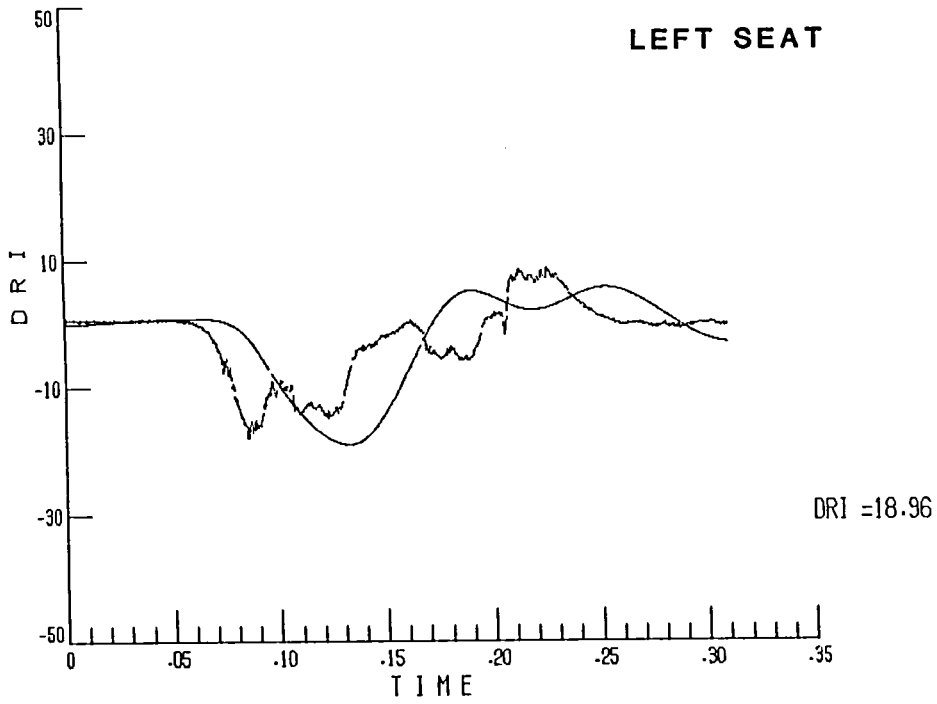
SEAT STROKE
NASA TEST NO. 7



**DYNAMIC RESPONSE INDEX
SEAT PAN Z-AXIS
NASA TEST NO. 7**



**DYNAMIC RESPONSE INDEX
BACK TANGENT LINE
NASA TEST NO. 7**



**DYNAMIC RESPONSE INDEX
DUMMY PELVIS Z-AXIS
NASA TEST NO. 7**

9.0 NASA TEST NO. 8

HORIZONTAL VELOCITY: 0 ft/sec

VERTICAL VELOCITY: 32 ft/sec

CREW MODULE PITCH: 2°

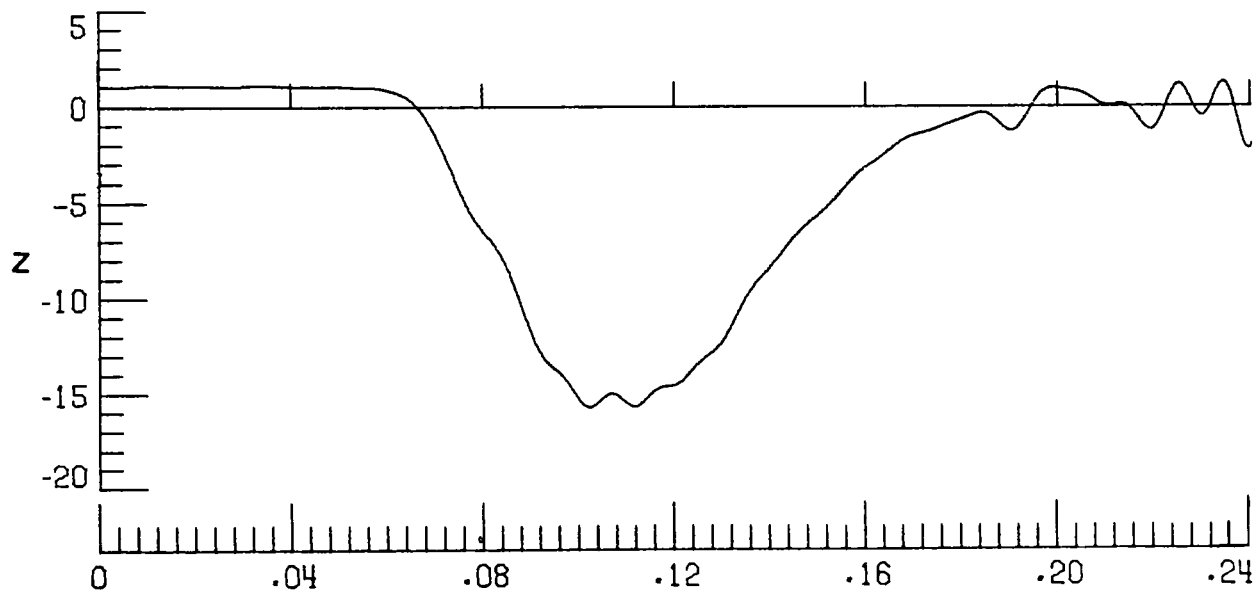
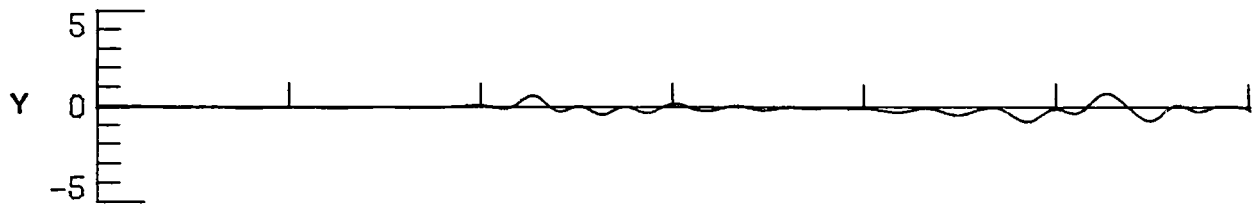
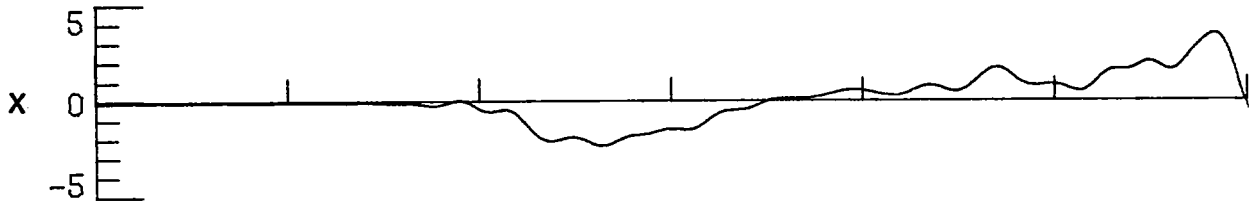
CREW MODULE ROLL: 0°

CREW MODULE YAW: 0°

LEFT SEAT: F-111 Operational

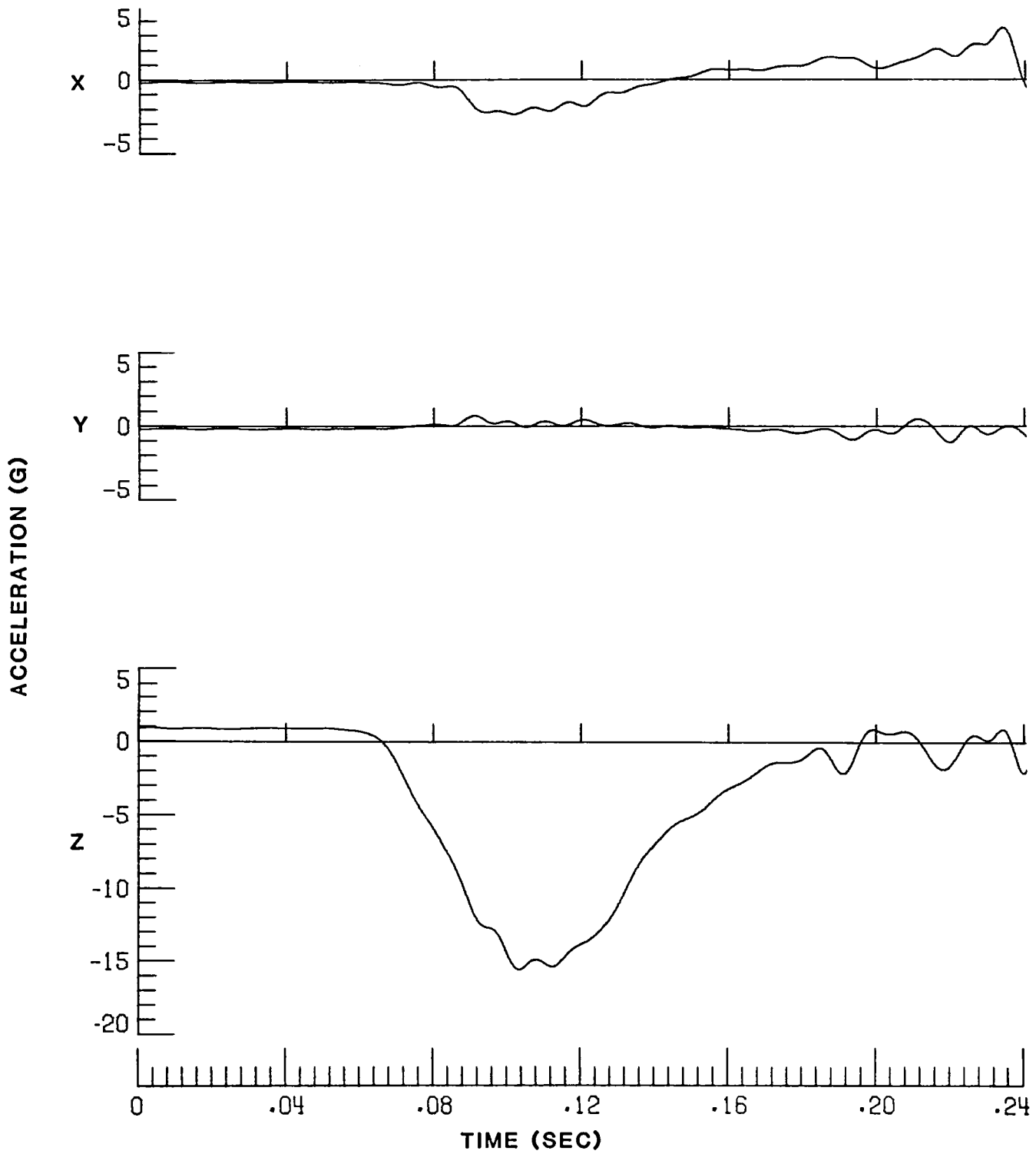
RIGHT SEAT: Energy Absorbing

ACCELERATION (G)

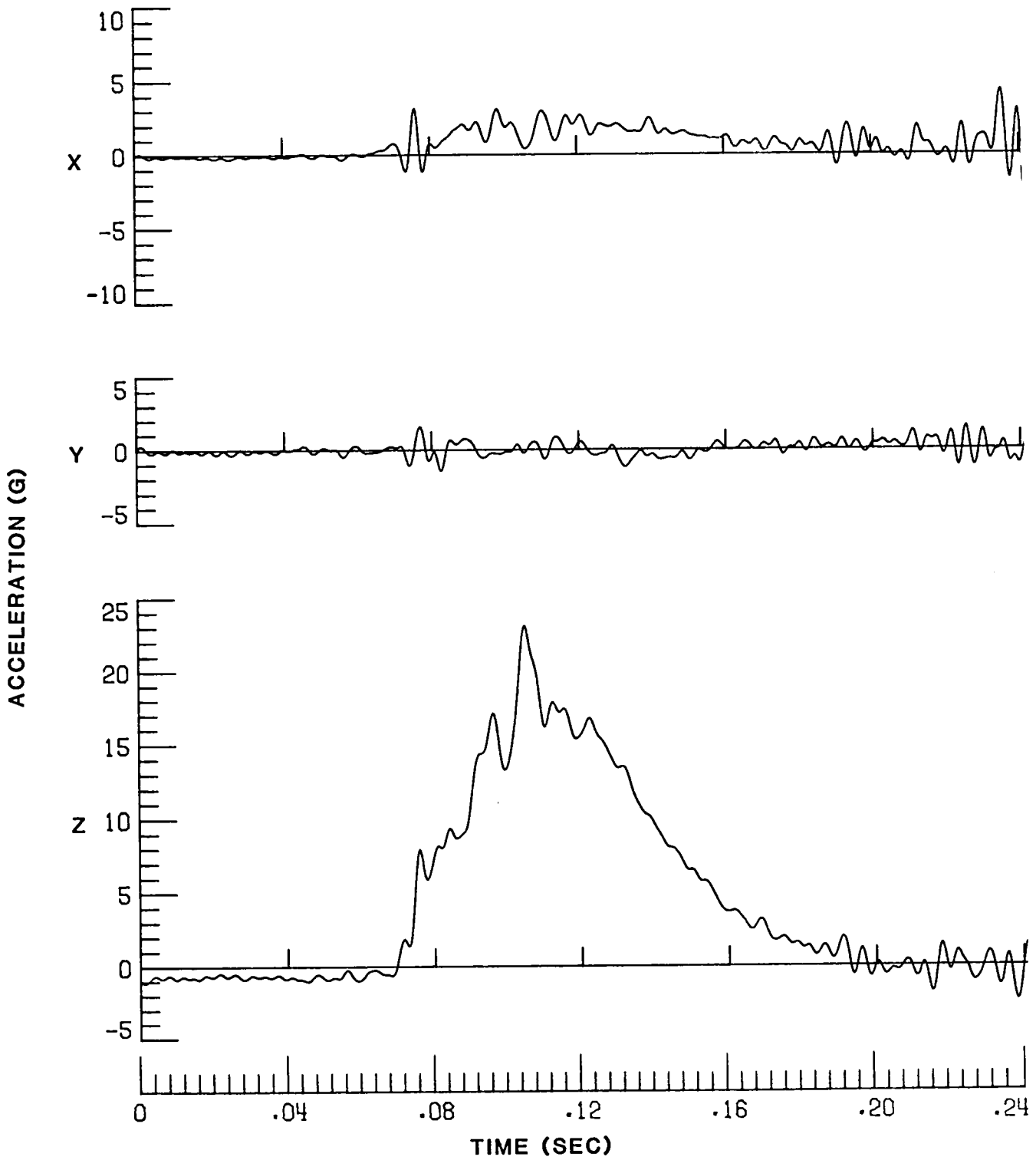


TIME (SEC)

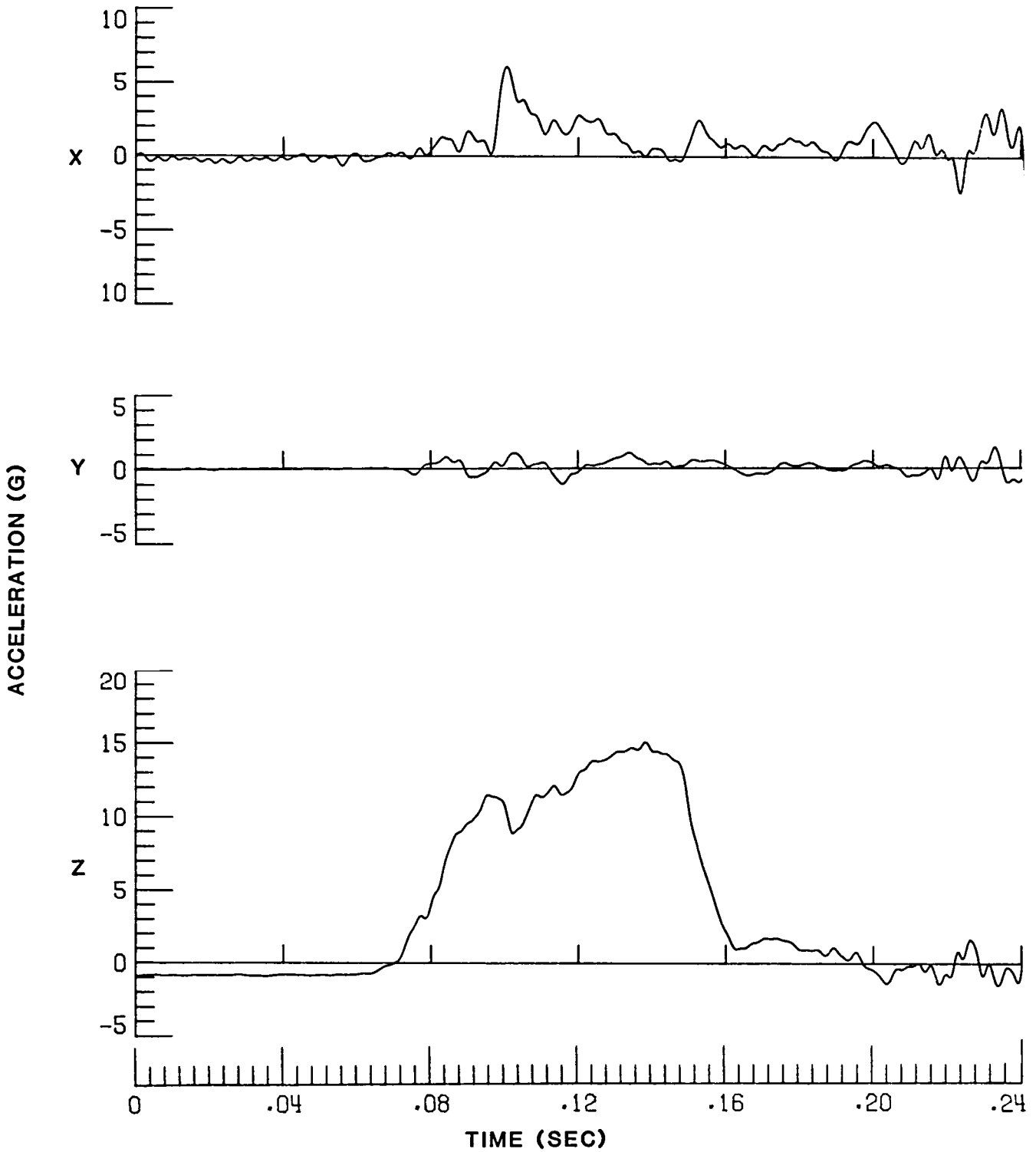
LEFT BULKHEAD
NASA TEST NO. 8



RIGHT BULKHEAD
NASA TEST NO. 8

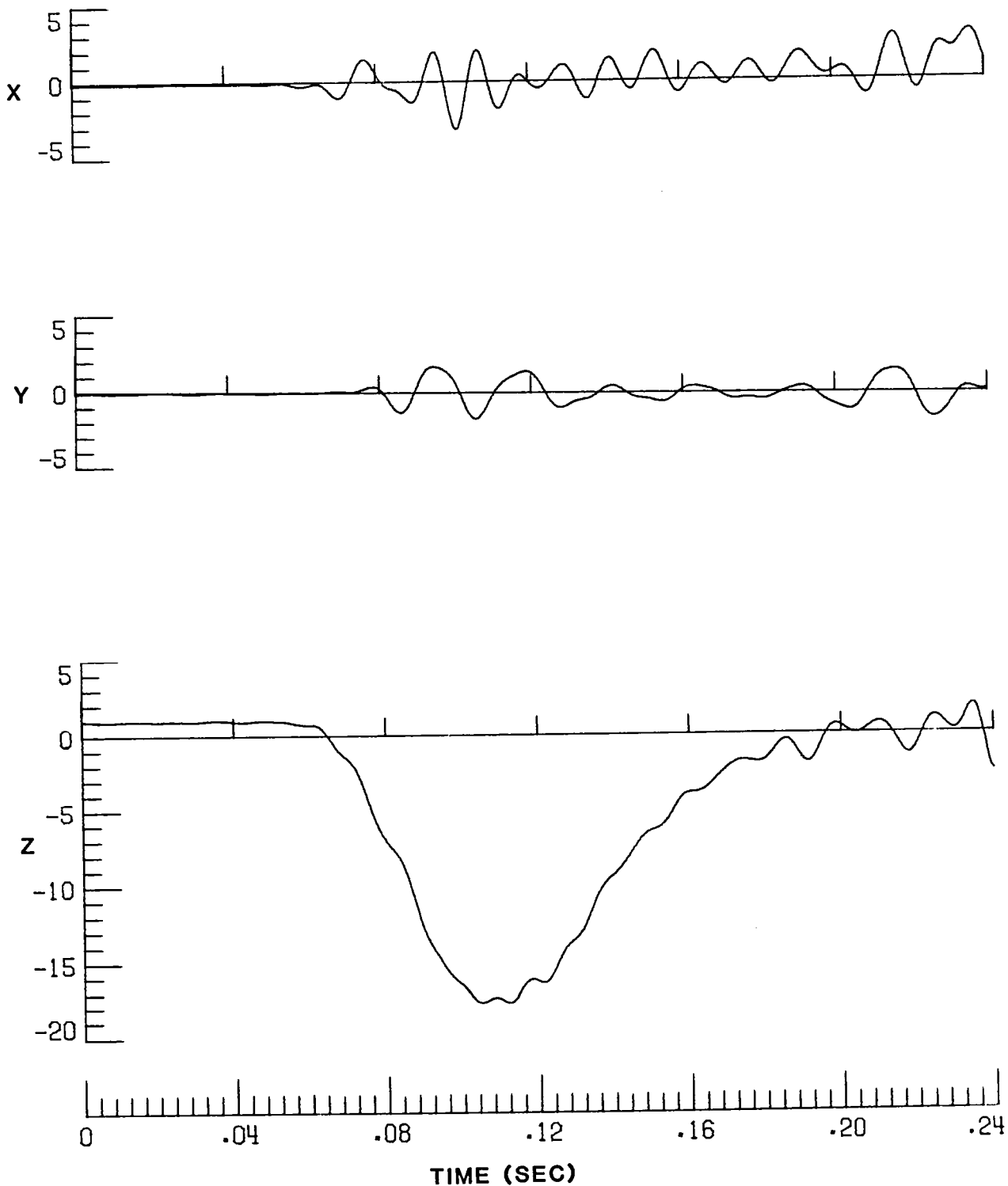


LEFT SEAT PAN
NASA TEST NO. 8

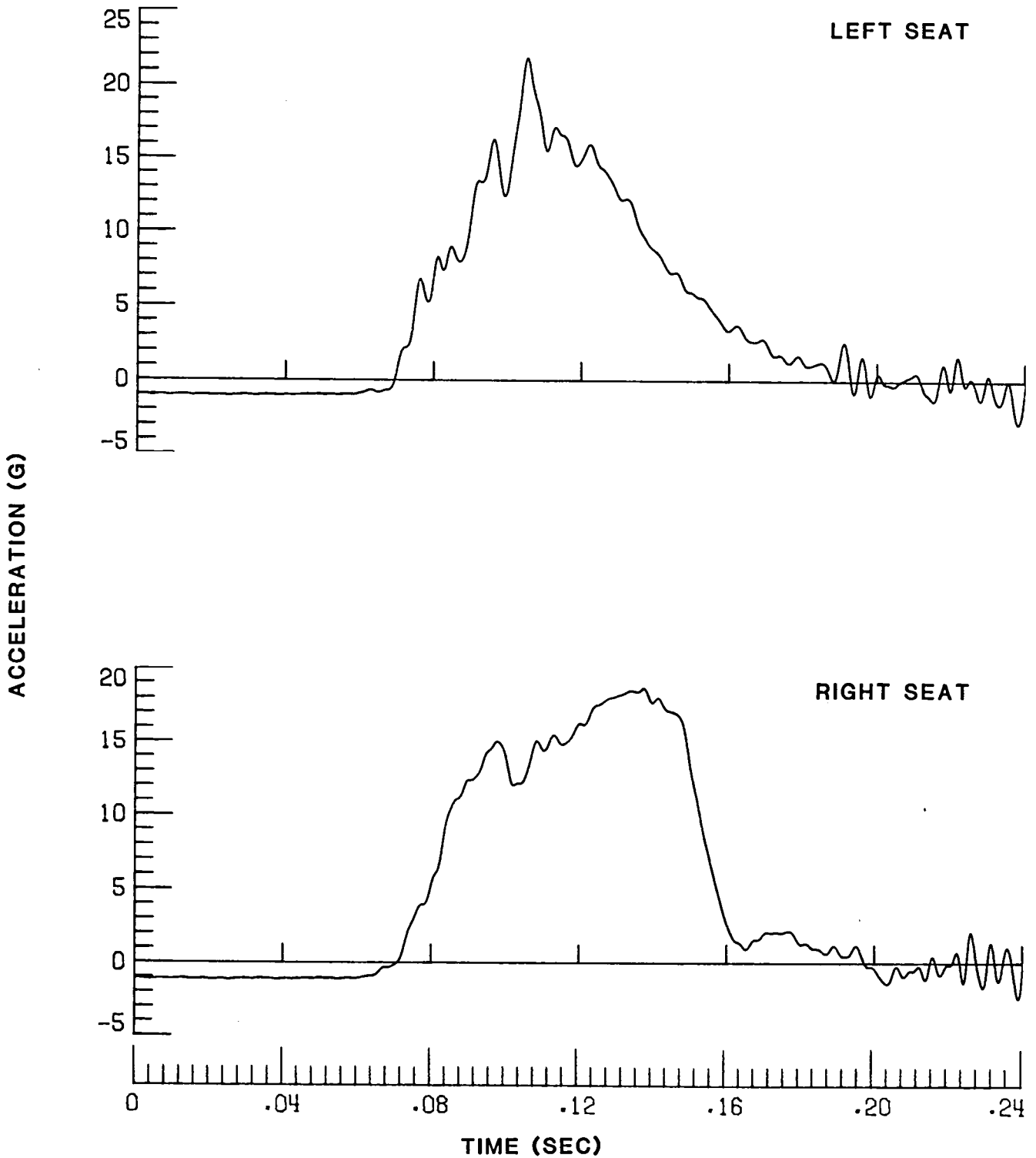


RIGHT SEAT PAN
NASA TEST NO. 8

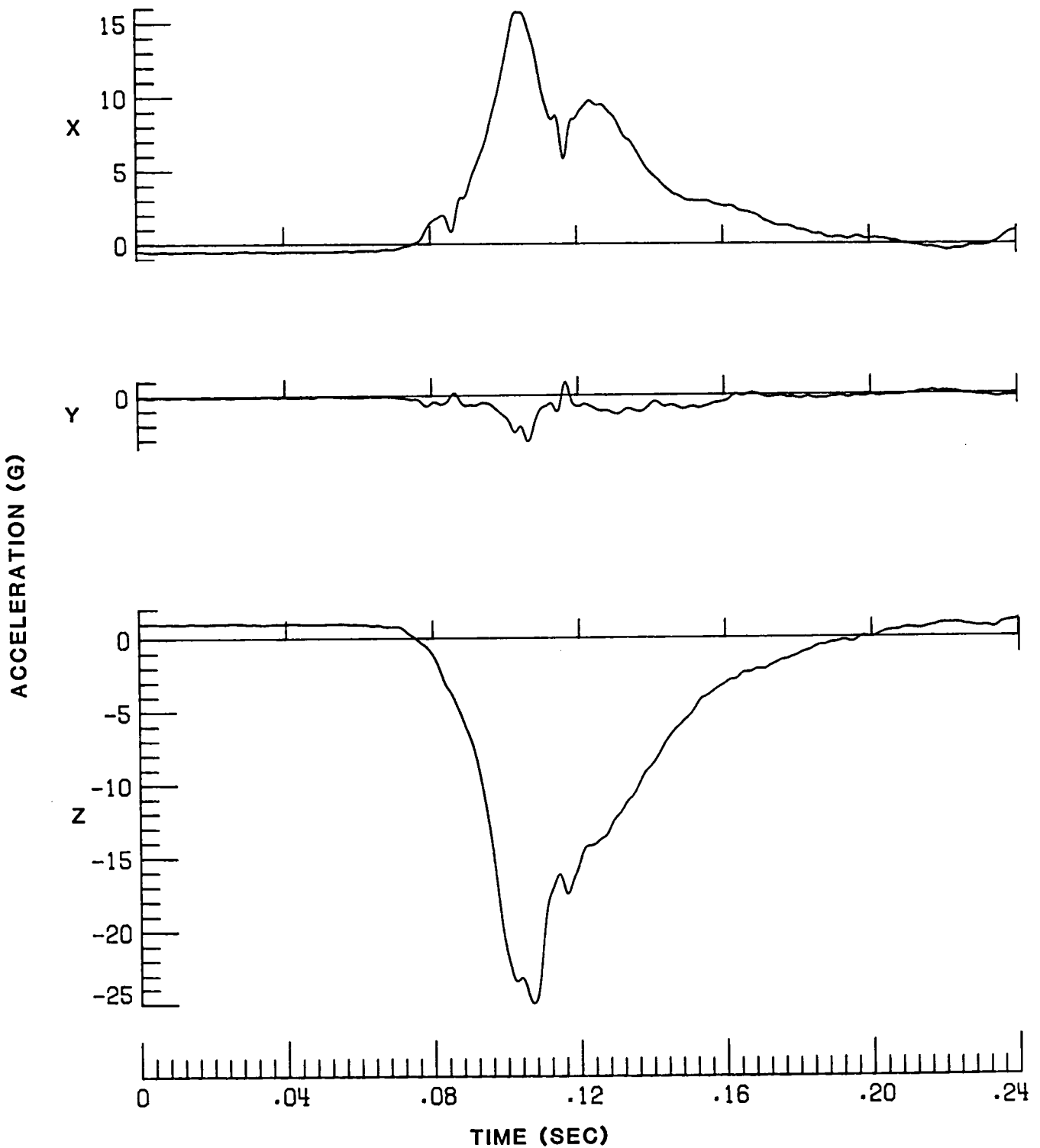
ACCELERATION (G)



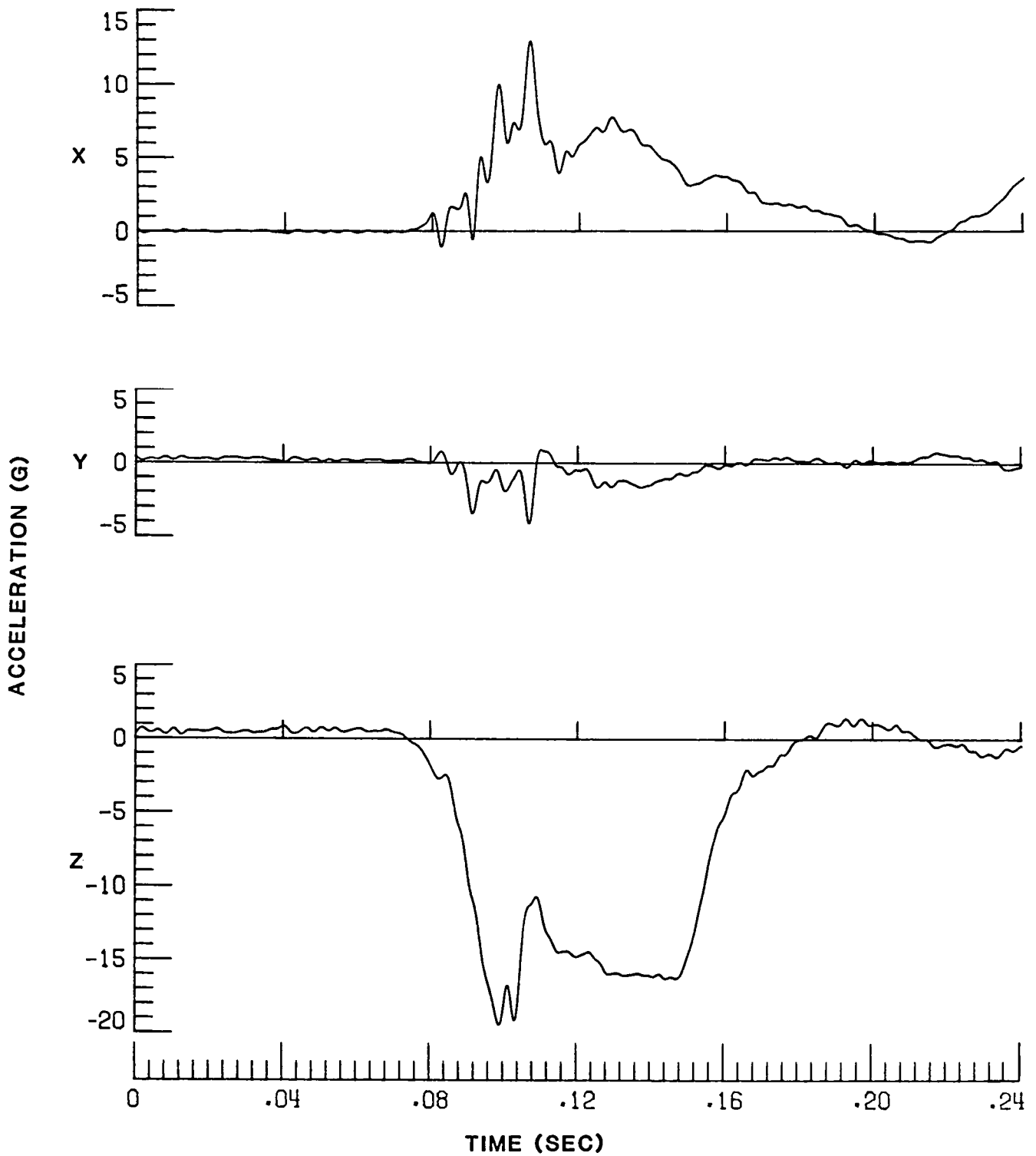
CAPSULE C.G.
NASA TEST NO. 8



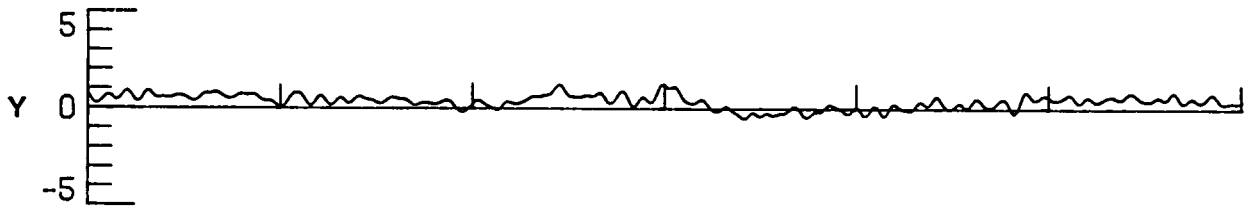
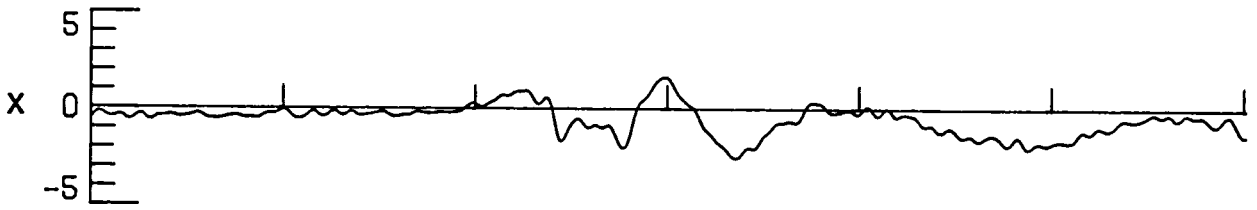
SEAT PAN ALONG BACK TANGENT LINE
NASA TEST NO. 8



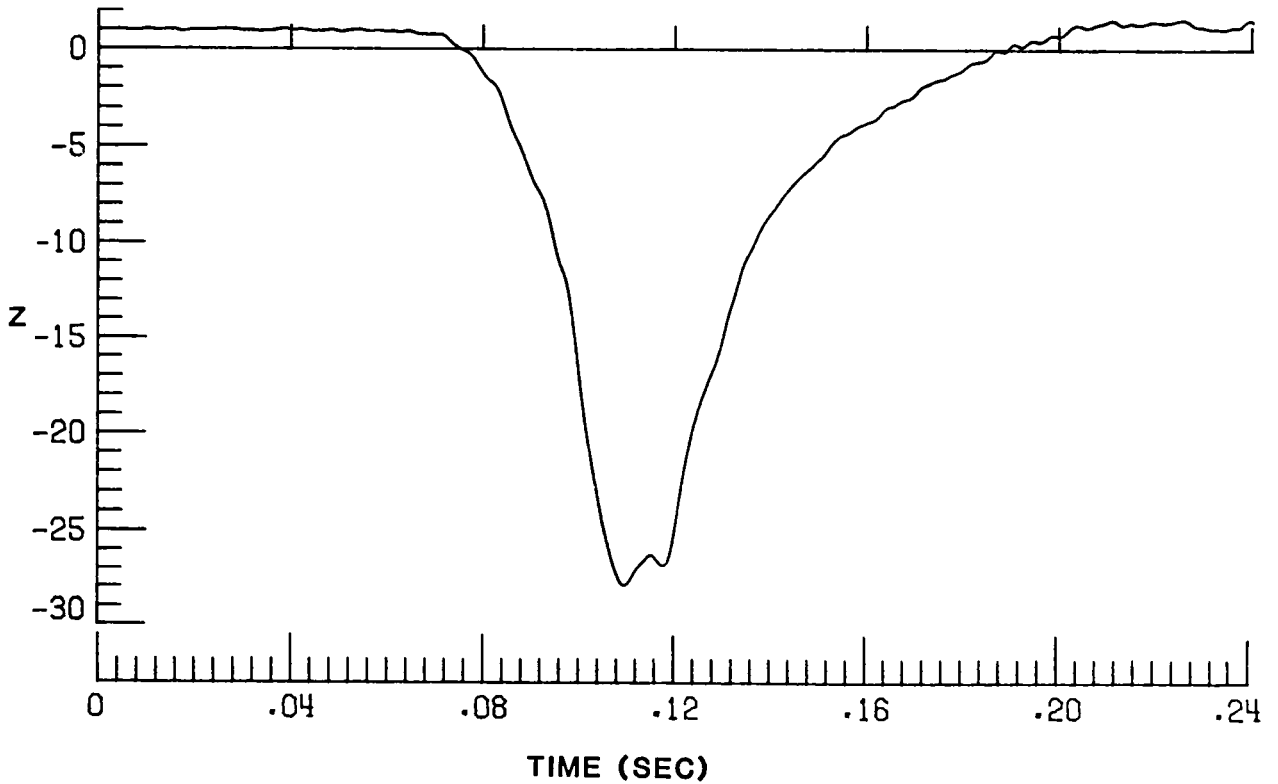
LEFT DUMMY PELVIS
NASA TEST NO. 8



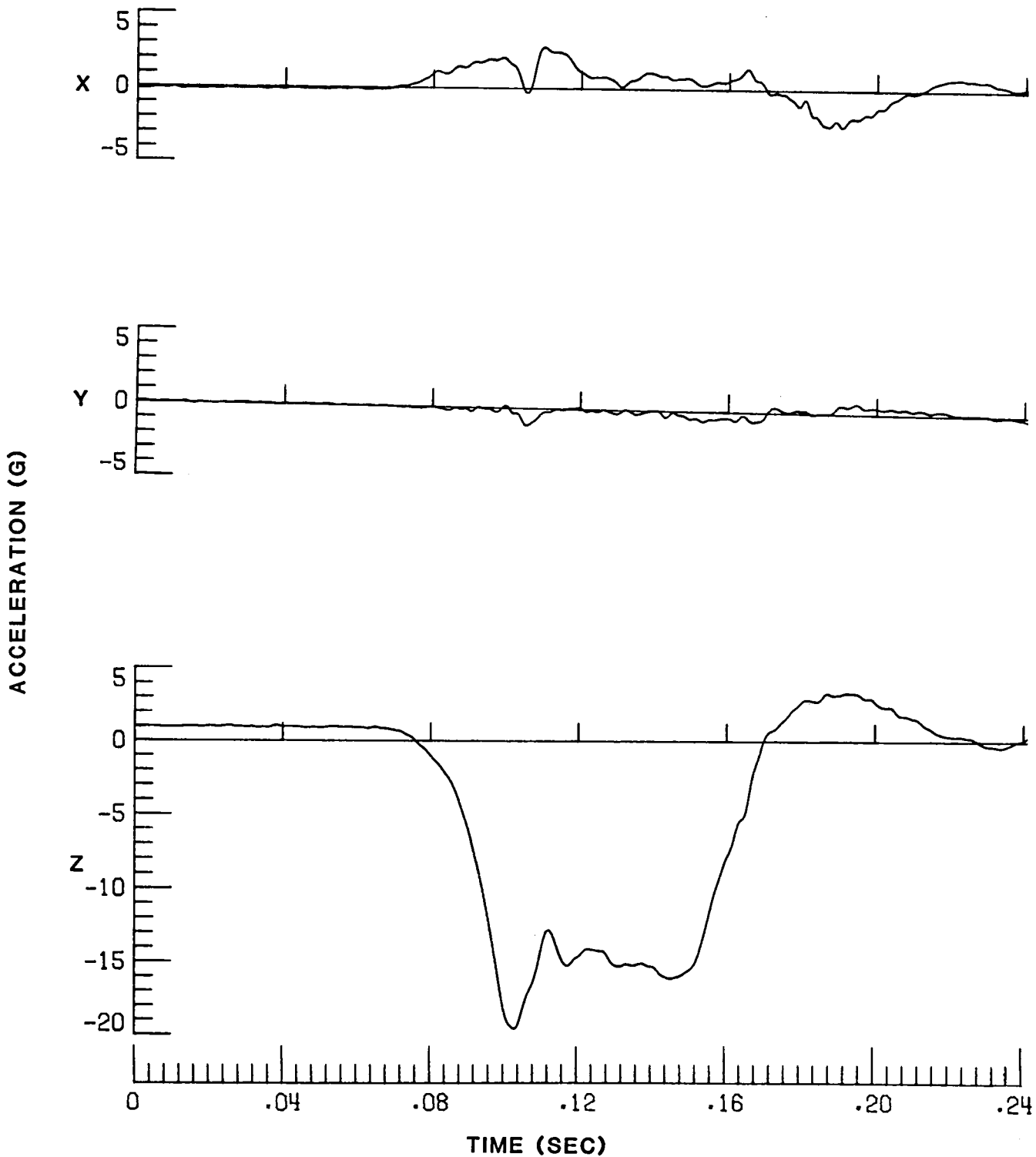
RIGHT DUMMY PELVIS
NASA TEST NO. 8



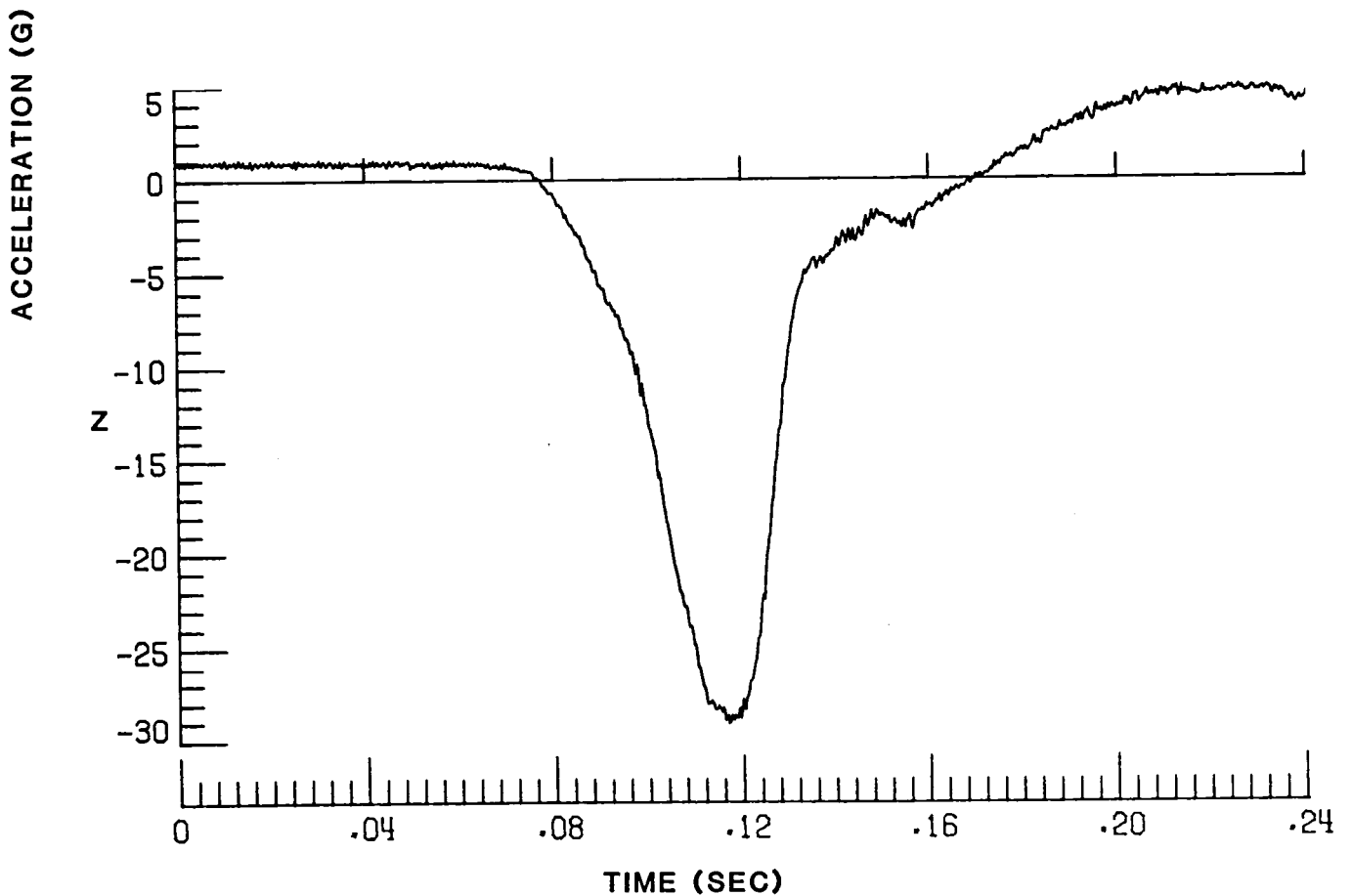
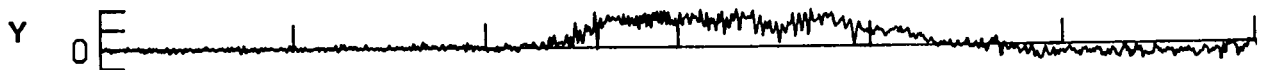
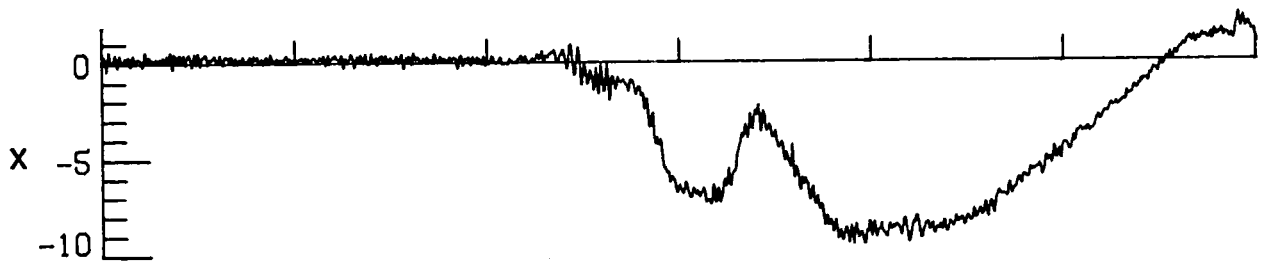
ACCELERATION (G)



LEFT DUMMY CHEST
NASA TEST NO. 8



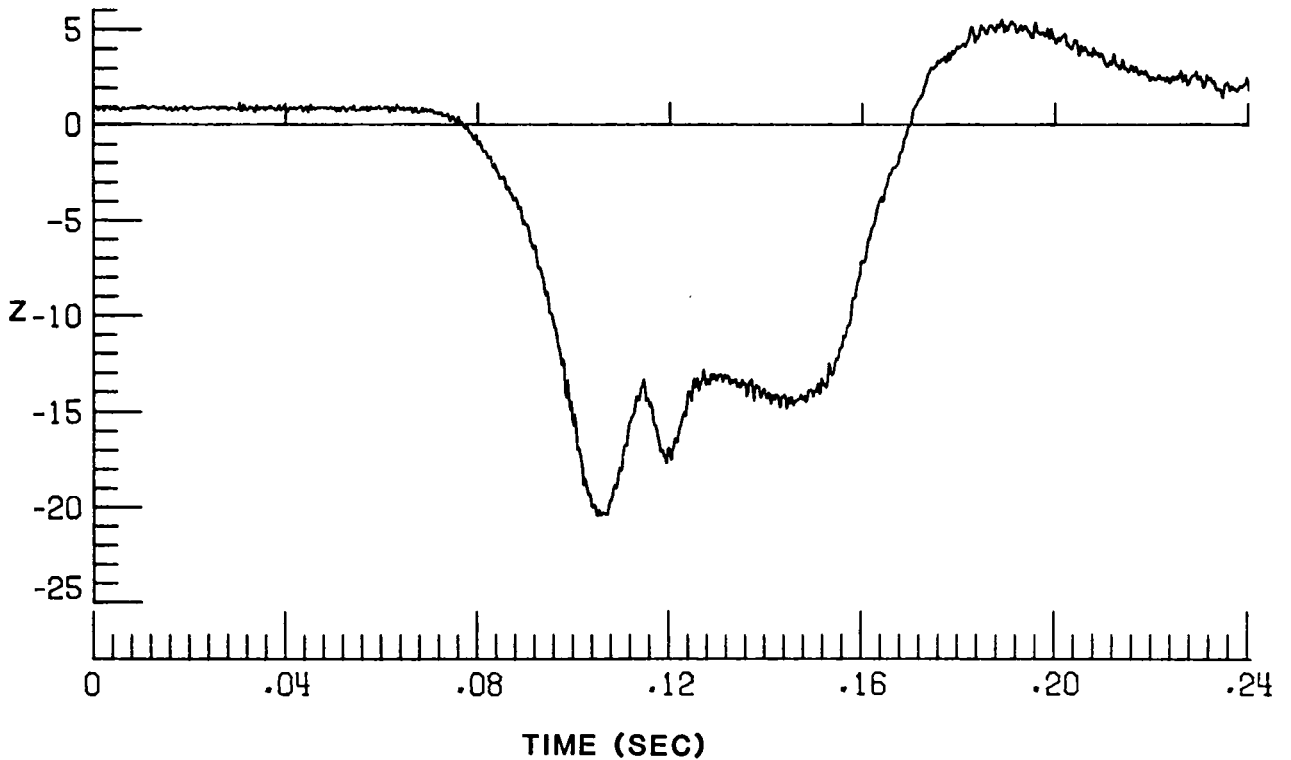
RIGHT DUMMY CHEST
NASA TEST NO. 8



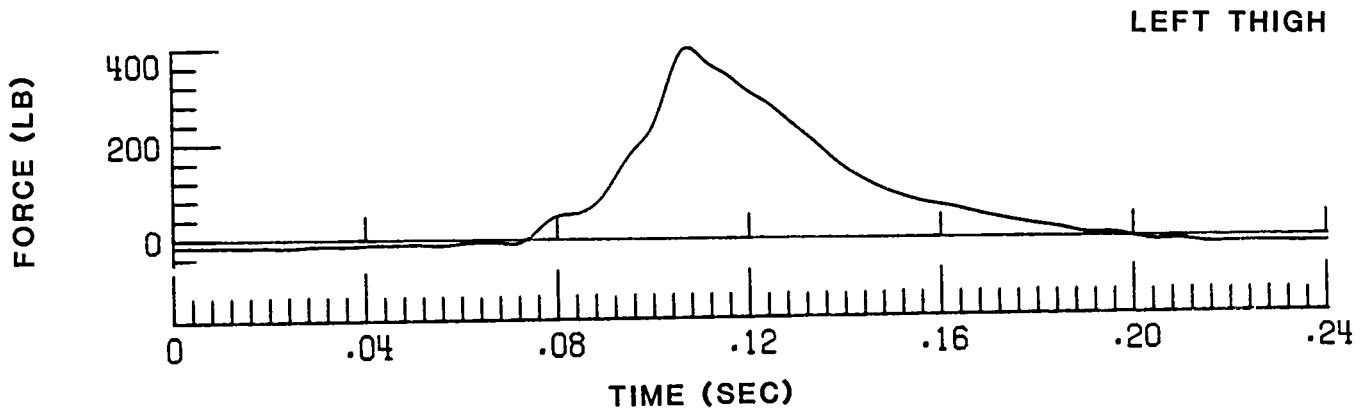
LEFT DUMMY HEAD
NASA TEST NO. 8



ACCELERATION (G)

