AD-A069 171 LOCKHEED-CALIFORNIA CO BURBANK F/G 1/3
SUMMARY OF RESULTS FOR A TWIN-ENGINE, LOW-WING AIRPLANE SUBSTRU--ETC(U)
JAN 79 G WITTLIN DOT-FA75WA-3707
UNCLASSIFIED LR-28869 FAA-RD-79-13 NL

1 OF 2
AD A069171

REPORT NO: FAA-RD-79-13

LEVEL II

Summary of Results for a Twin-Engine, Low-Wing Airplane Substructure Crash Impact Condition Analyzed With Program 'KRASH'

Gil Wittlin

January 1979
Final Report

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Systems Research & Development Service
Washington, D.C. 20590

NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FAA-RD-79-13		

4. Title and Subtitle	5. Report Date
SUMMARY OF RESULTS FOR A TWIN-ENGINE, LOW-WING AIRPLANE SUBSTRUCTURE CRASH IMPACT CONDITION ANALYZED WITH PROGRAM 'KRASH'	Jan[illegible]979
	6. Performing Organization Code: L
7. Author(s): Gil Wittlin	8. Performing Organization Report No.: LR-28869
9. Performing Organization Name and Address: Lockheed California Co., P.O. Box 551, Burbank, California 91520	10. Work Unit No. (TRAIS)
	11. Contract or Grant No.: DOT-FA75WA-3707
12. Sponsoring Agency Name and Address: U.S. Department of Transportation, Federal Aviation Administration, Systems Research and Development Service, Washington, D.C. 20590	13. Type of Report and Period Covered: Final rept. Jul[illegible]978 – Jan[illegible]979
	14. Sponsoring Agency Code: Federal Aviation Administration

15. Supplementary Notes

16. Abstract

This report contains the results of using digital computer program KRASH to model and analyze the dynamic response of a twin-engine, low-wing airplane substructure subjected to a 27.5 ft/sec vertical velocity impact. The test was performed previously by NASA-Langley as part of a joint FAA-NASA effort concerning general aviation airplane crash dynamics.

Included in this report are the math model description, pertinent test data, a comparison of analysis versus test results and the results of a limited parameter sensitivity study using program KRASH. Floor and occupant pelvis vertical acceleration responses obtained from test measurement are compared to corresponding analytical results. The effect of model representation and input data selection variations on dynamic behavior are evaluated.

Conclusions are presented based on the results of the effort.

17. Key Words	18. Distribution Statement
Program KRASH, Crash dynamics, Mathematical Models, Light Fixed-Wing Aircraft, Sub-Structure, Dynamic Responses, Parameter Sensitivity	Document is available to the public through the National Technical Information Service, Springfield Va. 22151

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	121	-

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

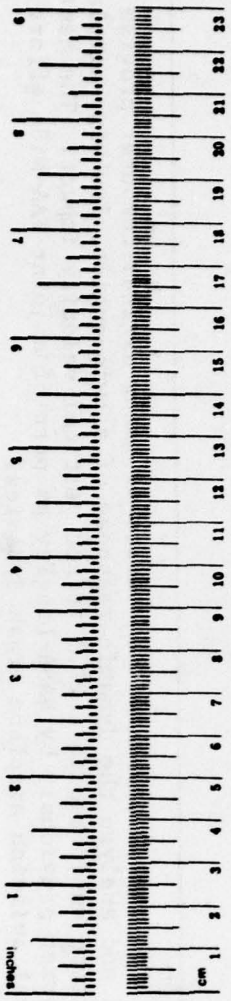
209 970

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

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

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



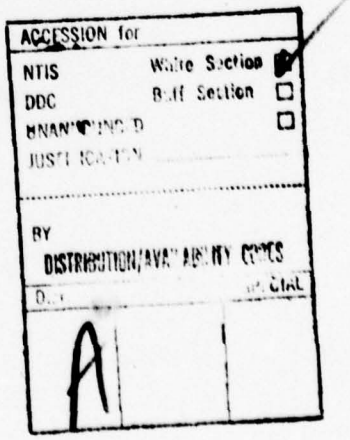
Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

FOREWORD

This report, prepared by the Lockheed-California Company under Contract DOT-FA75WA-3707, contains a description of the effort in which program KRASH was used to model and analyze a twin-engine, low-wing airplane substructure subjected to a vertical crash impact condition. The test was performed previously by NASA-Langley as part of a joint FAA-NASA effort concerning general aviation airplane crash dynamics. The work discussed in this report was administered under the direction of the Federal Aviation Administration with H. Spicer acting as Technical Monitor.

Gil Wittlin of the Lockheed-California Company performed the analysis and correlation with test data. Bill LaBarge of the Lockheed-California Company assisted in the initial phases of the math model development. Dr. Robert Hayduk of the NASA-Langley Impact Dynamics Research Facility coordinated the effort and provided structure, test and film data. The data presented in this report are a partial input to NASA for purposes of evaluating the state of the art in light-airplane crash dynamics modeling and analysis. The Lockheed effort was performed under the supervision of J.E. Wignot.



LOCKHEED CALIFORNIA COMPANY

SUMMARY

The results of using program KRASH to analyze the dynamic response of a twin-engine, low-wing airplane substructure