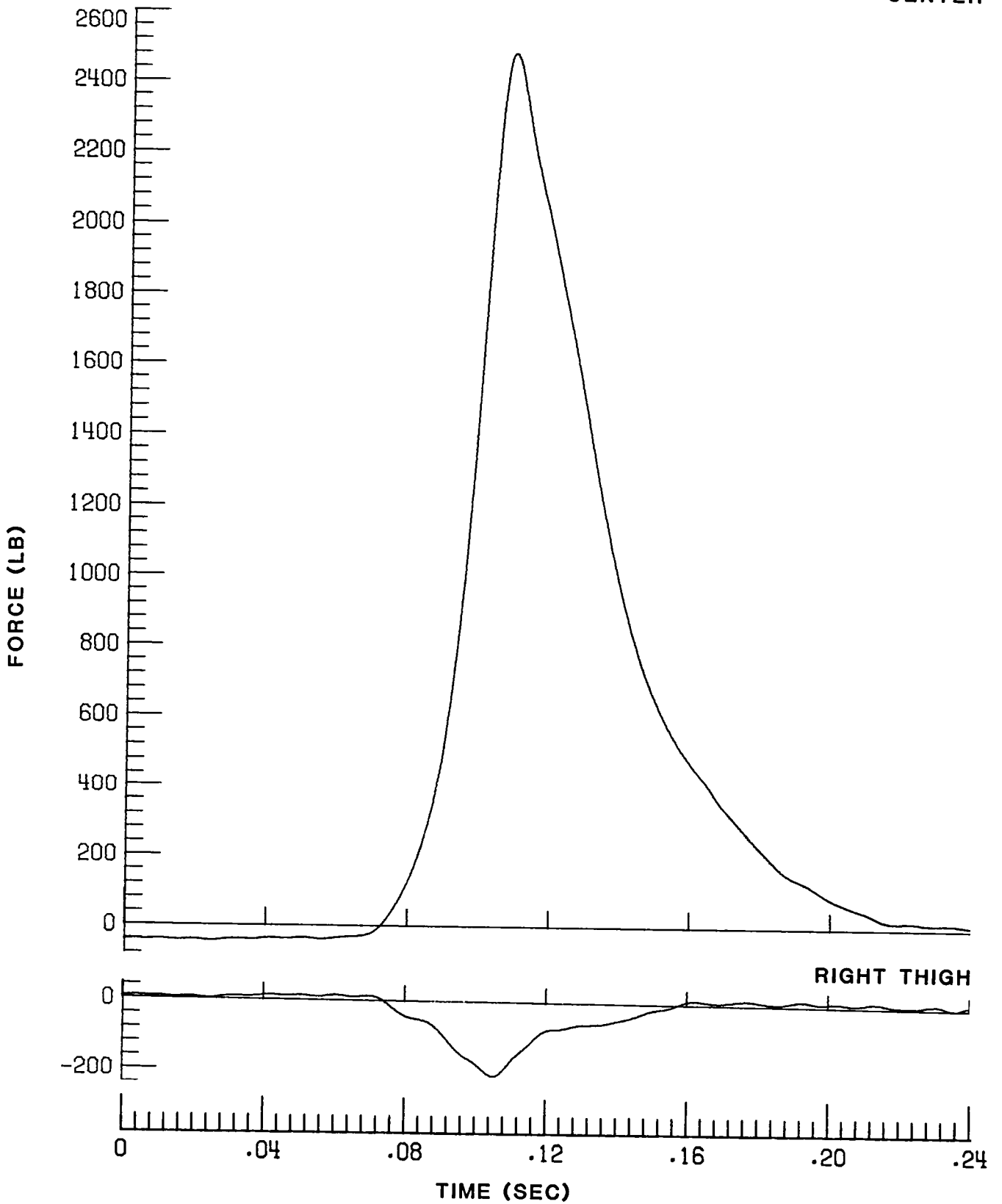


RIGHT DUMMY HEAD
NASA TEST NO. 8

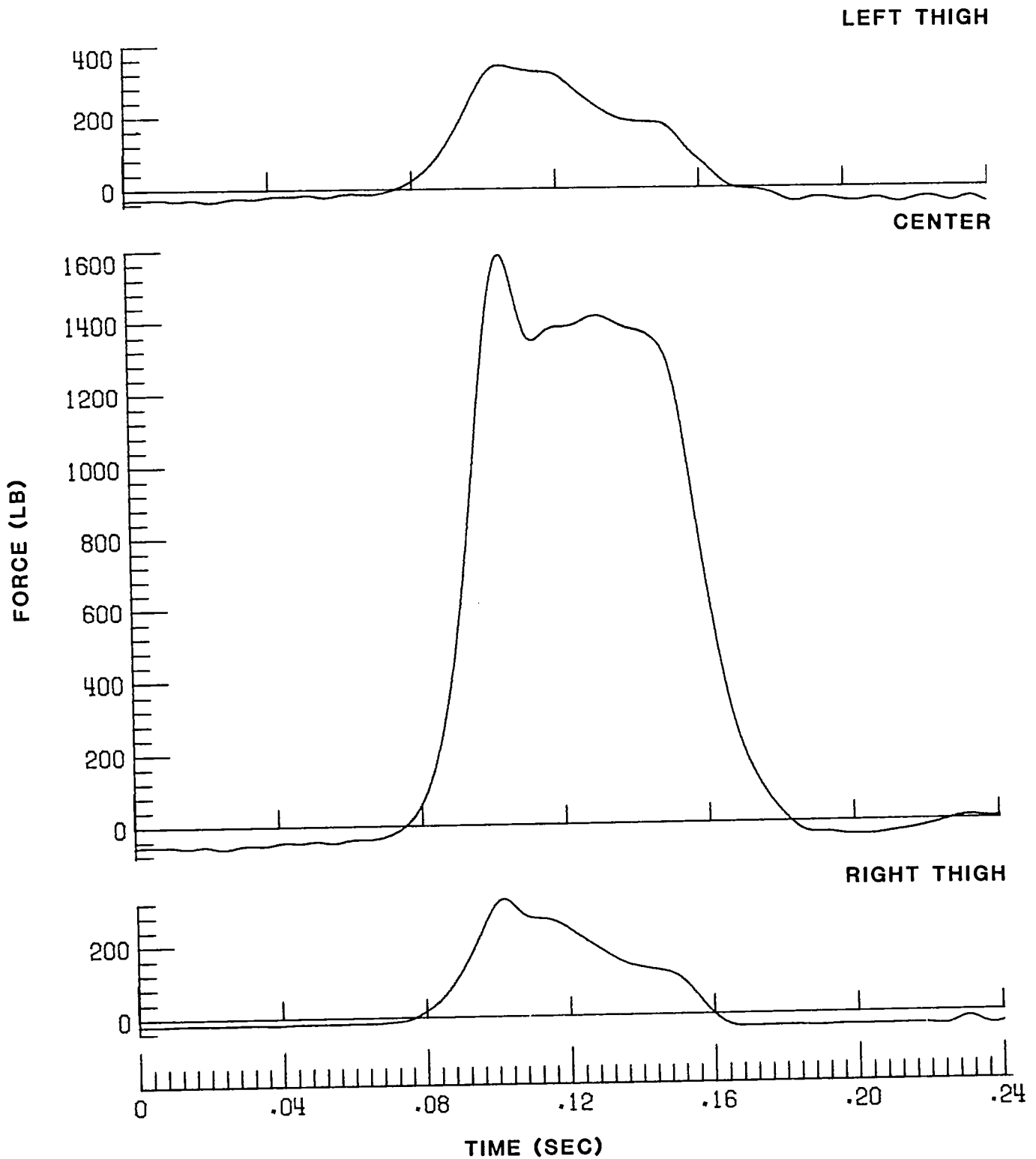


LEFT SEAT PAN LOADS
NASA TEST NO. 8

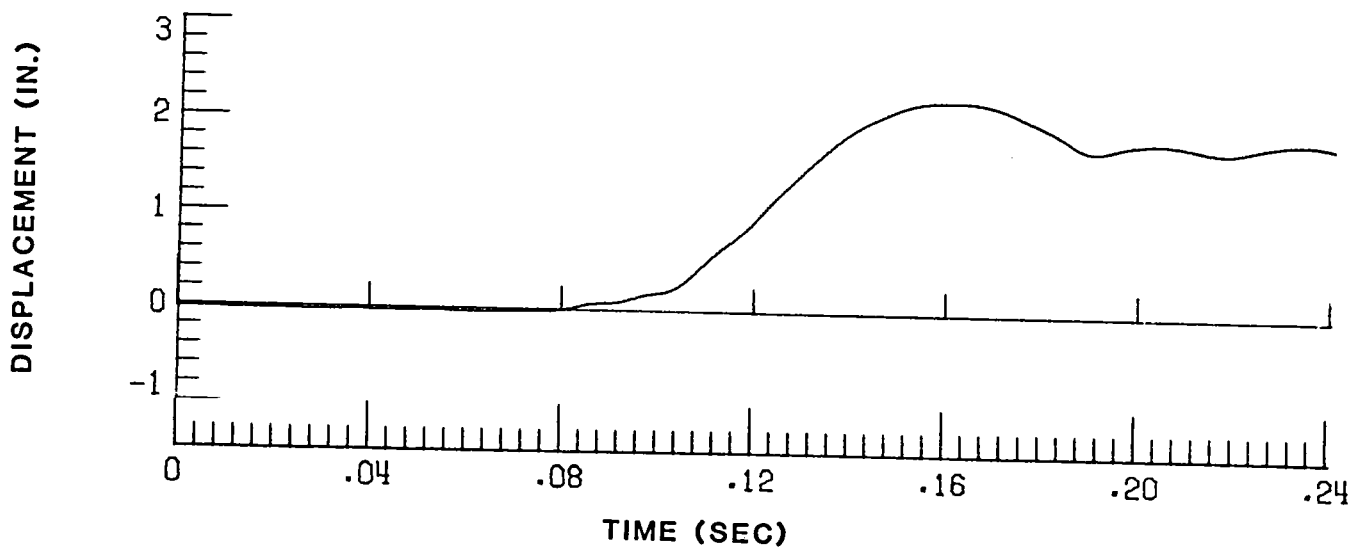
CENTER



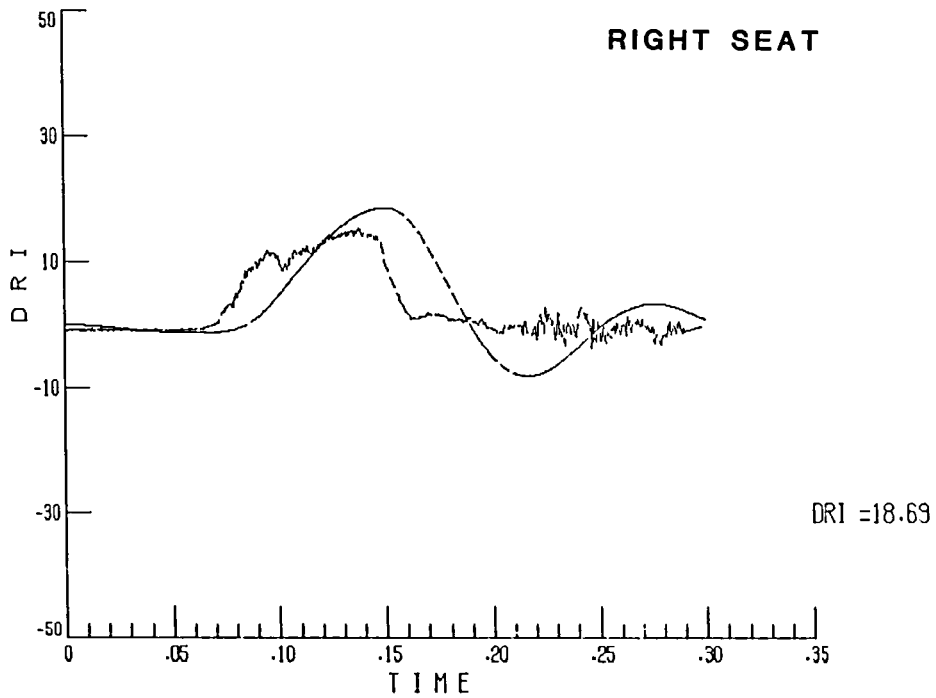
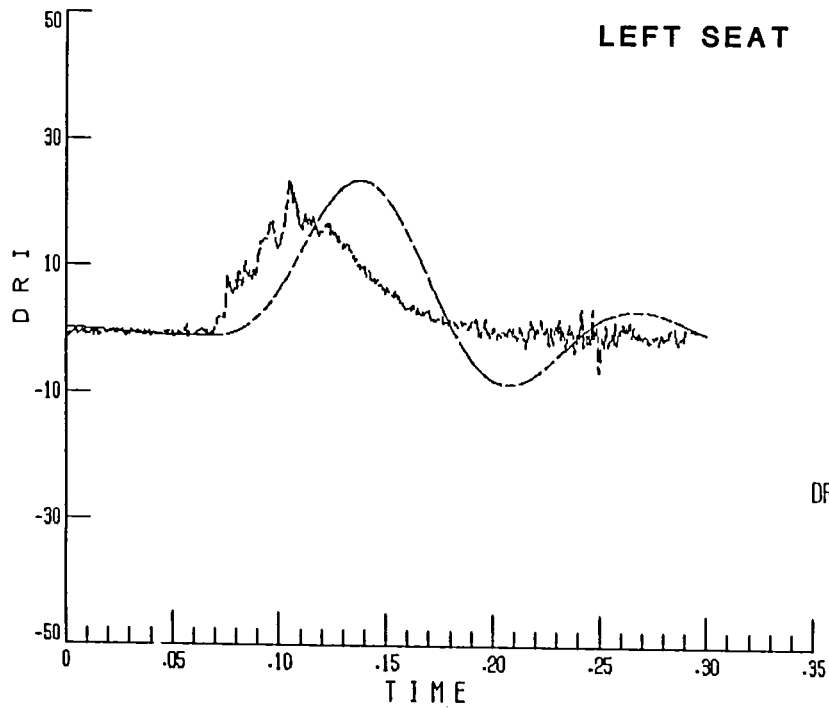
LEFT SEAT PAN LOADS
NASA TEST NO. 8



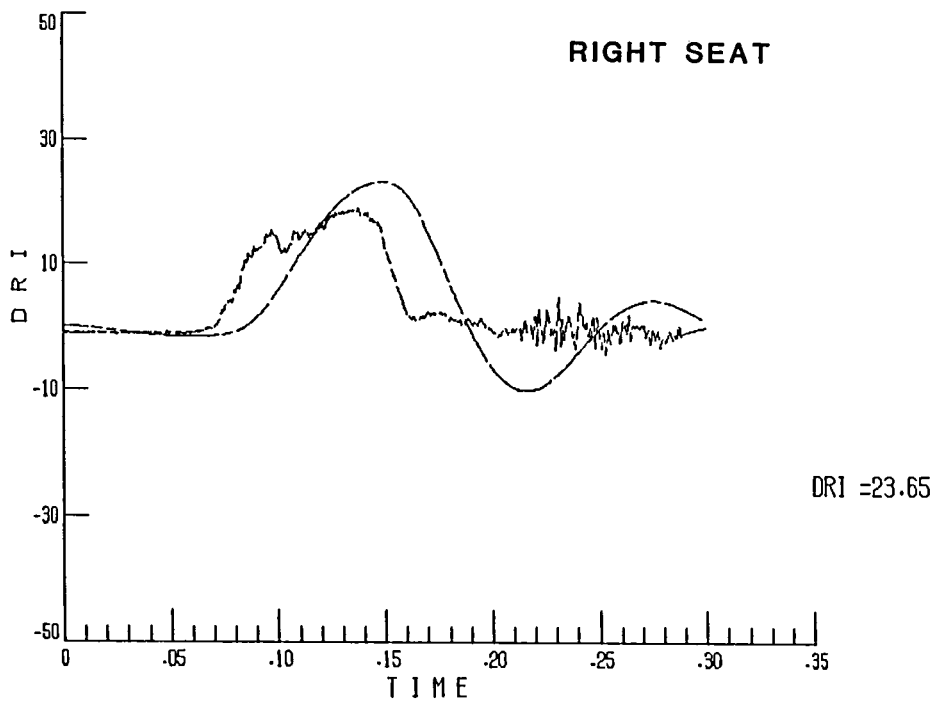
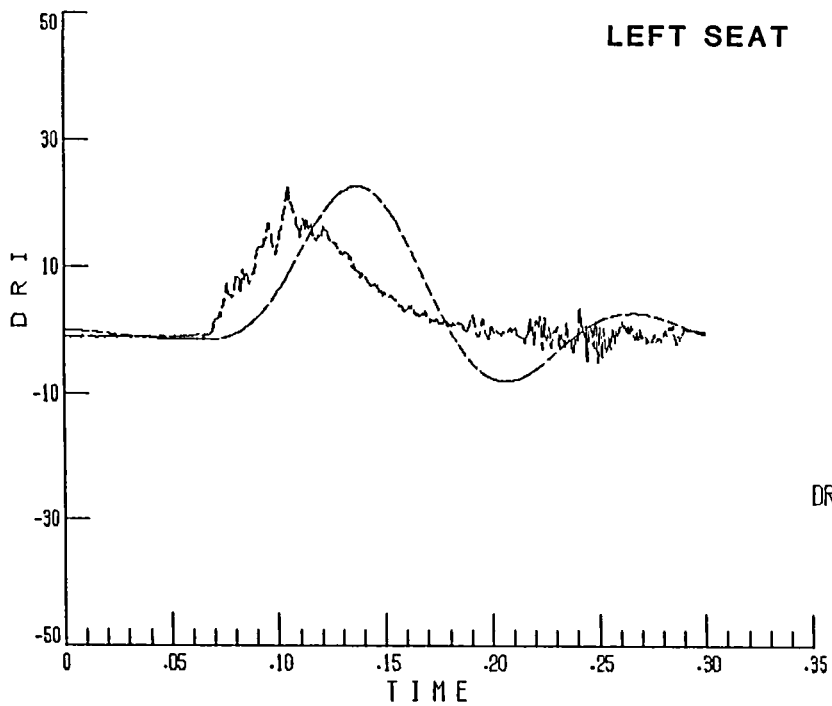
RIGHT SEAT PAN LOADS
NASA TEST NO. 8



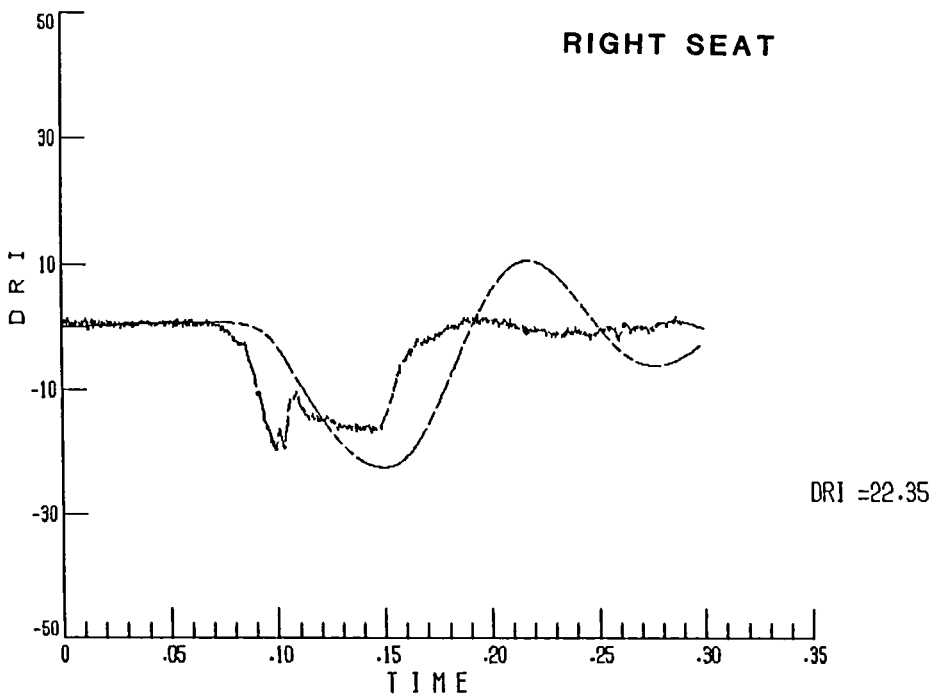
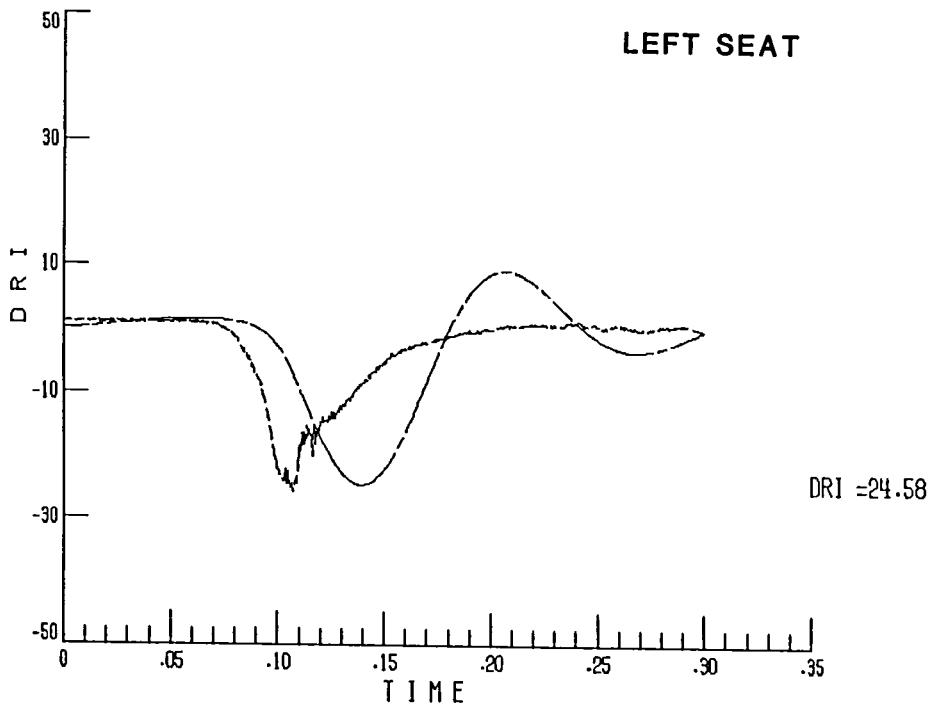
RIGHT SEAT STROKE
NASA TEST NO. 8



**DYNAMIC RESPONSE INDEX
SEAT PAN Z-AXIS
NASA TEST NO. 8**



**DYNAMIC RESPONSE INDEX
BACK TANGENT LINE
NASA TEST NO. 8**



DYNAMIC RESPONSE INDEX
DUMMY PELVIS Z-AXIS
NASA TEST NO. 8
 151

10.0 NASA TEST NO. 9

HORIZONTAL VELOCITY: 0 ft/sec

VERTICAL VELOCITY: 25 ft/sec

CREW MODULE PITCH: 2⁰

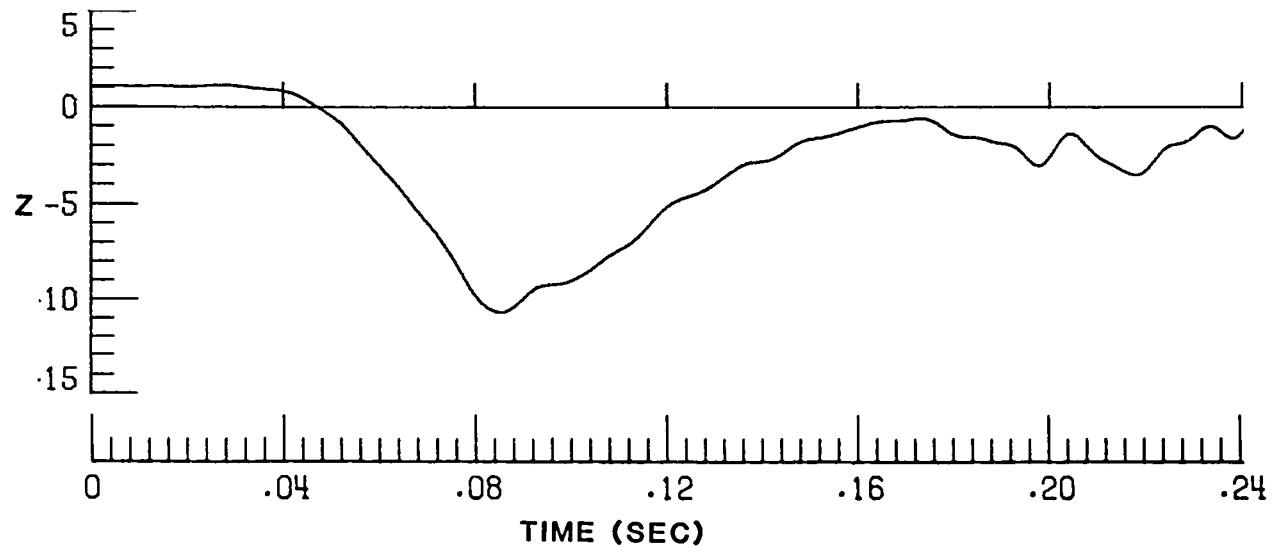
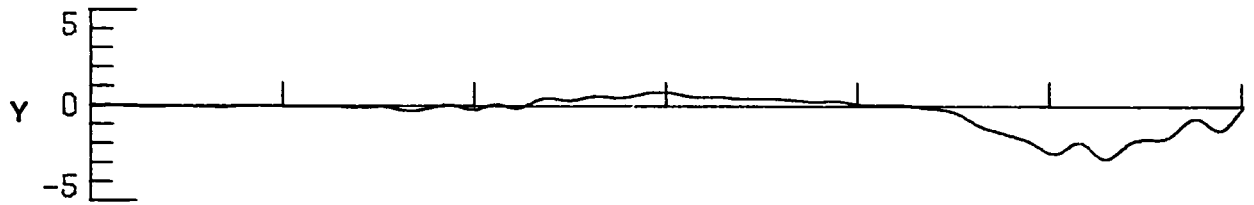
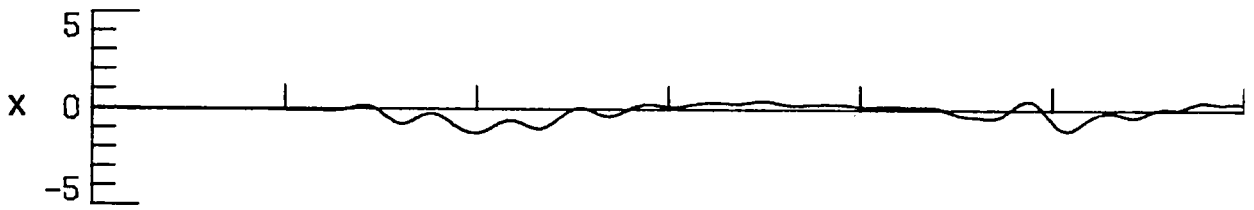
CREW MODULE ROLL: 0⁰

CREW MODULE YAW: 0⁰

LEFT SEAT: F-111 Operational

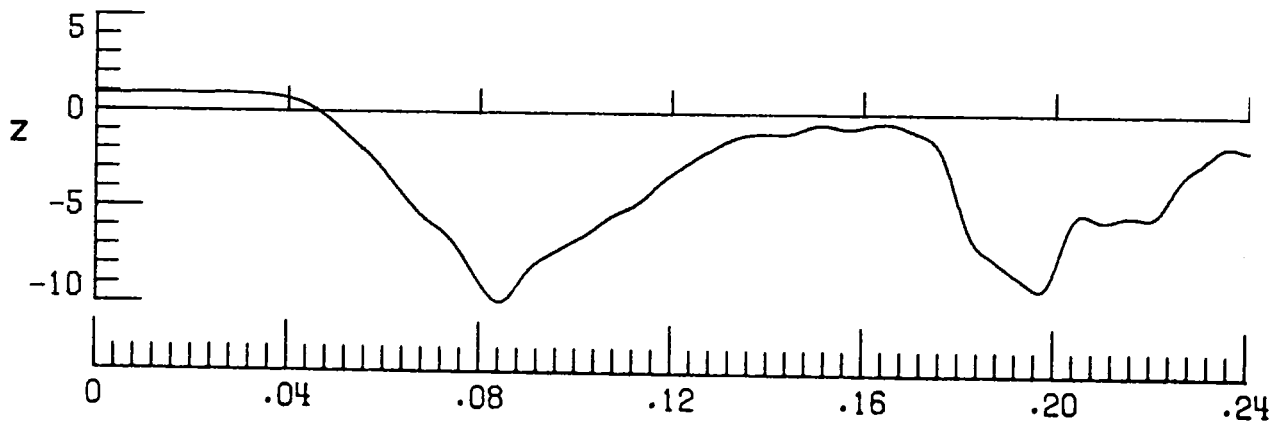
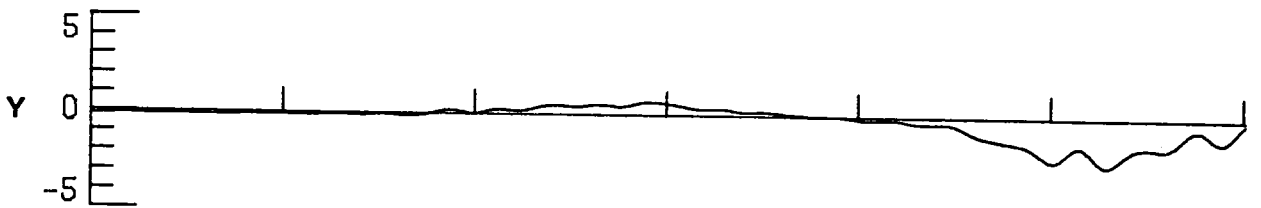
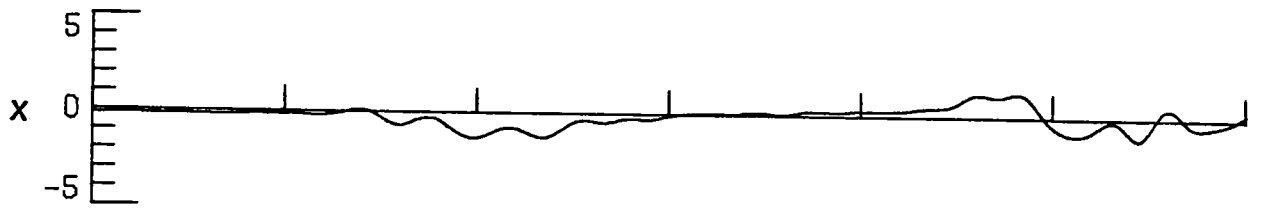
RIGHT SEAT: Energy Absorbing

ACCELERATION (G)



LEFT BULKHEAD
NASA TEST NO. 9

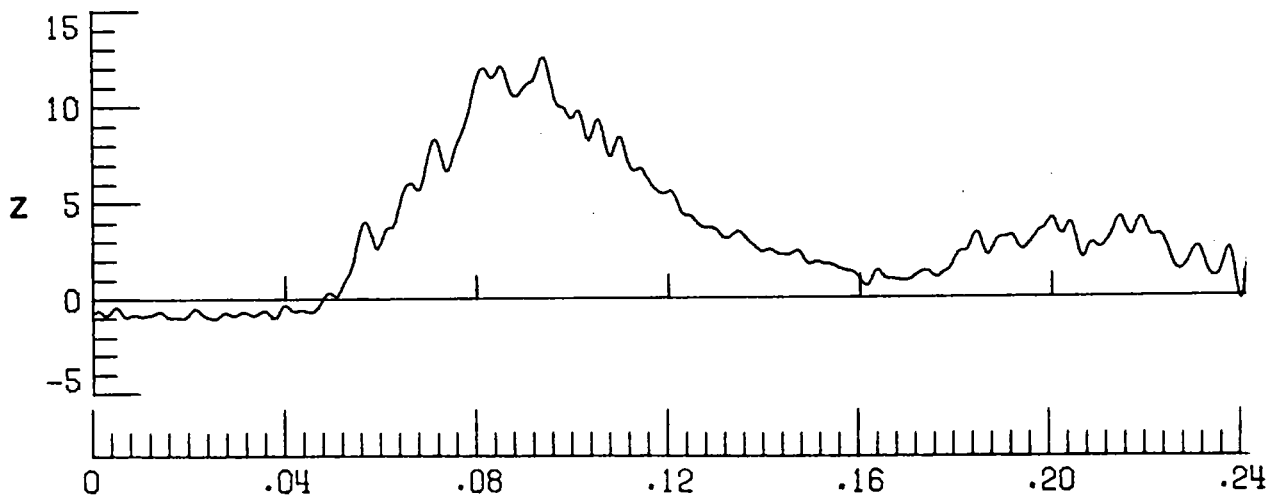
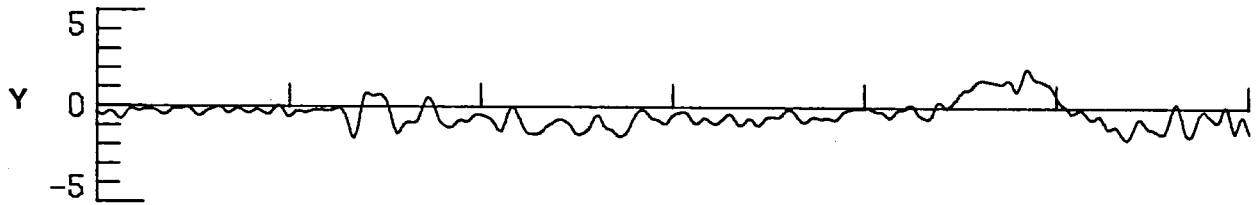
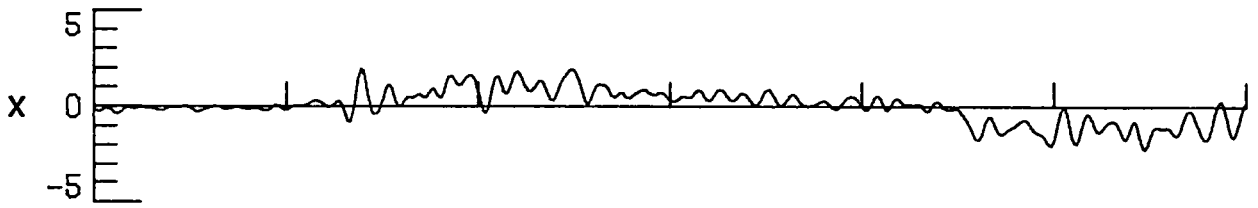
ACCELERATION (G)



TIME (SEC)

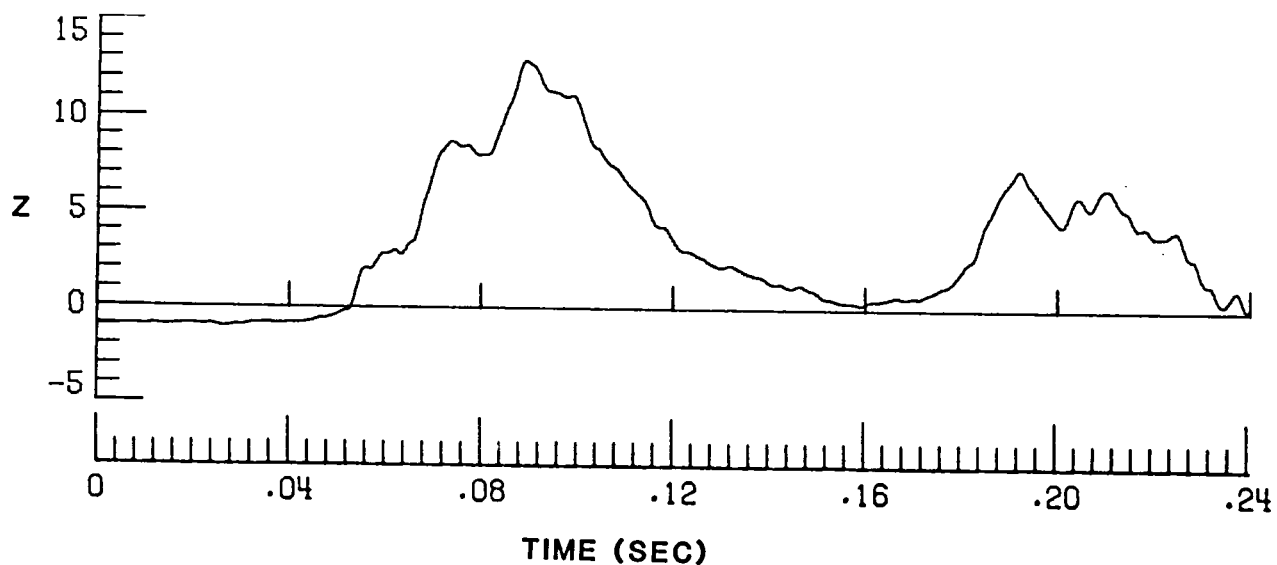
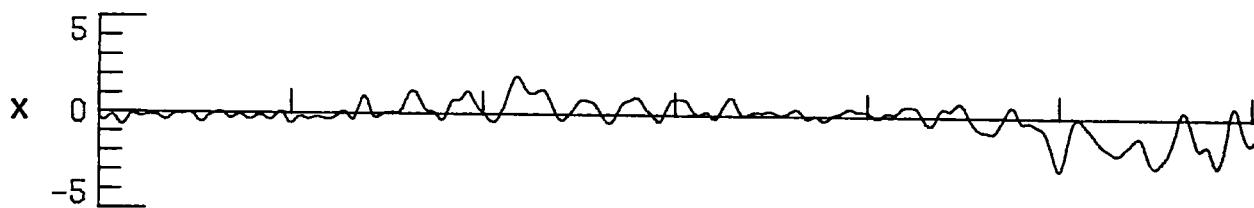
RIGHT BULKHEAD
NASA TEST NO. 9

ACCELERATION (G)



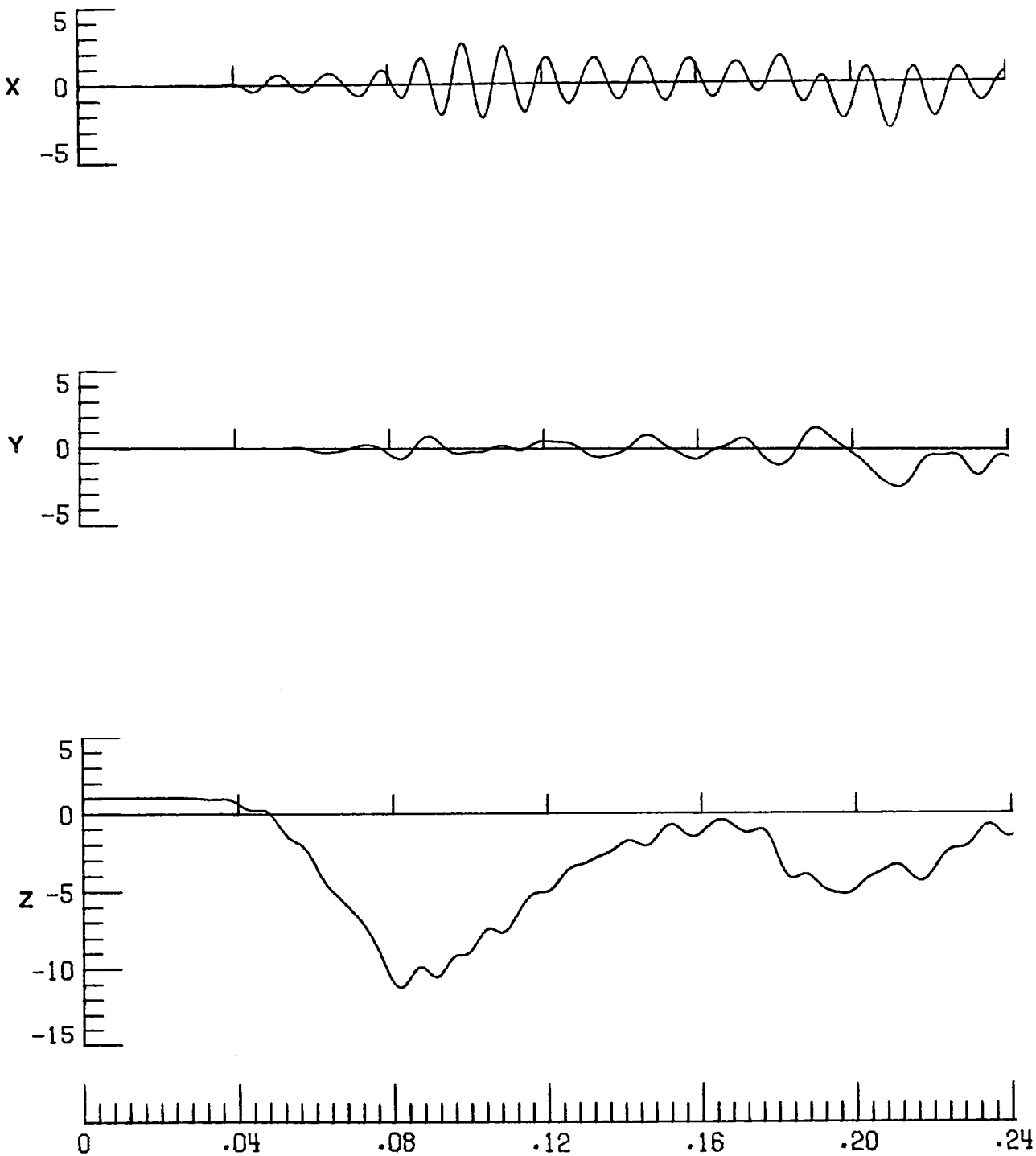
TIME (SEC)

LEFT SEAT PAN
NASA TEST NO. 9

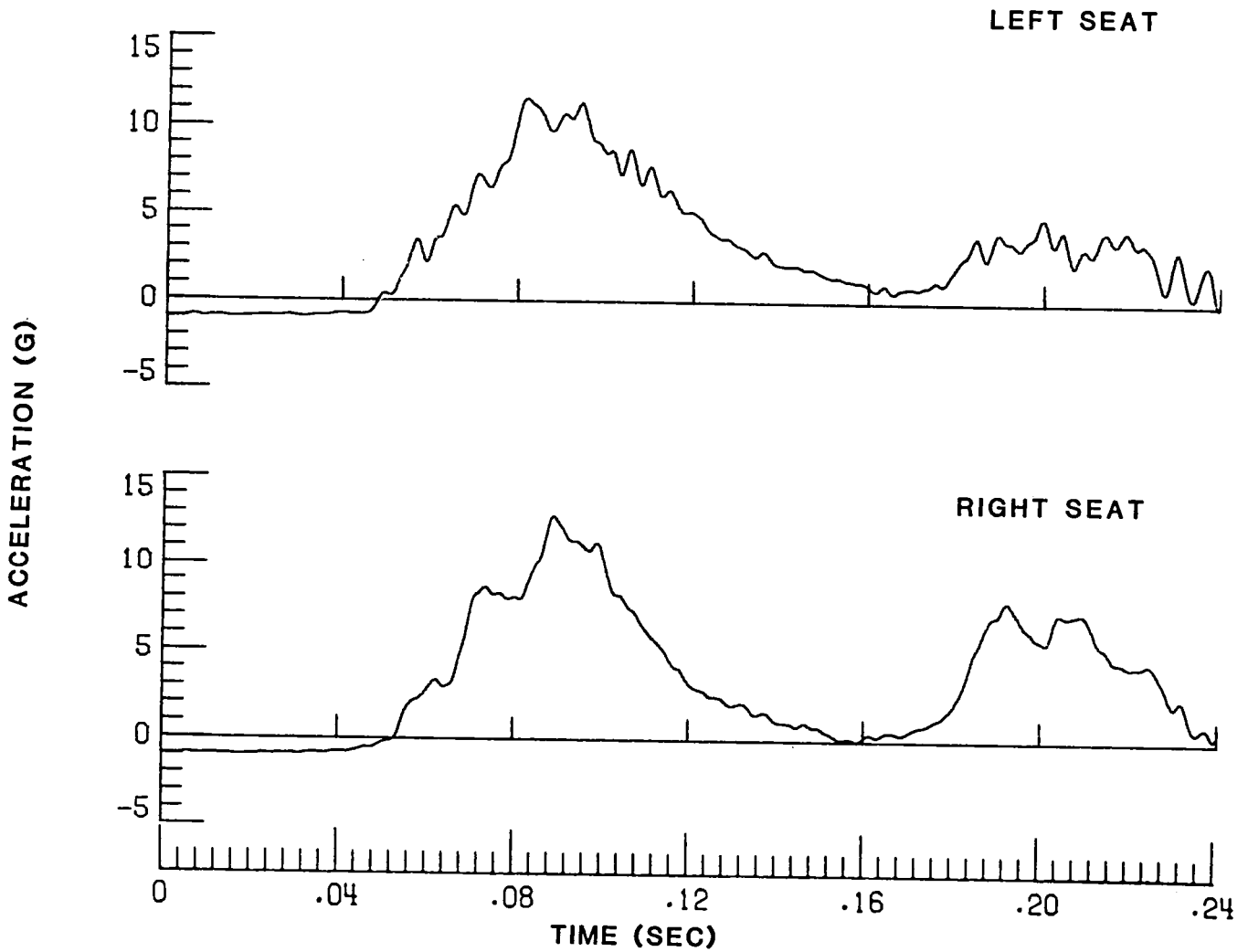


RIGHT SEAT PAN
NASA TEST NO. 9
156

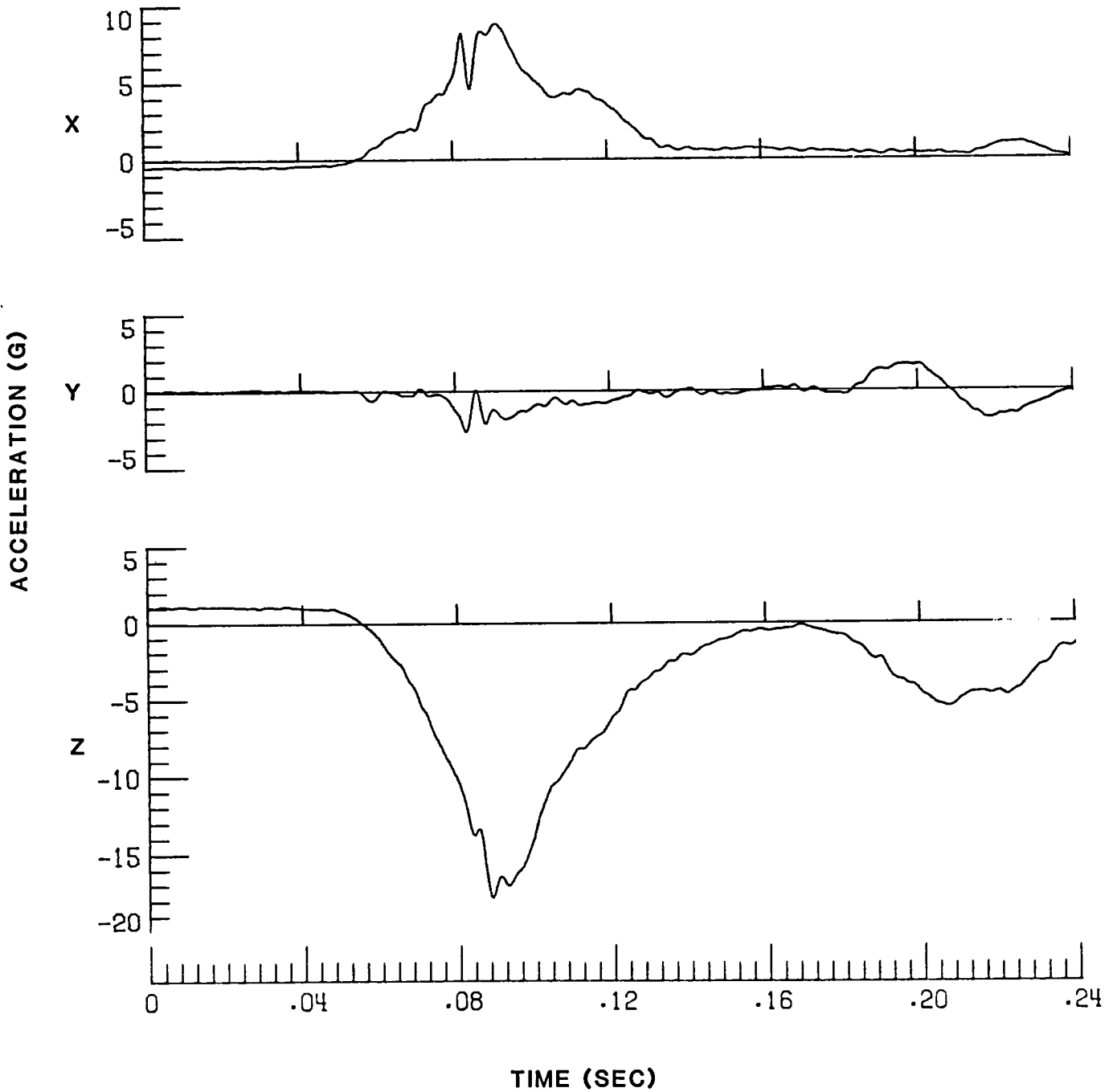
ACCELERATION (G)



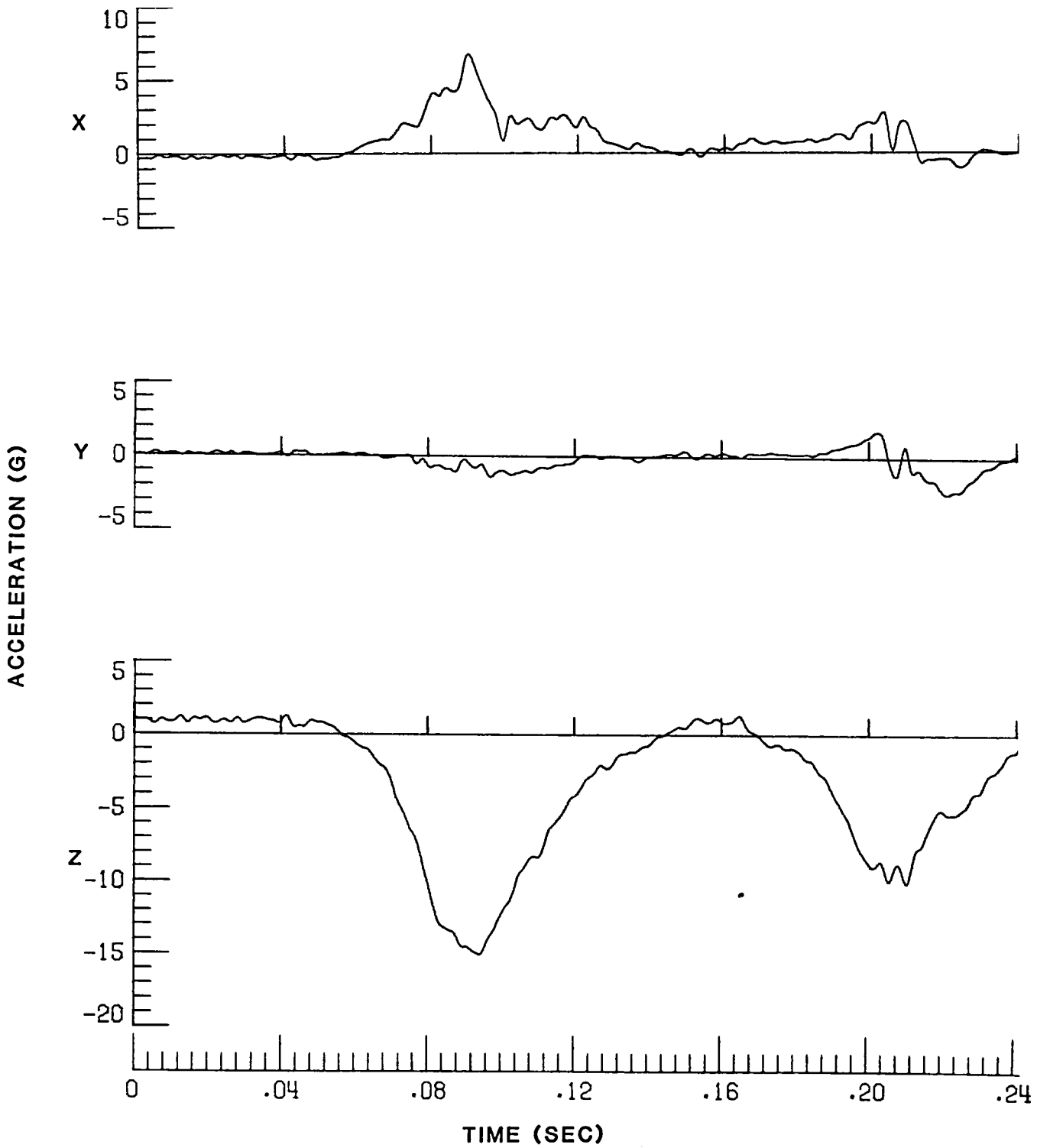
CAPSULE C.G.
NASA TEST NO. 9



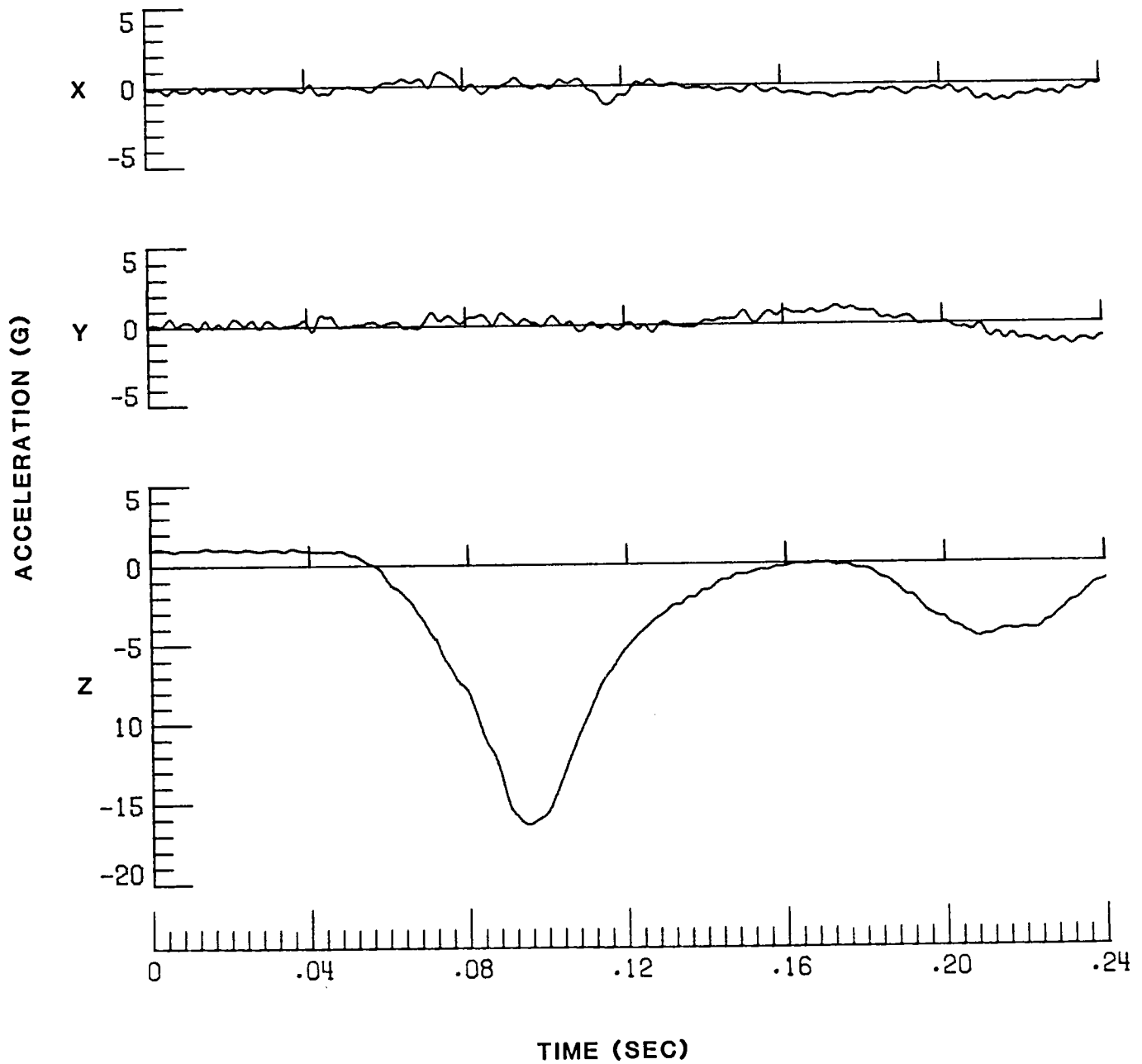
SEAT PAN ALONG BACK TANGENT LINE
NASA TEST NO. 9



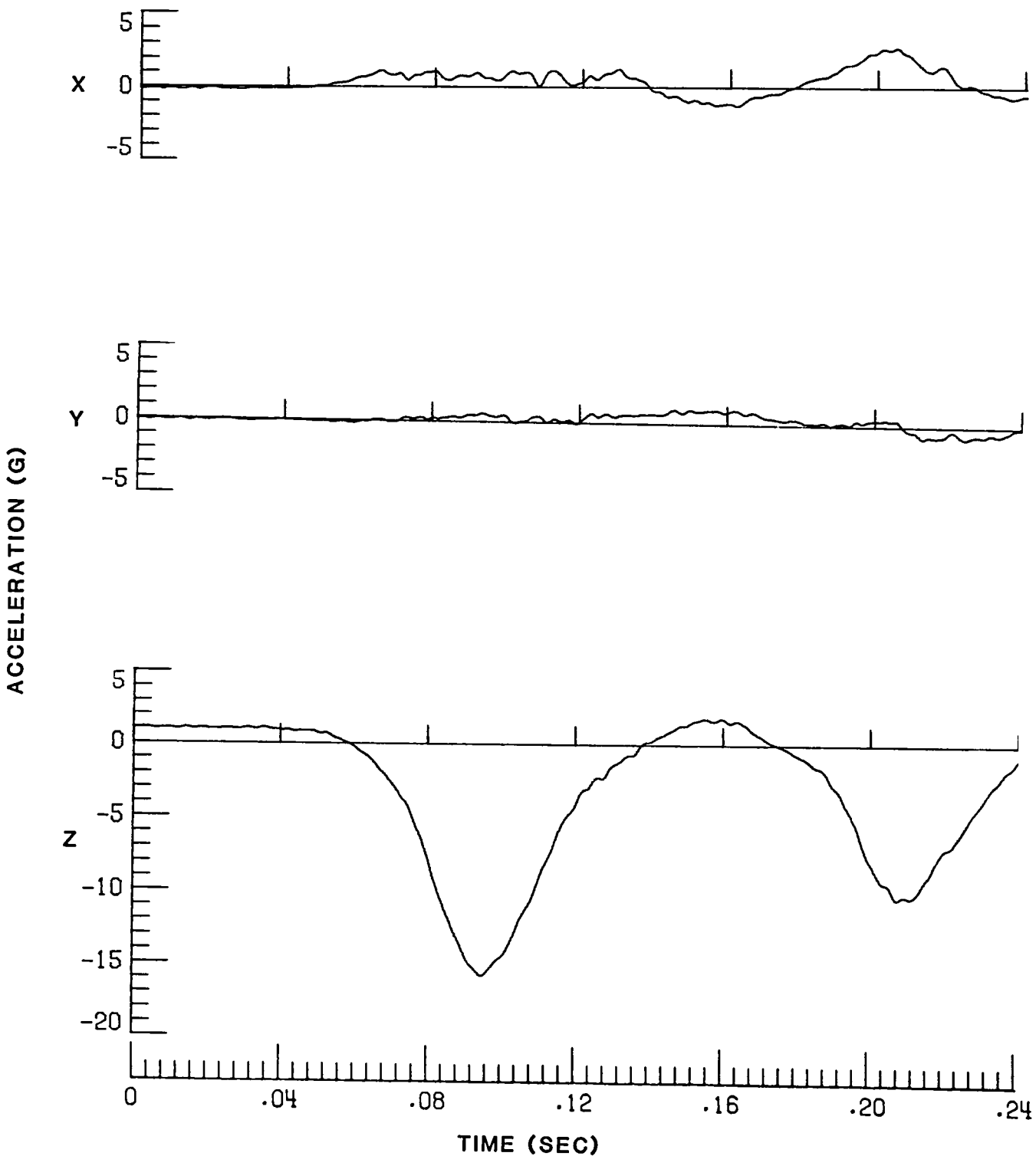
LEFT DUMMY PELVIS
NASA TEST NO. 9



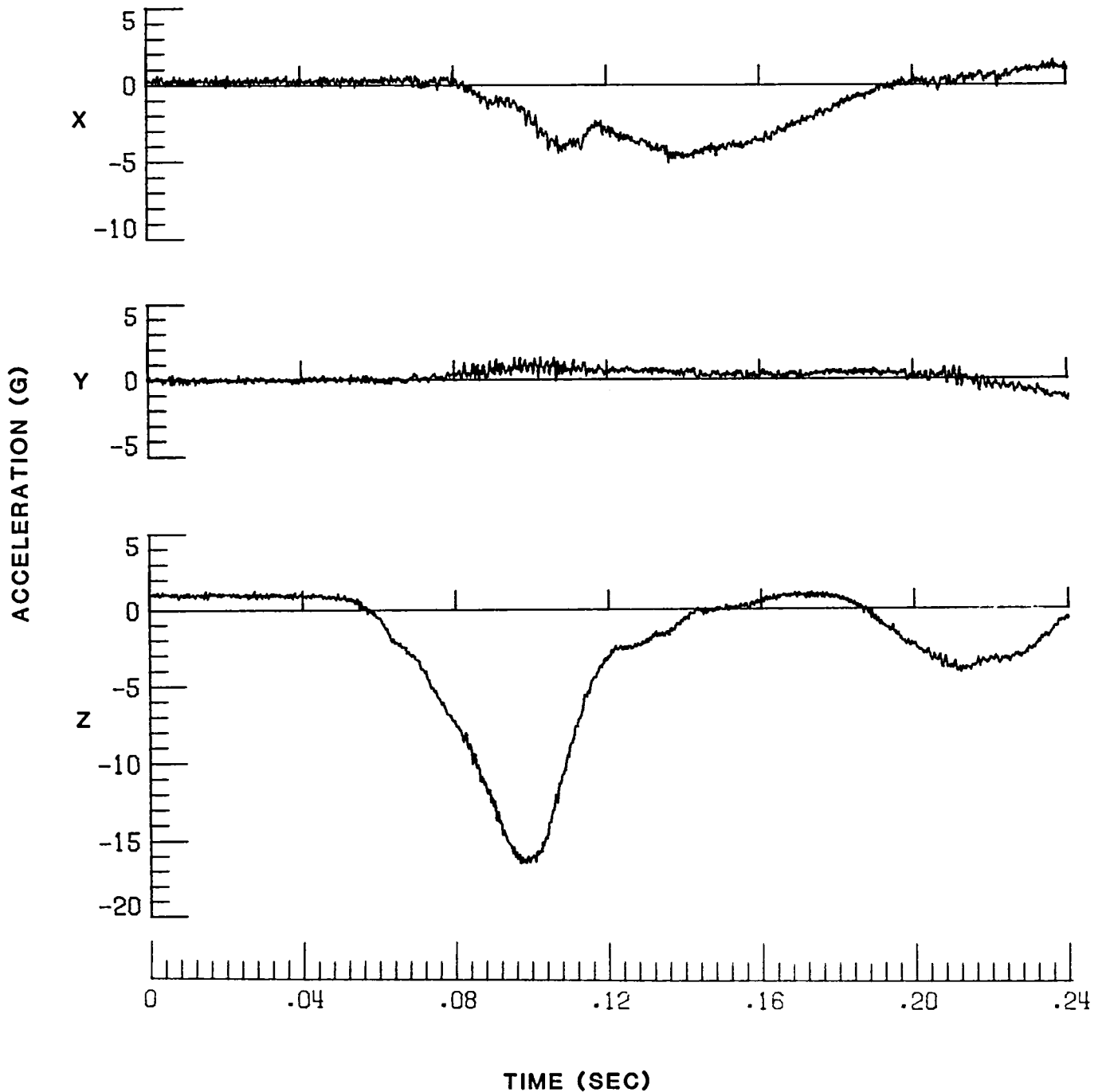
RIGHT DUMMY PELVIS
NASA TEST NO. 9



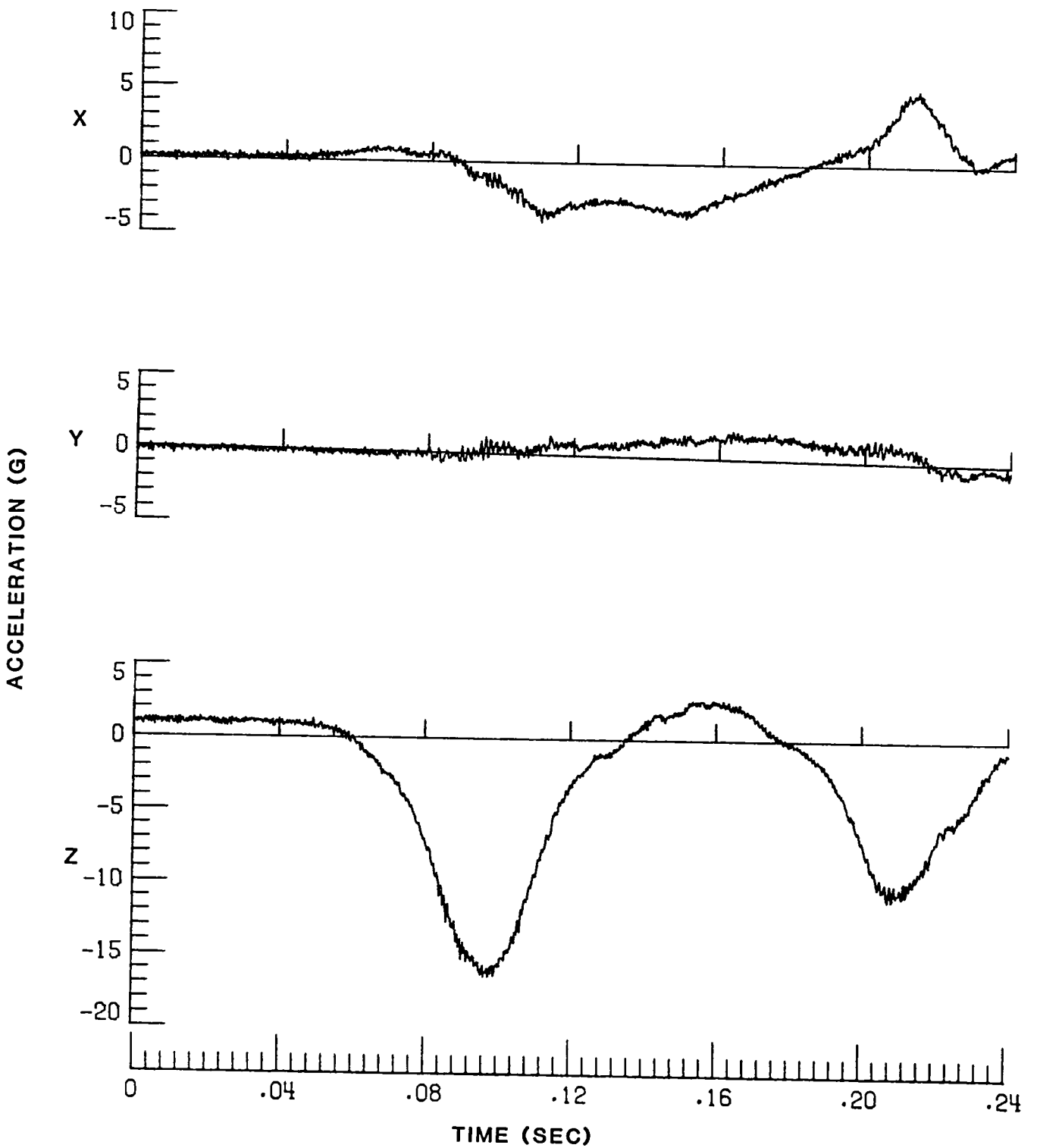
LEFT DUMMY CHEST
NASA TEST NO. 9



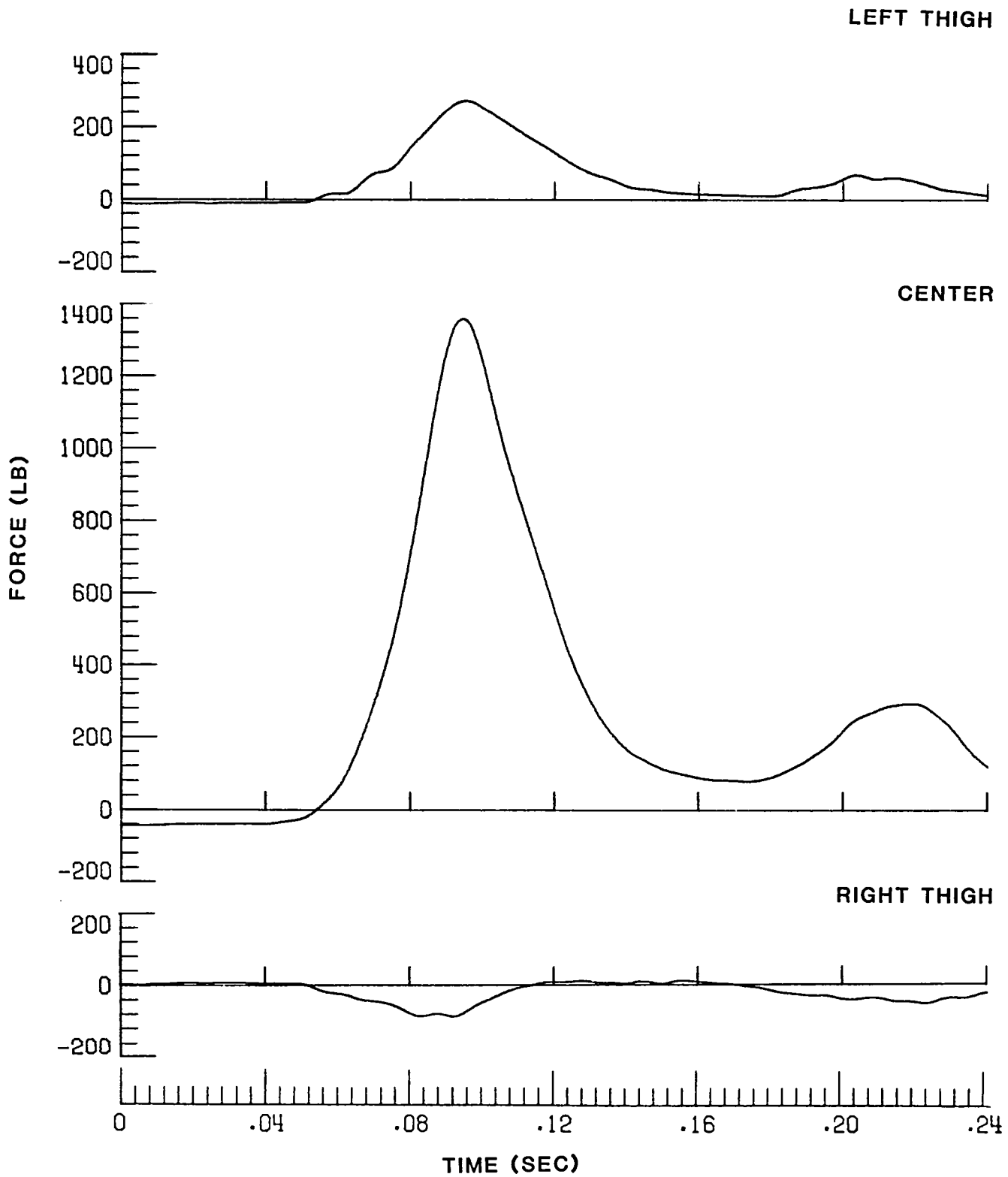
RIGHT DUMMY CHEST
NASA TEST NO. 9



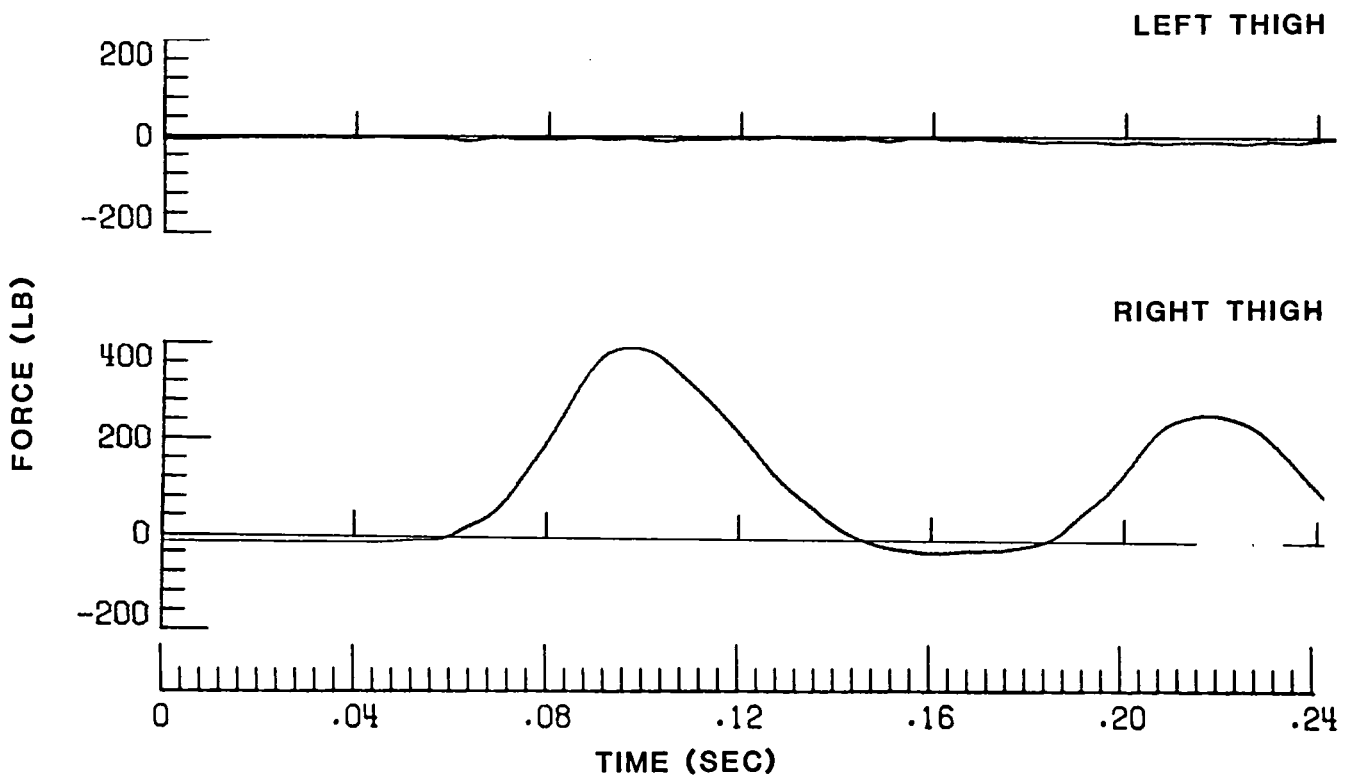
LEFT DUMMY HEAD
NASA TEST NO. 9



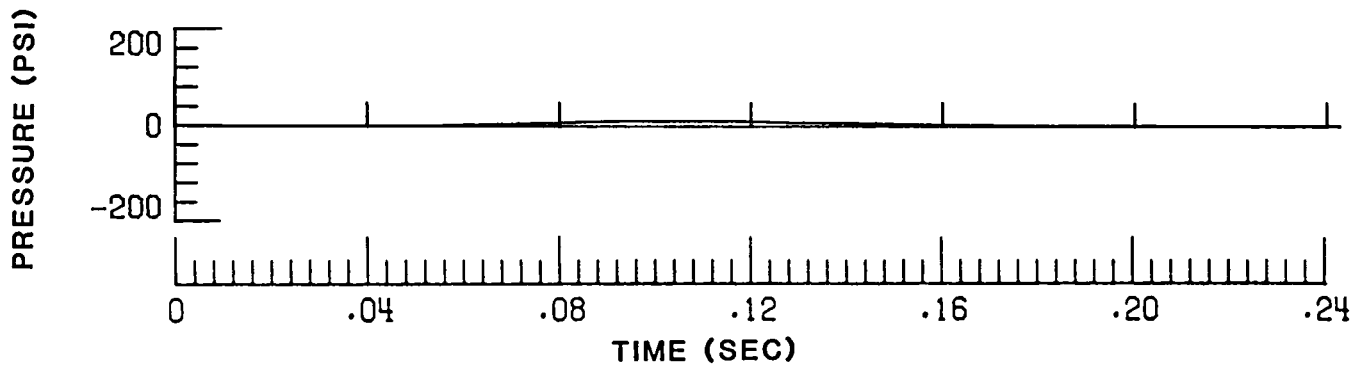
RIGHT DUMMY HEAD
NASA TEST NO. 9



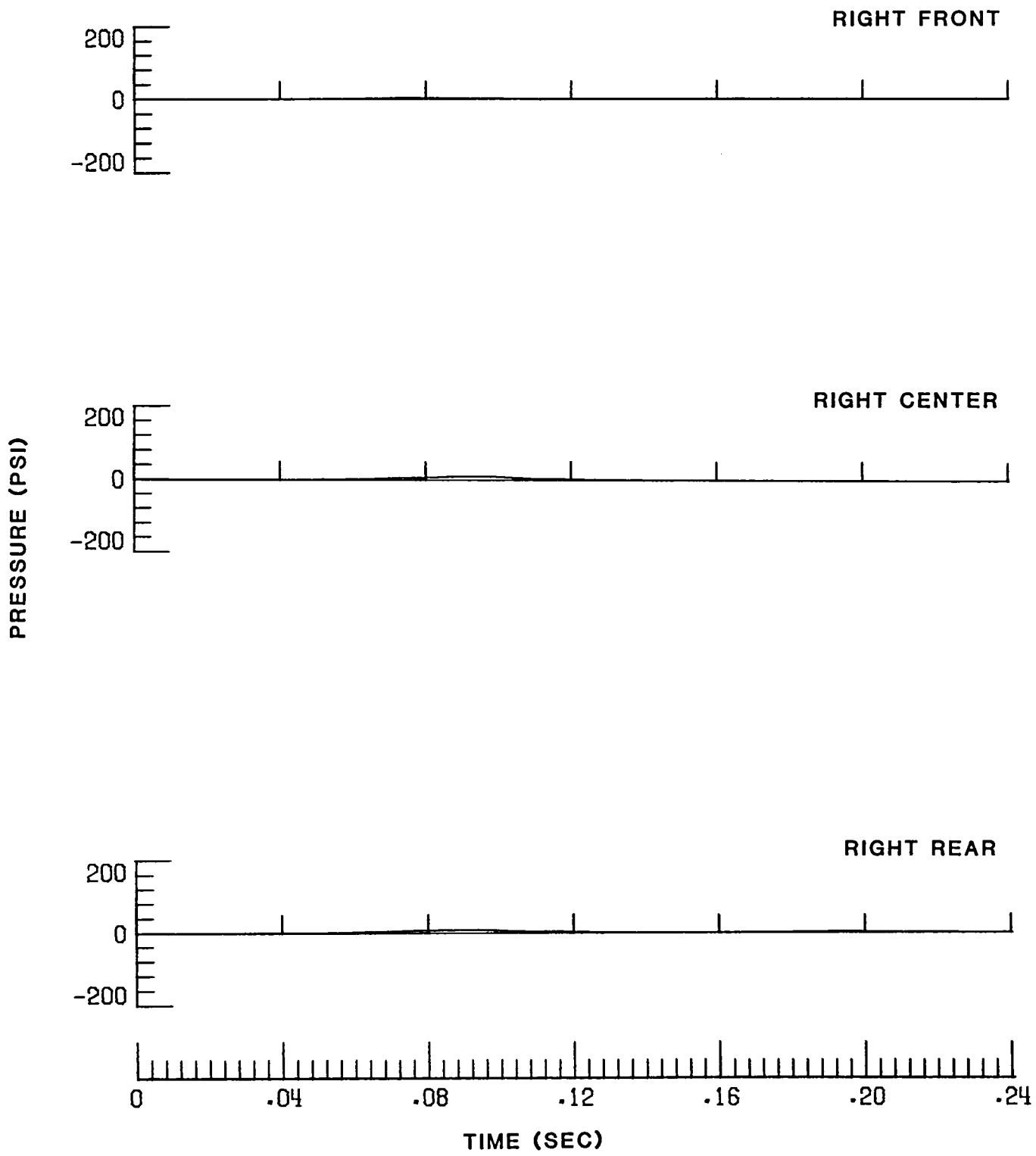
LEFT SEAT PAN LOADS
NASA TEST NO. 9



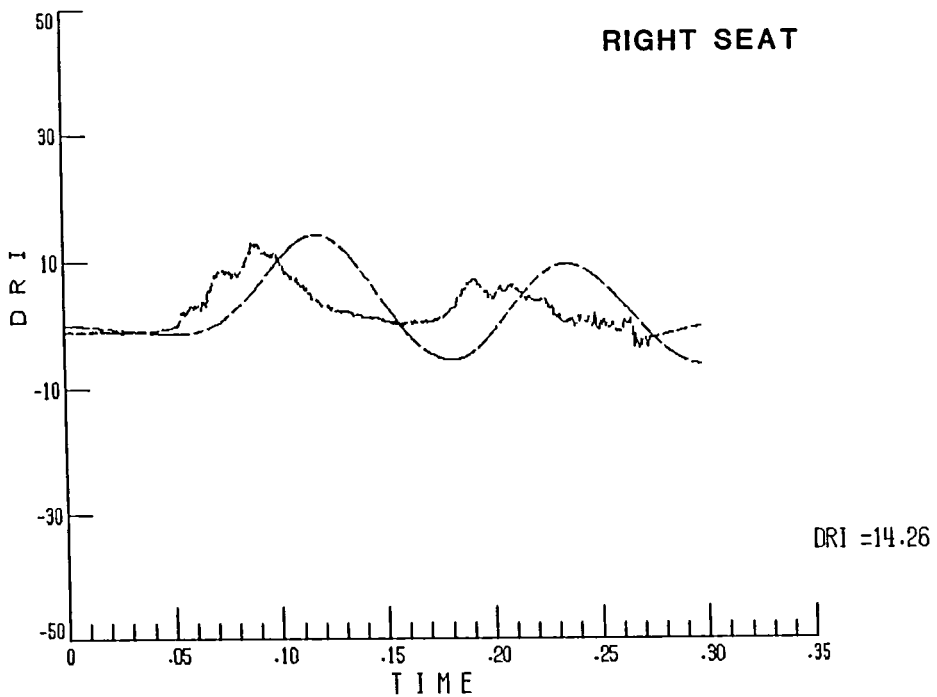
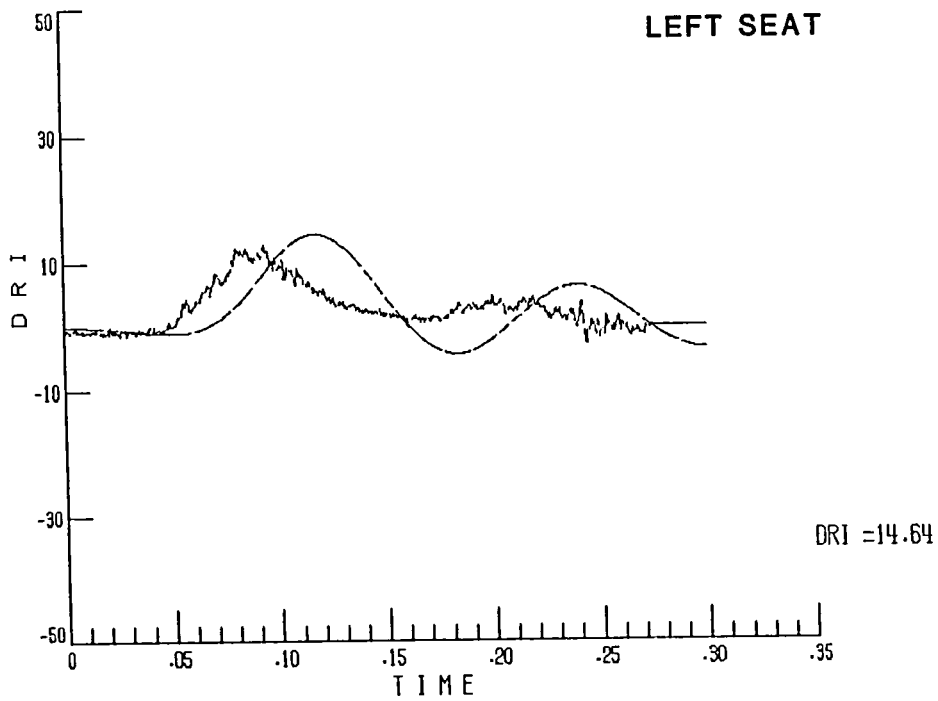
RIGHT SEAT PAN LOADS
NASA TEST NO. 9



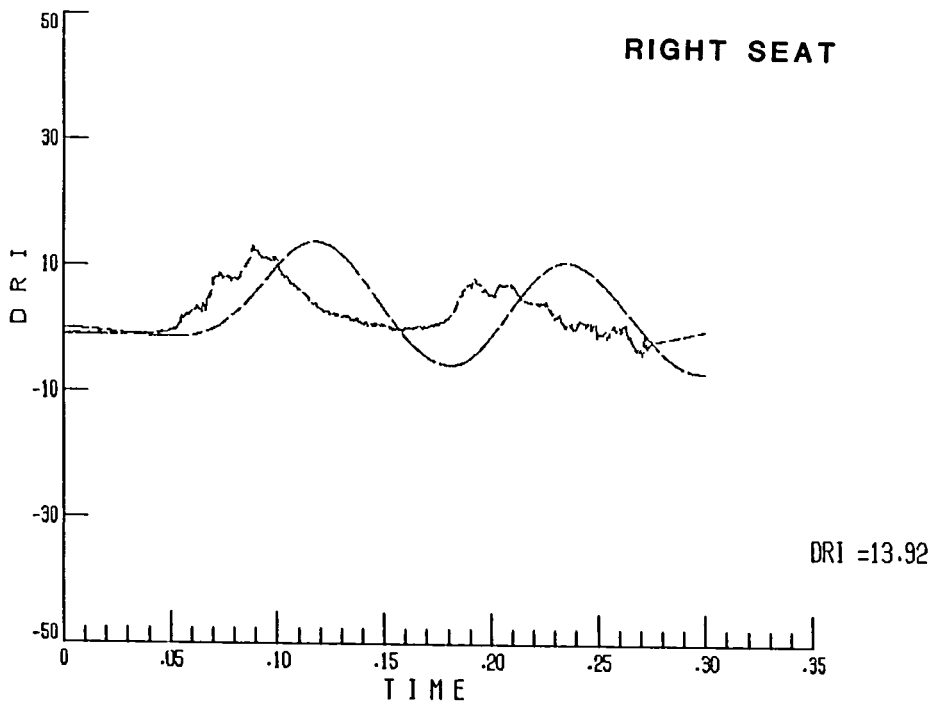
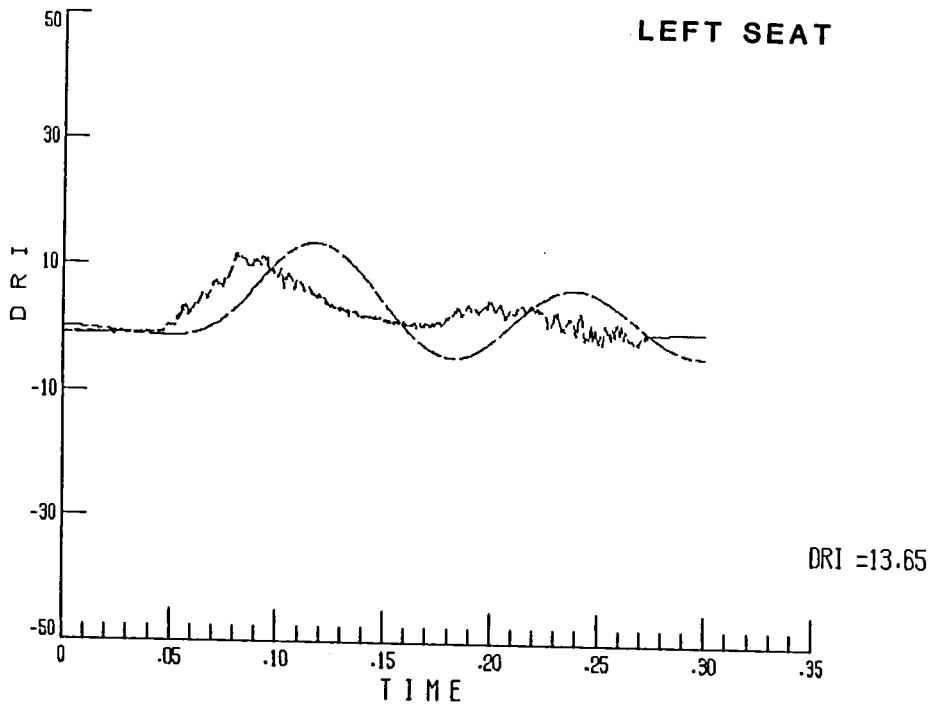
LEFT REAR EXIT PORT PRESSURE
NASA TEST NO. 9



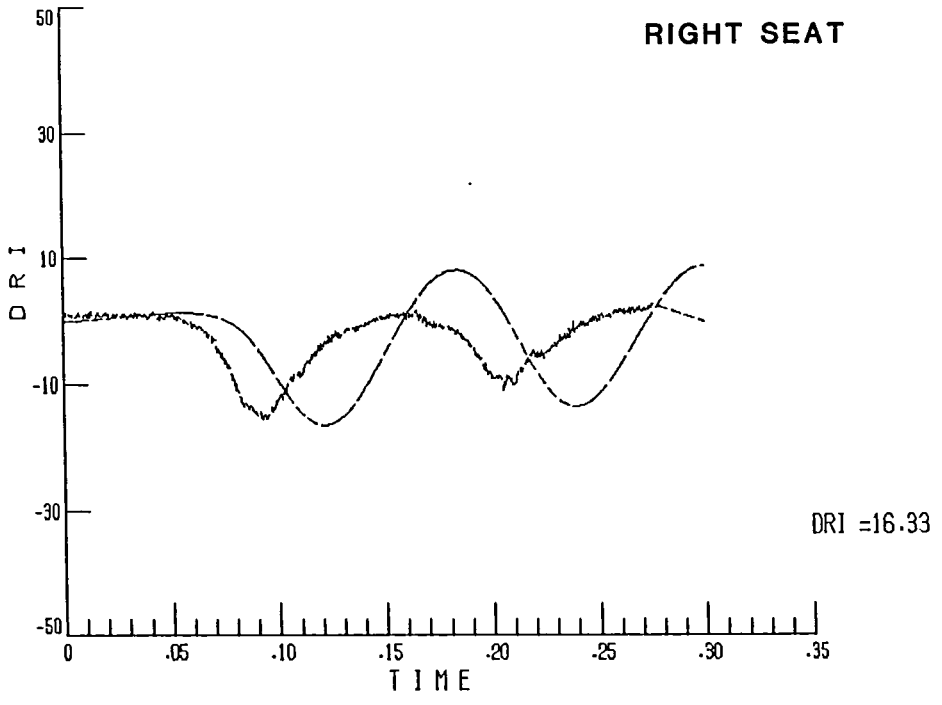
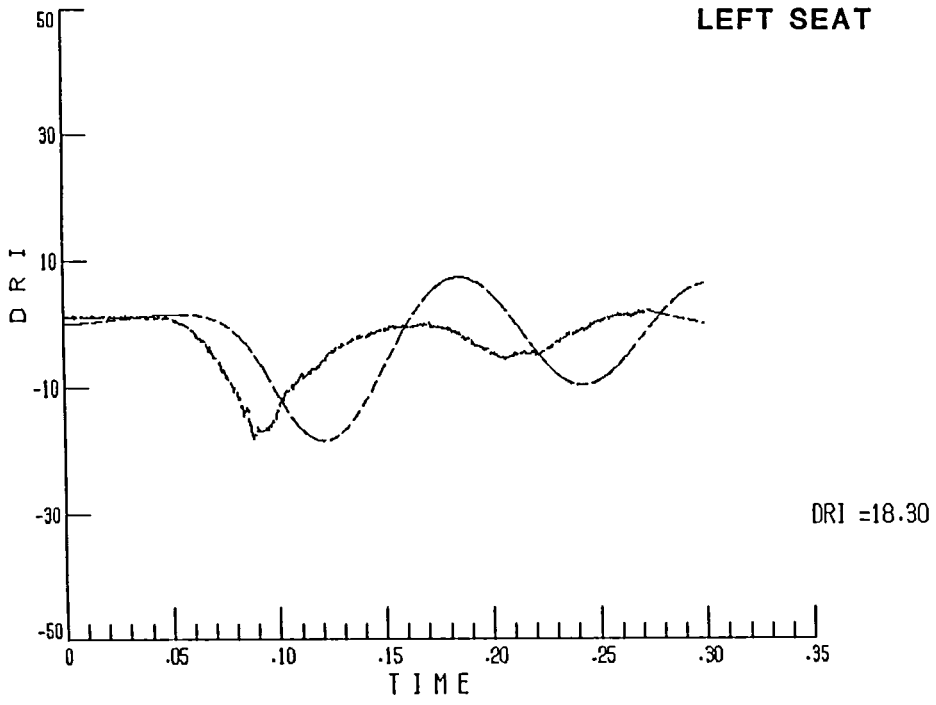
EXIT PORT PRESSURES
 NASA TEST NO. 9



**DYNAMIC RESPONSE INDEX
SEAT PAN Z-AXIS
NASA TEST NO. 9**



**DYNAMIC RESPONSE INDEX
BACK TANGENT LINE
NASA TEST NO. 9**



**DYNAMIC RESPONSE INDEX
DUMMY PELVIS Z-AXIS
NASA TEST NO. 9
171**

11.0 NASA TEST NO. 10

HORIZONTAL VELOCITY: 0 ft/sec

VERTICAL VELOCITY: 25 ft/sec

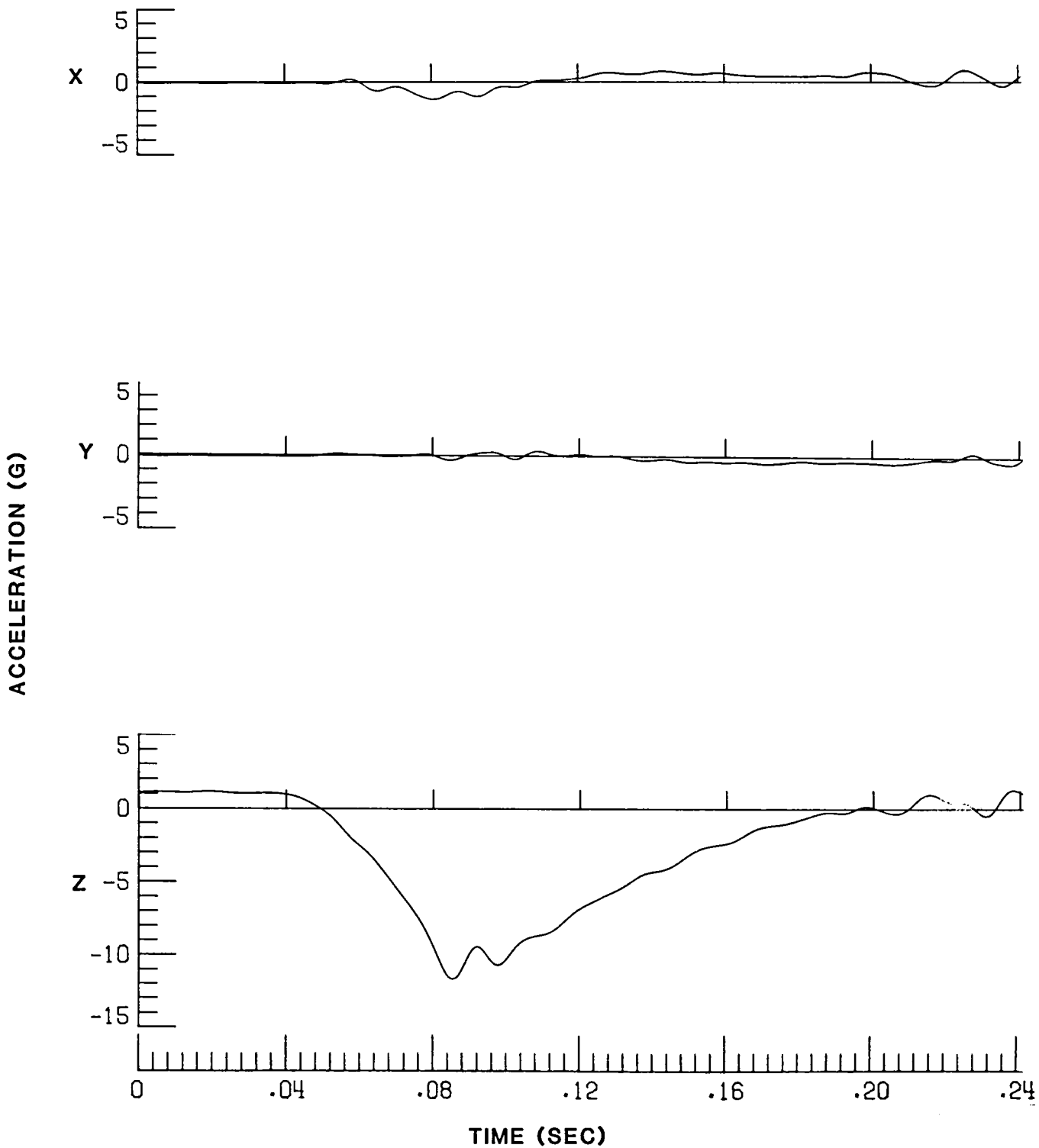
CREW MODULE PITCH: 2°

CREW MODULE ROLL: 0°

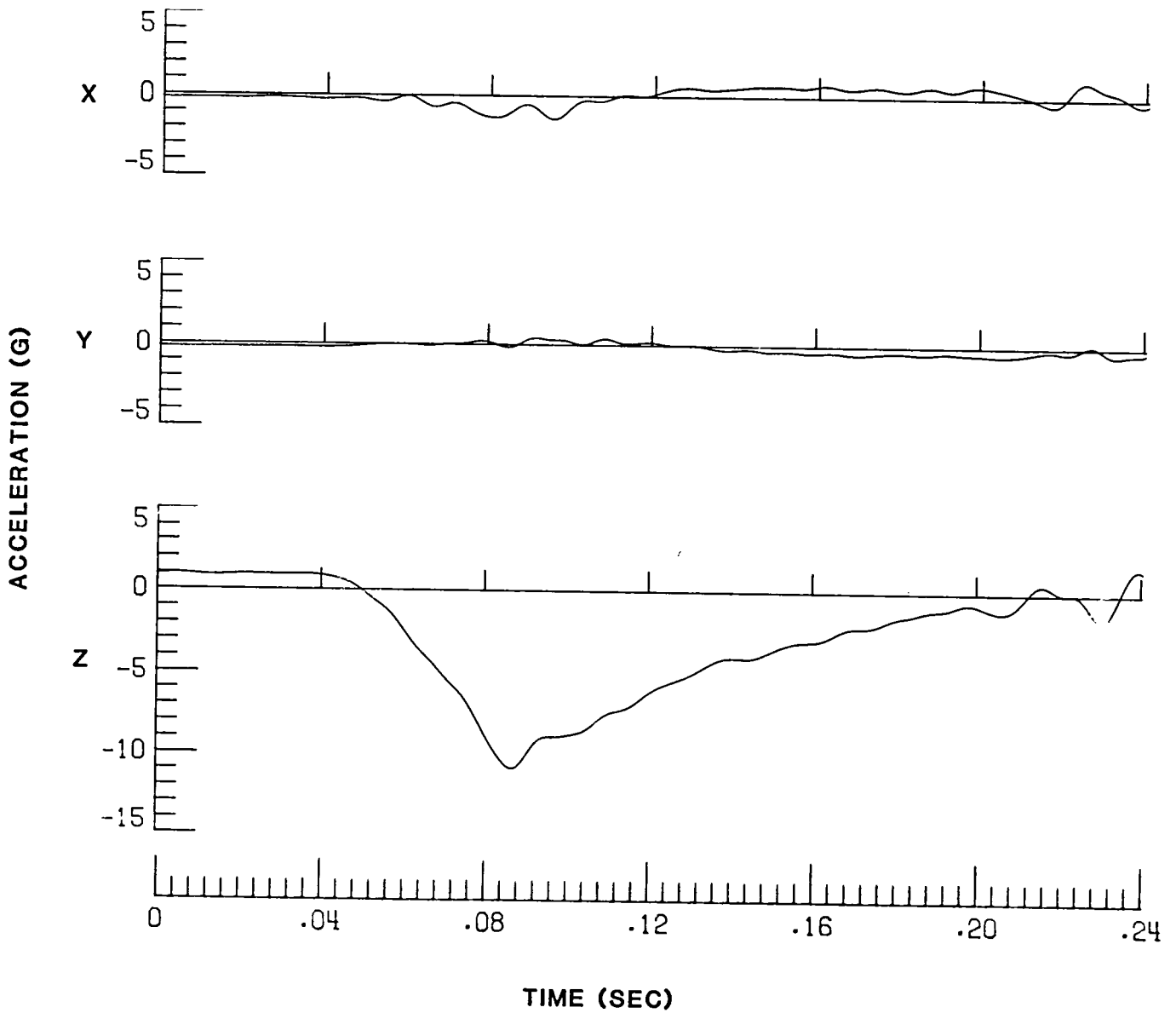
CREW MODULE YAW: 0°

LEFT SEAT: F-111 Operational

RIGHT SEAT: Energy Absorbing

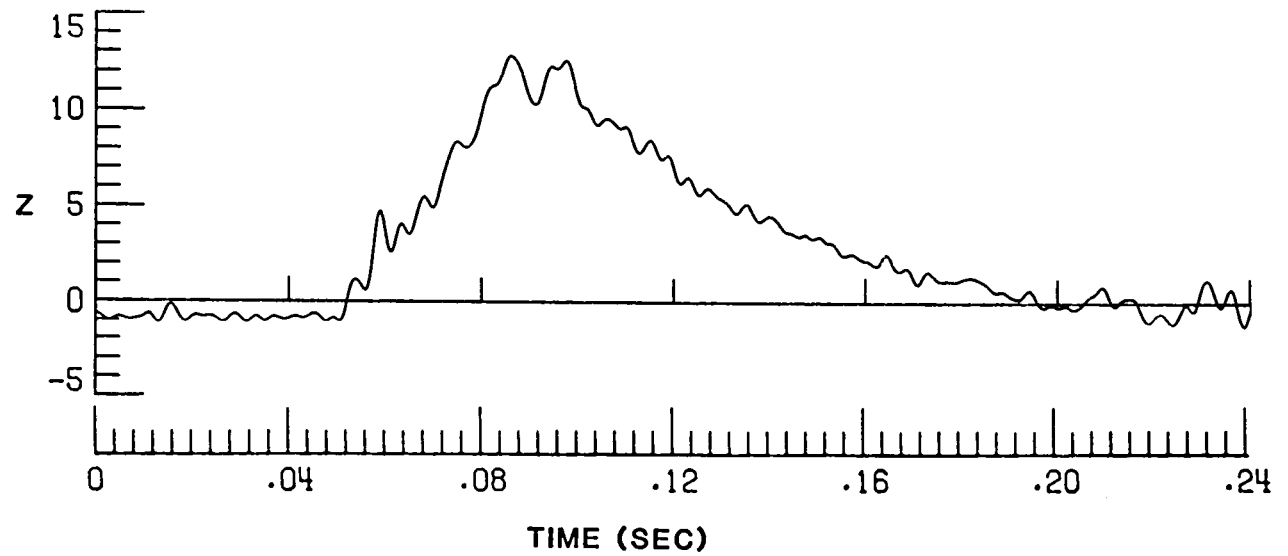
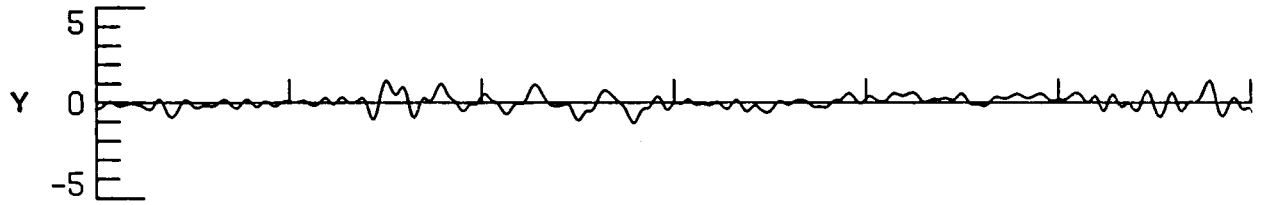
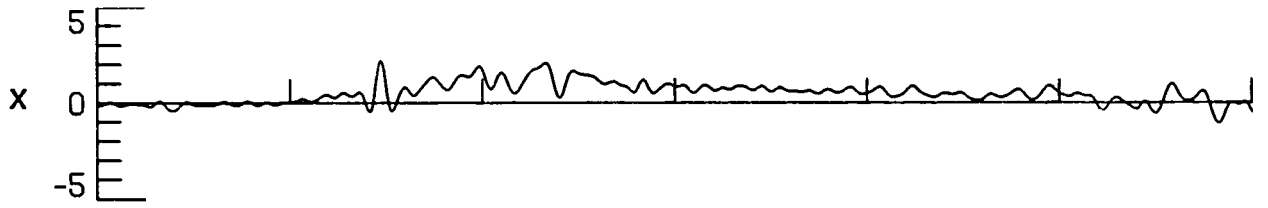


LEFT BULKHEAD
NASA TEST NO. 10

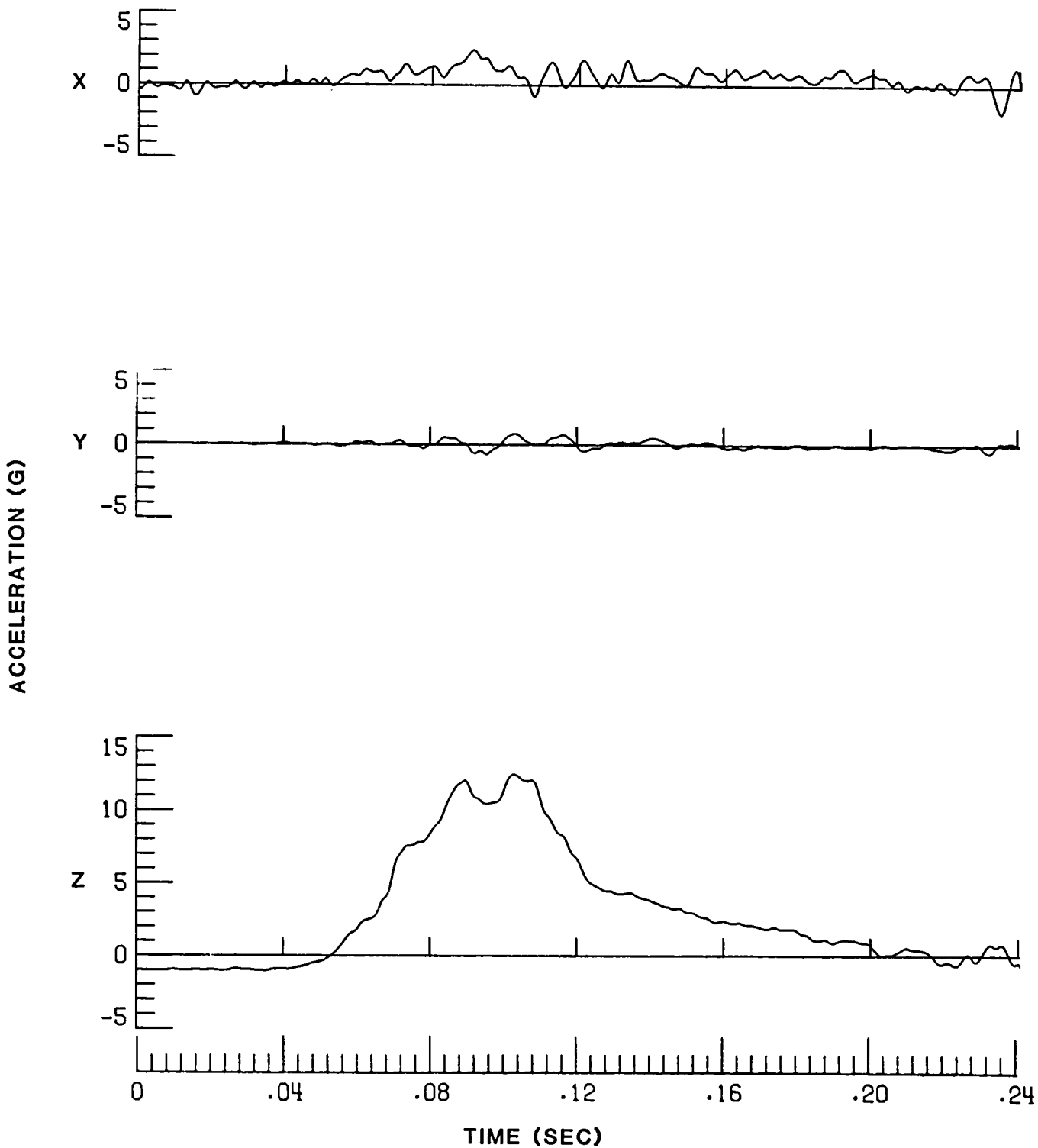


RIGHT BULKHEAD
NASA TEST NO. 10

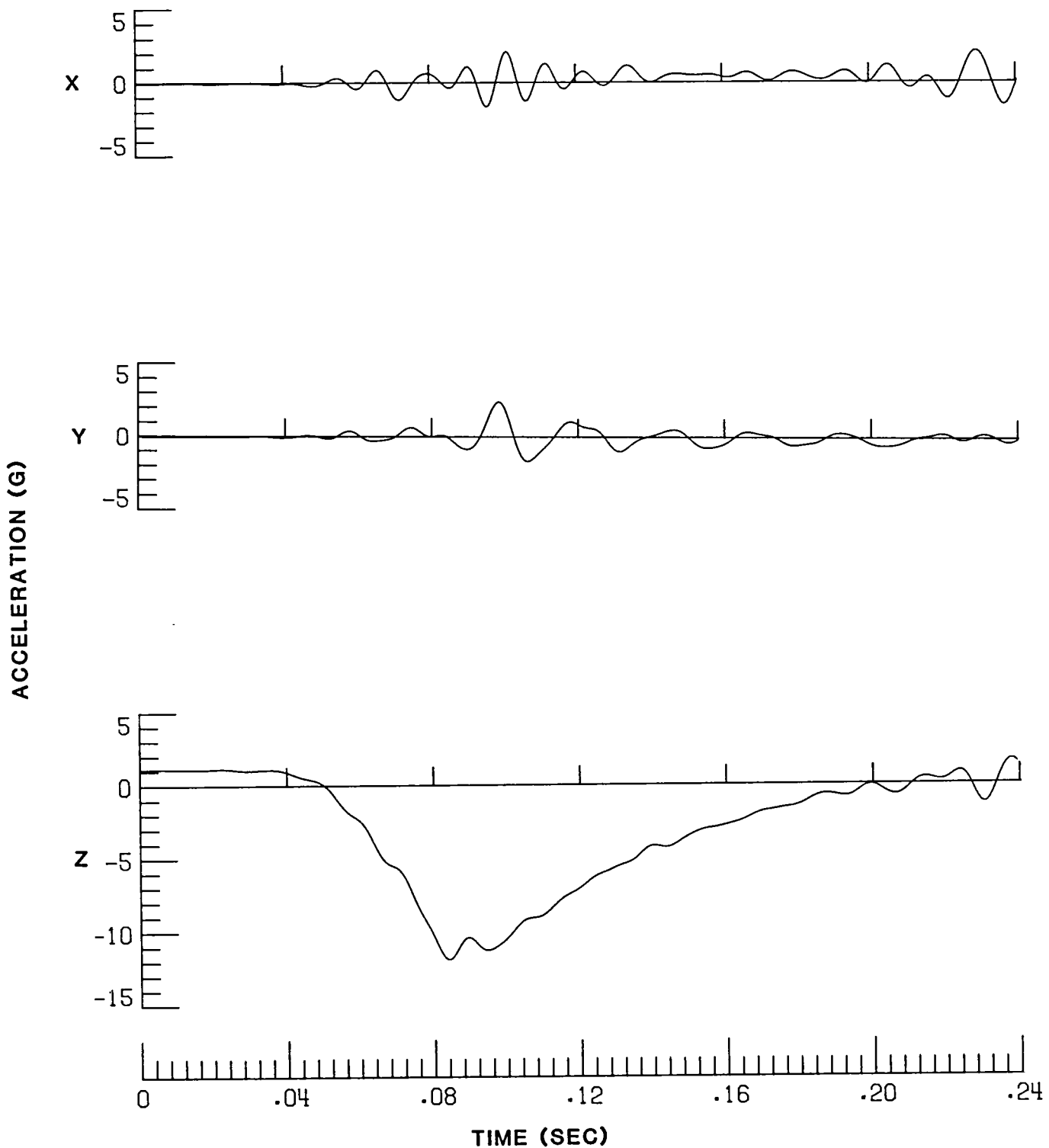
ACCELERATION (G)



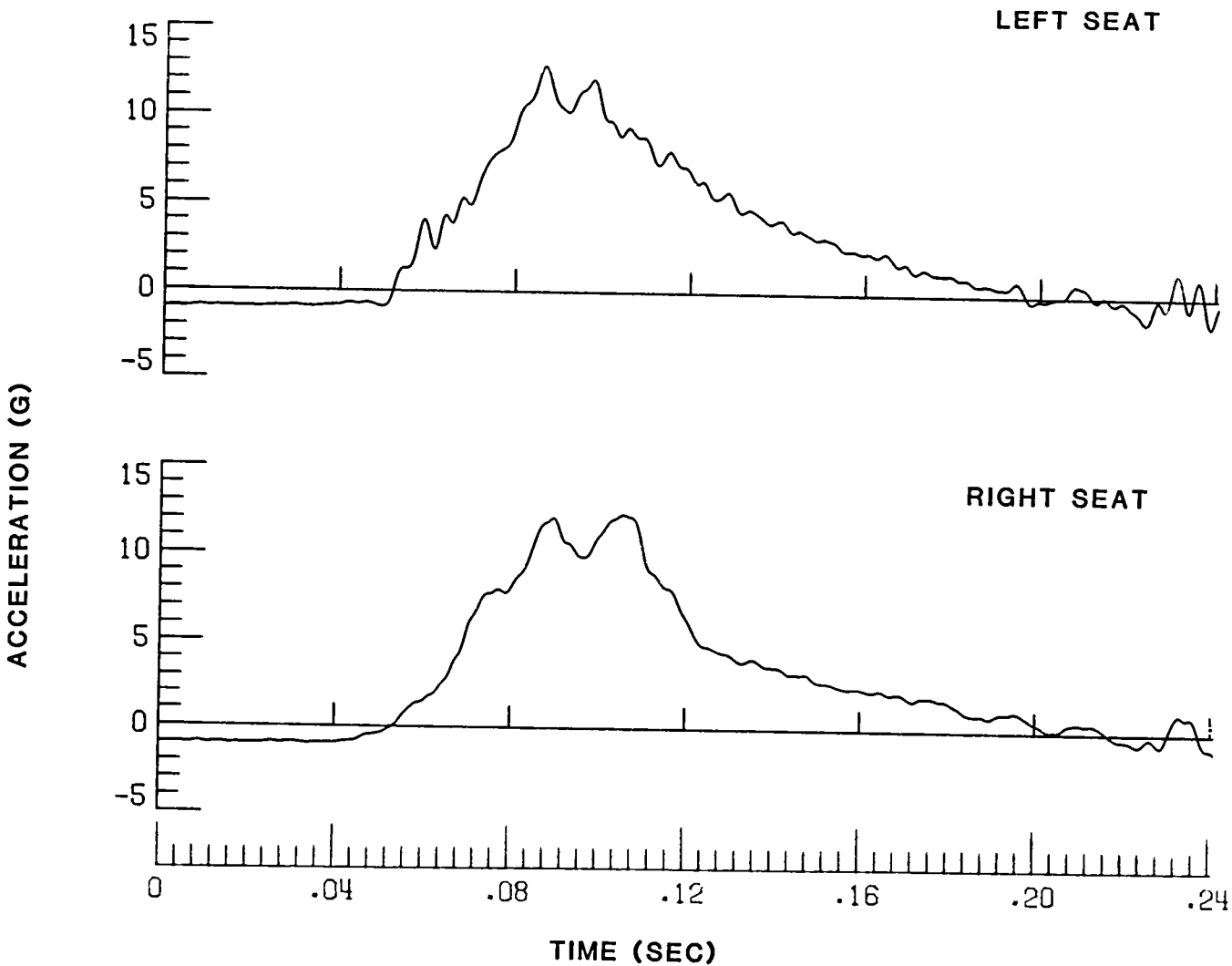
LEFT SEAT PAN
NASA TEST NO. 10



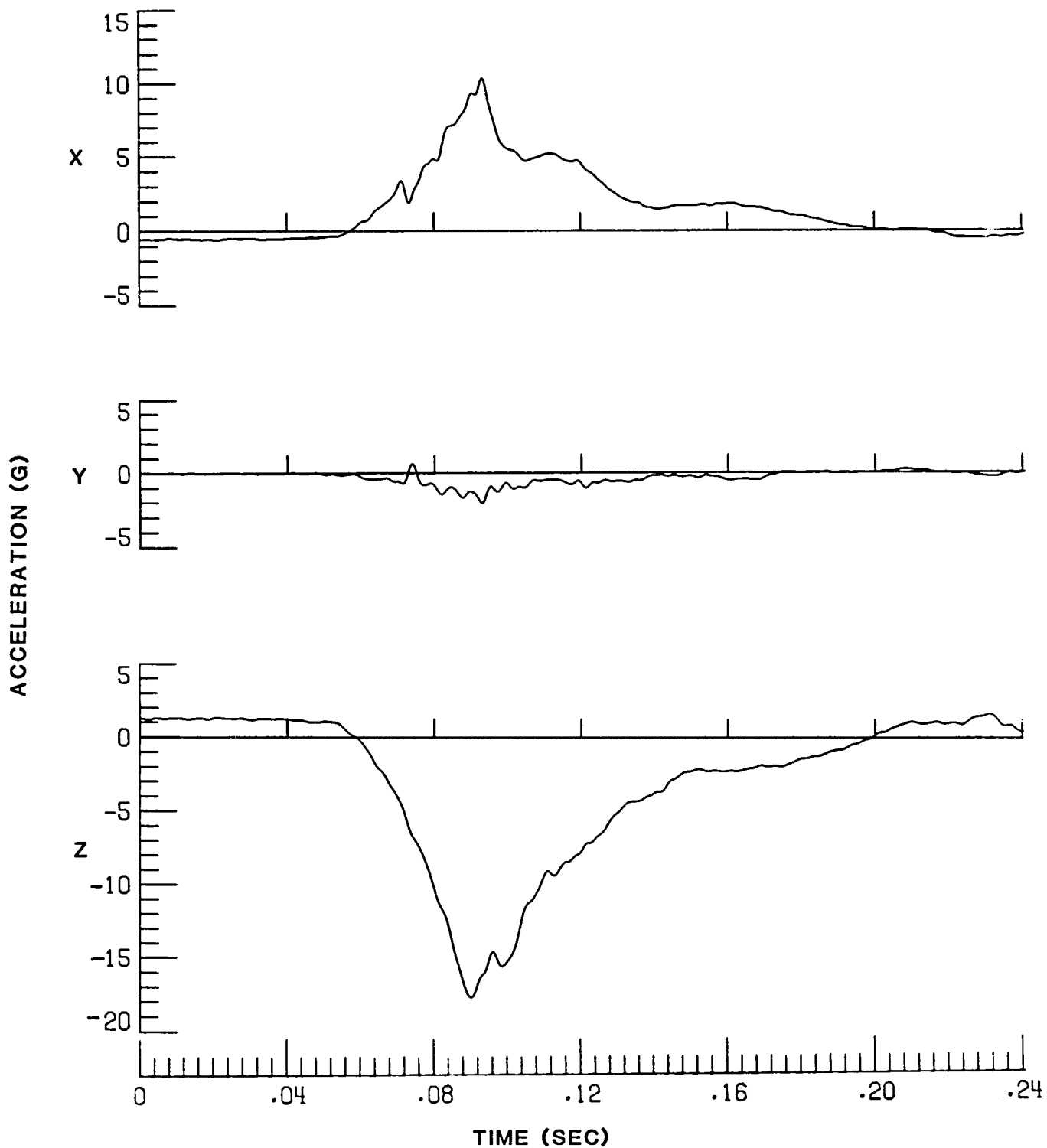
RIGHT SEAT PAN
NASA TEST NO. 10



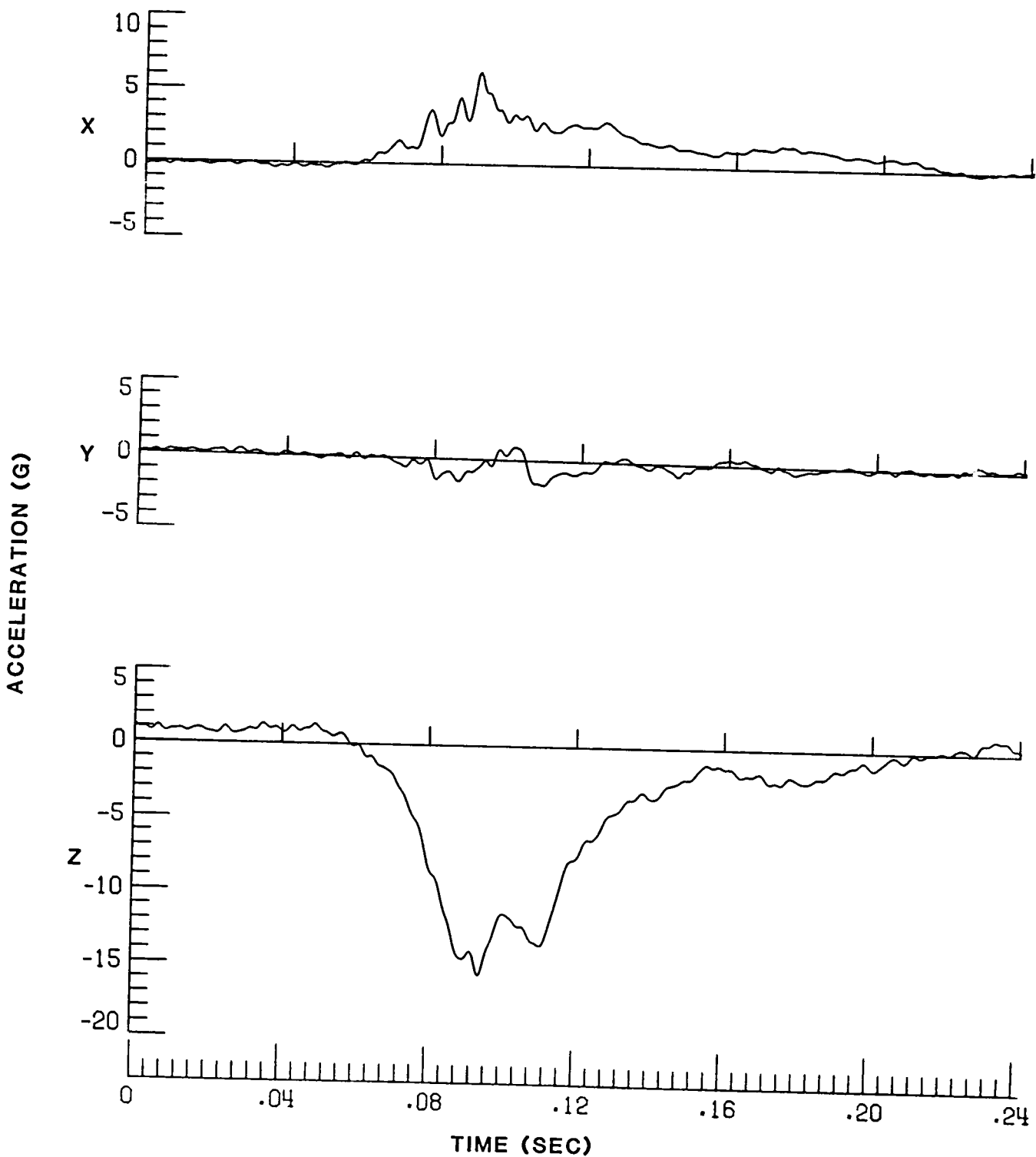
CAPSULE C.G.
NASA TEST NO. 10



SEAT PAN ALONG BACK TANGENT LINE
 NASA TEST NO. 10

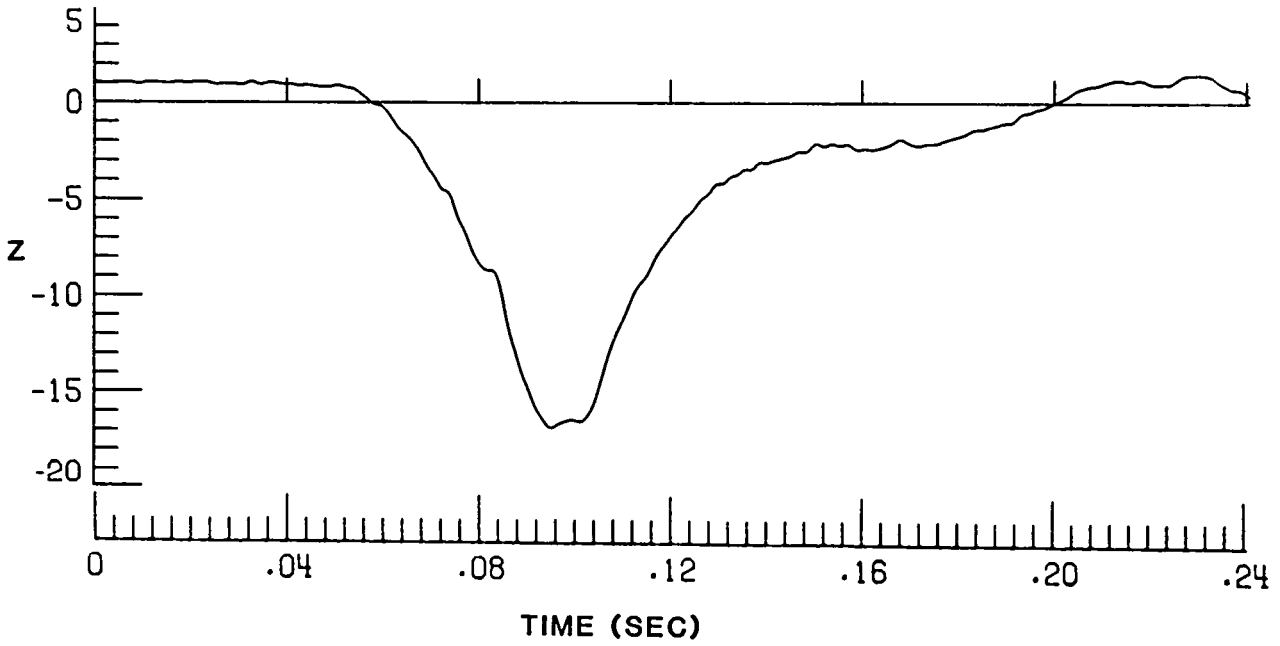
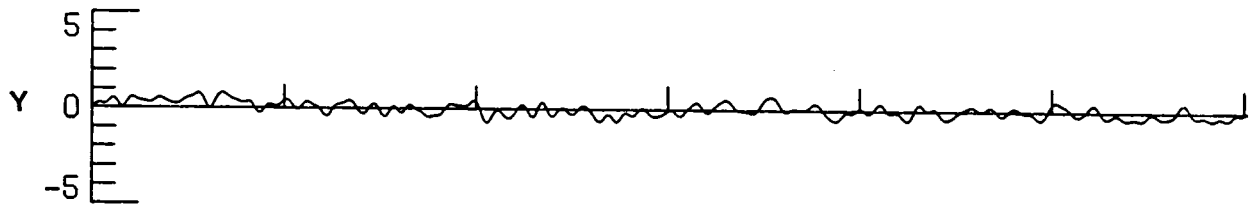
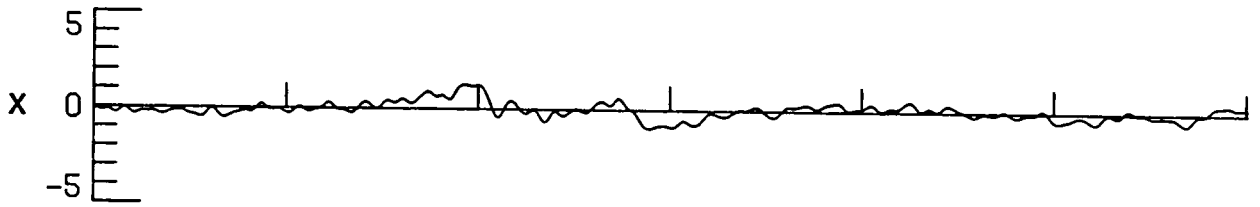


LEFT DUMMY PELVIS
NASA TEST NO. 10

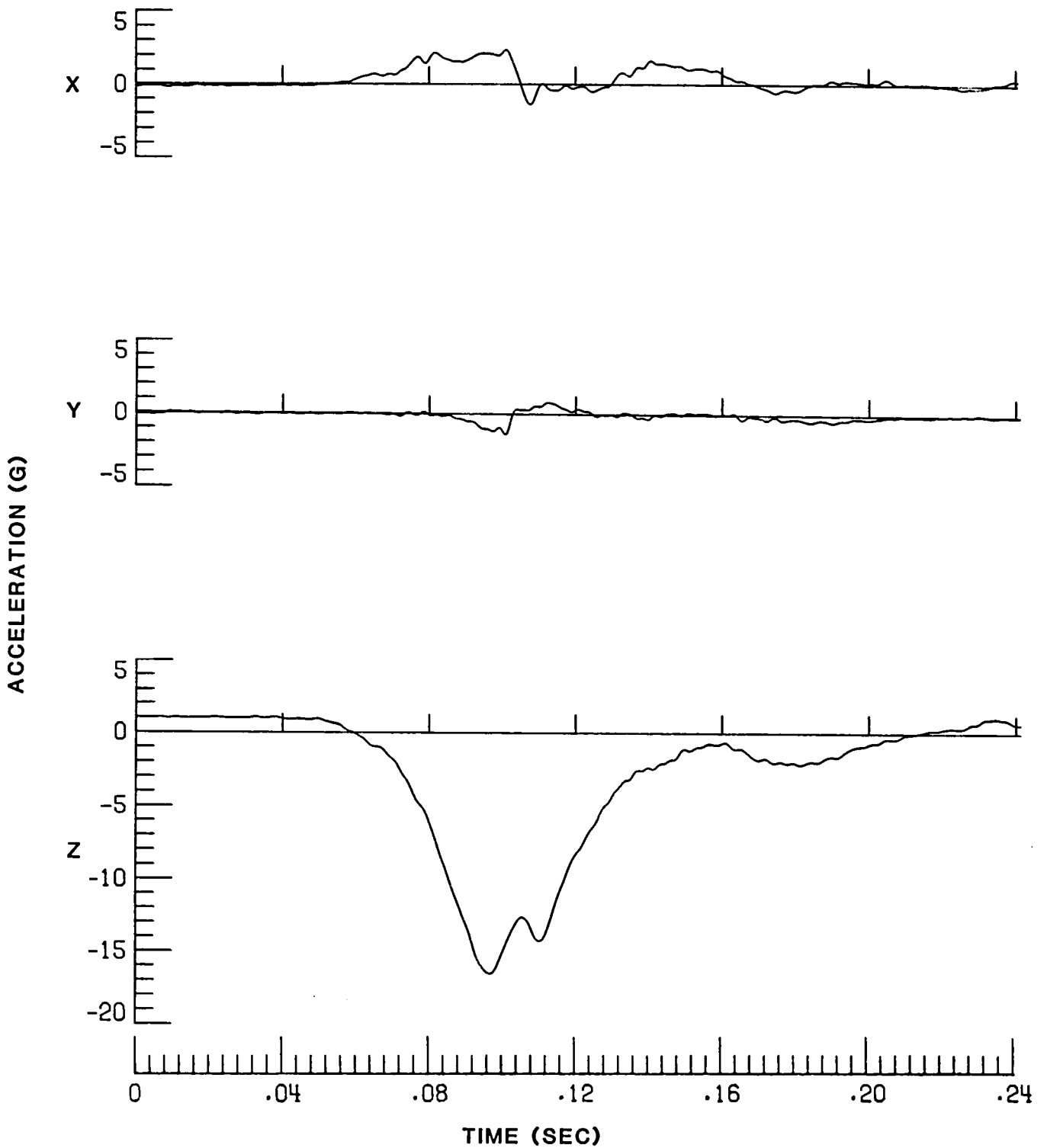


RIGHT DUMMY PELVIS
NASA TEST NO. 10

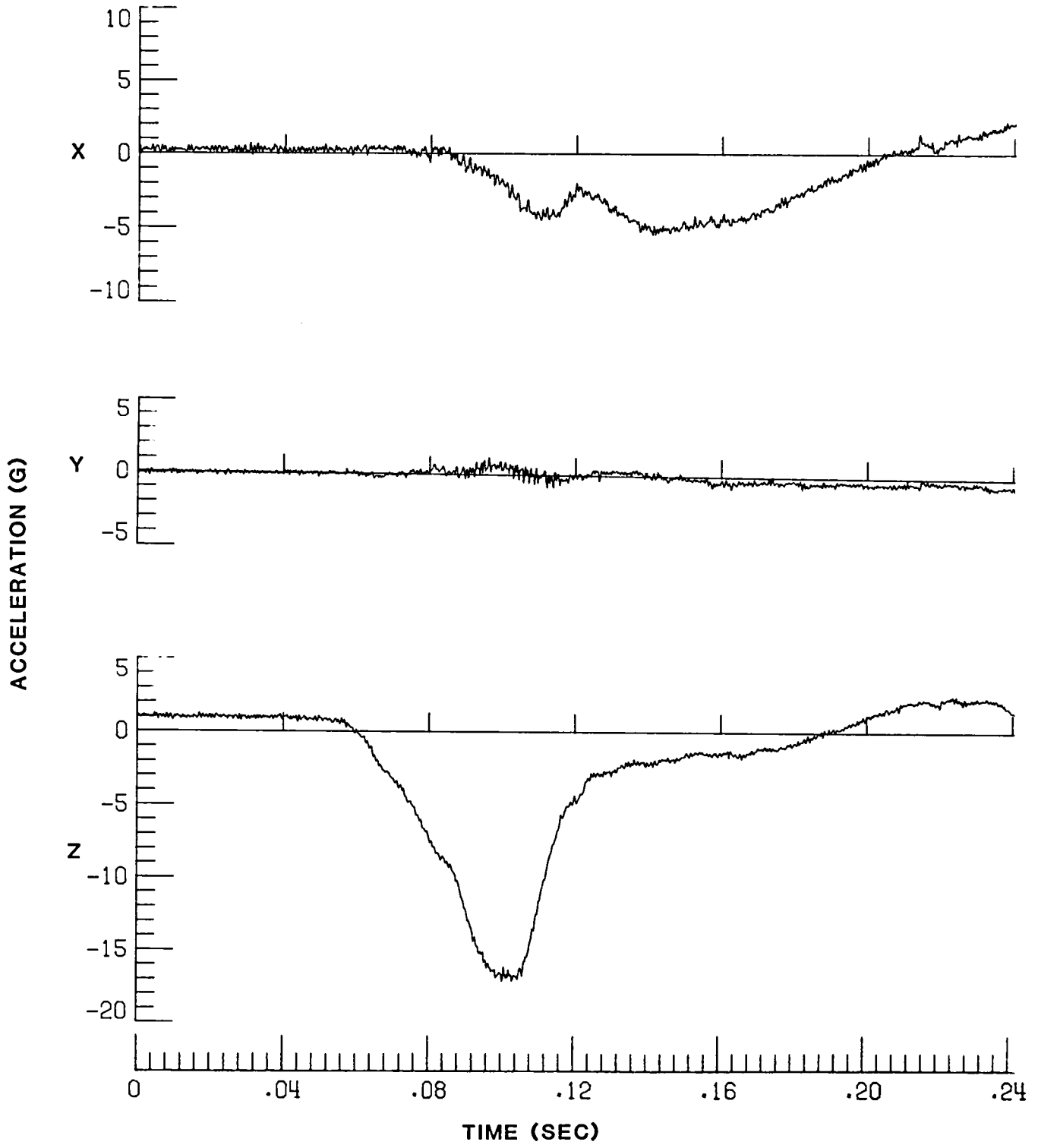
ACCELERATION (G)



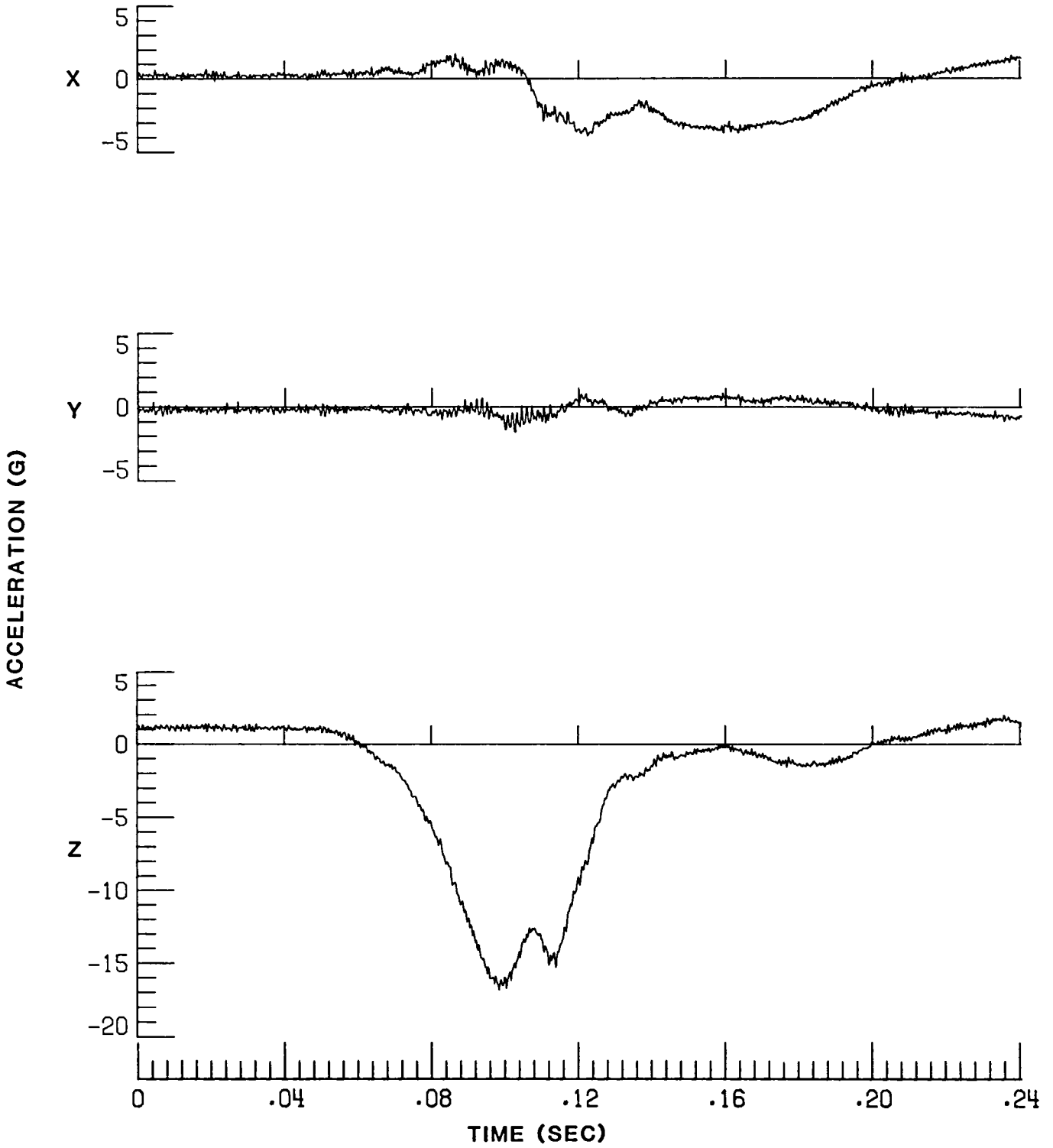
LEFT DUMMY CHEST
NASA TEST NO. 10



RIGHT DUMMY CHEST
NASA TEST NO. 10



LEFT DUMMY HEAD
NASA TEST NO. 10

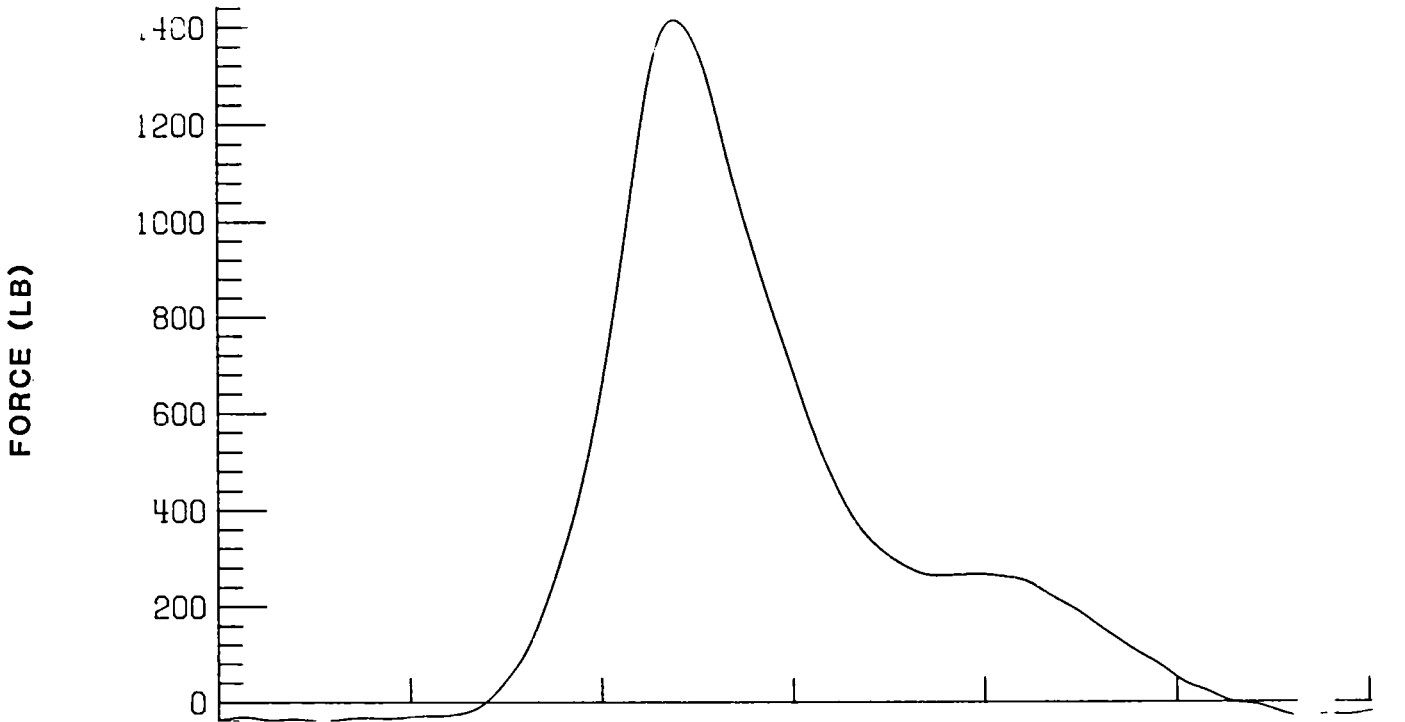


RIGHT DUMMY HEAD
NASA TEST NO. 10

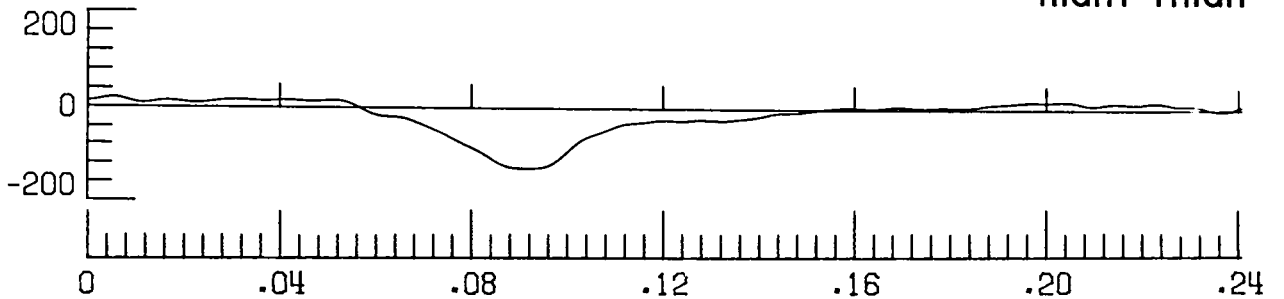
LEFT THIGH



CENTER

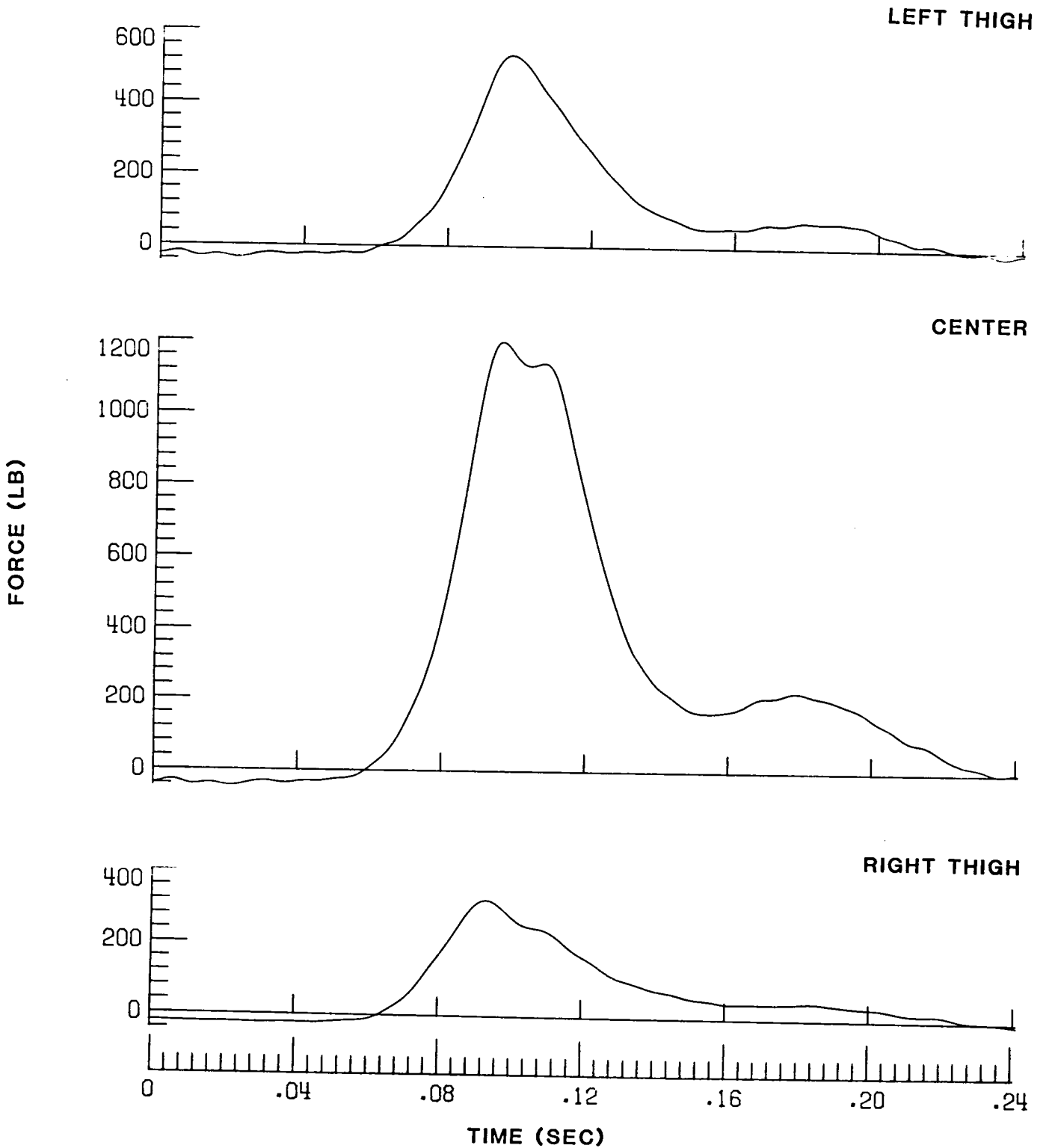


RIGHT THIGH

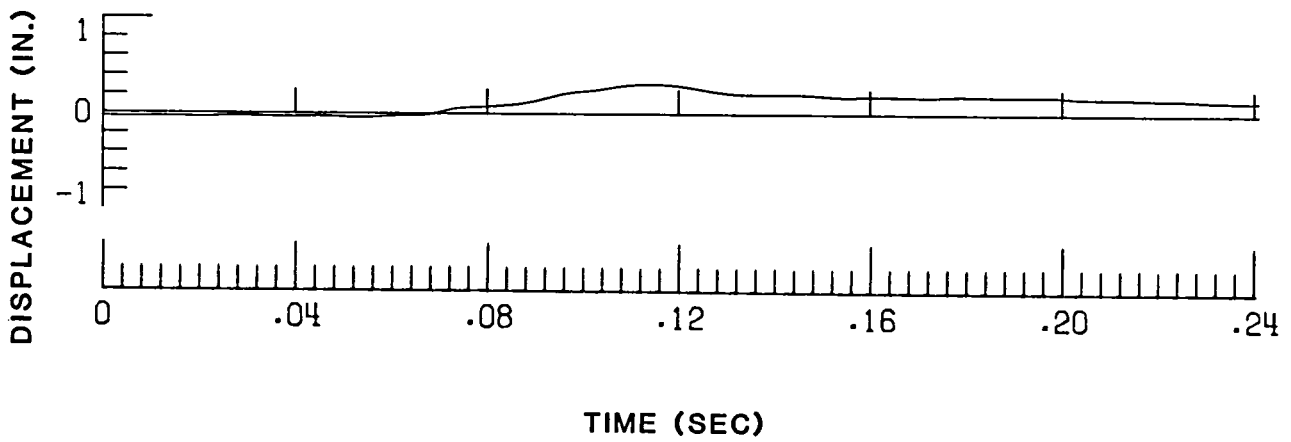


TIME (SEC)

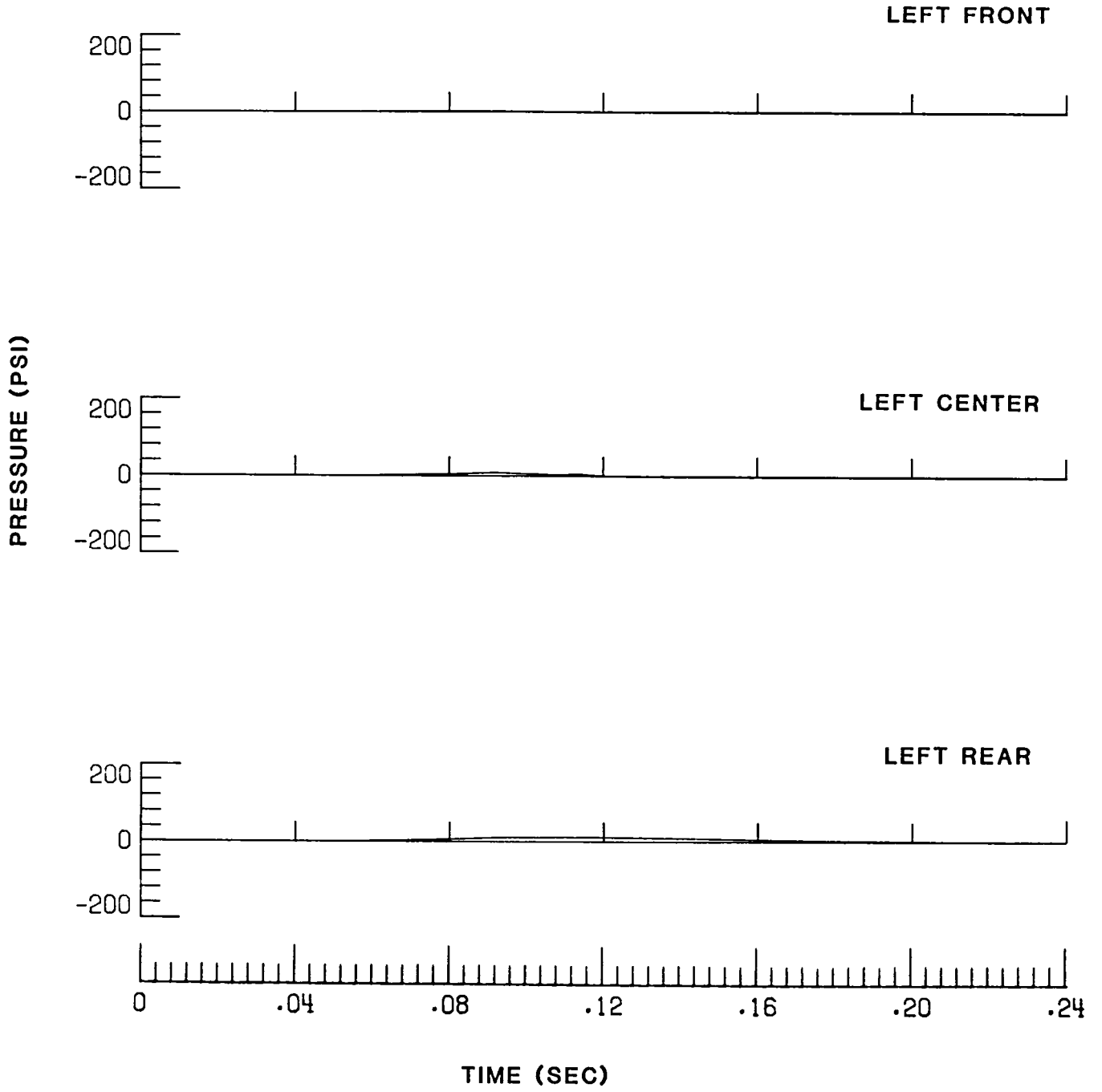
LEFT SEAT PAN LOADS
NASA TEST NO. 10



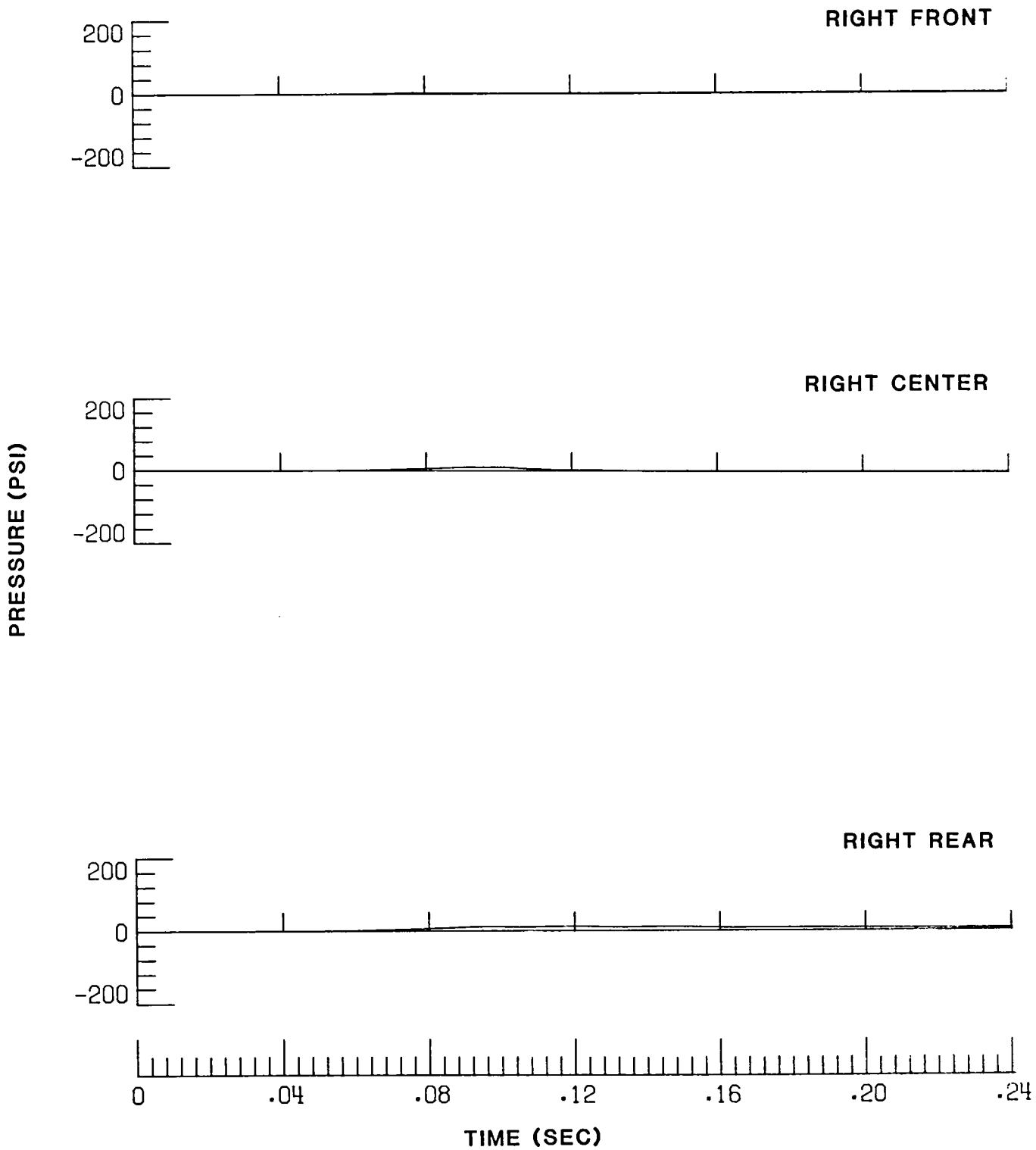
RIGHT SEAT PAN LOADS
NASA TEST NO. 10



RIGHT SEAT STROKE
NASA TEST NO. 10

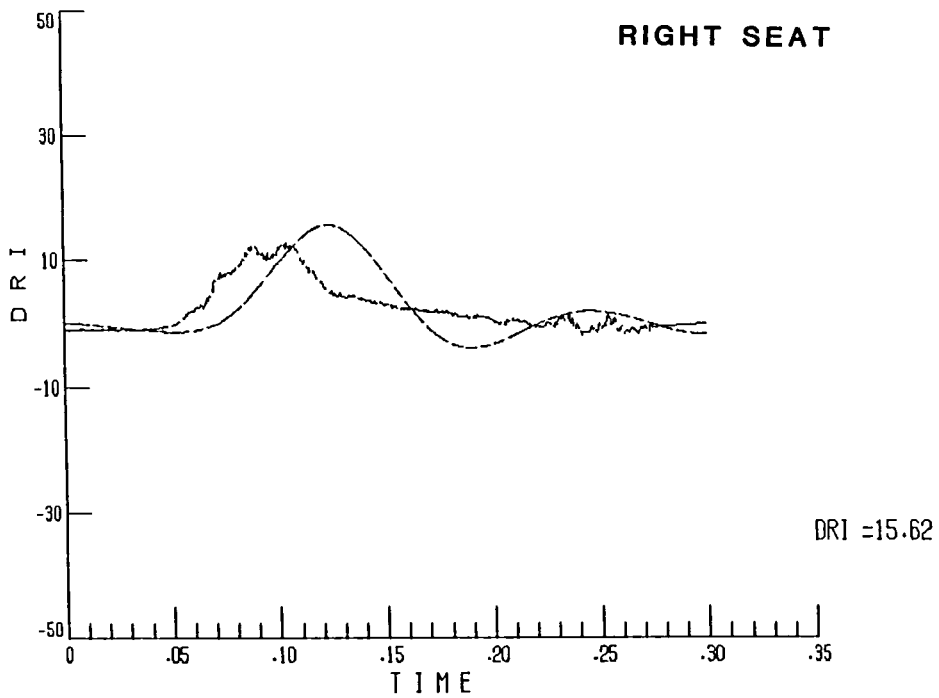
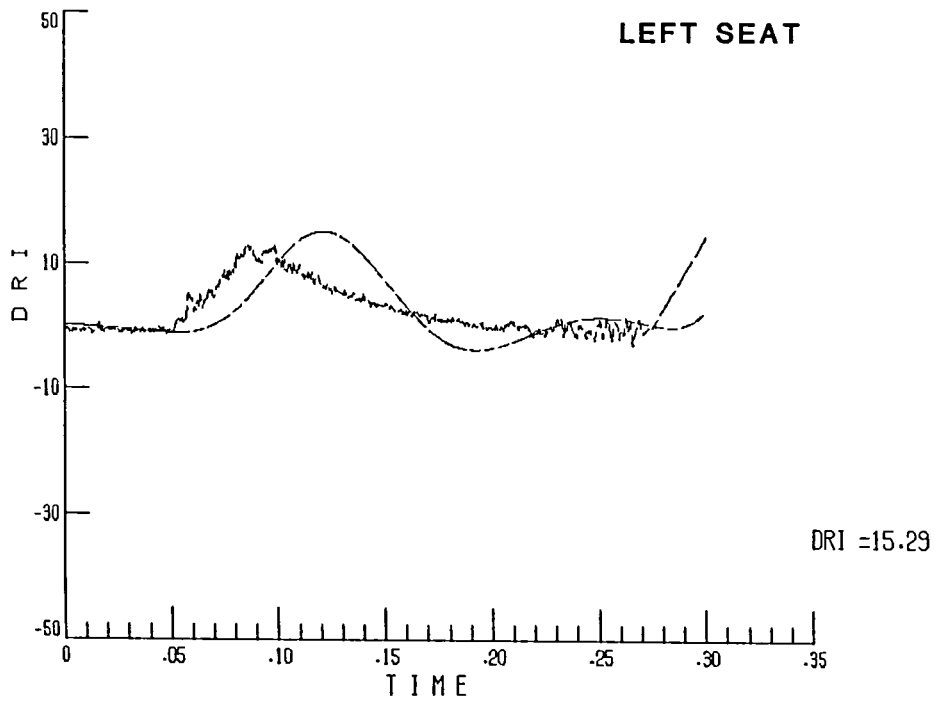


EXIT PORT PRESSURES
 NASA TEST NO. 10

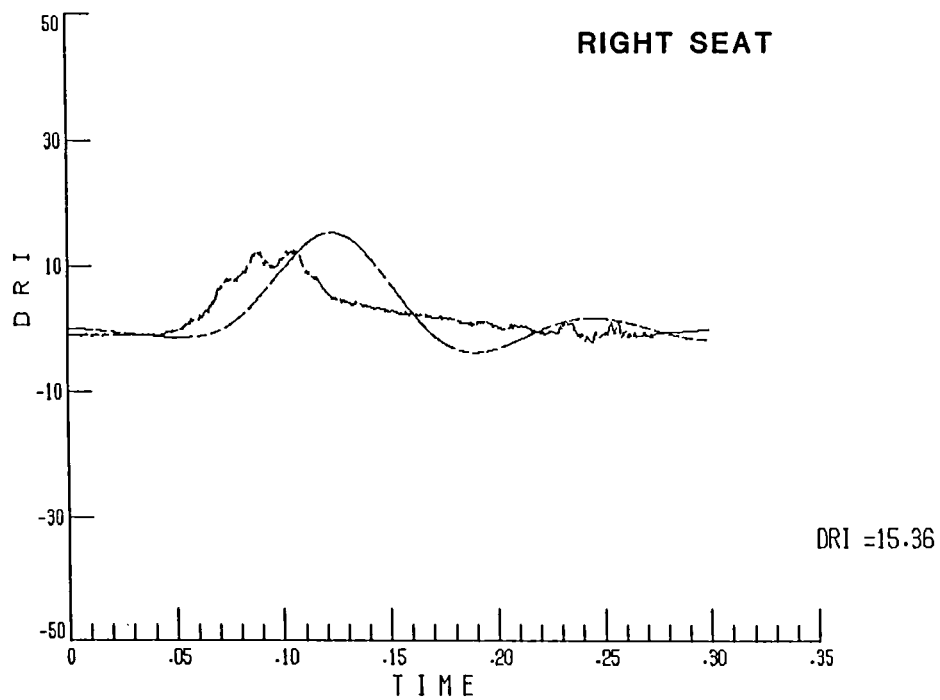
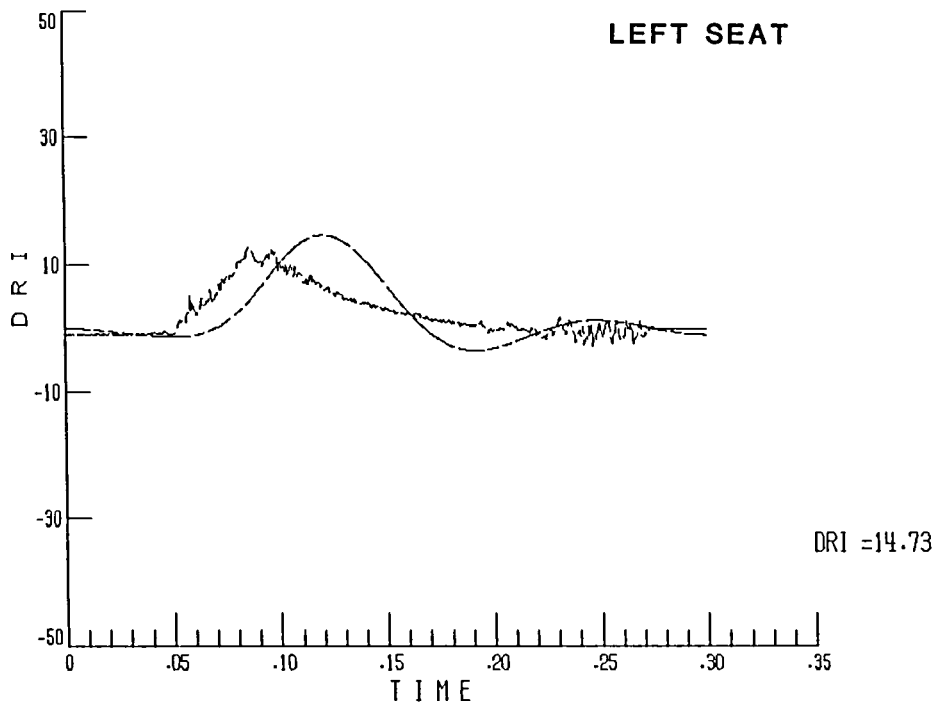


EXIT PORT PRESSURES

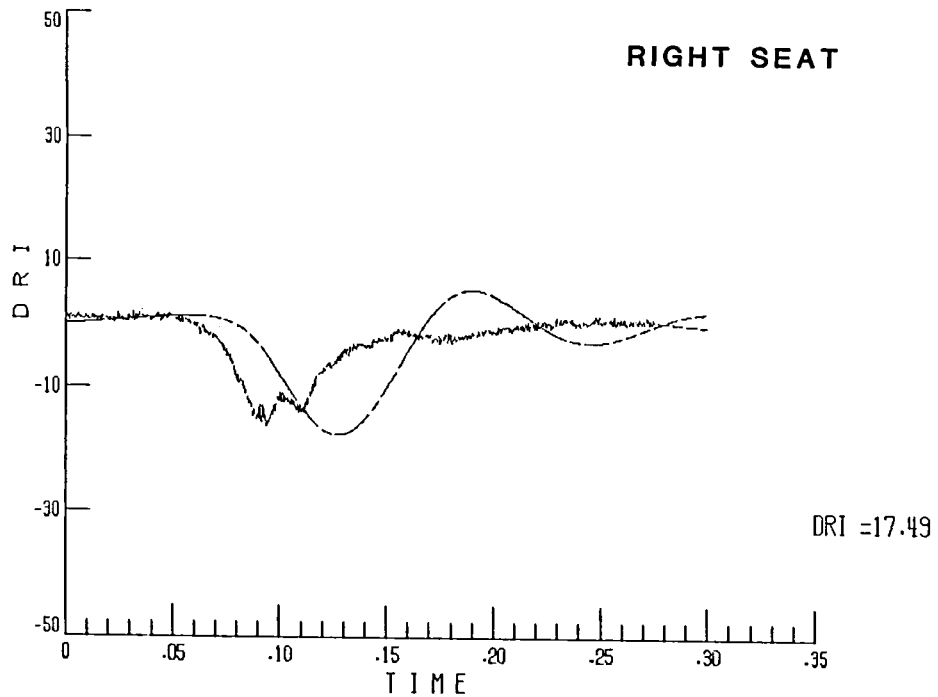
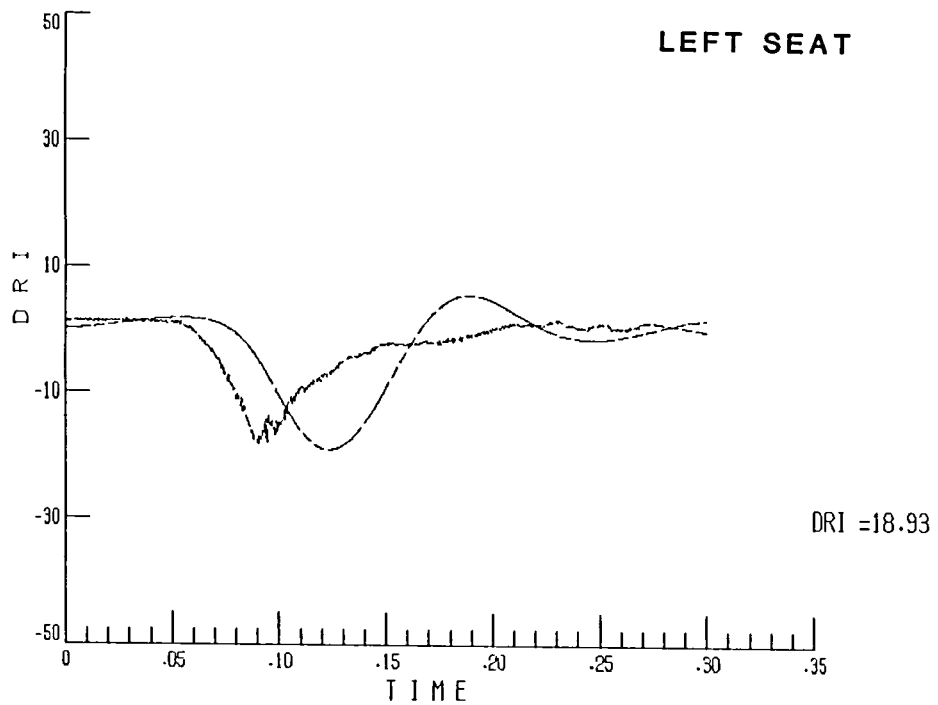
NASA TEST NO. 10



**DYNAMIC RESPONSE INDEX
SEAT PAN Z-AXIS
NASA TEST NO. 10**



**DYNAMIC RESPONSE INDEX
BACK TANGENT LINE
NASA TEST NO. 10**



**DYNAMIC RESPONSE INDEX
DUMMY PELVIS Z-AXIS
NASA TEST NO. 10**

12.0 NASA TEST NO. 11

HORIZONTAL VELOCITY: 0 ft/sec

VERTICAL VELOCITY: 25 ft/sec

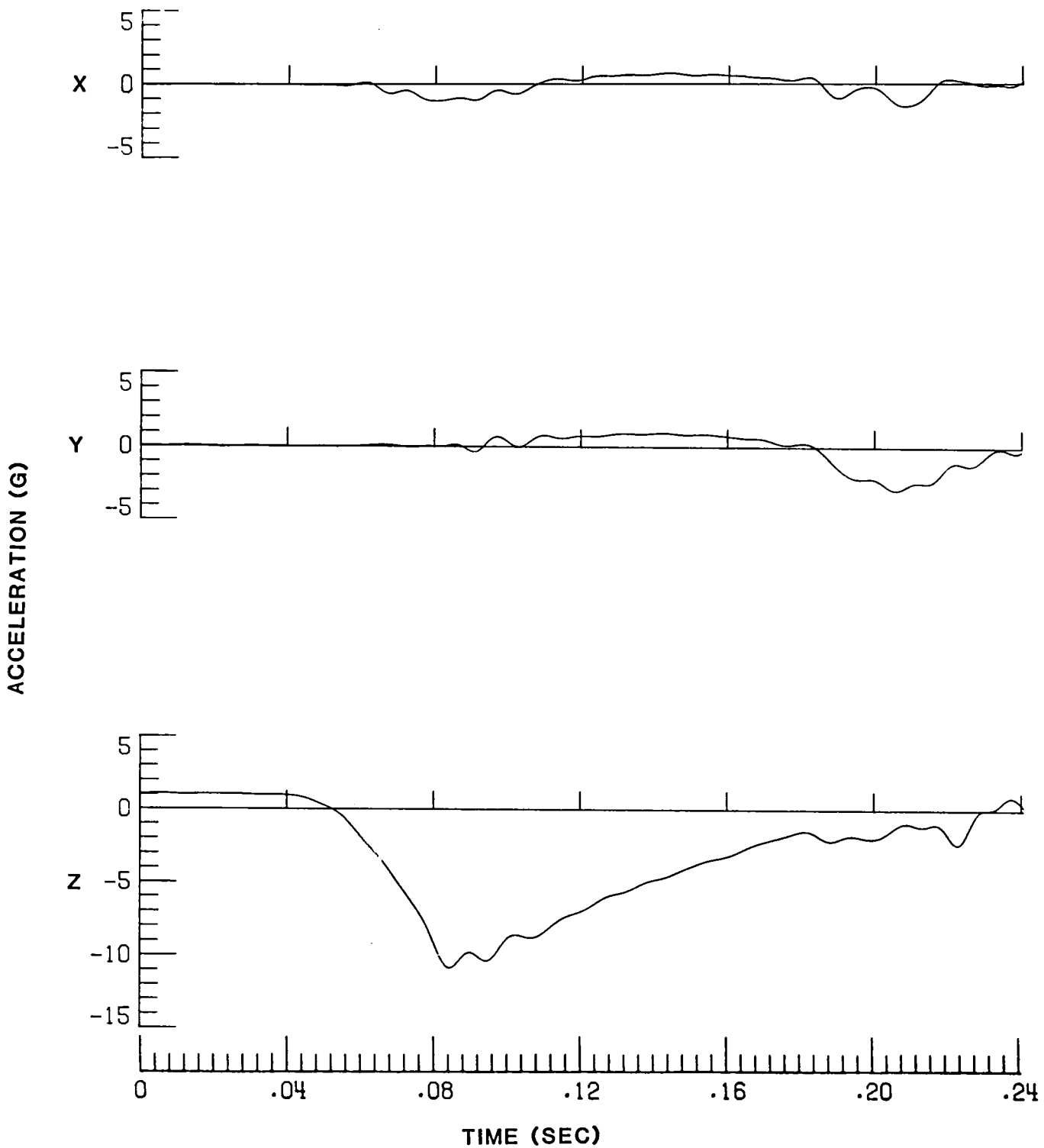
CREW MODULE PITCH: 2°

CREW MODULE ROLL: 0°

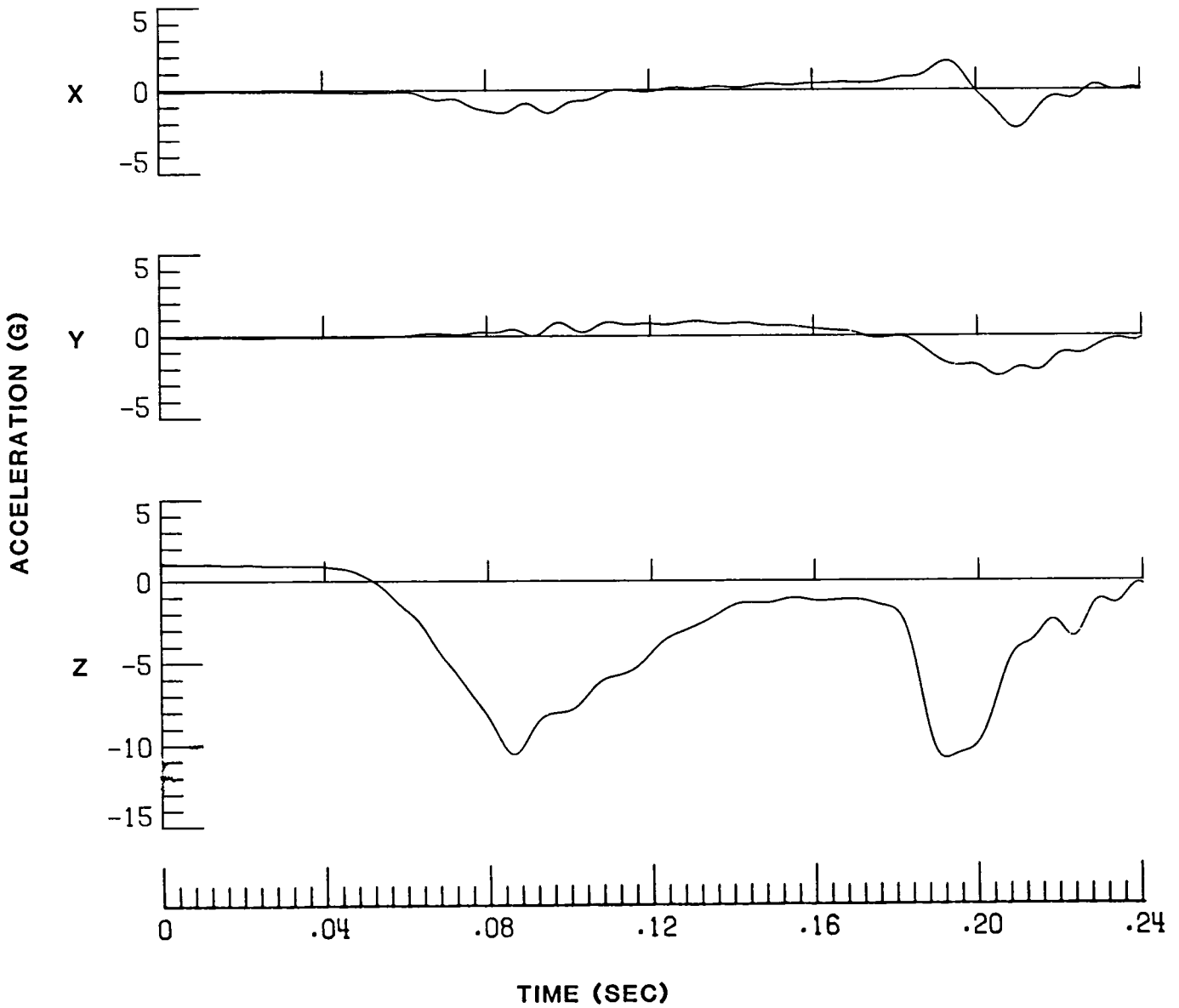
CREW MODULE YAW: 0°

LEFT SEAT: F-111 Operational

RIGHT SEAT: Energy Absorbing

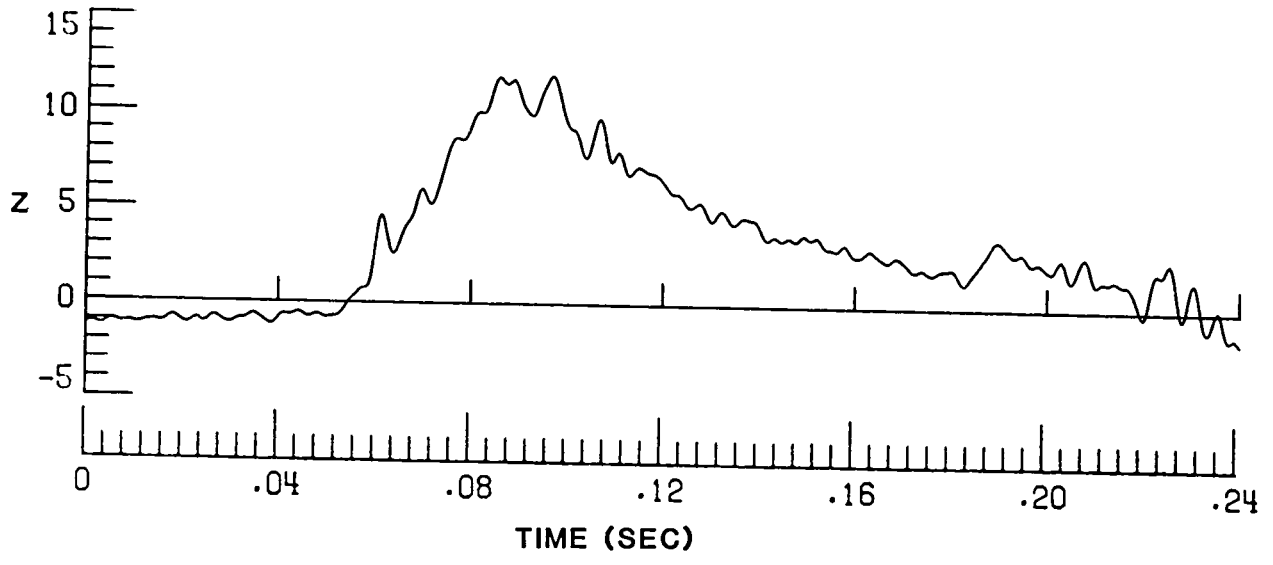
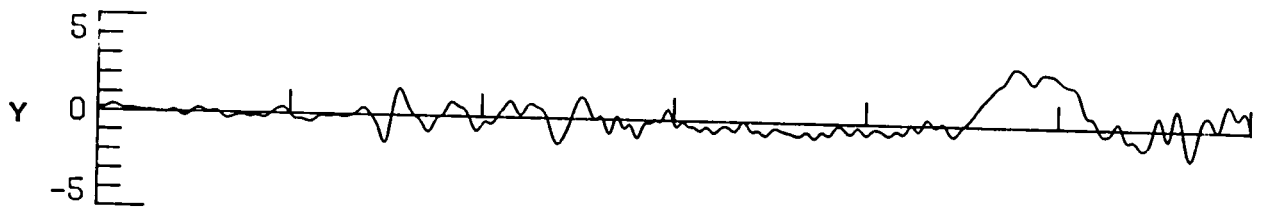
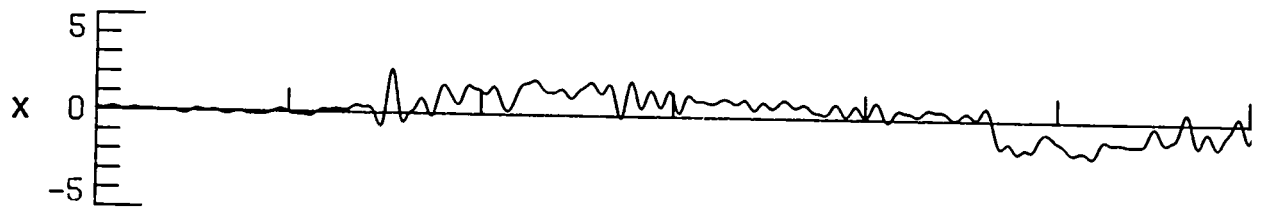


LEFT BULKHEAD
NASA TEST NO. 11



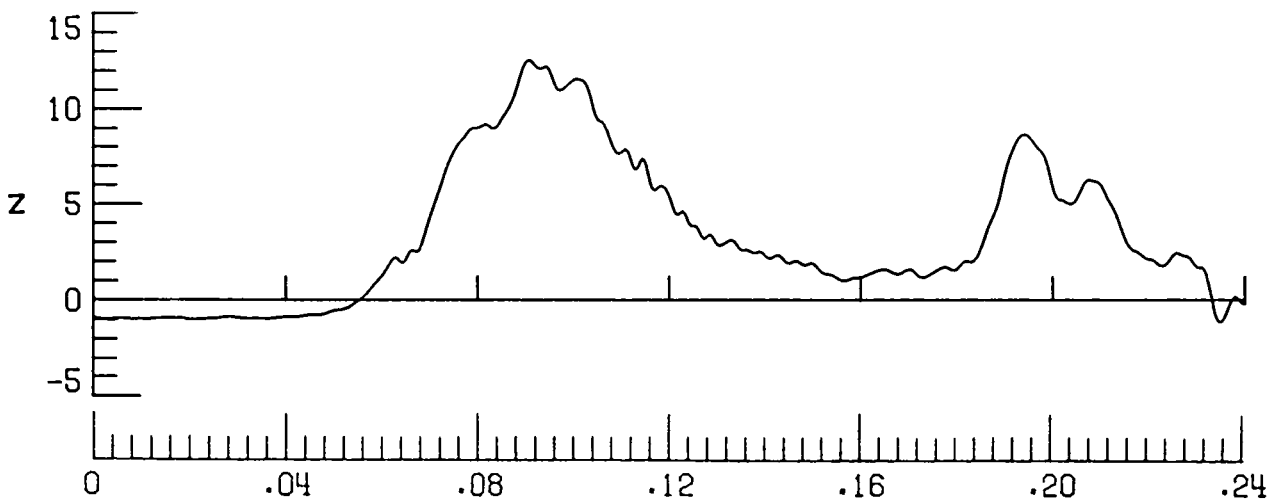
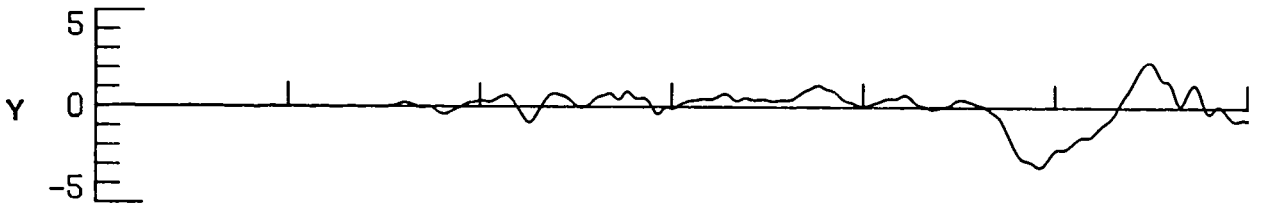
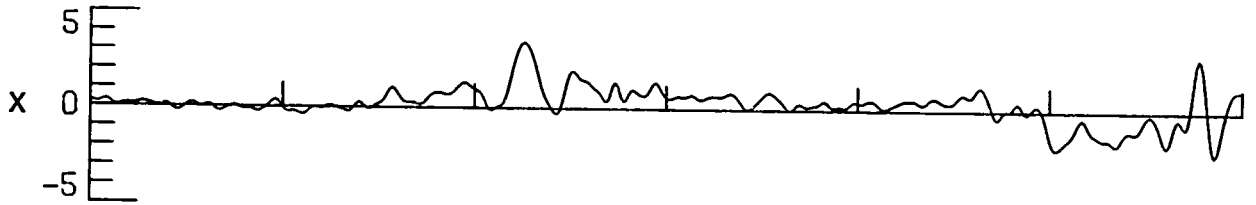
RIGHT BULKHEAD
NASA TEST NO. 11

ACCELERATION (G)



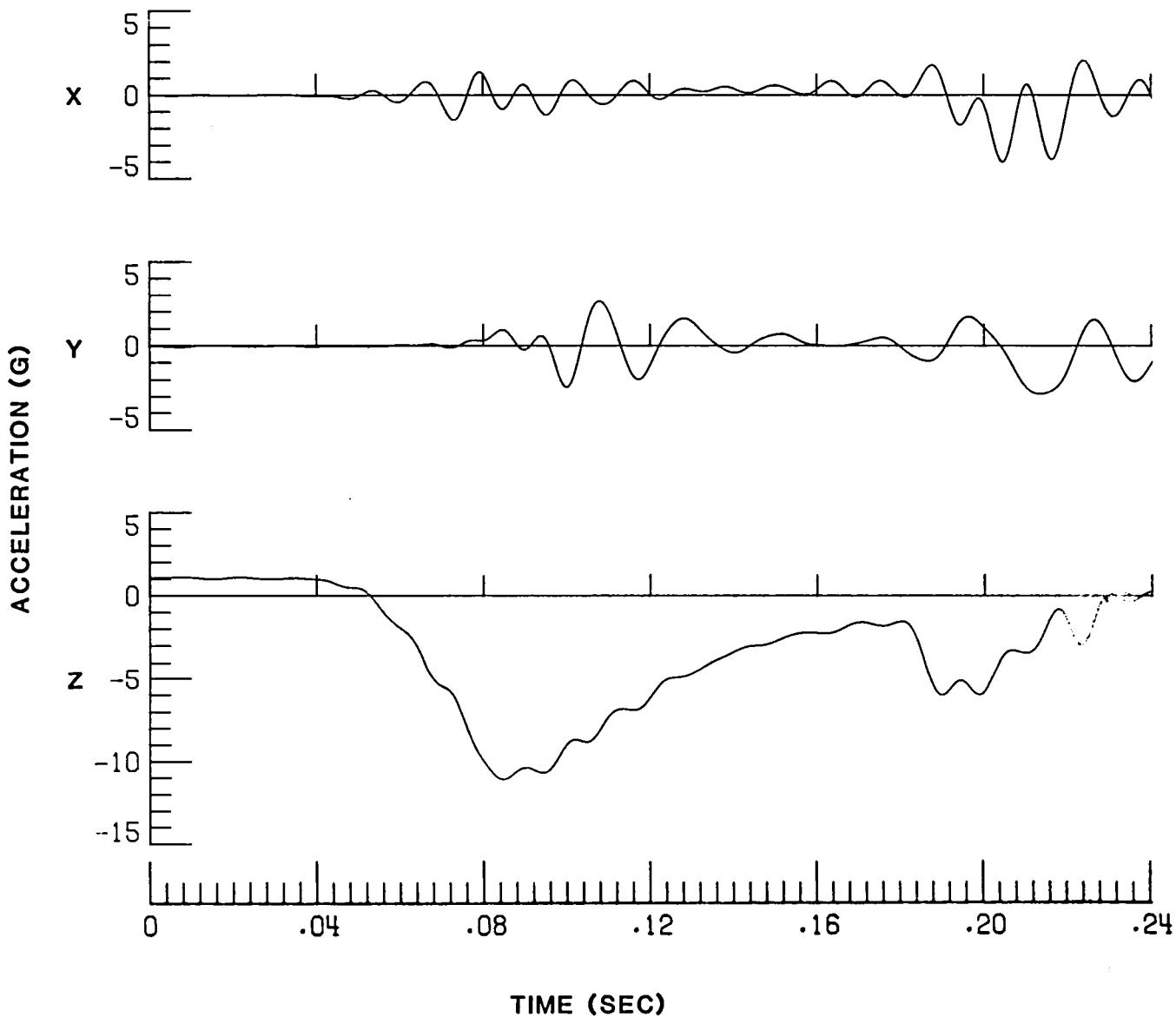
LEFT SEAT PAN
NASA TEST NO. 11

ACCELERATION (G)

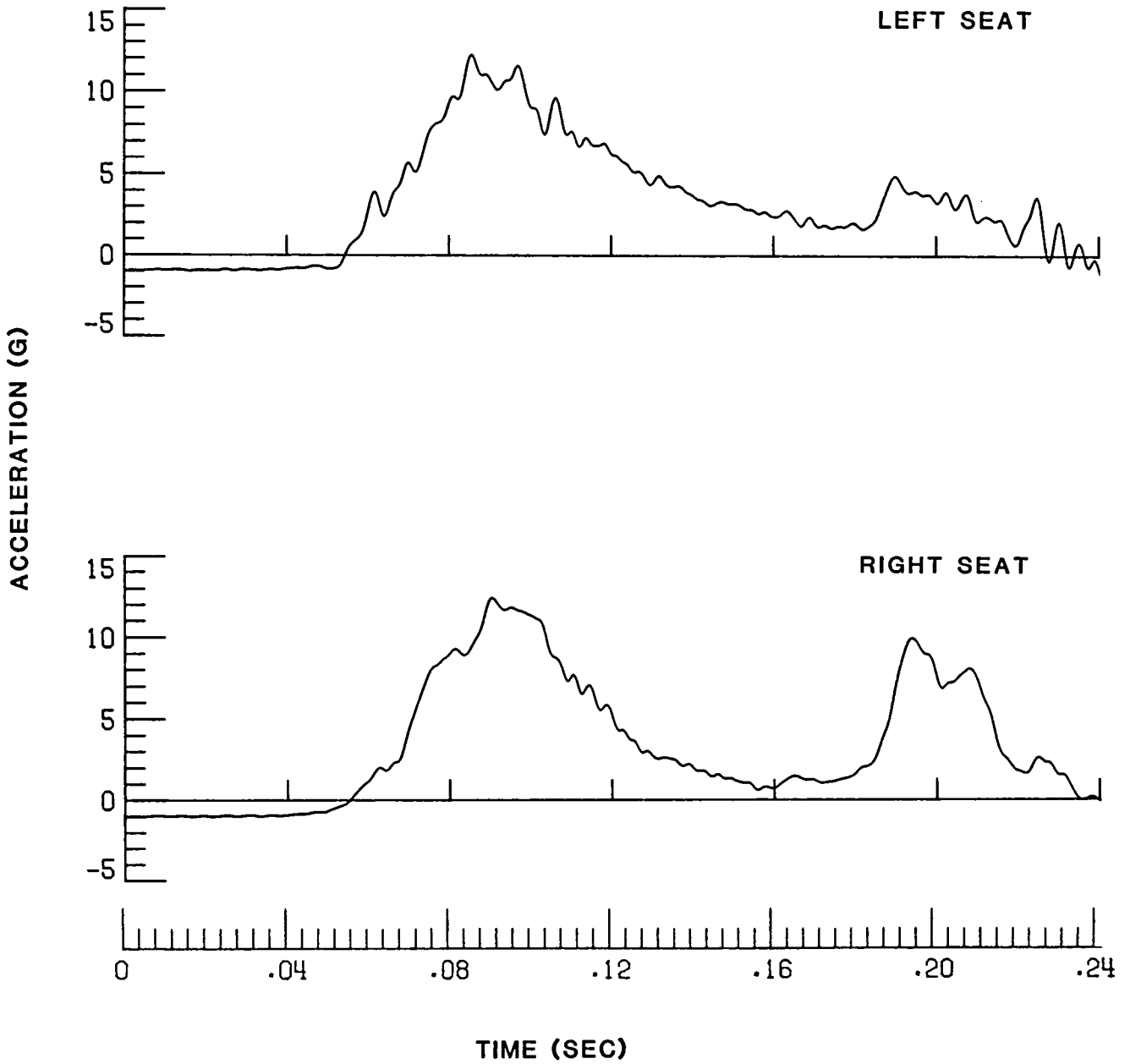


TIME (SEC)

RIGHT SEAT PAN
NASA TEST NO. 11

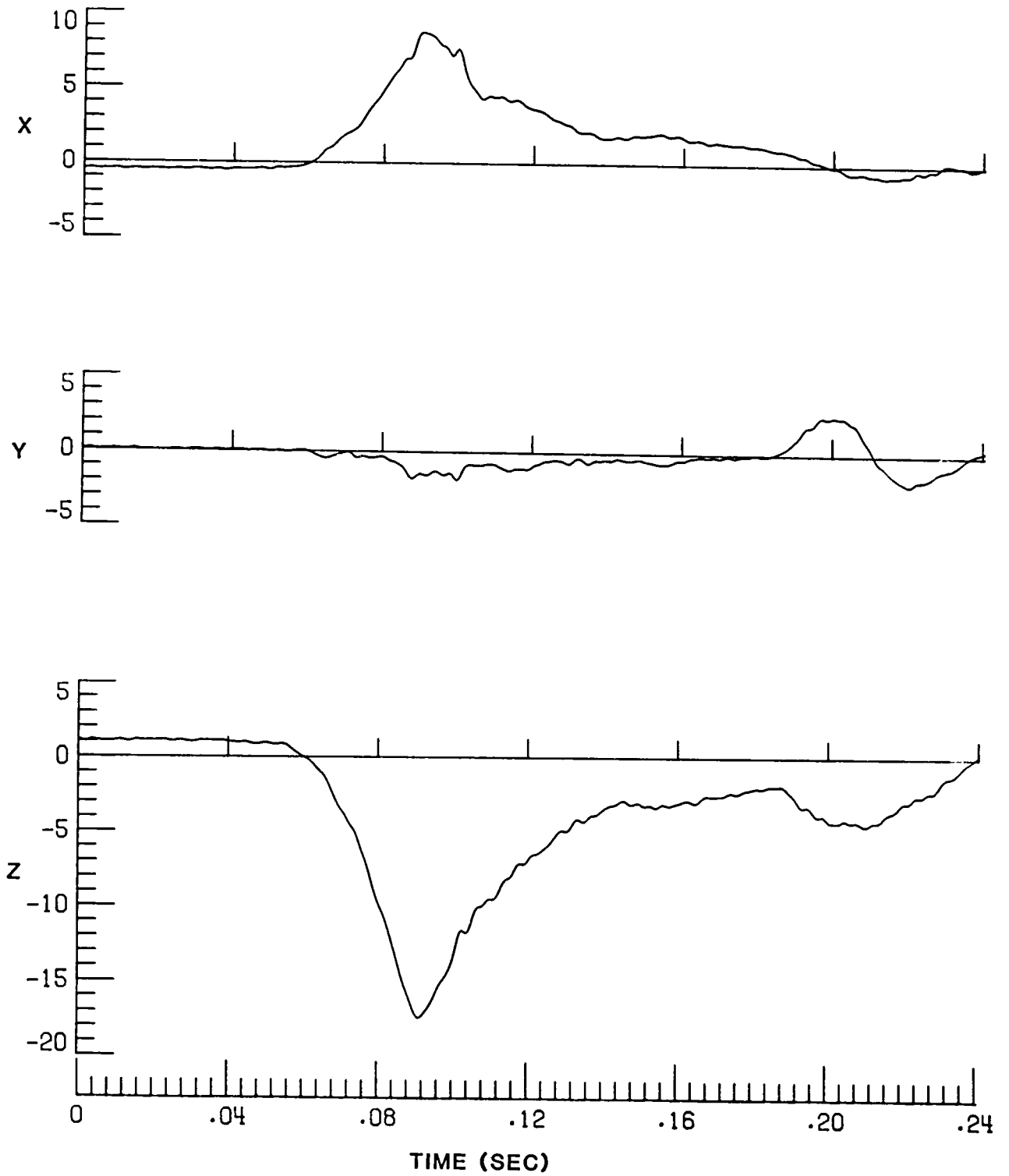


**CAPSULE C.G.
NASA TEST NO. 11**

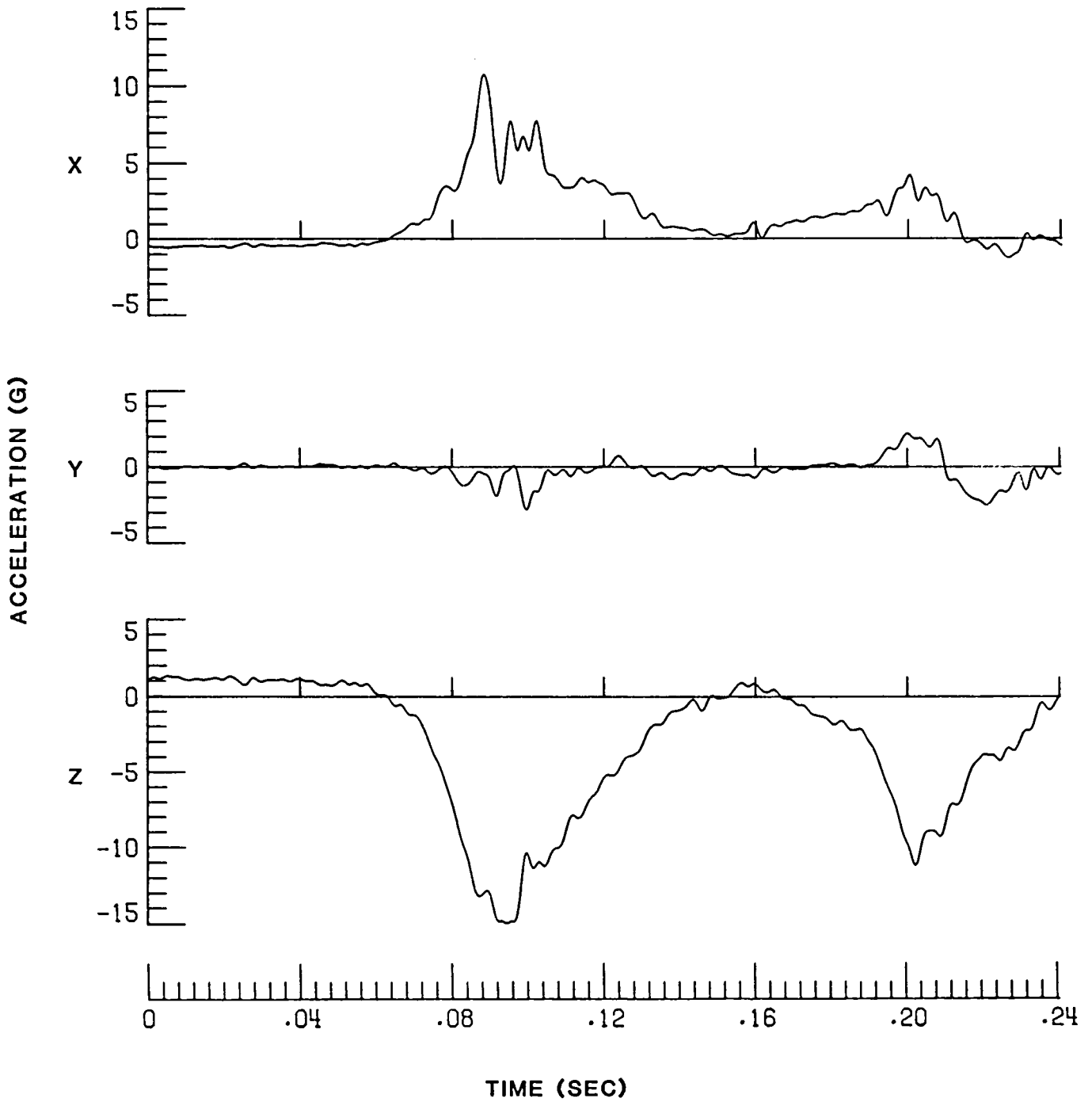


SEAT PAN ALONG BACK TANGENT LINE
NASA TEST NO. 11

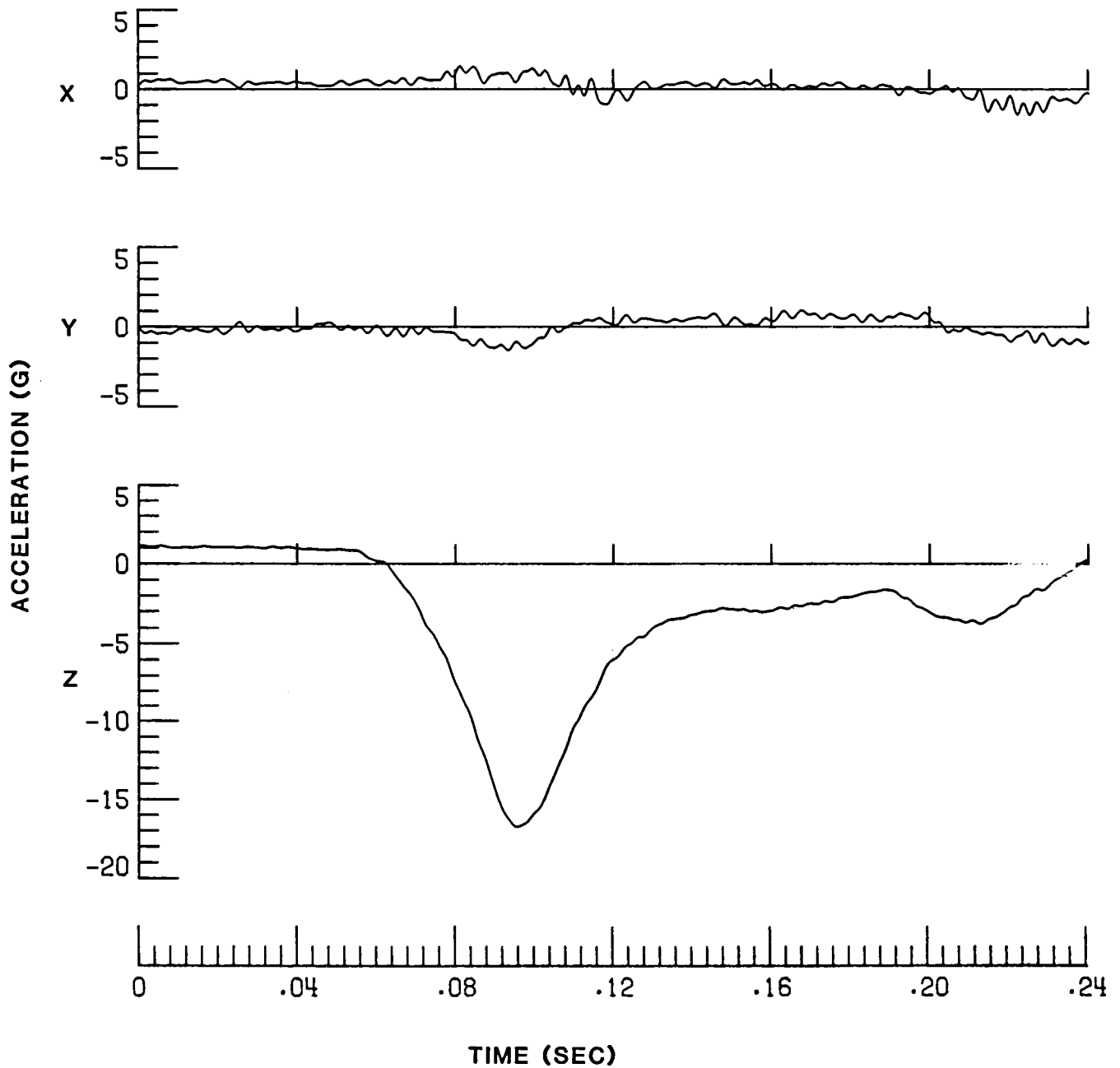
ACCELERATION (G)



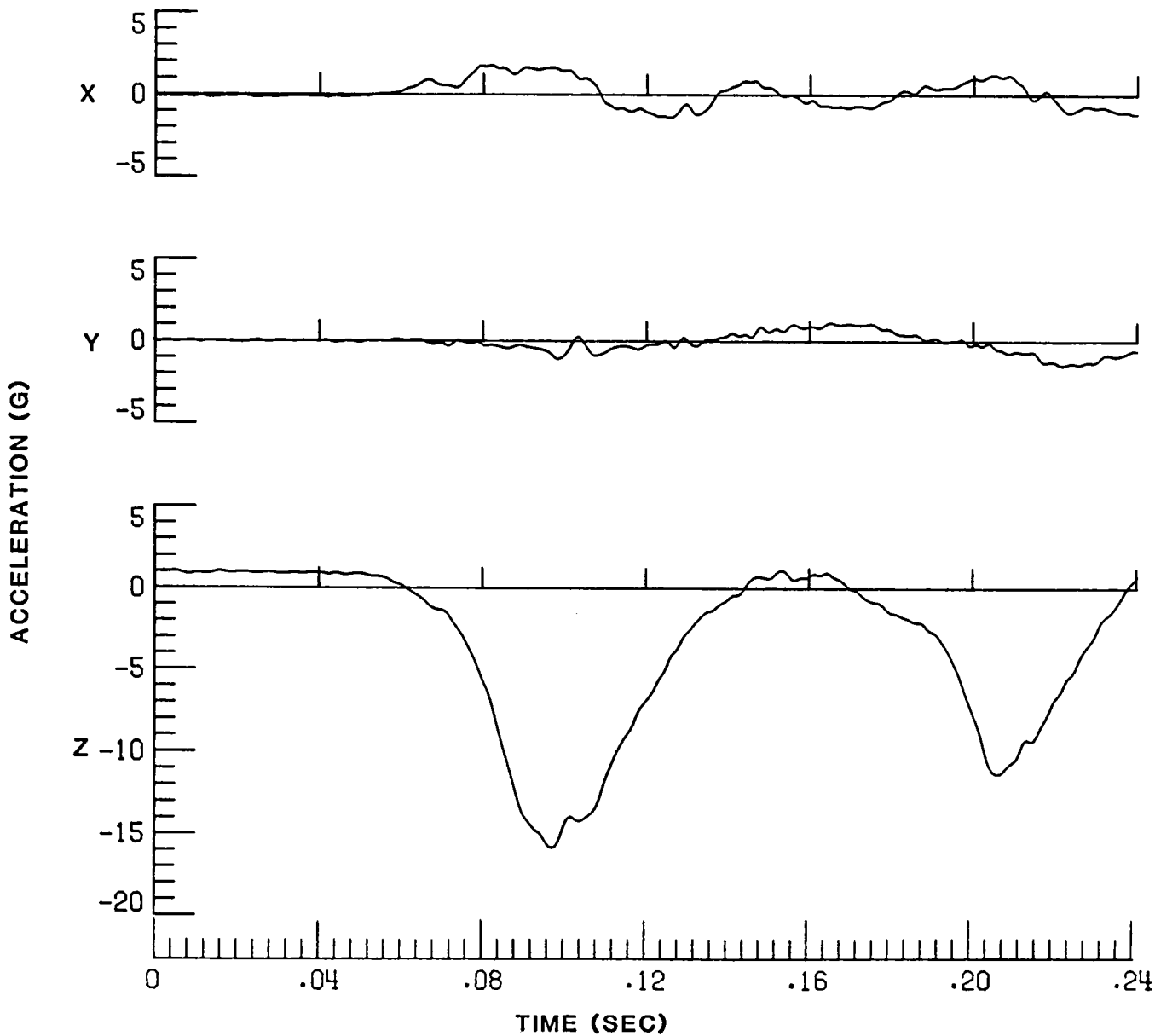
LEFT DUMMY PELVIS
NASA TEST NO. 11



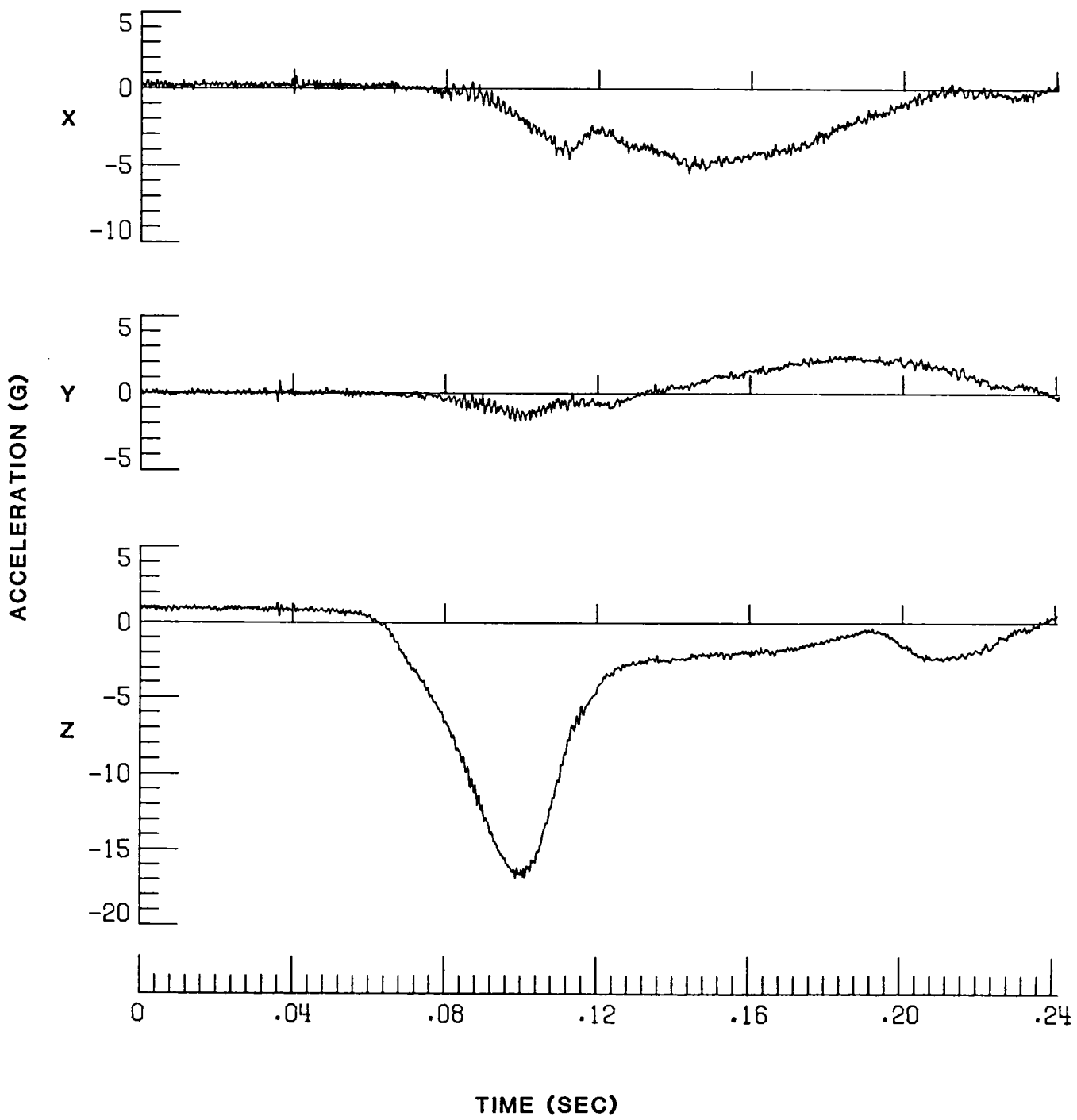
RIGHT DUMMY PELVIS
NASA TEST NO. 11



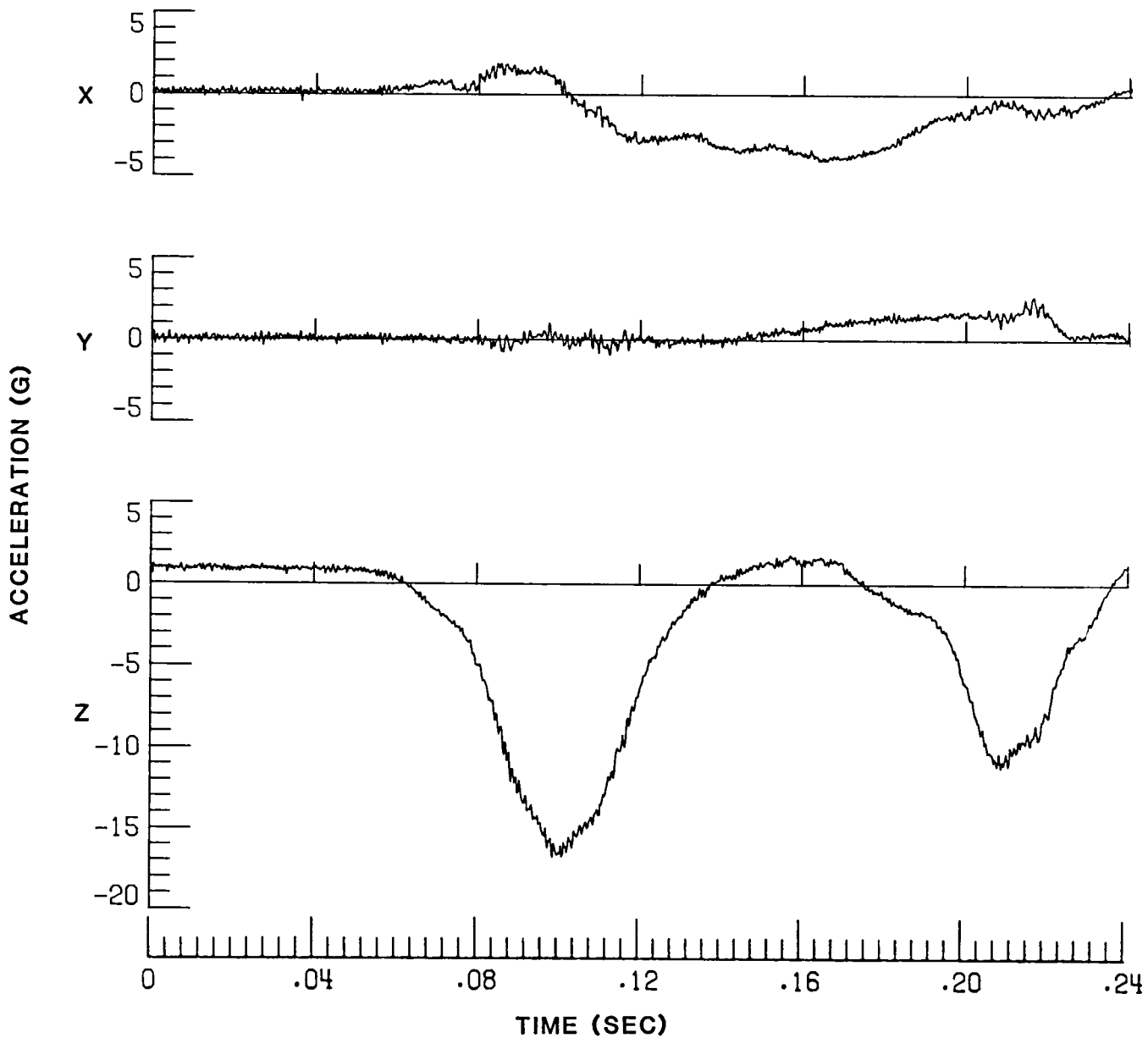
LEFT DUMMY CHEST
NASA TEST NO. 11



RIGHT DUMMY CHEST
NASA TEST NO. 11

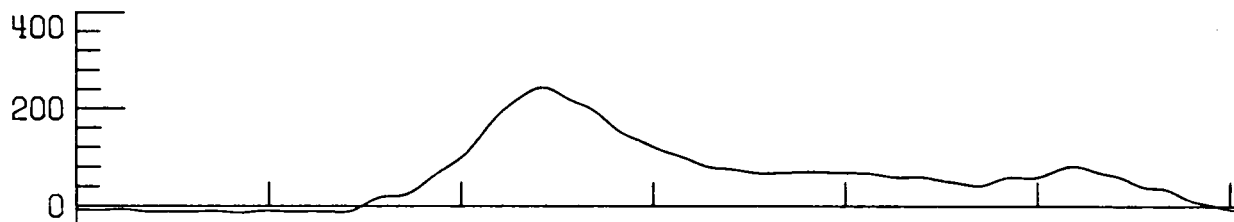


LEFT DUMMY HEAD
NASA TEST NO. 11

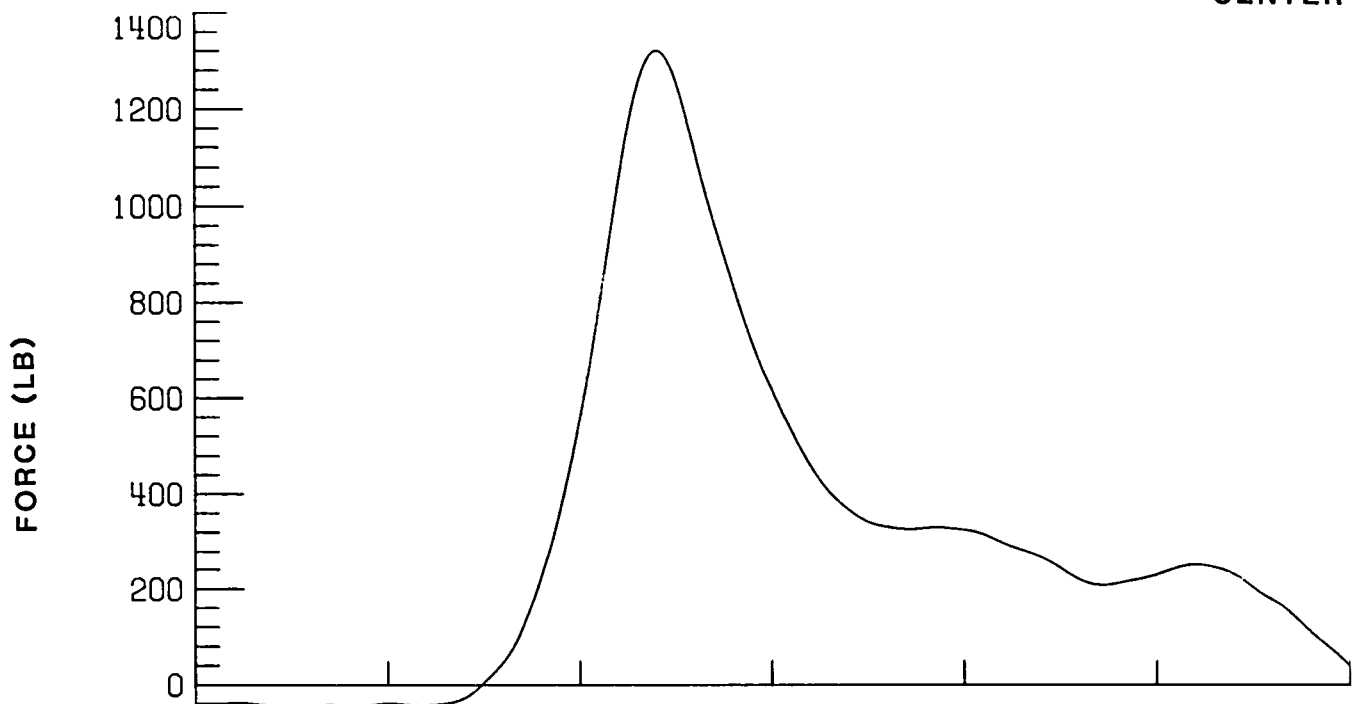


RIGHT DUMMY HEAD
NASA TEST NO. 11

LEFT THIGH

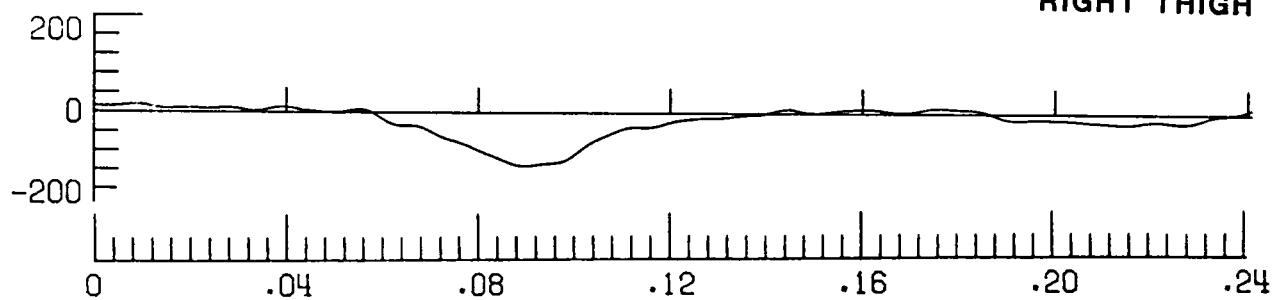


CENTER



FORCE (LB)

RIGHT THIGH

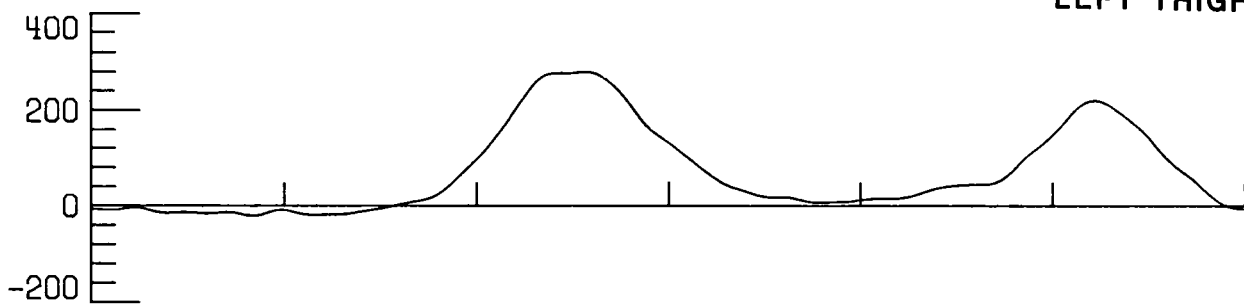


TIME (SEC)

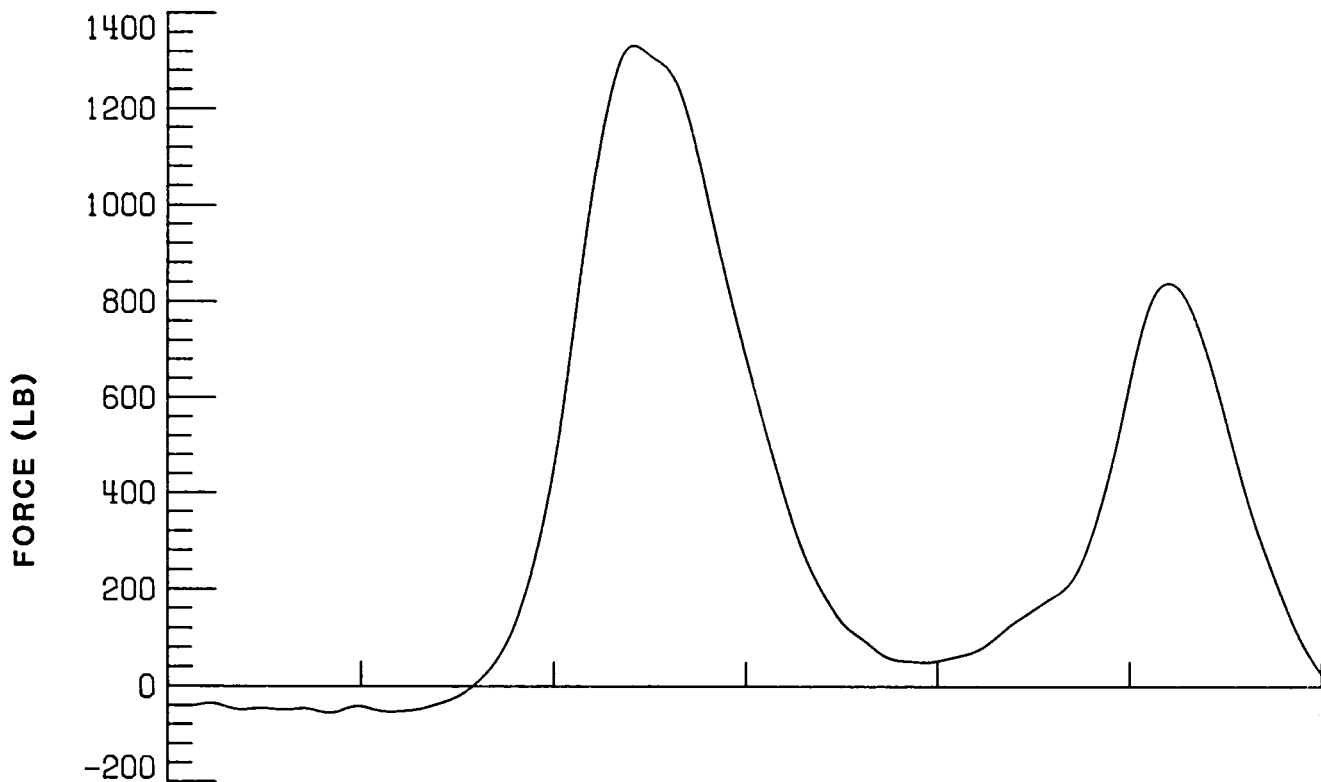
LEFT SEAT PAN LOADS

NASA TEST NO. 11

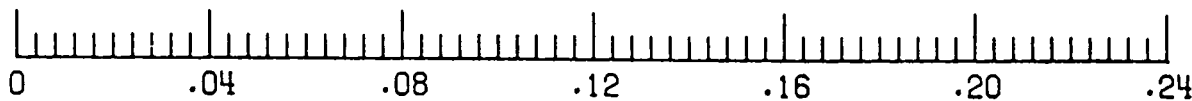
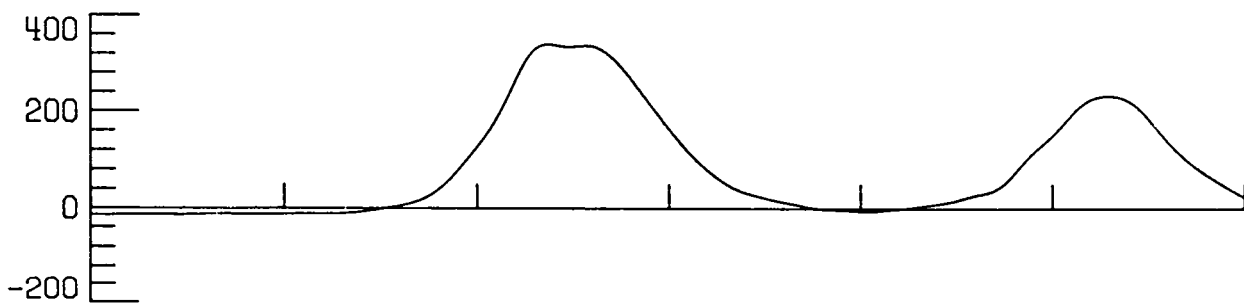
LEFT THIGH



CENTER



RIGHT THIGH

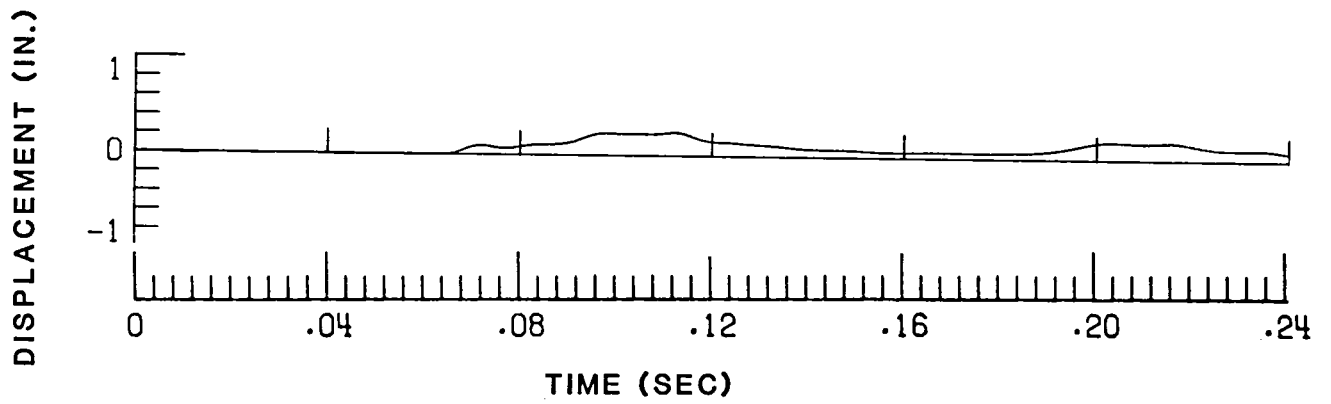


TIME (SEC)

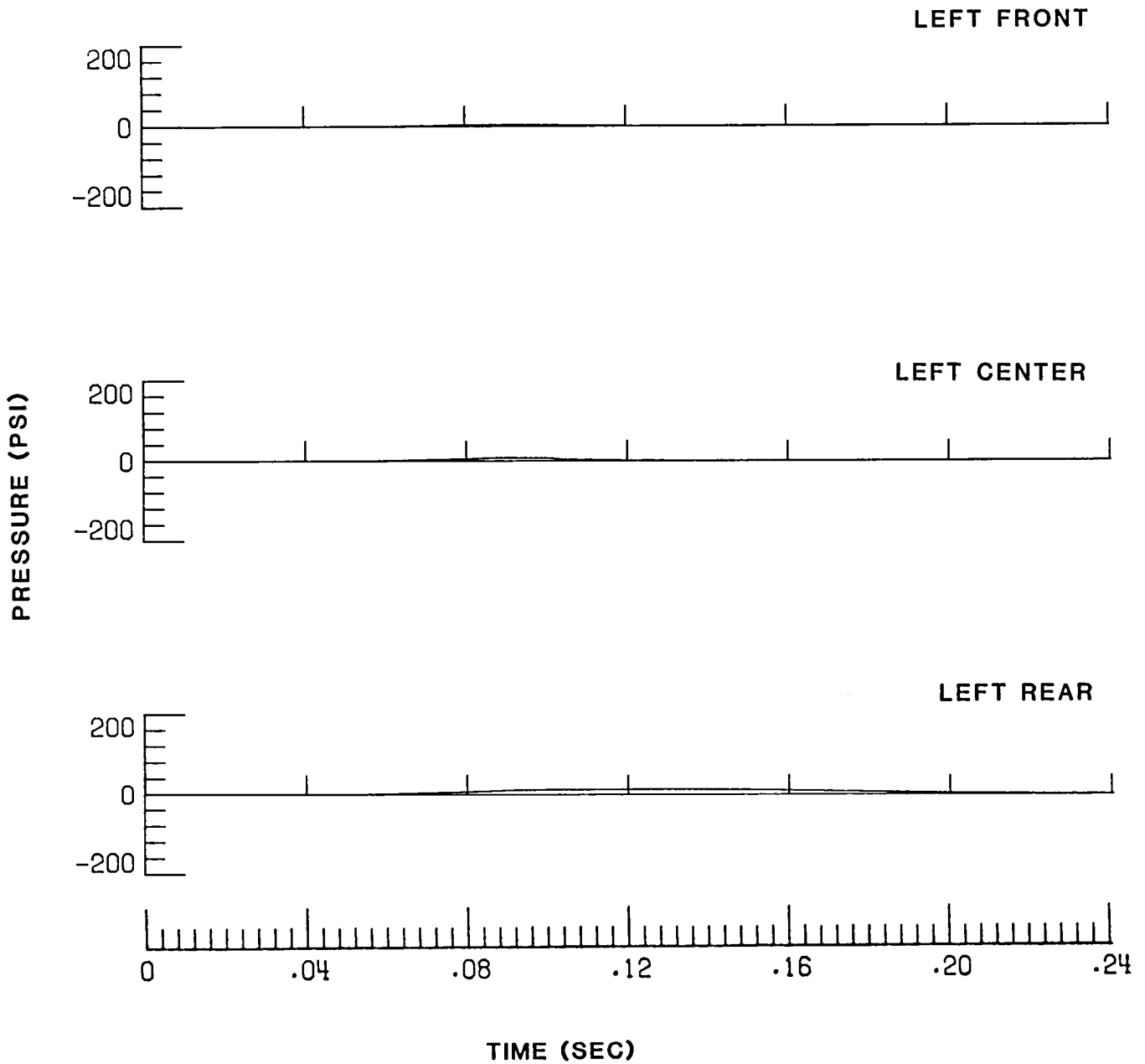
RIGHT SEAT PAN LOADS

NASA TEST NO. 11

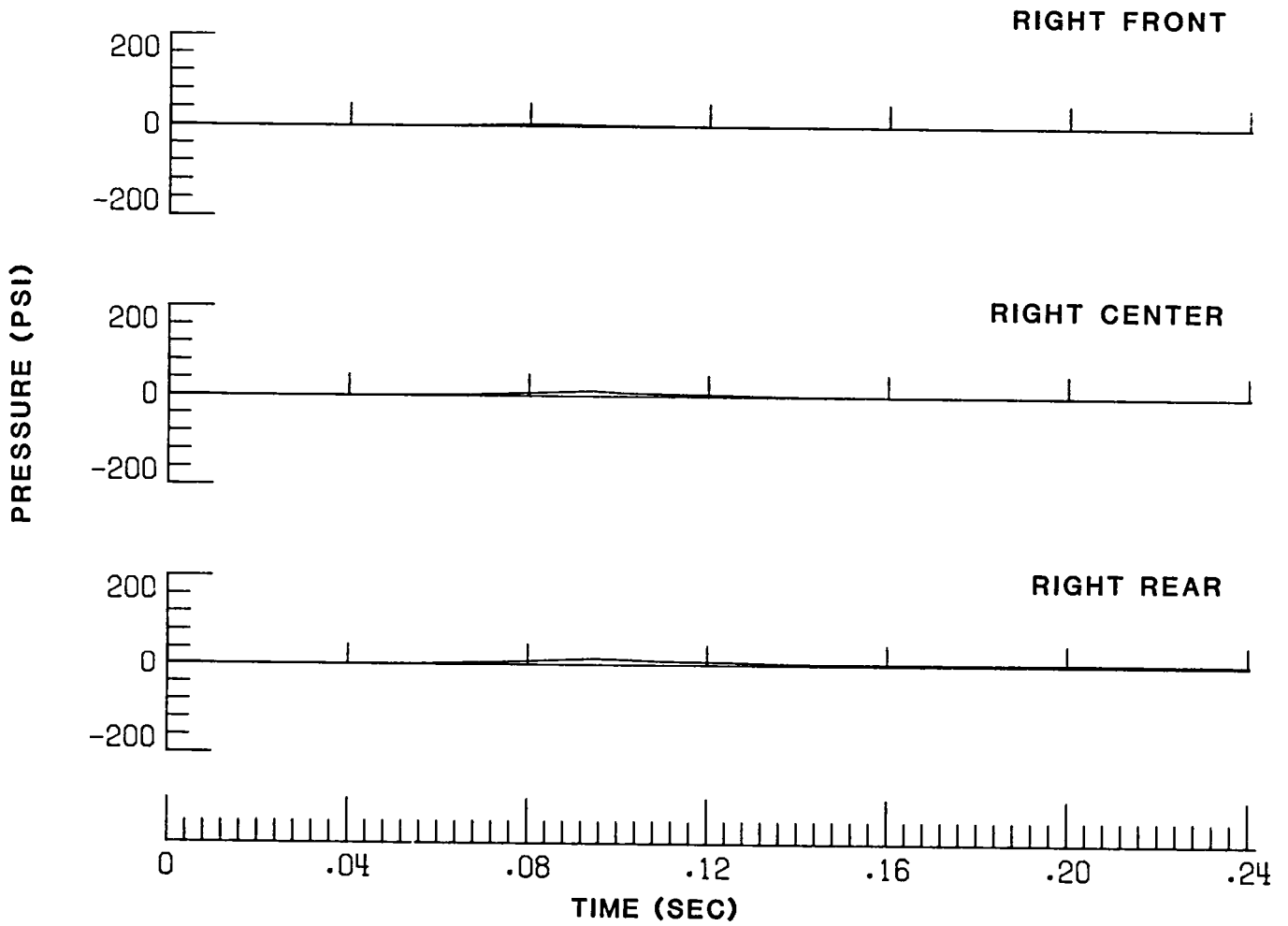
207



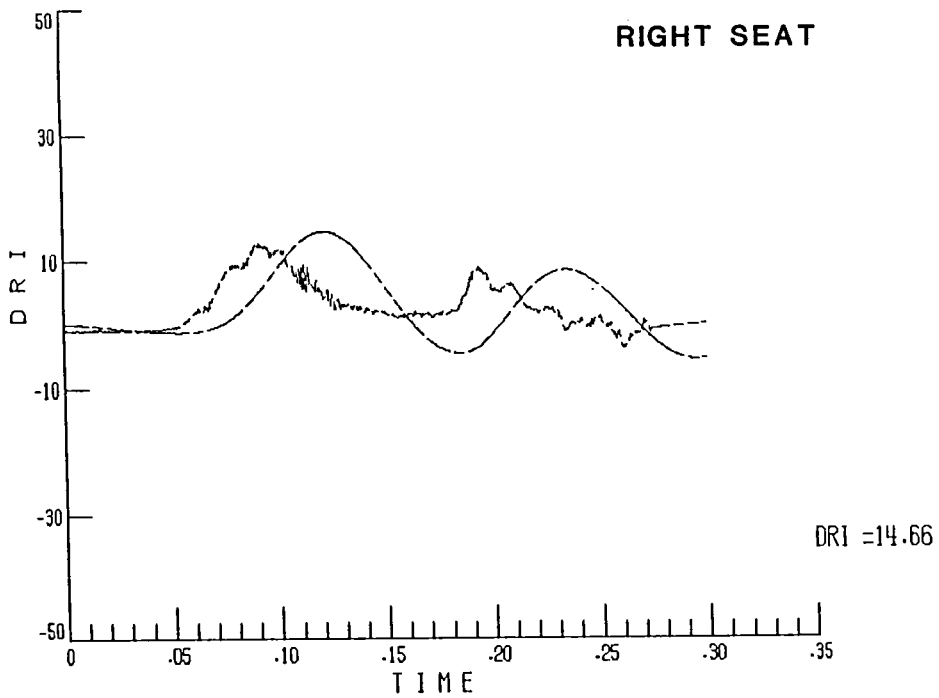
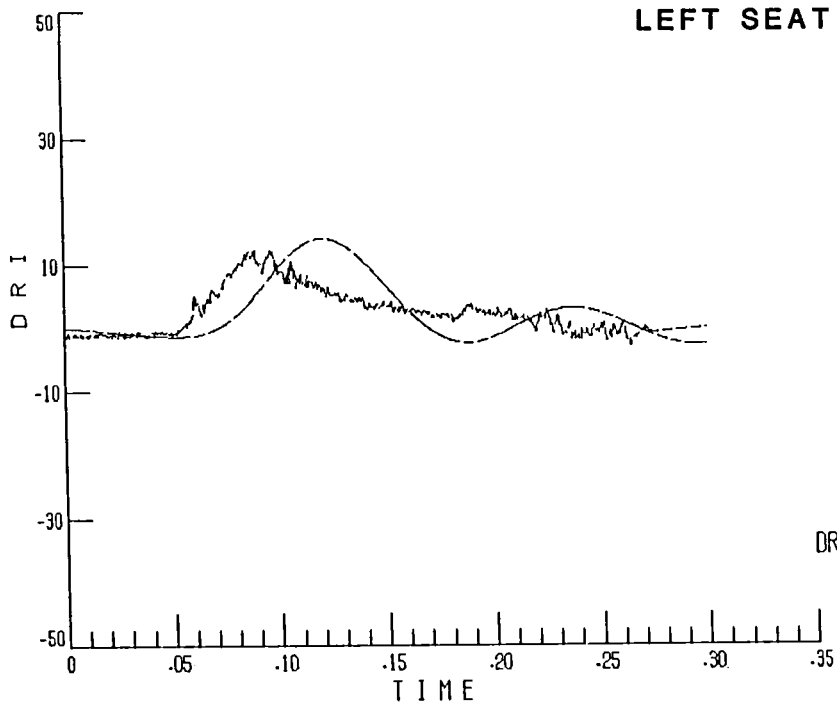
RIGHT SEAT STROKE
NASA TEST NO. 11



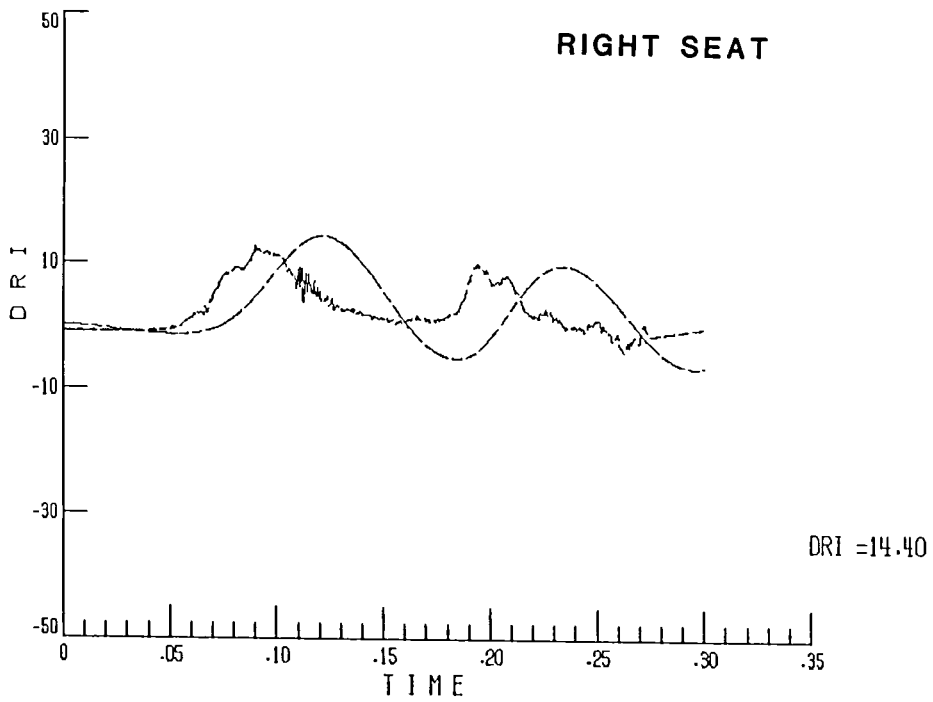
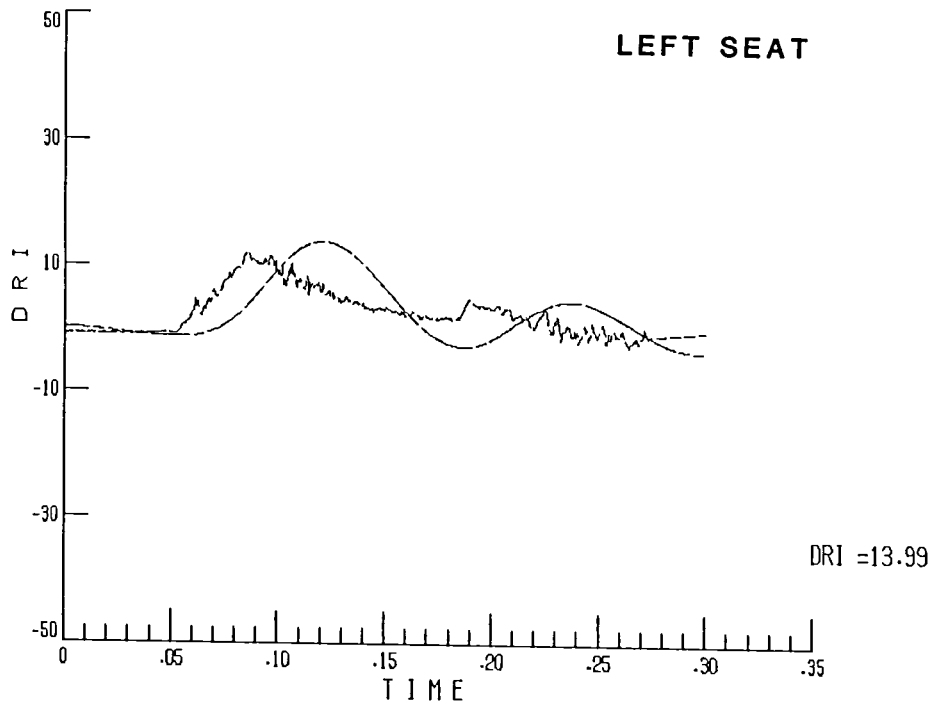
EXIT PORT PRESSURE
NASA TEST NO.11



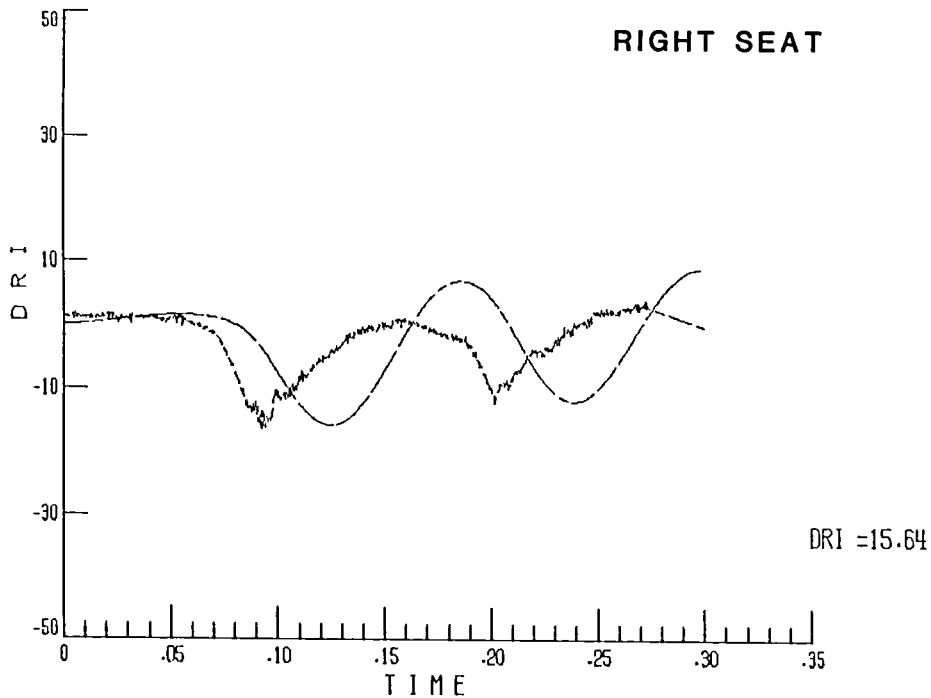
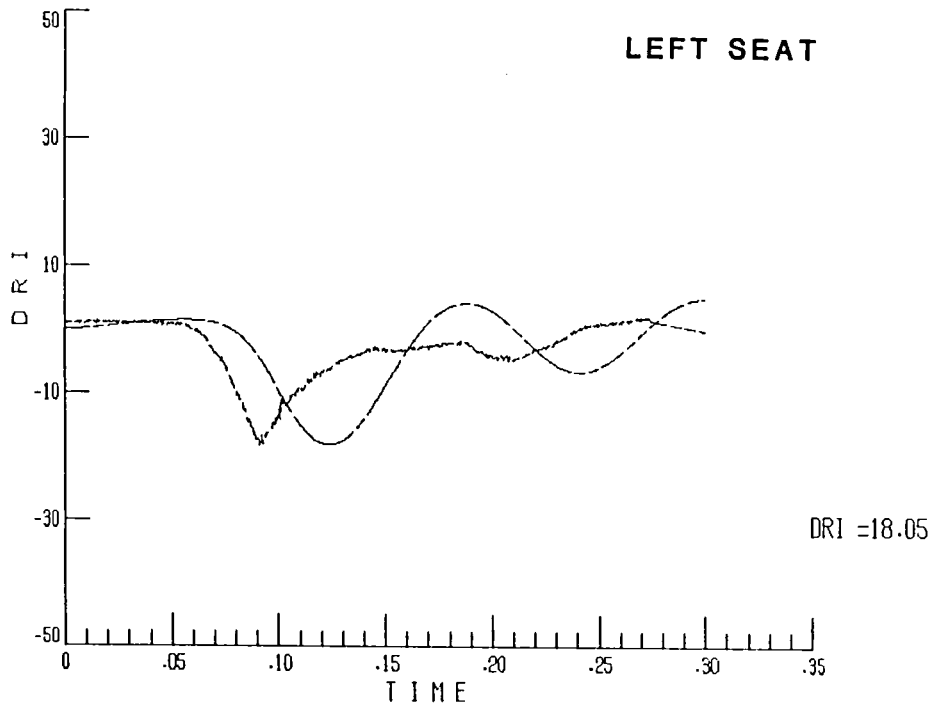
EXIT PORT PRESSURES
NASA TEST NO. 11



DYNAMIC RESPONSE INDEX
SEAT PAN Z-AXIS
NASA TEST NO. 11
 211



DYNAMIC RESPONSE INDEX
BACK TANGENT LINE
NASA TEST NO. 11
 212



DYNAMIC RESPONSE INDEX
DUMMY PELVIS Z-AXIS
NASA TEST NO. 11

13.0 NASA TEST NO. 12

HORIZONTAL VELOCITY: 0 ft/sec

VERTICAL VELOCITY: 32 ft/sec

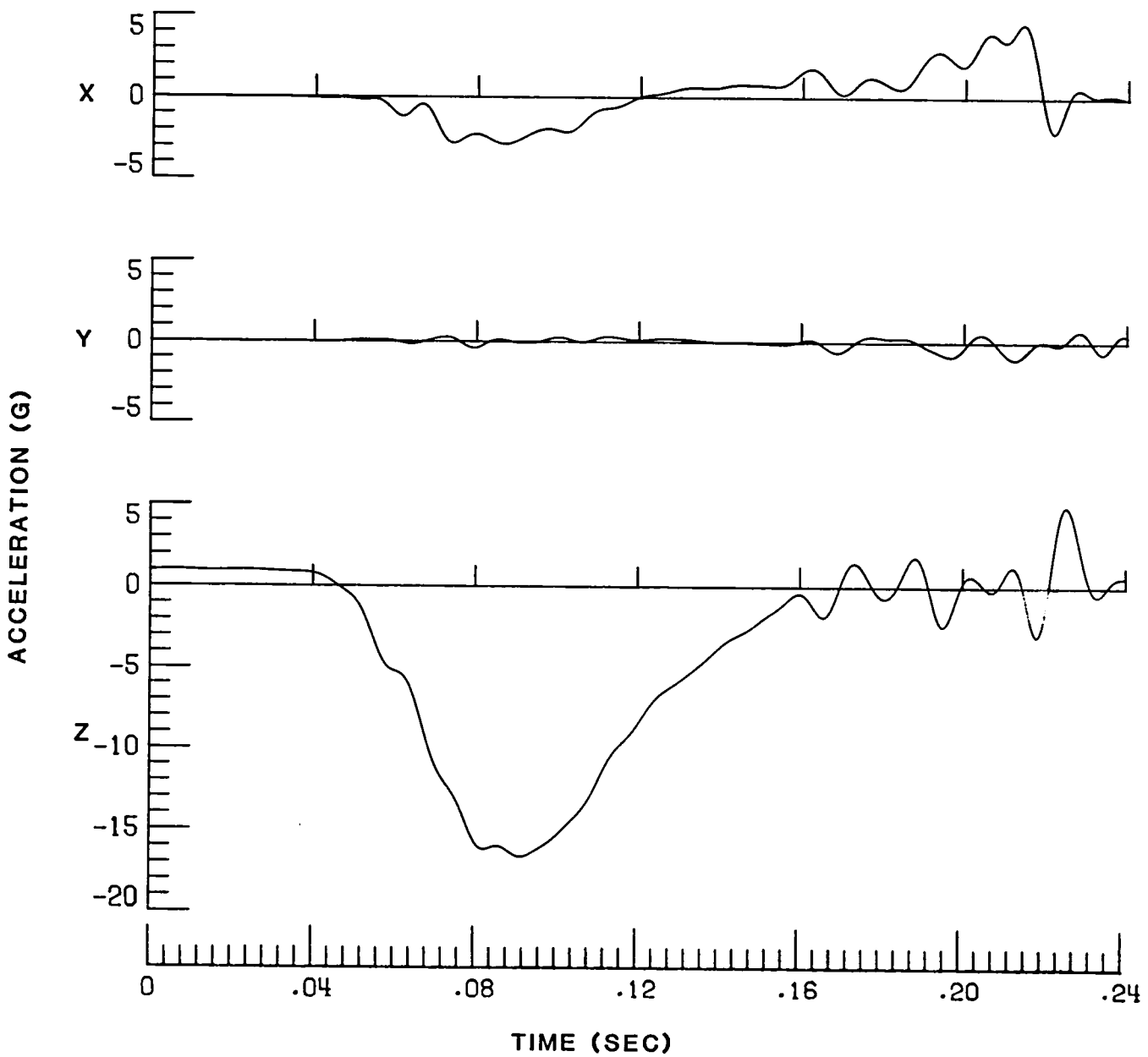
CREW MODULE PITCH: 2°

CREW MODULE ROLL: 0°

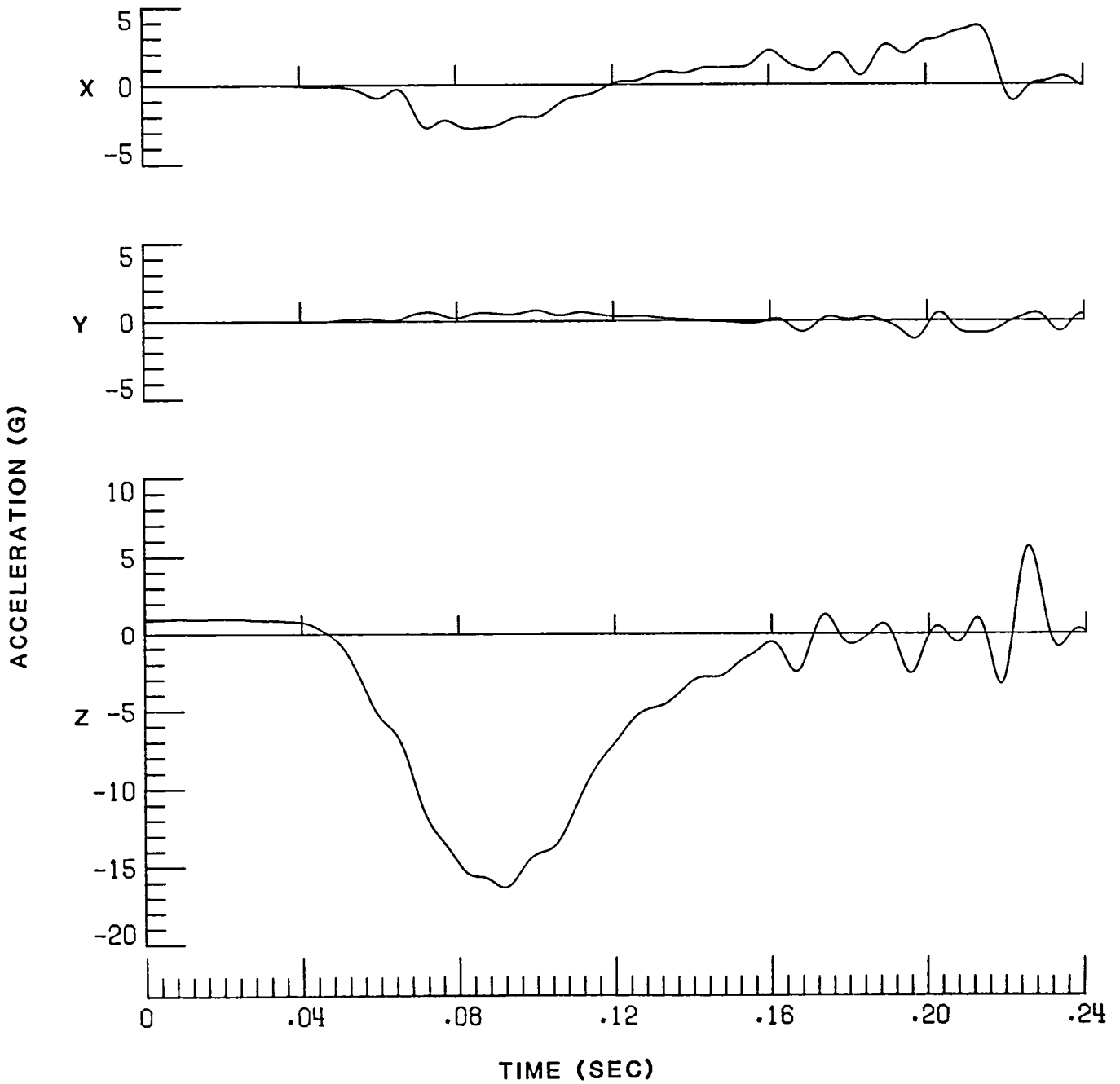
CREW MODULE YAW: 0°

LEFT SEAT: F-111 Operational

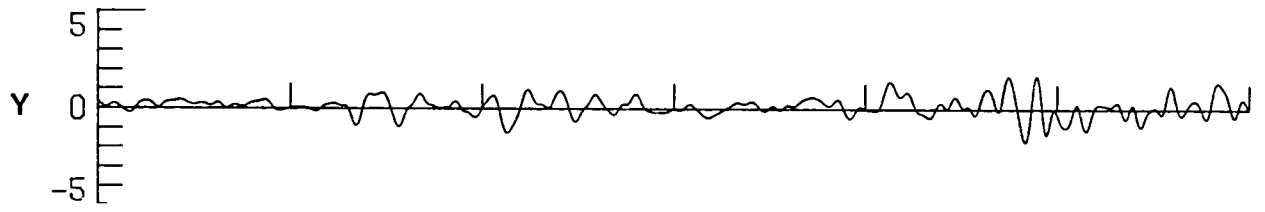
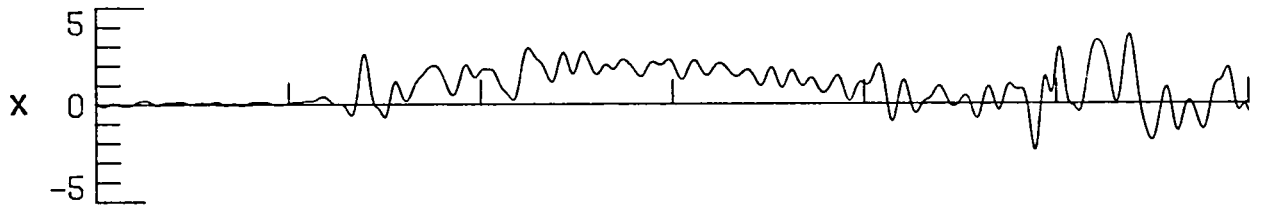
RIGHT SEAT: Energy Absorbing



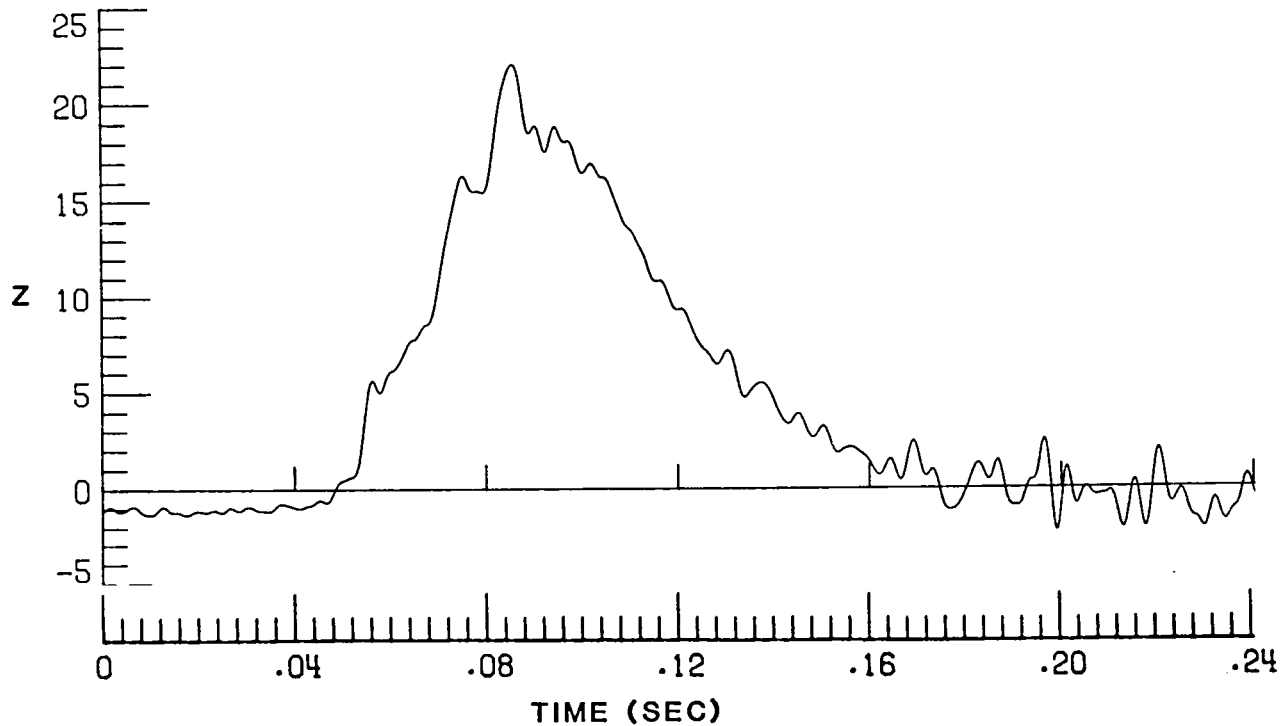
LEFT BULKHEAD
NASA TEST NO. 12



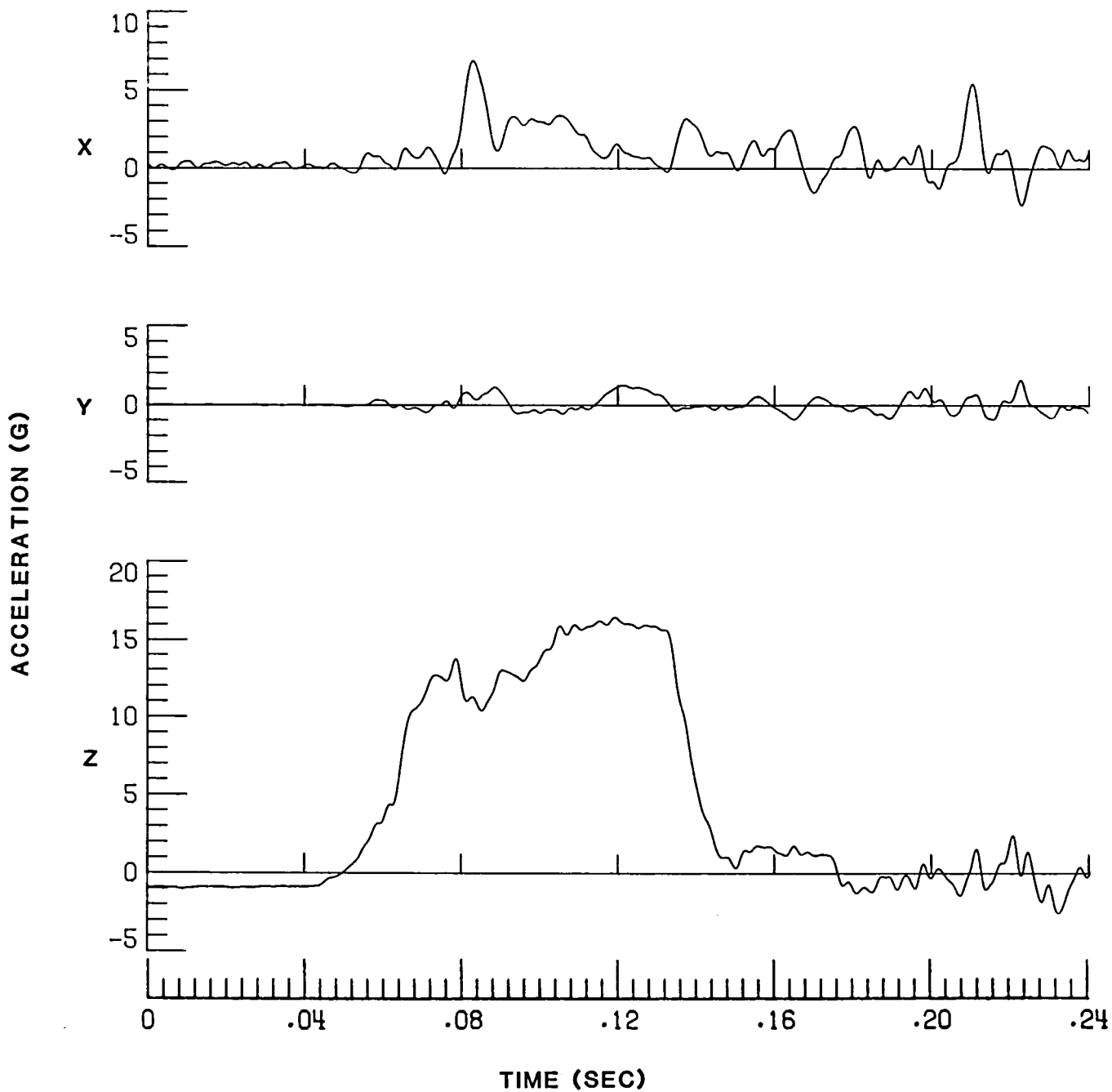
RIGHT BULKHEAD
NASA TEST NO. 12



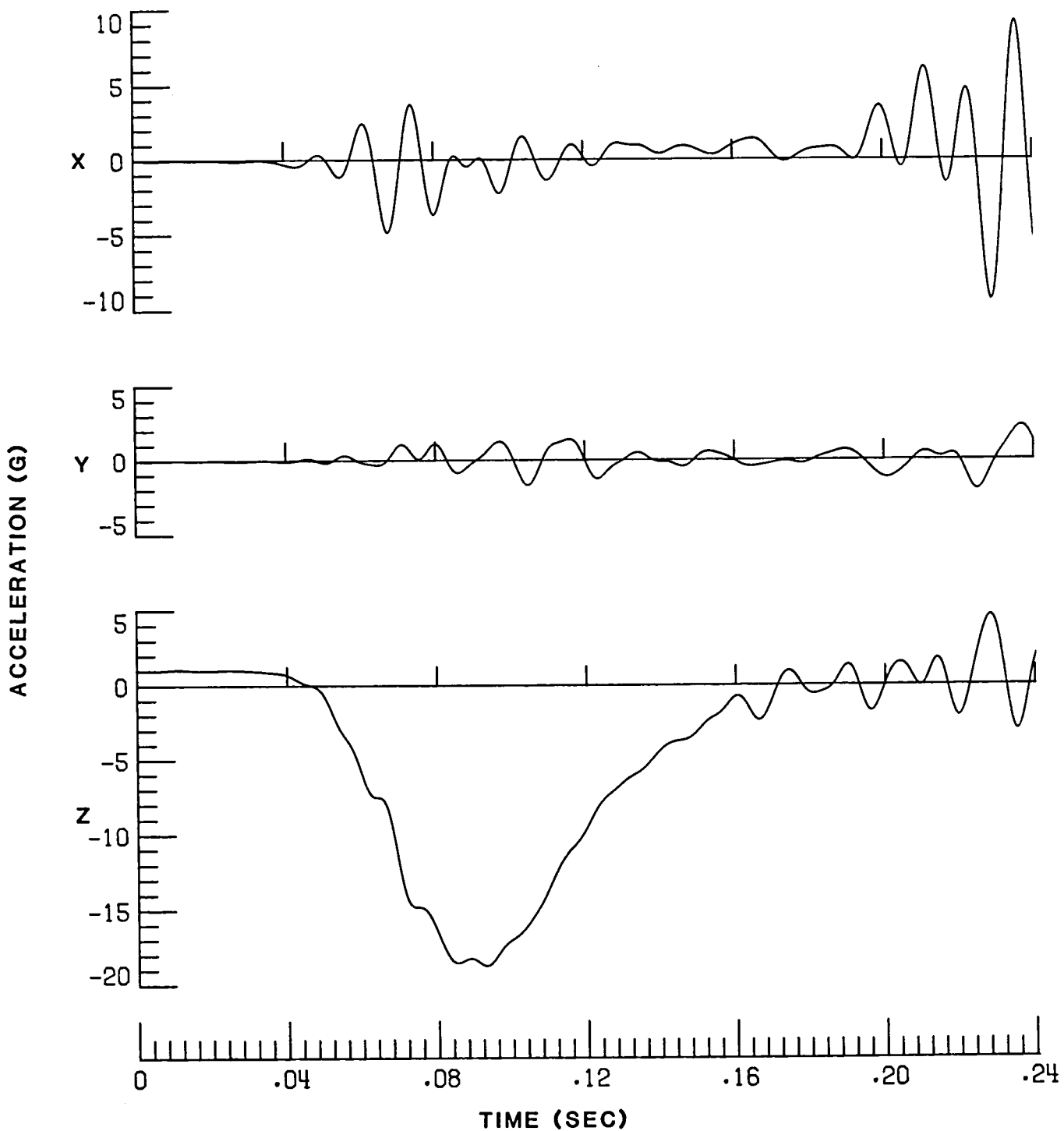
ACCELERATION (G)



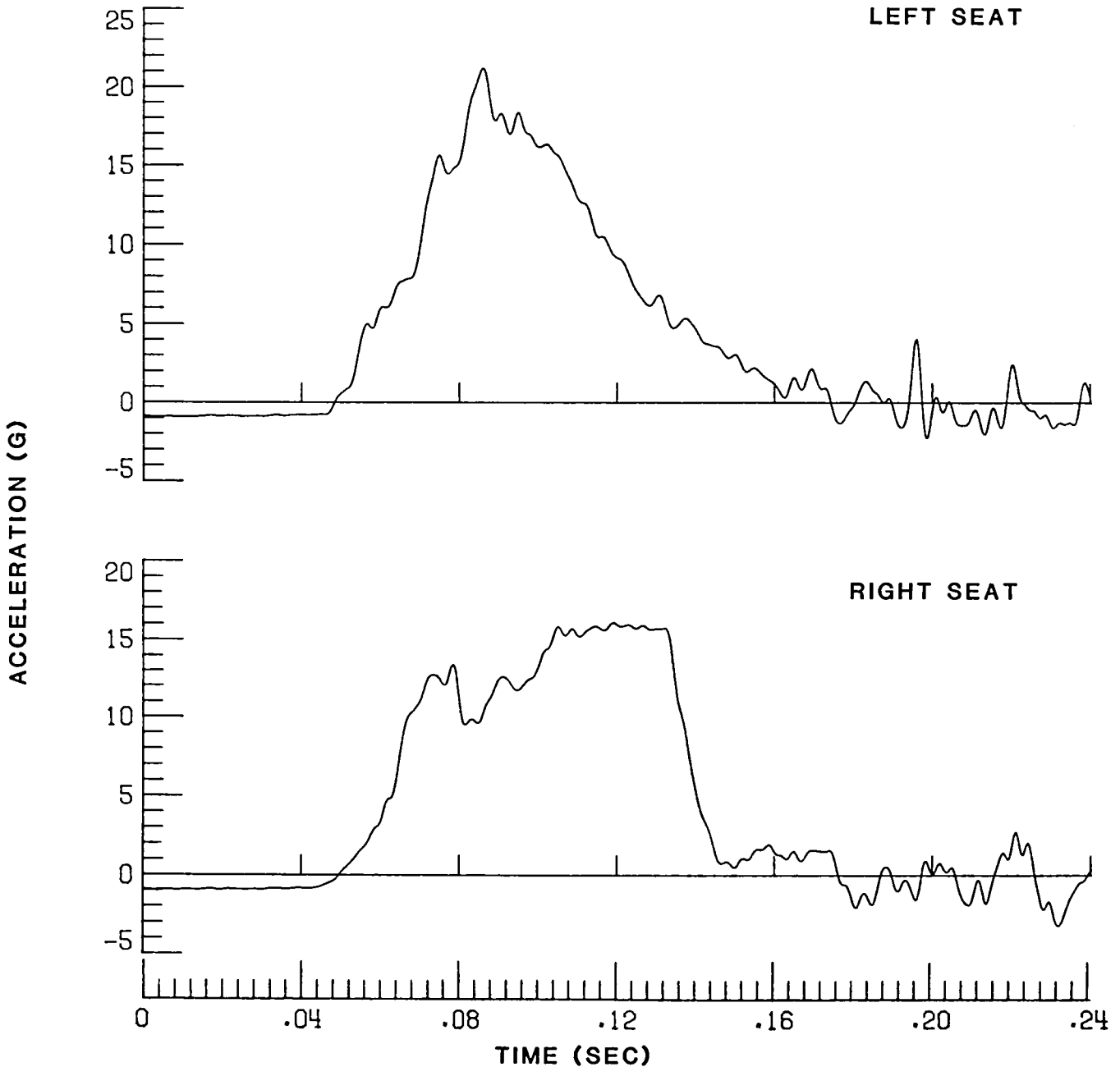
LEFT SEAT PAN
NASA TEST NO. 12



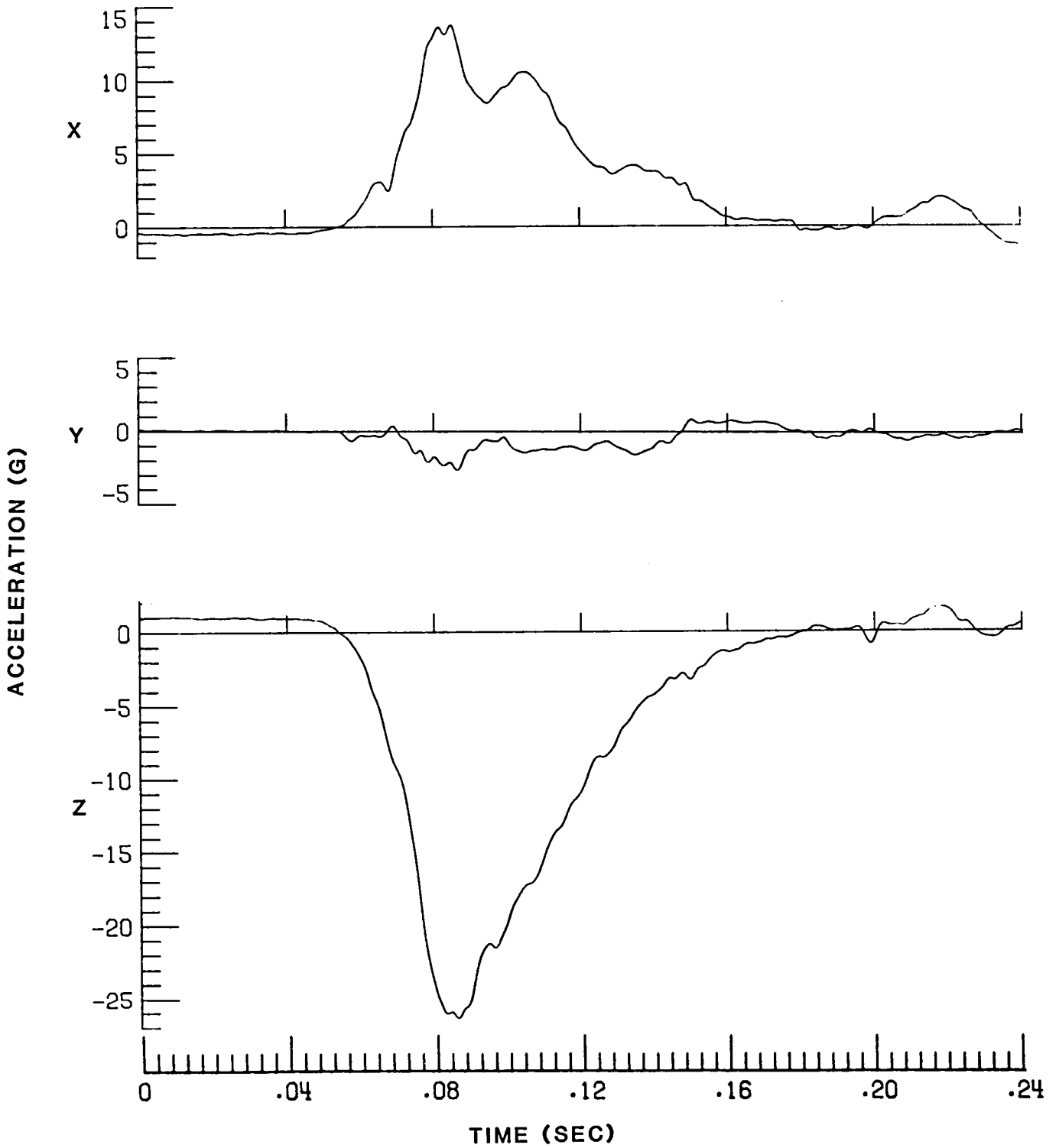
RIGHT SEAT PAN
NASA TEST NO. 12



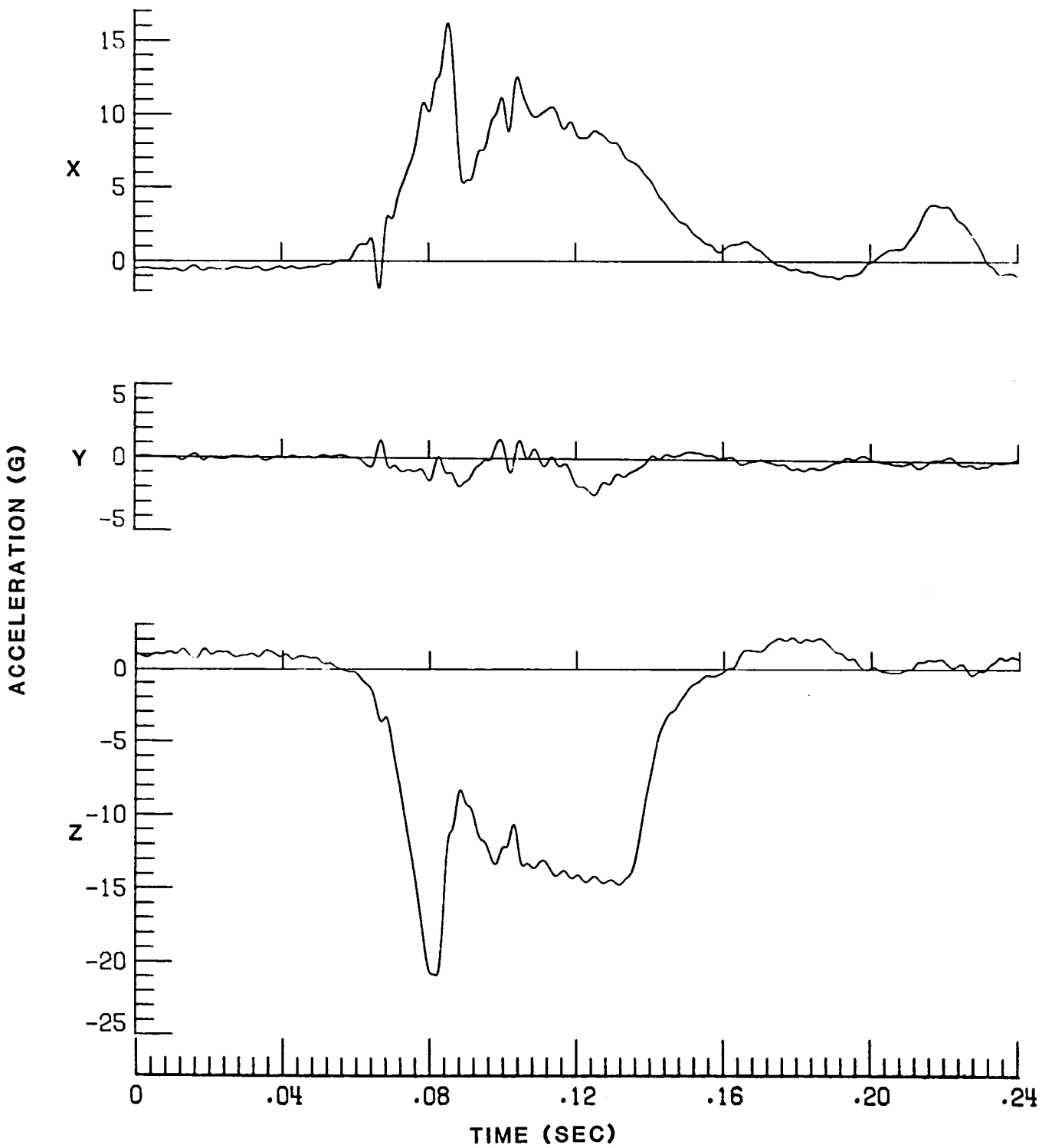
CAPSULE C.G.
 NASA TEST NO.12



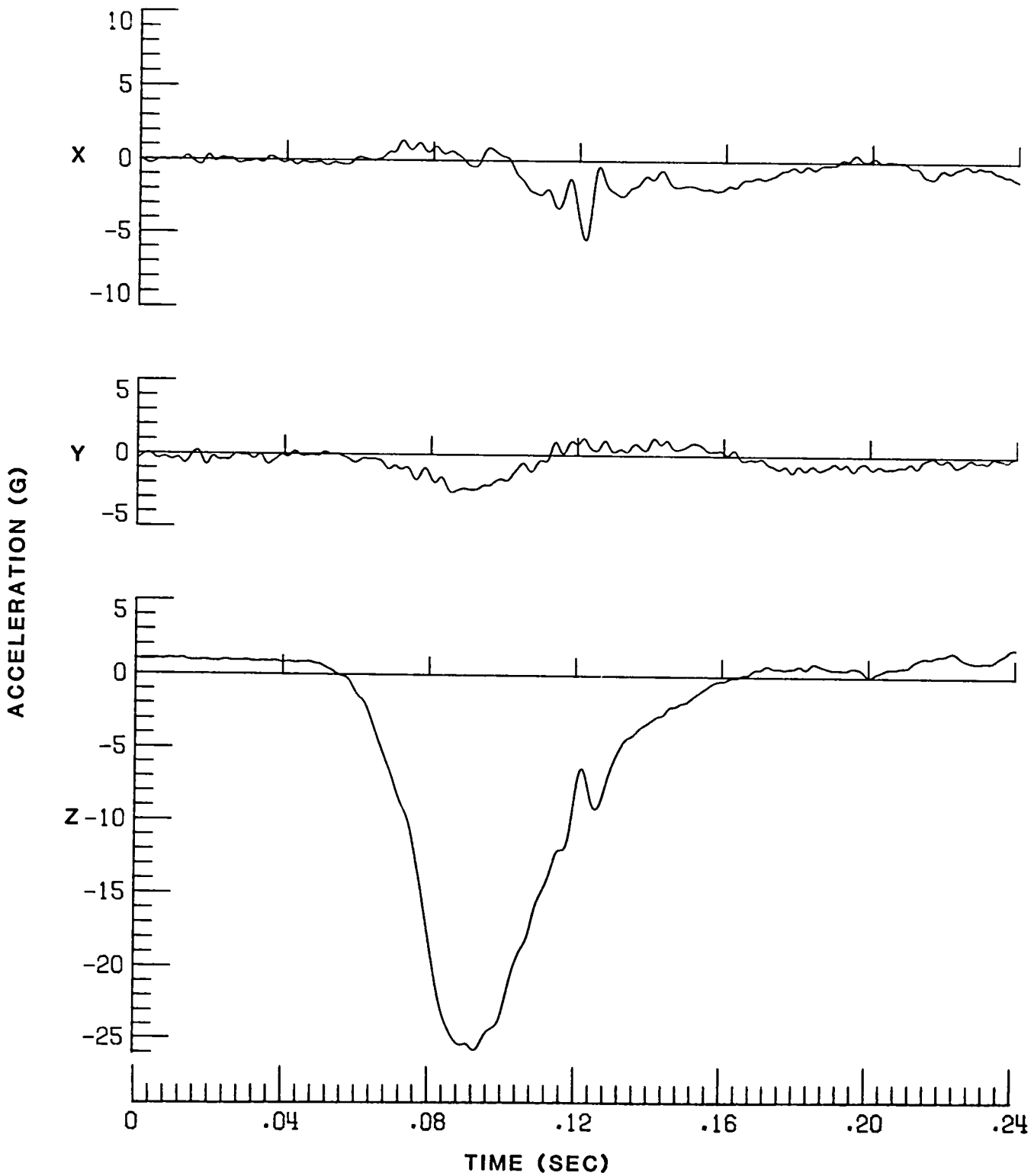
SEAT PAN ALONG BACK TANGENT LINE
NASA TEST NO. 12



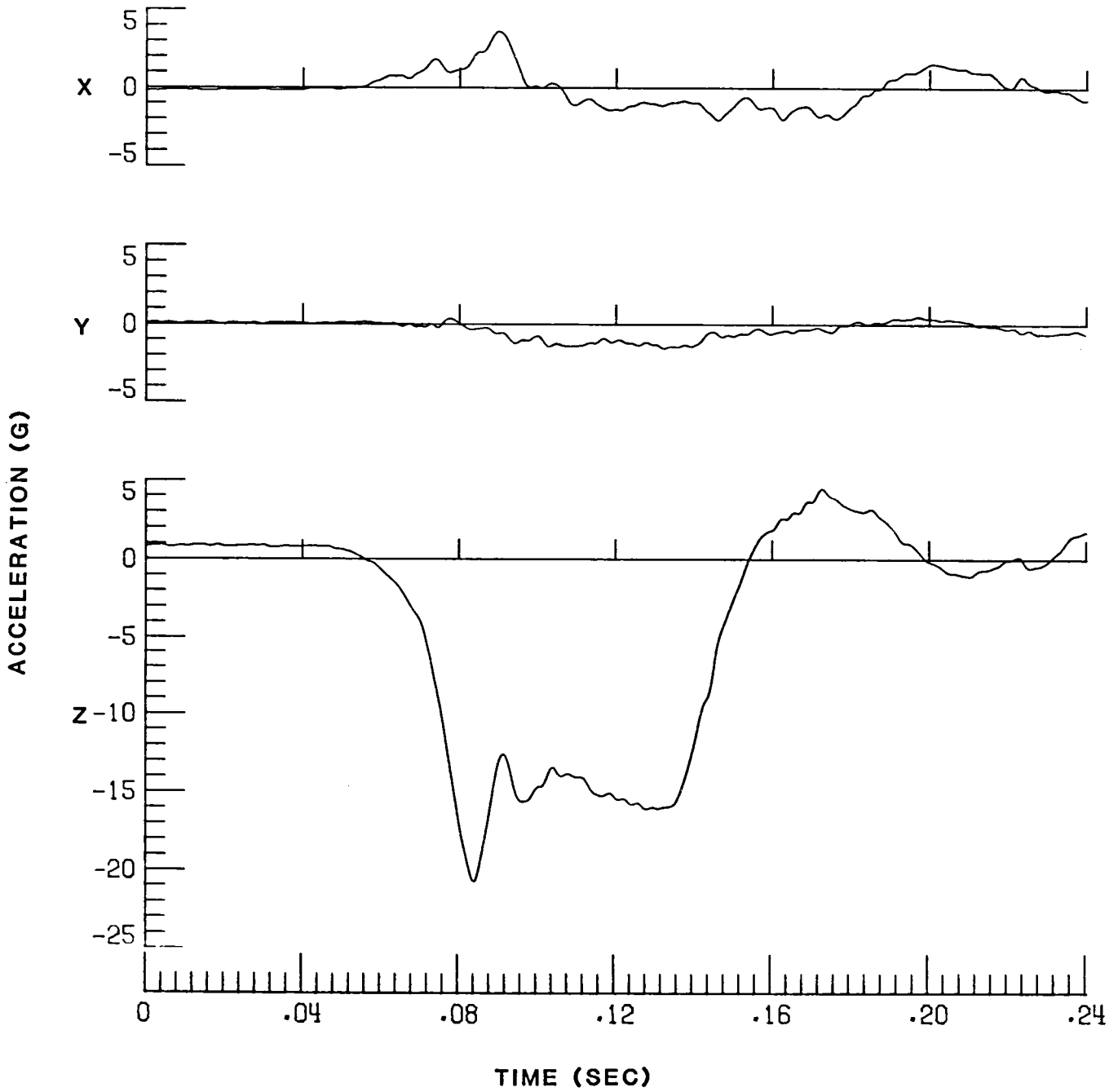
LEFT DUMMY PELVIS
NASA TEST NO. 12



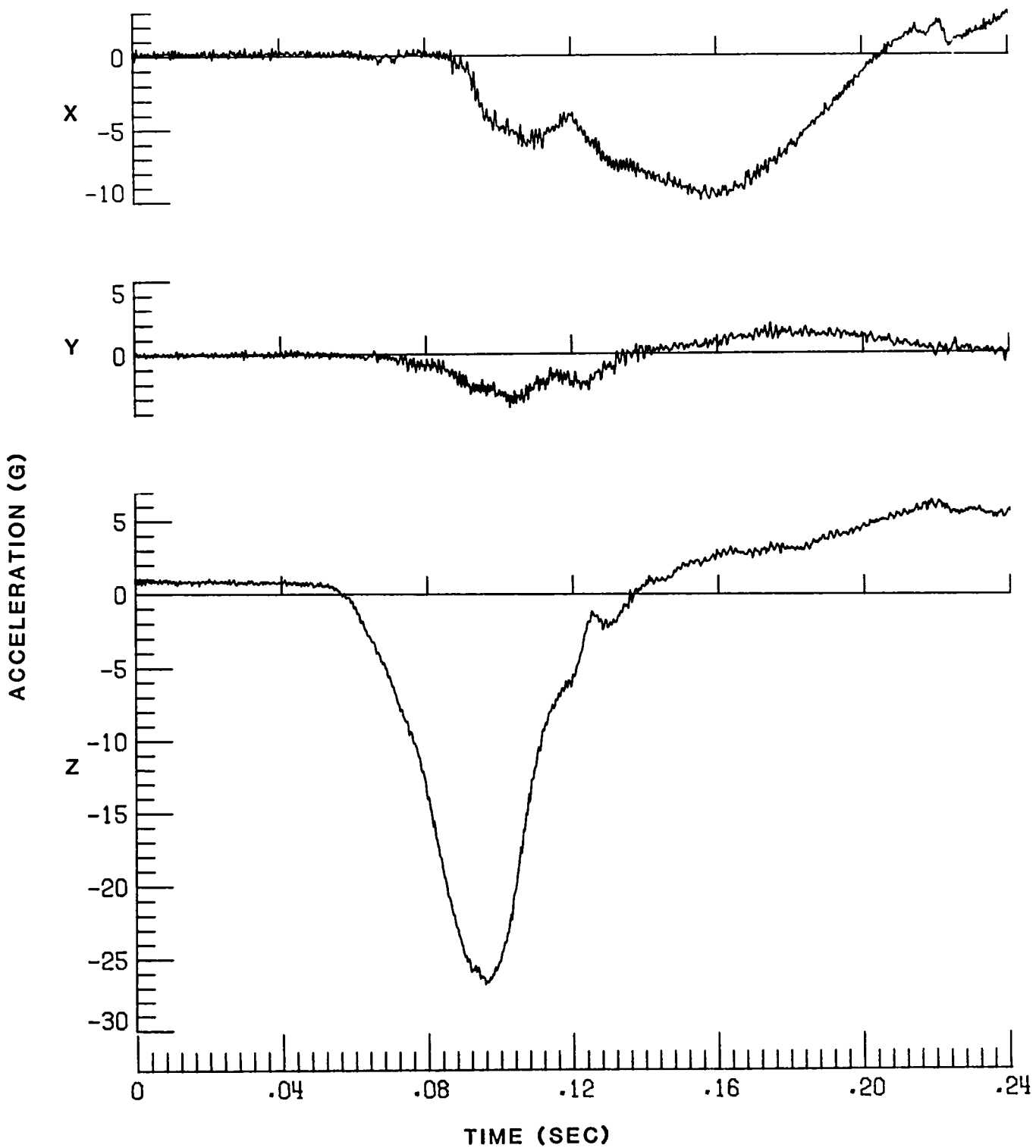
RIGHT DUMMY PELVIS
NASA TEST NO. 12



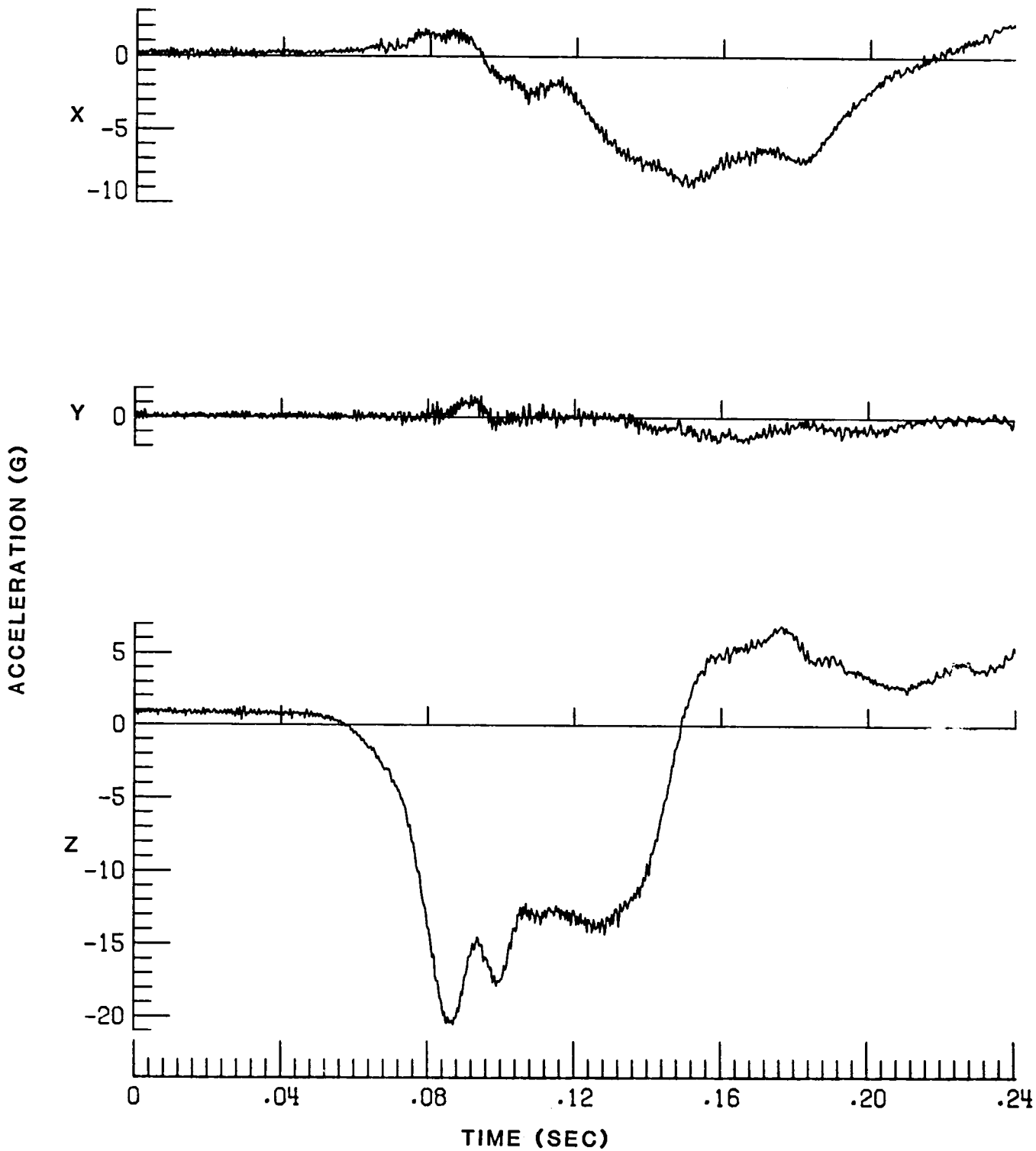
LEFT DUMMY CHEST
NASA TEST NO. 12



RIGHT DUMMY CHEST
NASA TEST NO. 12

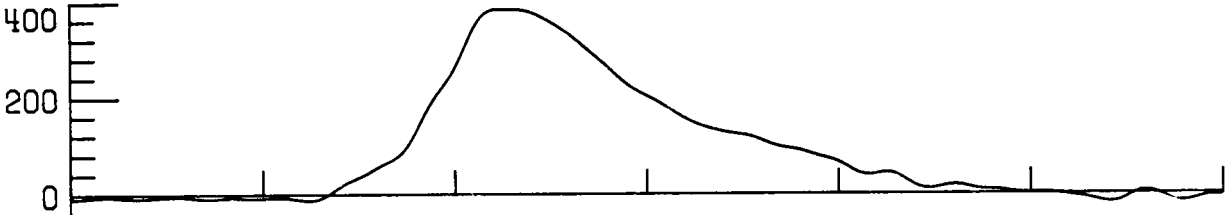


LEFT DUMMY HEAD
NASA TEST NO. 12

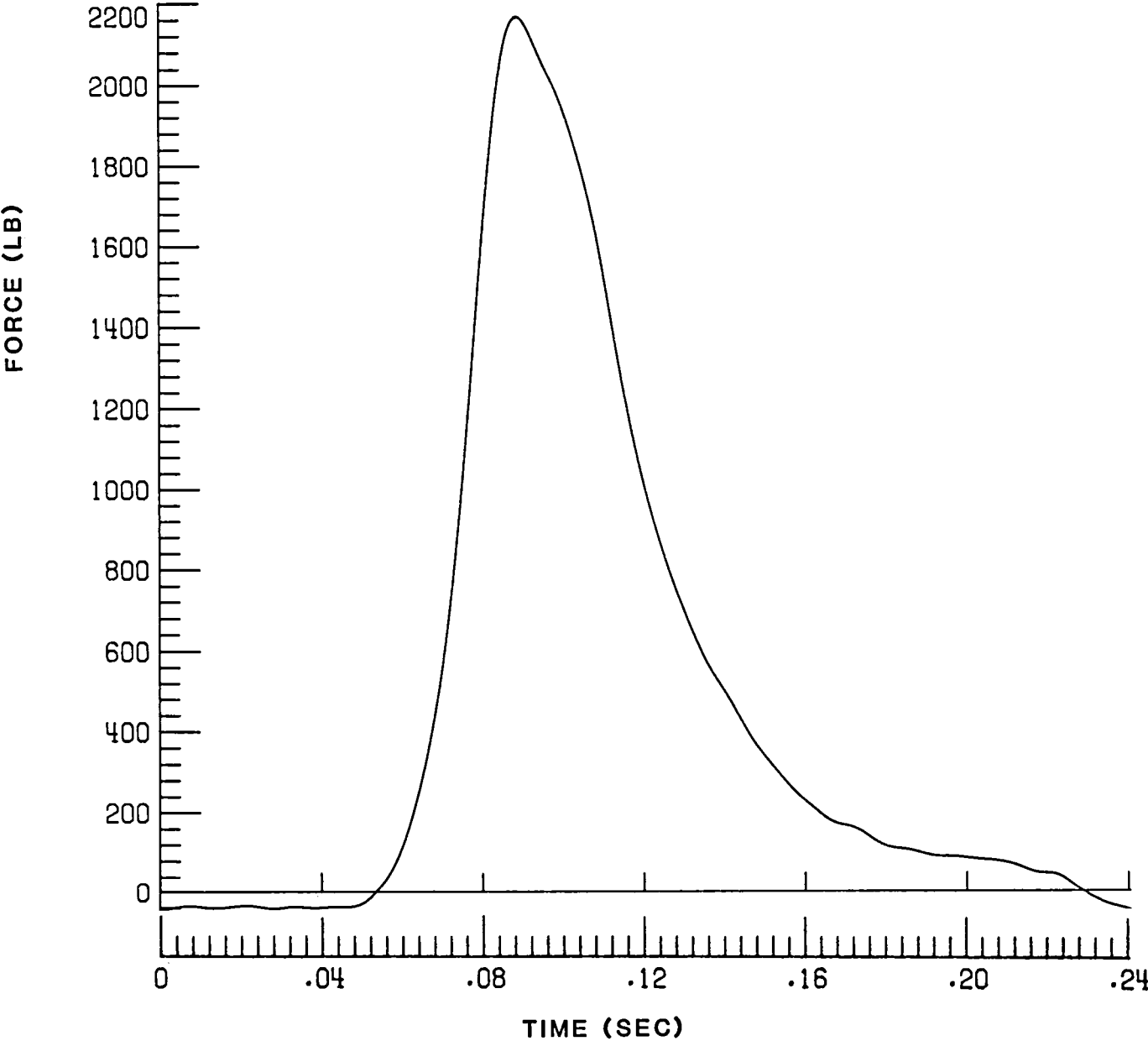


RIGHT DUMMY HEAD
NASA TEST NO. 12

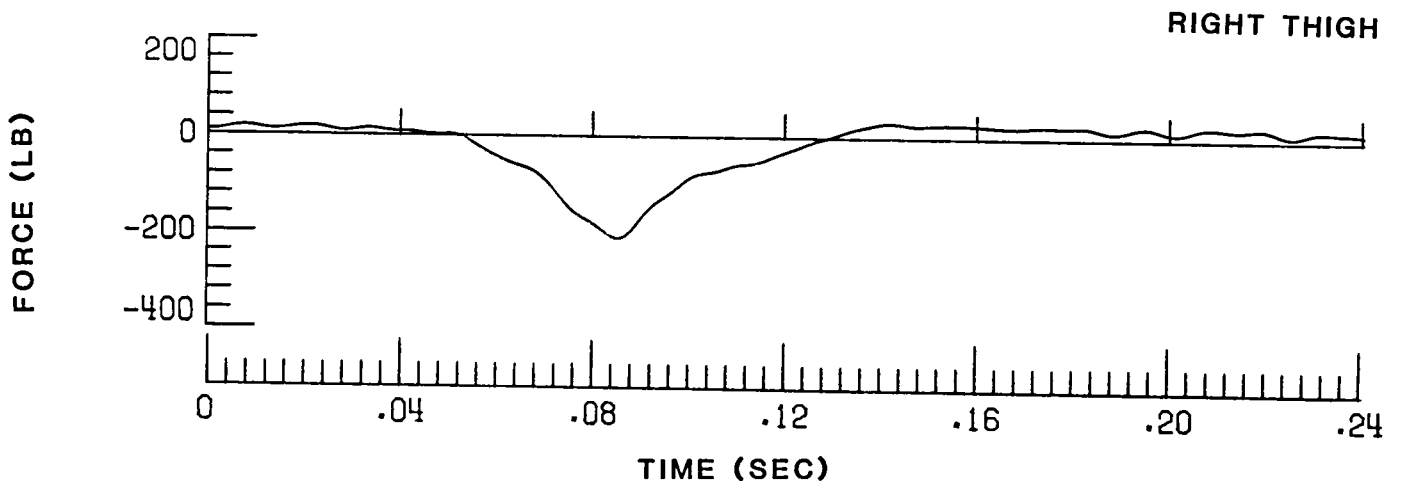
LEFT THIGH



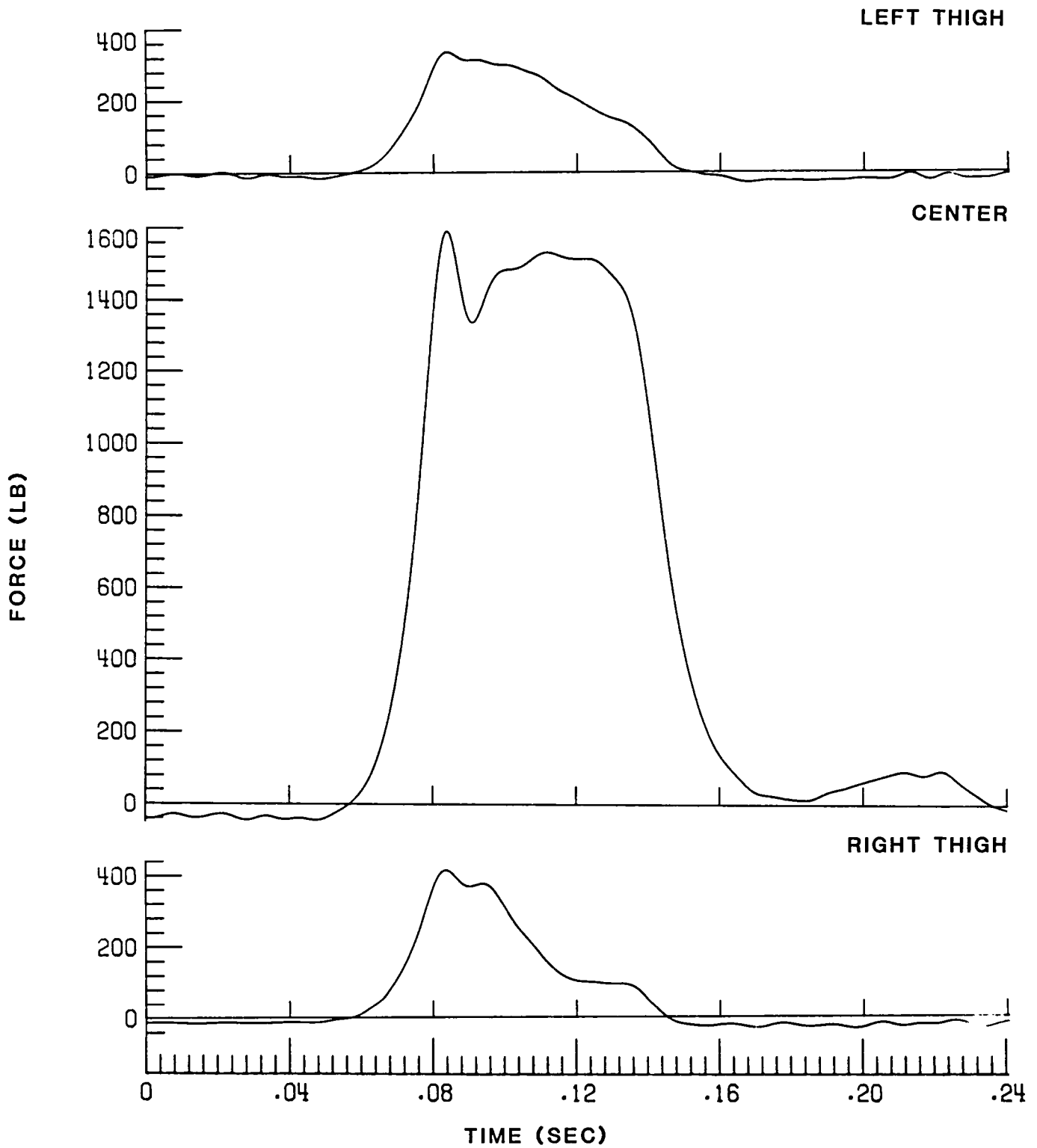
CENTER



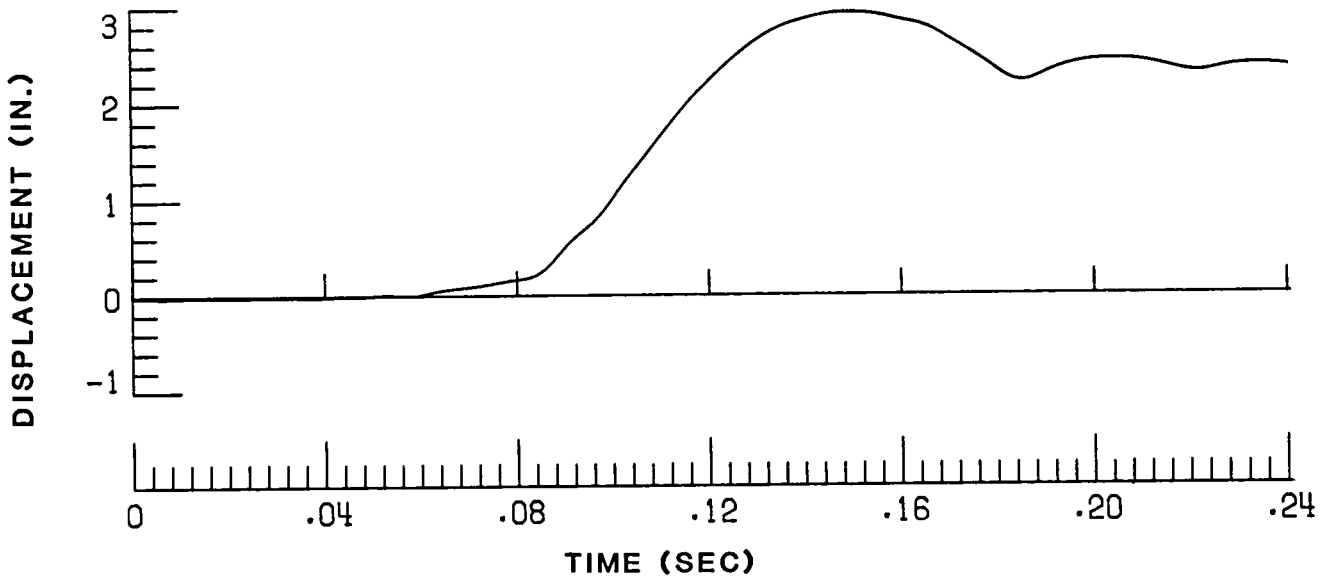
LEFT SEAT PAN LOADS
NASA TEST NO. 12



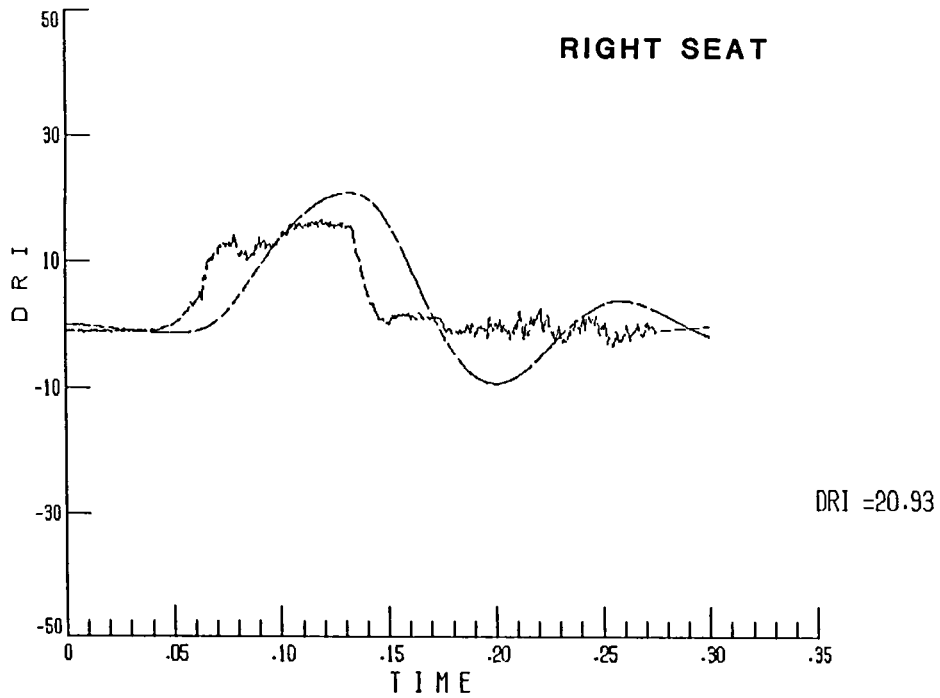
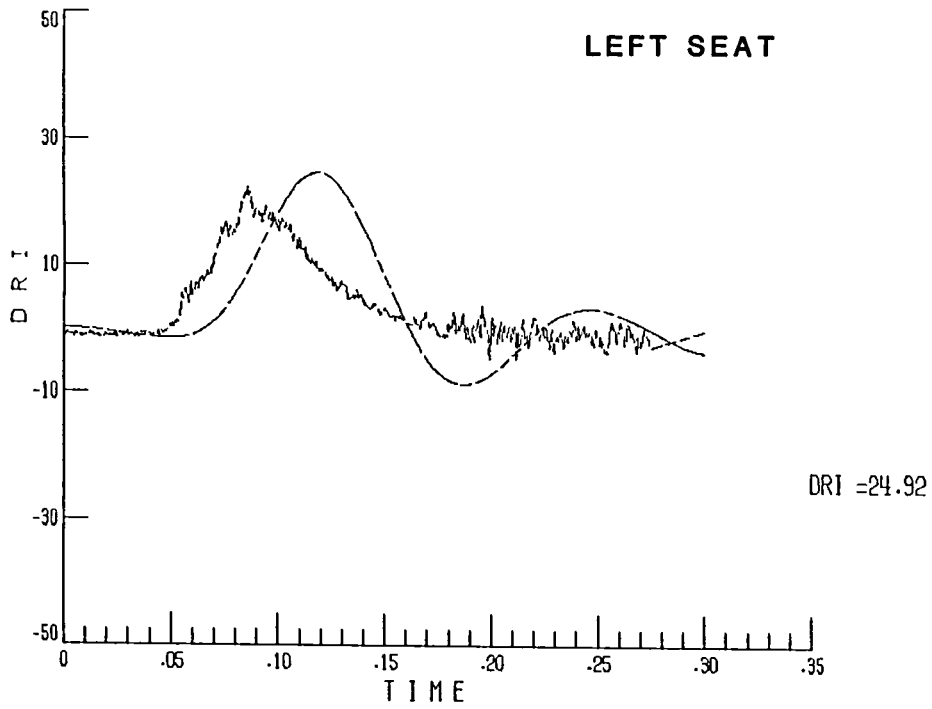
LEFT SEAT PAN LOAD
NASA TEST NO. 12



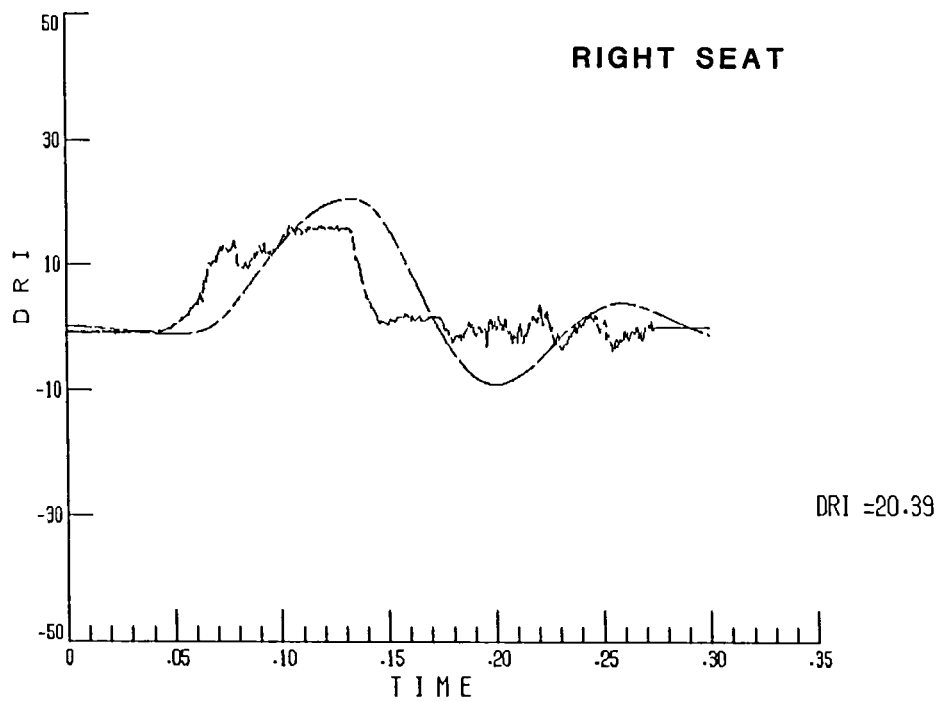
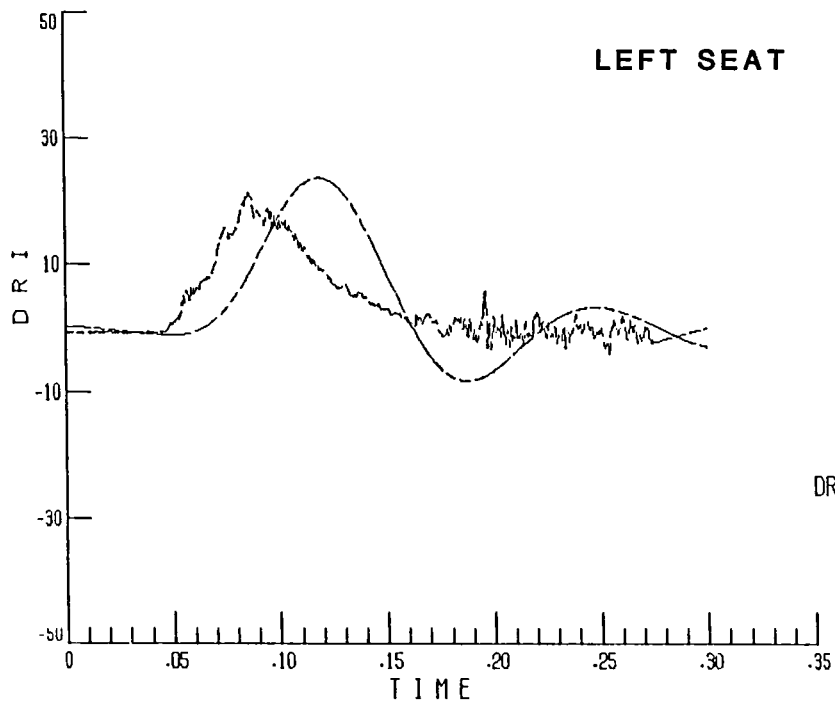
RIGHT SEAT PAN LOADS
NASA TEST NO. 12



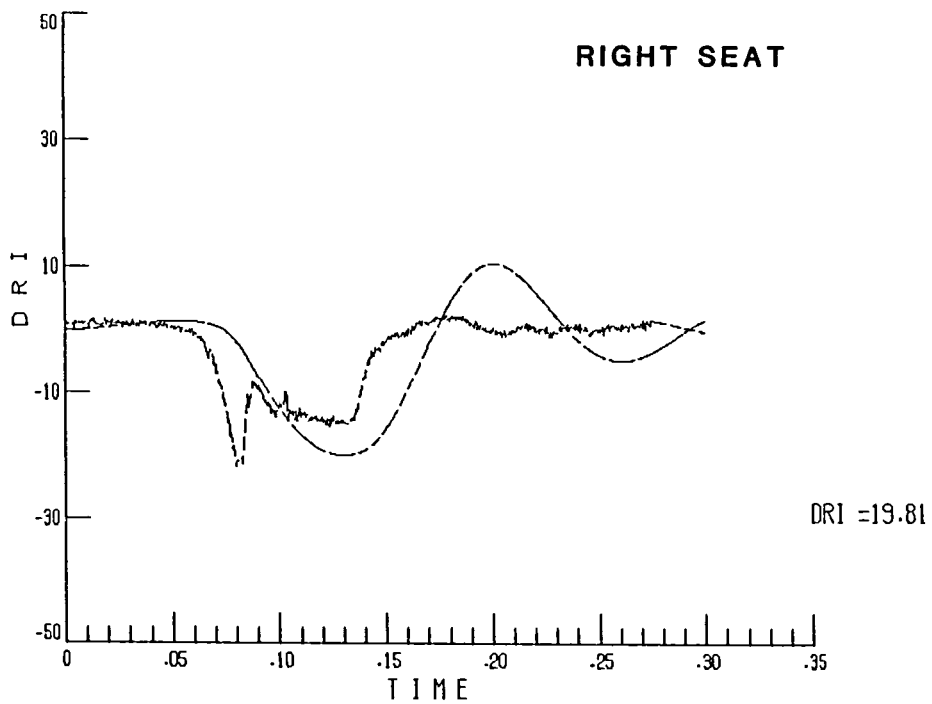
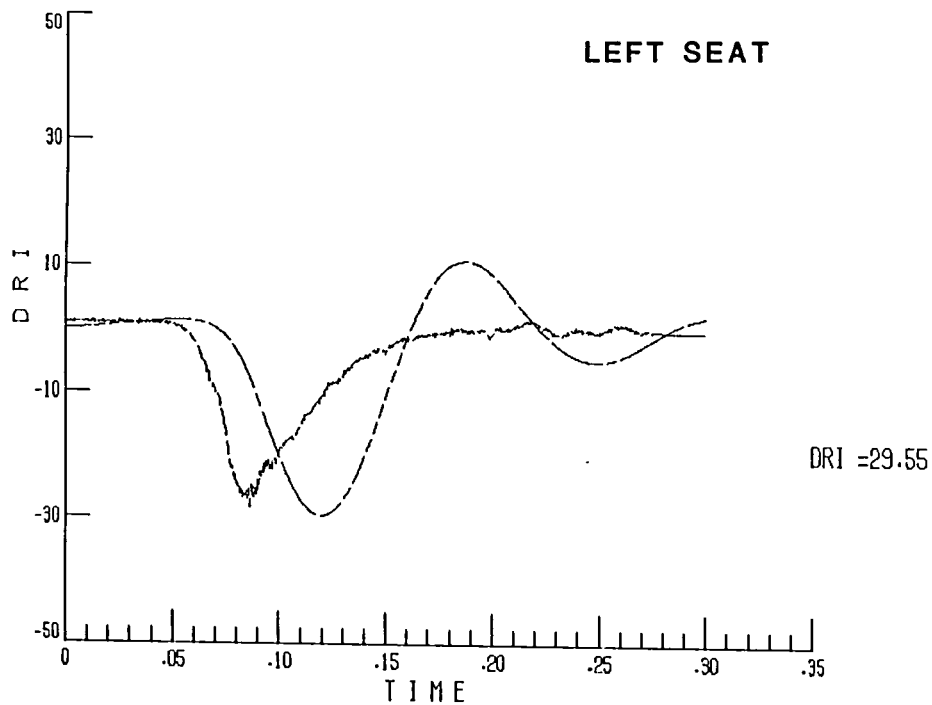
RIGHT SEAT STROKE
NASA TEST NO. 12



**DYNAMIC RESPONSE INDEX
SEAT PAN Z-AXIS
NASA TEST NO. 12**



**DYNAMIC RESPONSE INDEX
BACK TANGENT LINE
NASA TEST NO. 12**



**DYNAMIC RESPONSE INDEX
DUMMY PELVIS Z-AXIS
NASA TEST NO. 12**

14.0 NASA (IBAHRS) NO. 17

HORIZONTAL VELOCITY: 34 ft/sec

VERTICAL VELOCITY: 32 ft/sec

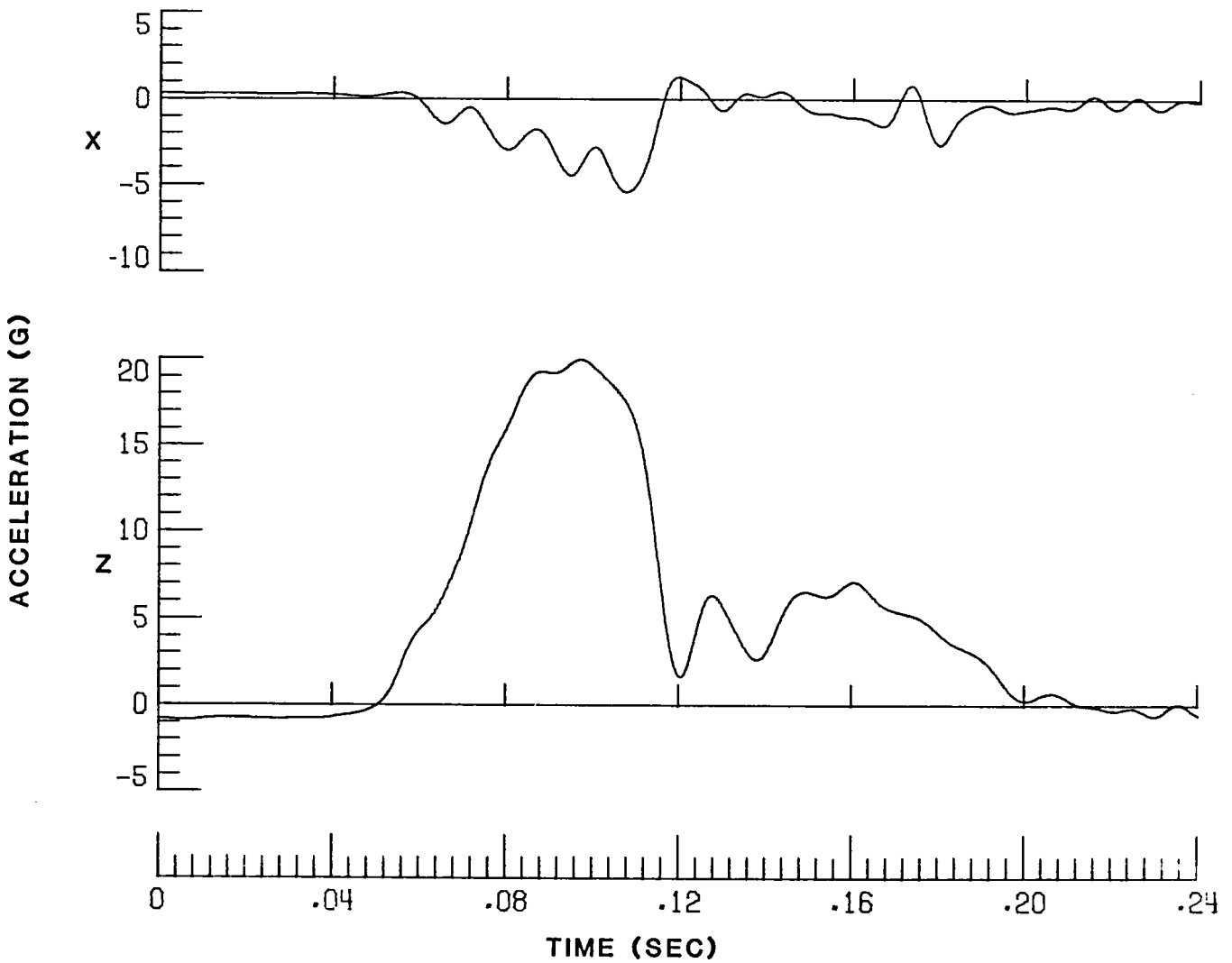
CREW MODULE PITCH: 2°

CREW MODULE ROLL: 0°

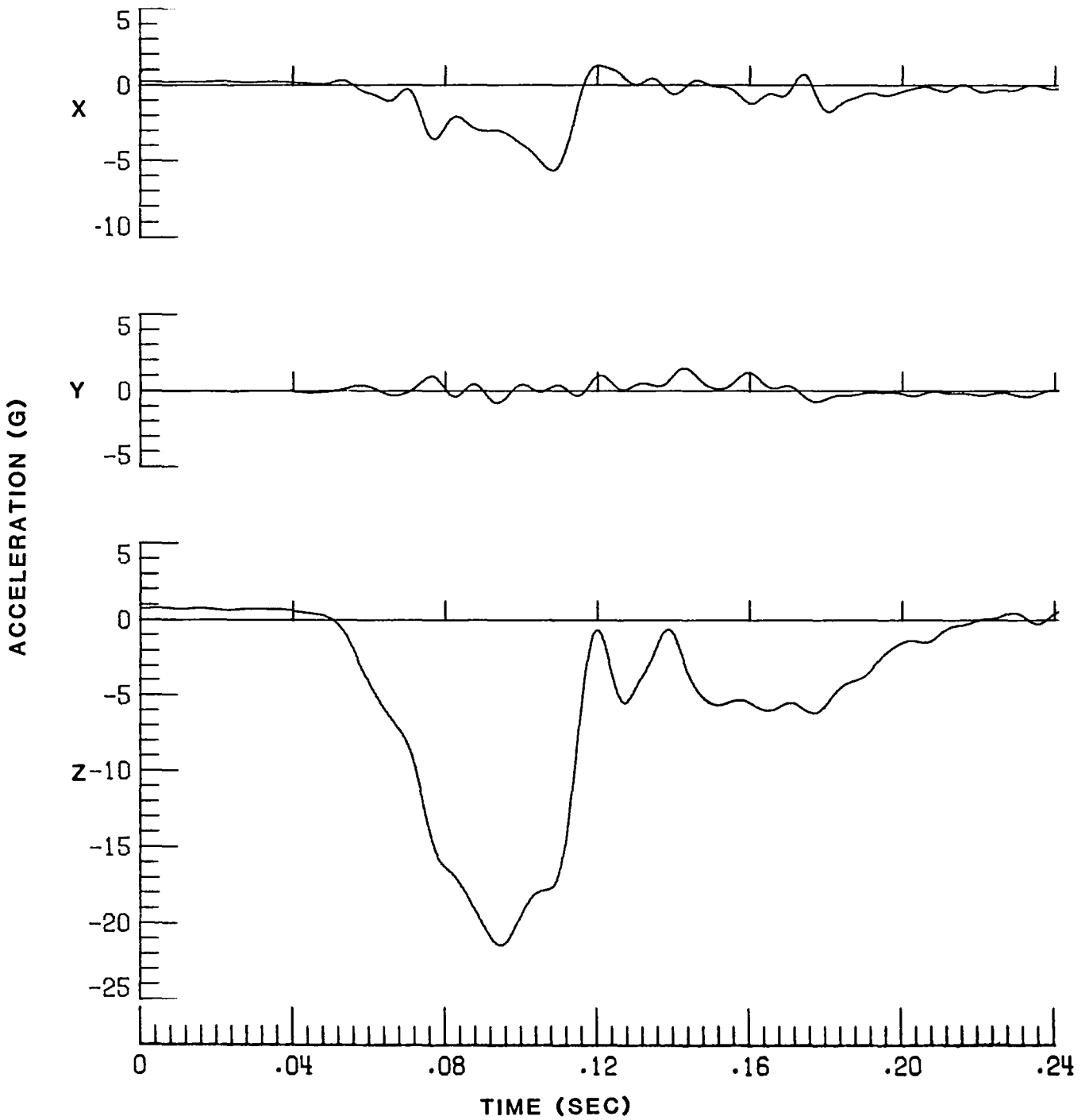
CREW MODULE YAW: 0°

LEFT SEAT: F-111 Operational

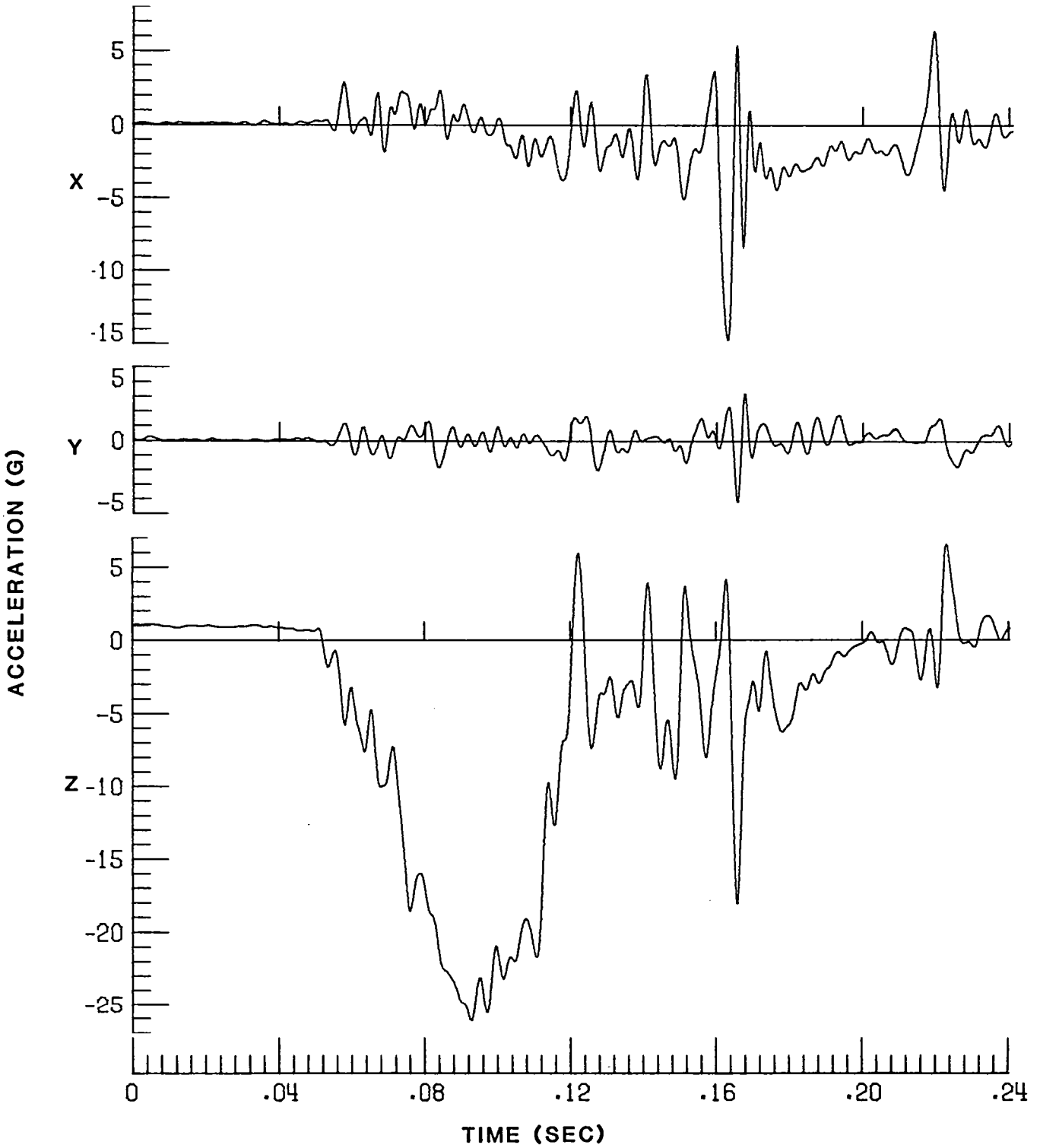
RIGHT SEAT: Energy Absorbing



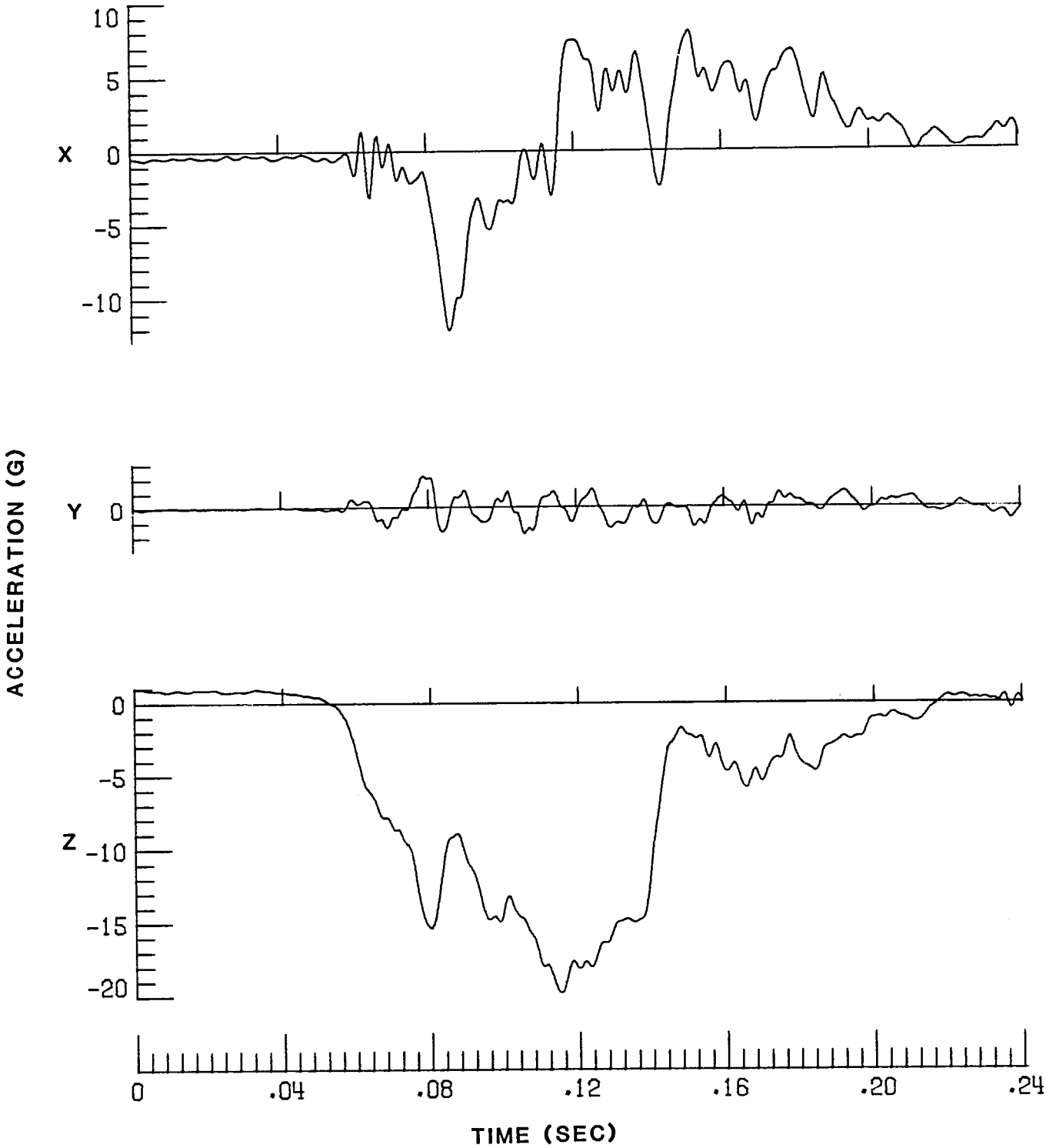
LEFT BULKHEAD
NASA TEST NO. 17



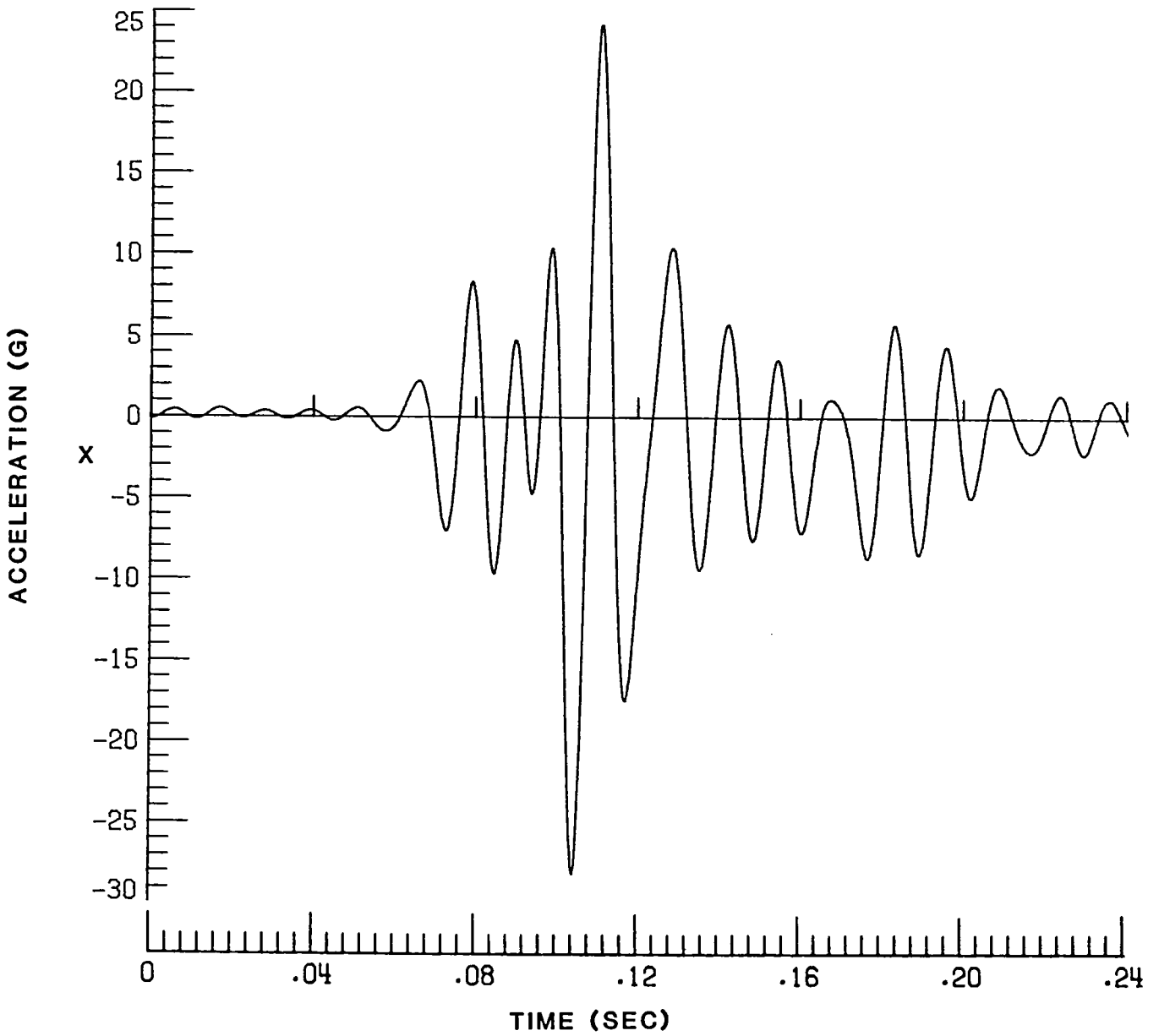
RIGHT BULKHEAD
NASA TEST NO. 17



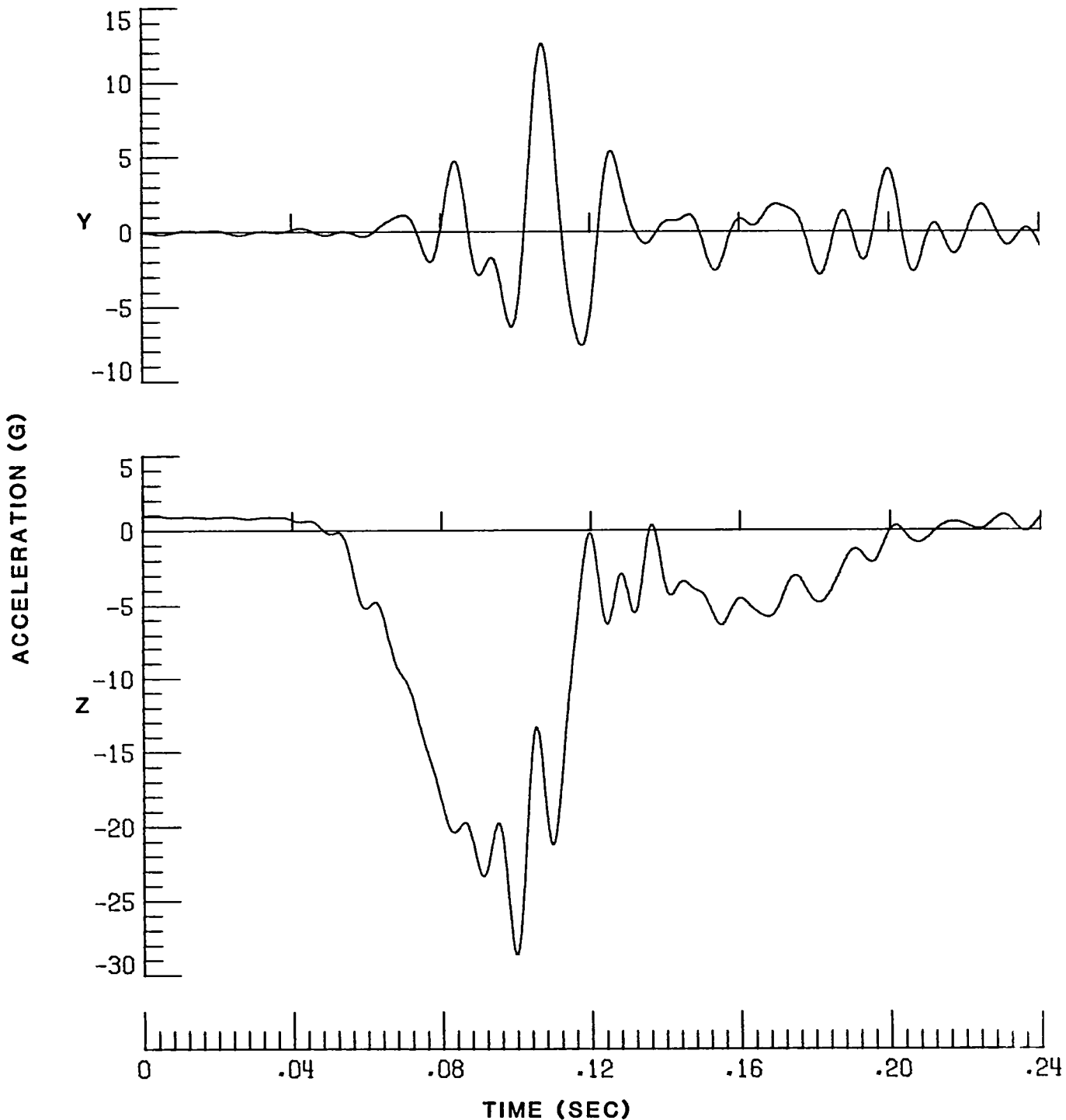
LEFT SEAT PAN
NASA TEST NO. 17



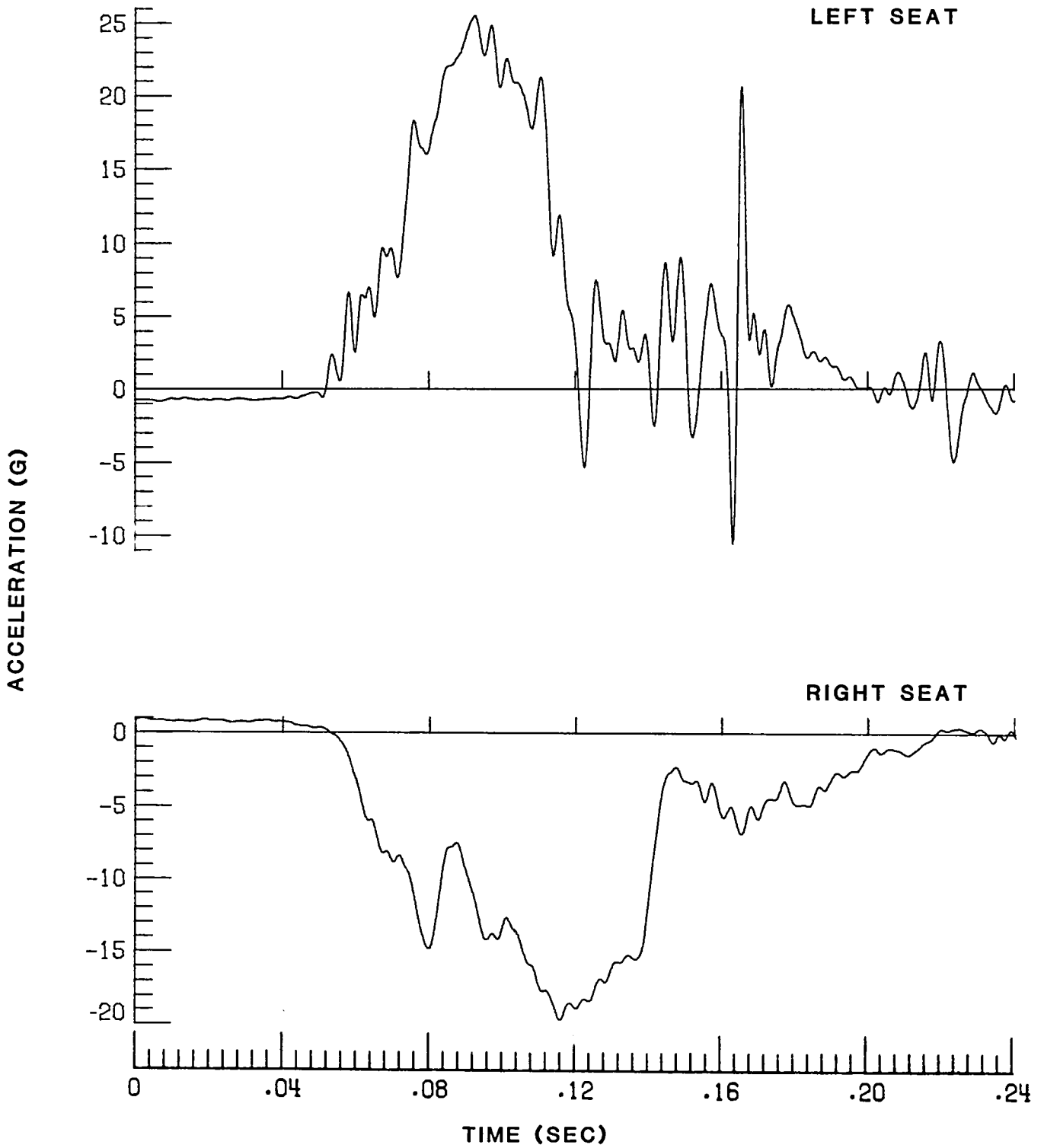
RIGHT SEAT PAN
NASA TEST NO. 17



CAPSULE C.G.
NASA TEST NO. 17

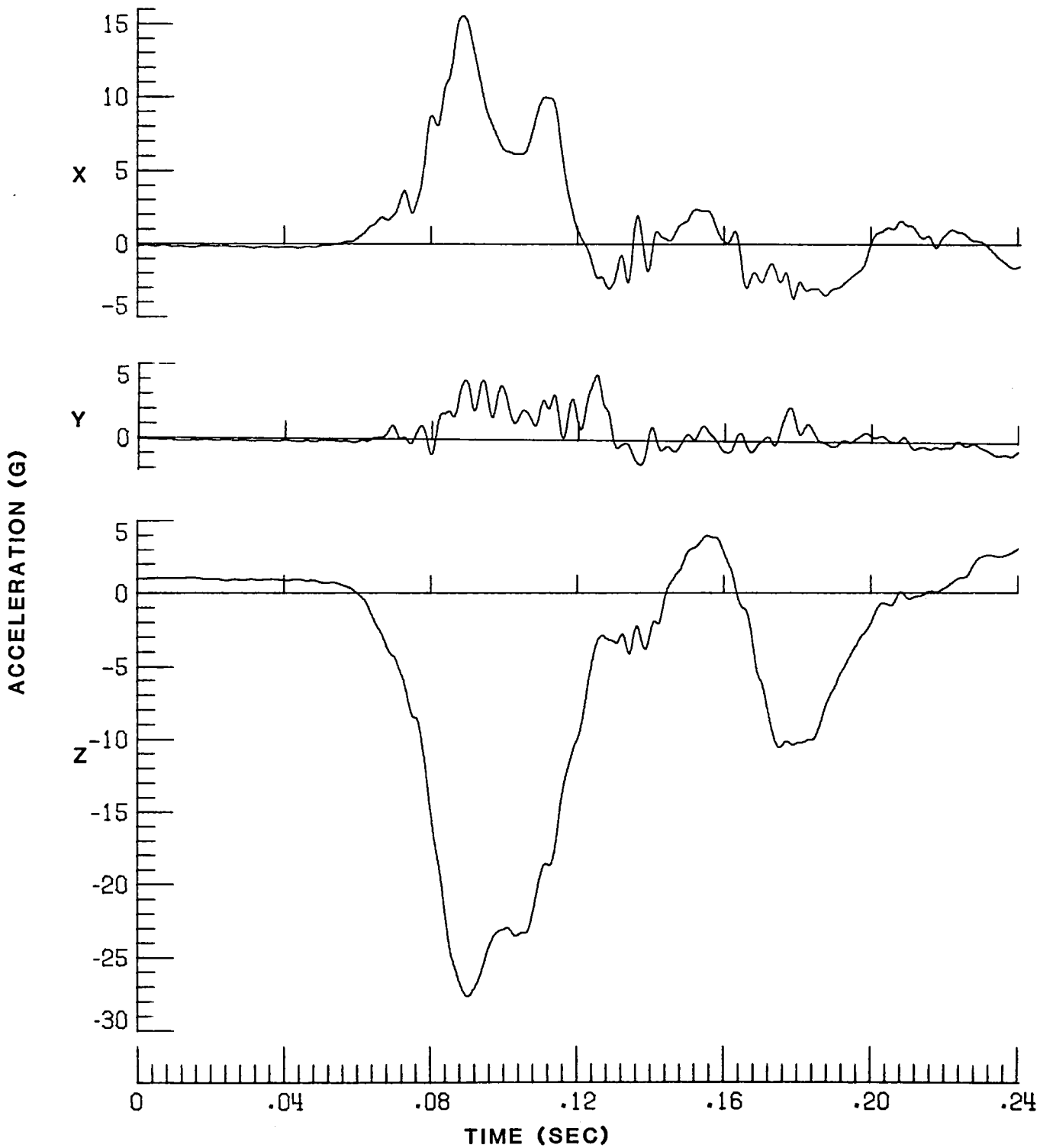


CAPSULE C.G.
NASA TEST NO. 17

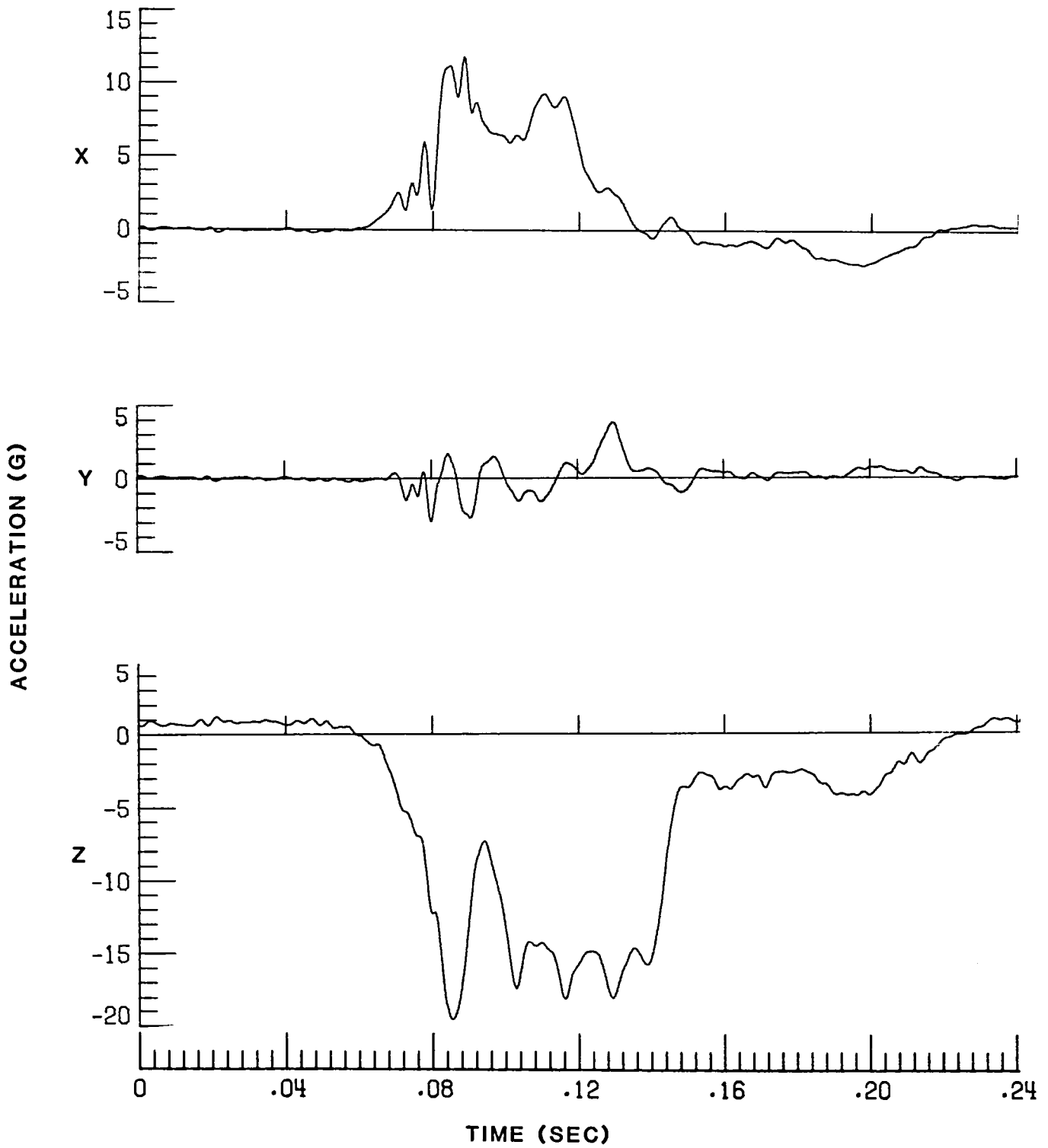


SEAT PAN ALONG BACK TANGENT LINE

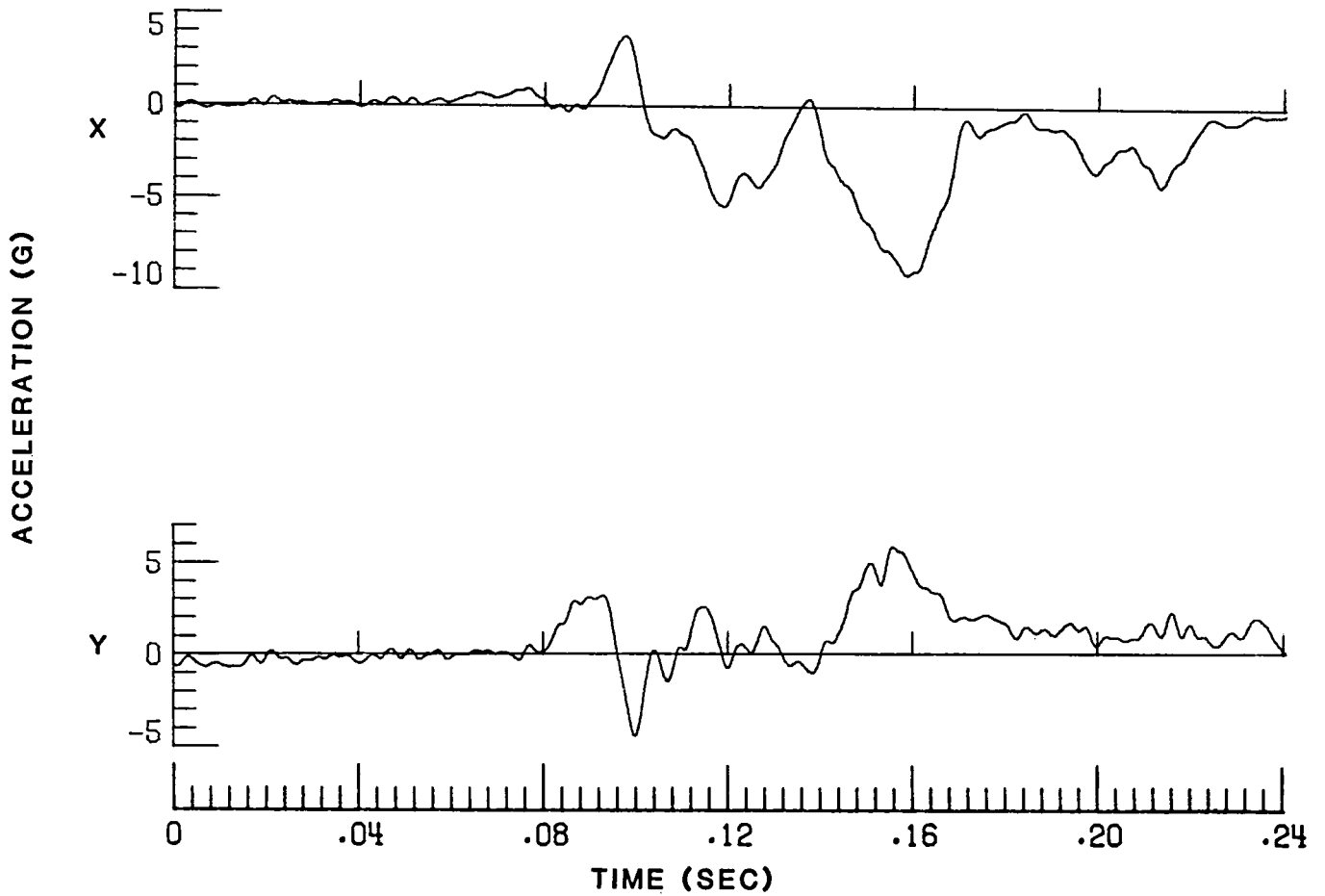
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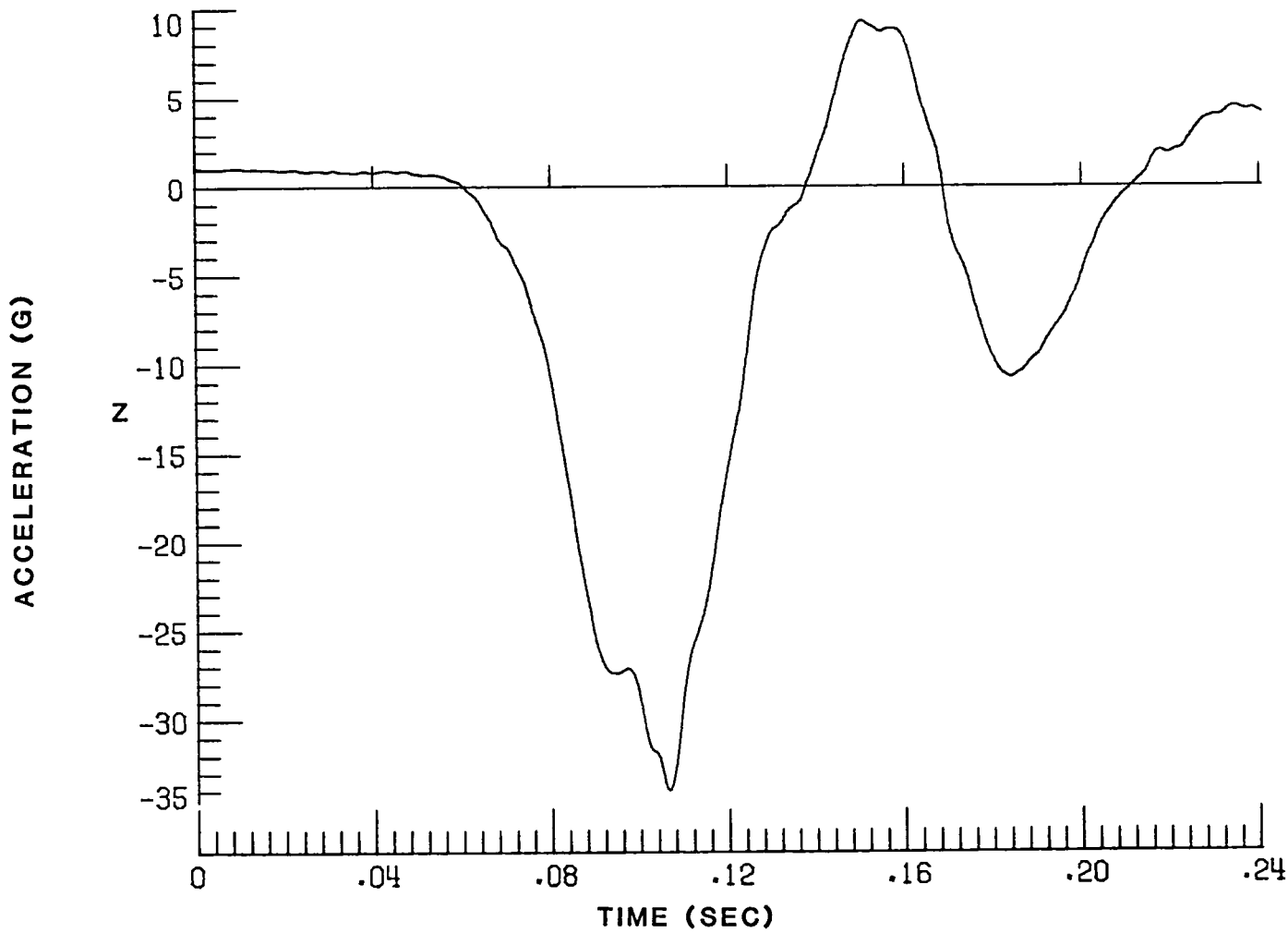
LEFT DUMMY PELVIS
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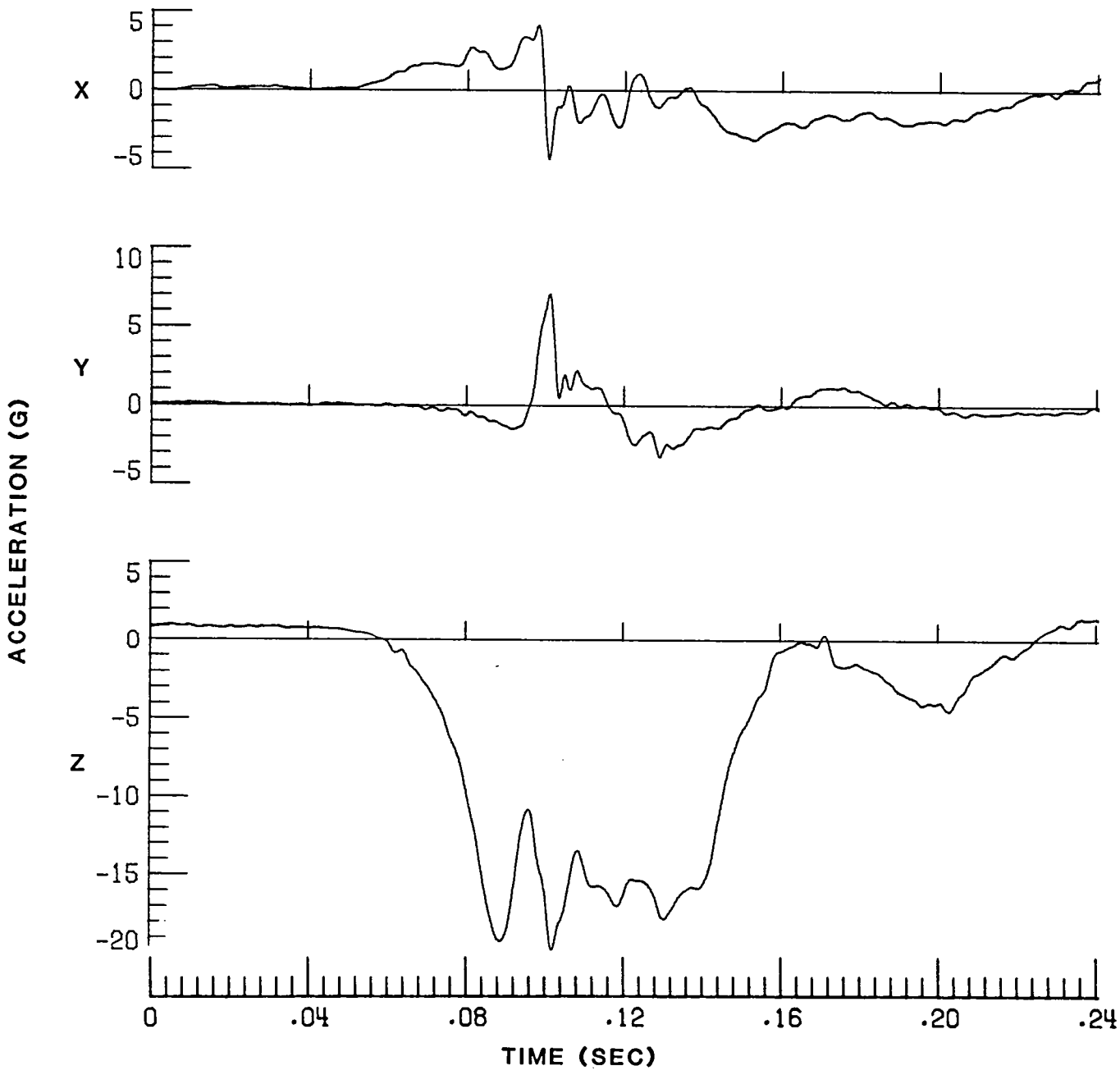
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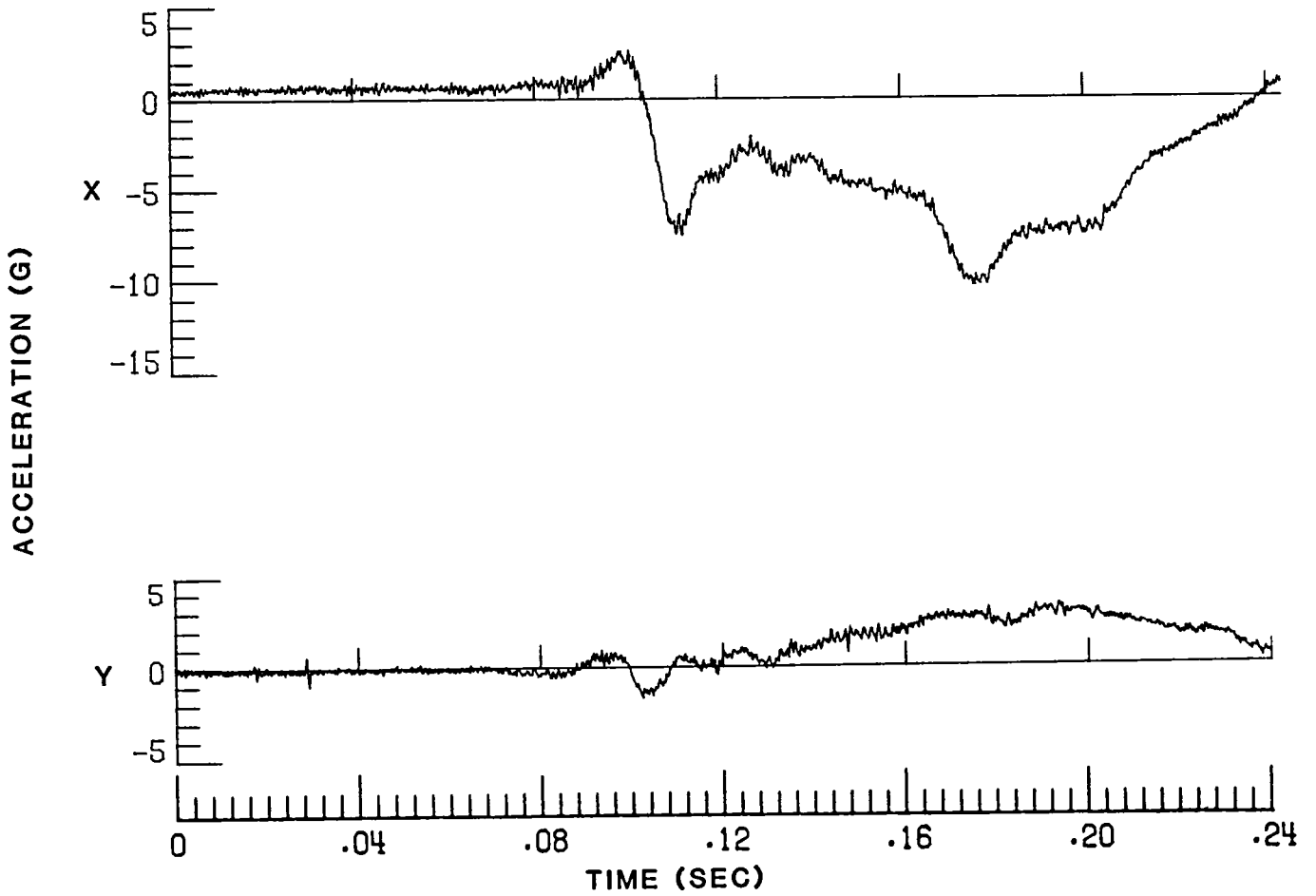
LEFT DUMMY CHEST
NASA TEST NO. 17



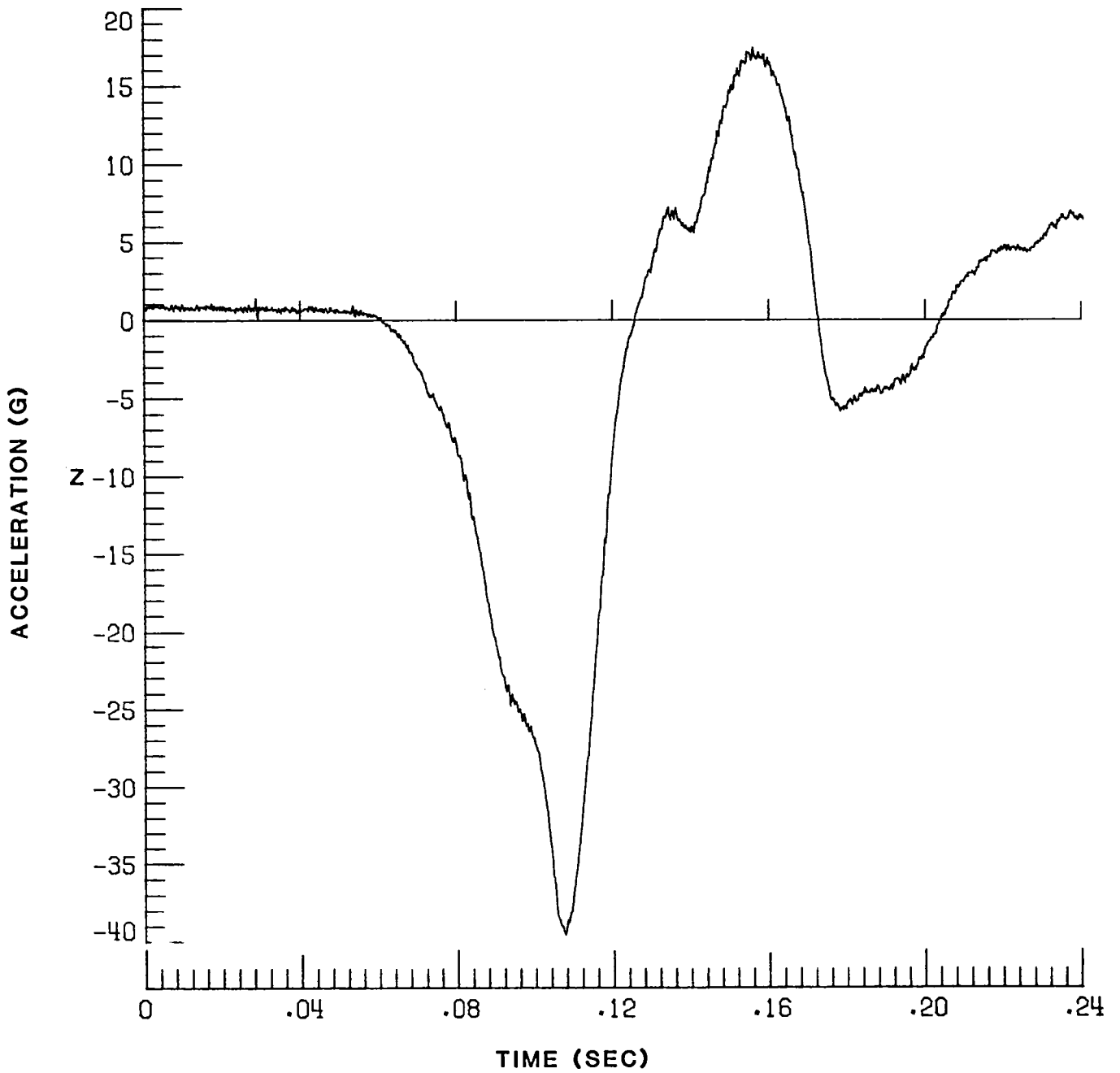
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NASA TEST NO. 17



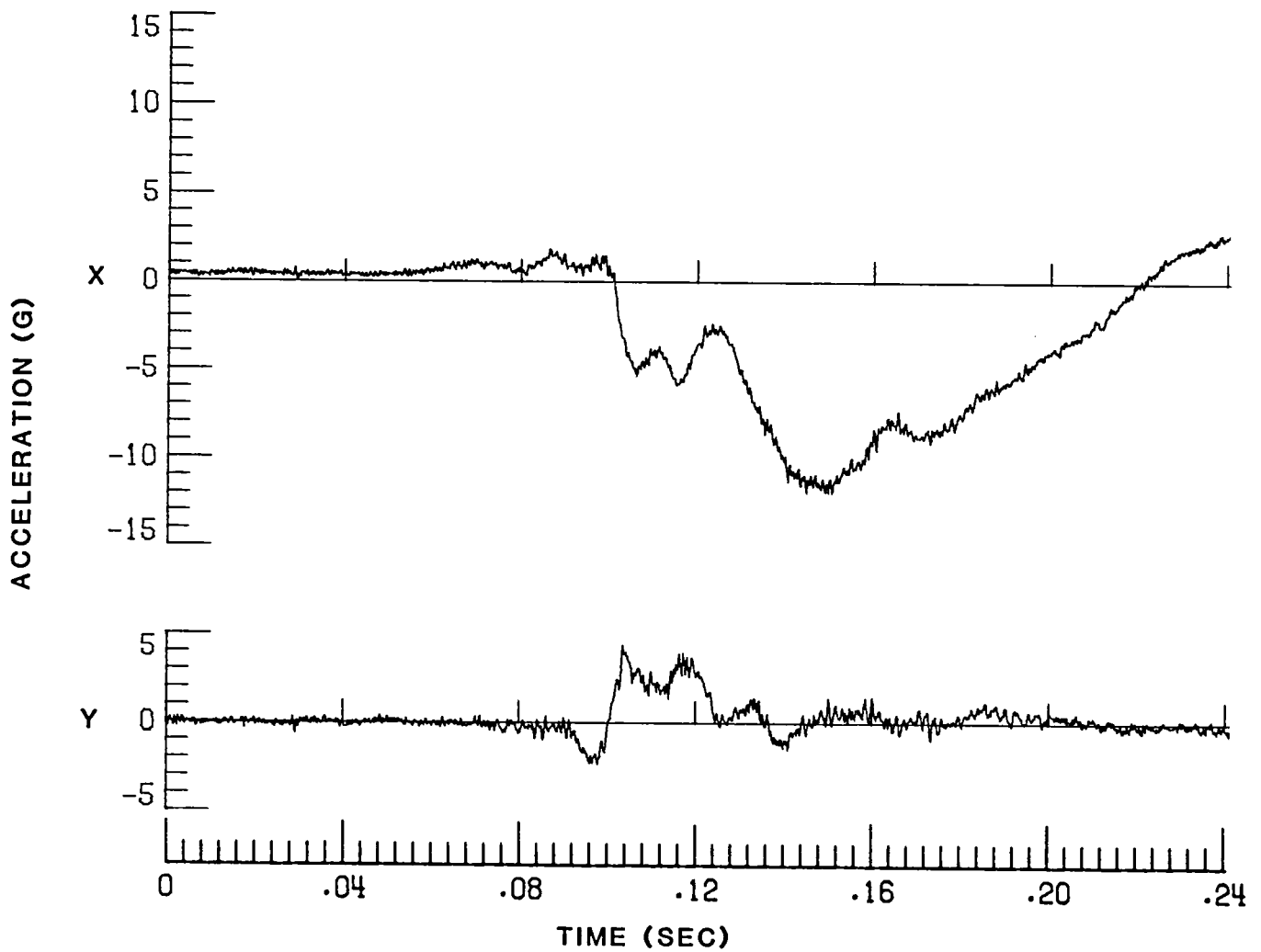
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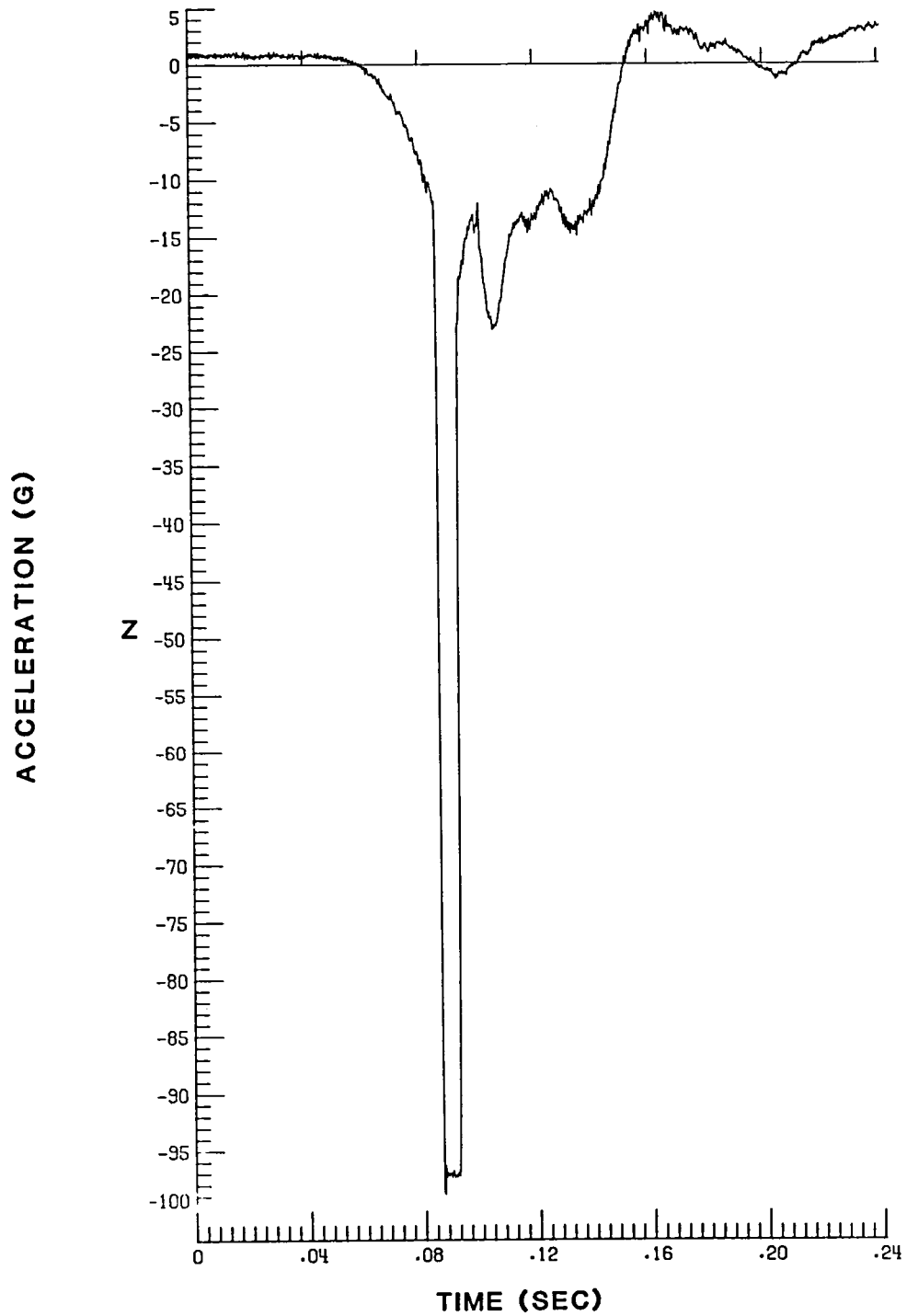
LEFT DUMMY HEAD
NASA TEST NO. 17



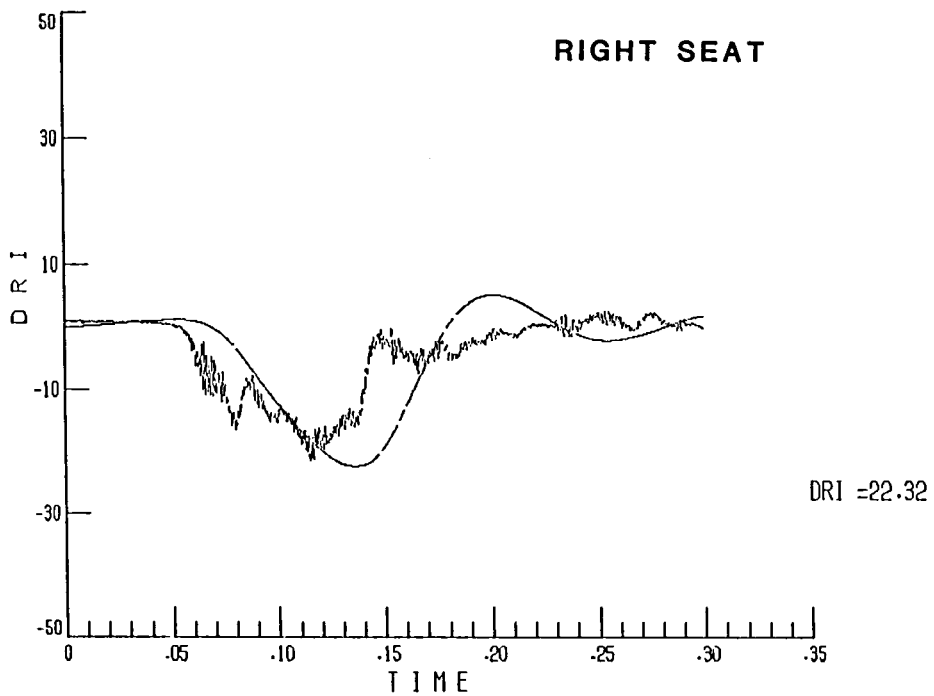
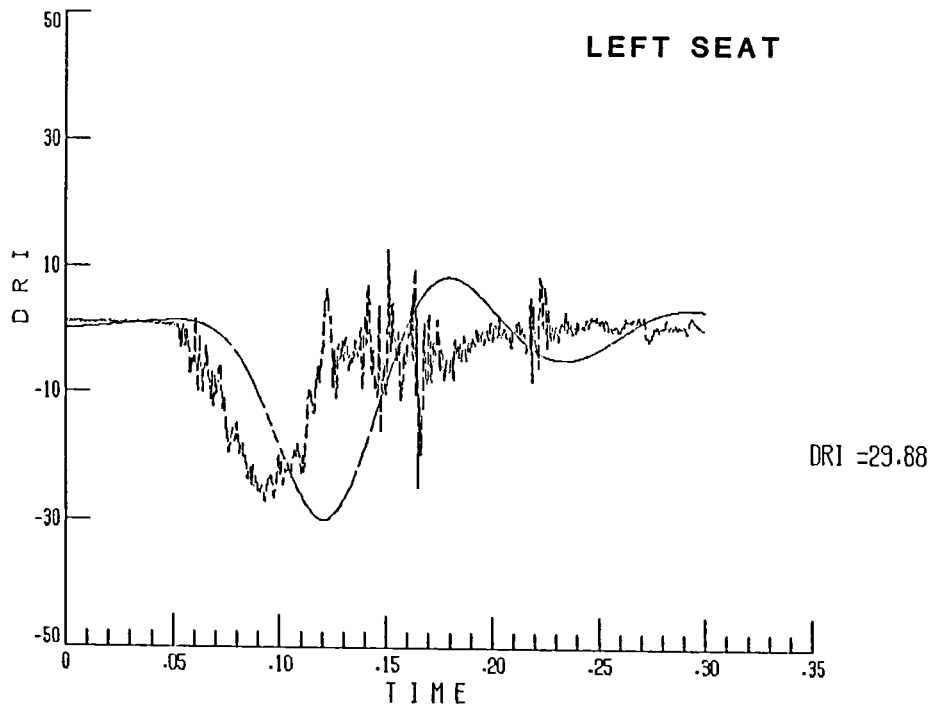
LEFT DUMMY HEAD
NASA TEST NO. 17



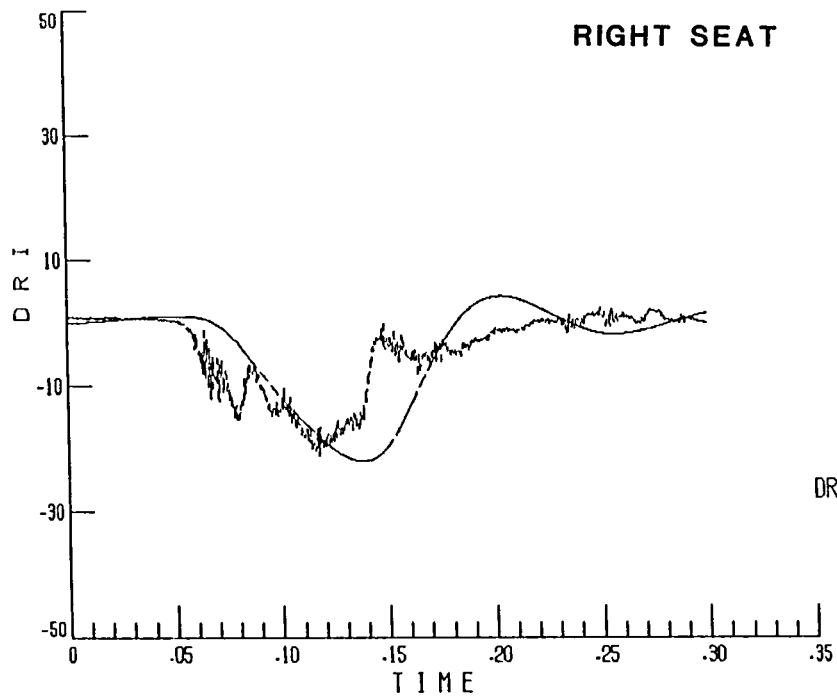
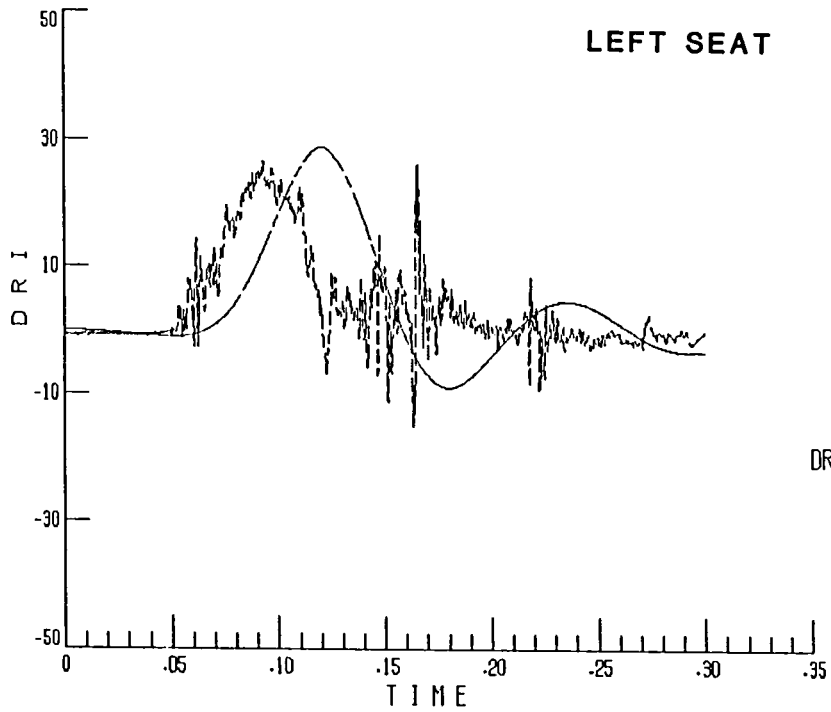
RIGHT DUMMY HEAD
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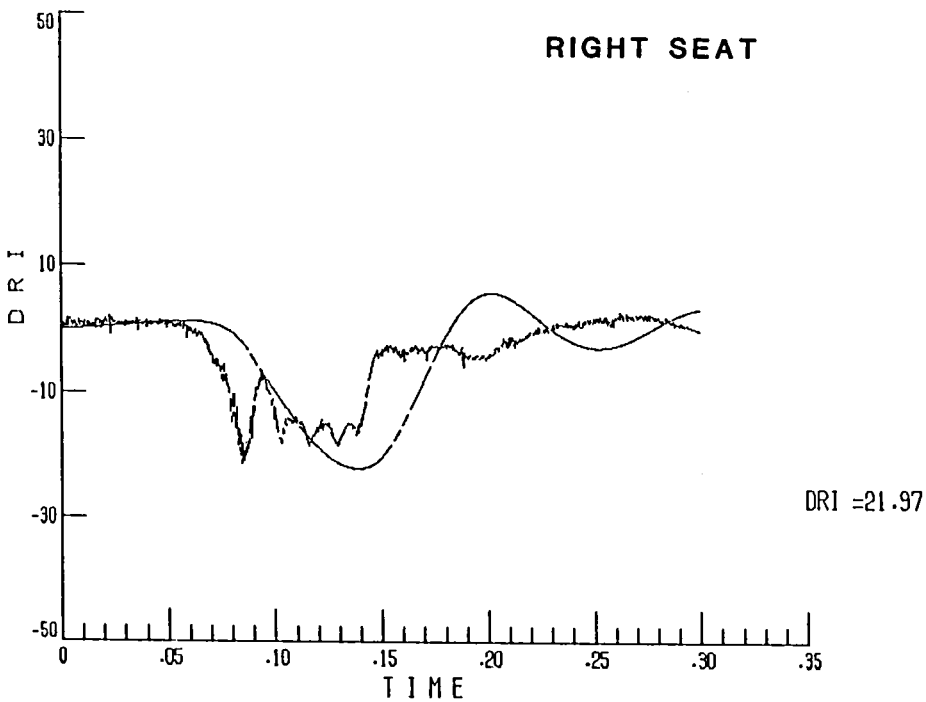
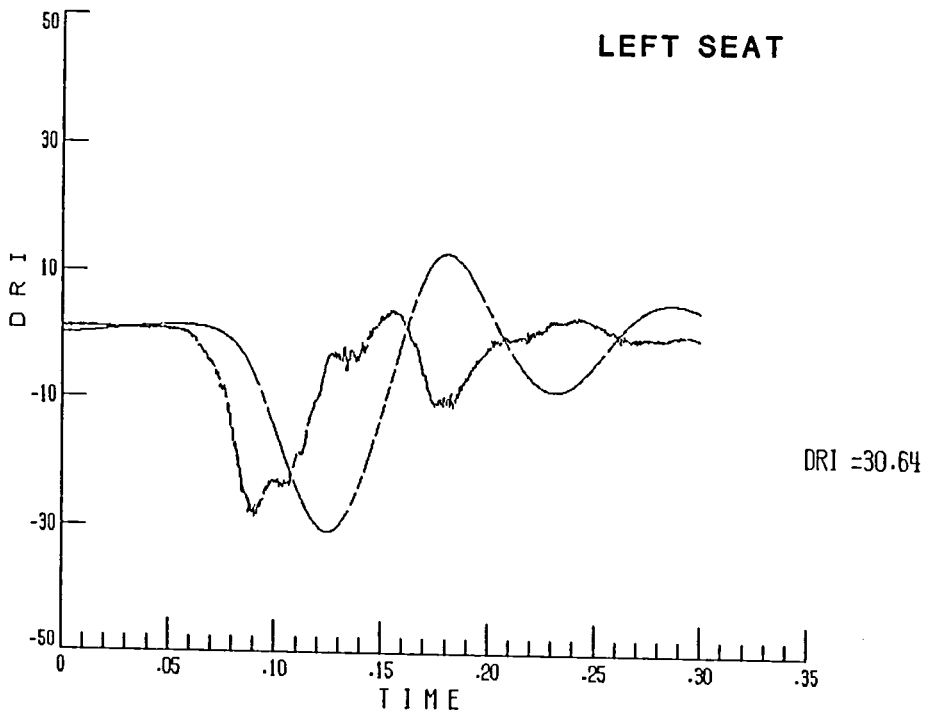
RIGHT DUMMY HEAD
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DYNAMIC RESPONSE INDEX
DUMMY PELVIS Z-AXIS
NASA TEST NO. 17

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16. Abstract <p>Over the past years, several papers and reports have documented the unacceptably high injury rate during the escape sequence (including the ejection and ground impact) of the crew module for F/FB-111 aircraft. This report documents a program to determine if the injury potential could be reduced by replacing the existing crewseats with energy-absorbing crewseats. An energy-absorbing test seat was designed using much of the existing seat hardware. An extensive dynamic seat test series, designed to duplicate various crew module ground impact conditions, was conducted at a sled test facility. Comparative tests with operational F-111 crewseats were also conducted. After successful dynamic testing of the seat, more testing was conducted with the seats mounted in an F-111 crew module. Both swing tests and vertical drop tests were conducted. The vertical drop tests were used to obtain comparative data between the energy-absorbing and operational seats. Volume I describes the energy-absorbing test seat and testing conducted, and evaluates the data from both test series. Volume II presents the data obtained during the seat test series, while Volume III presents the data from the crew module test series.</p>			
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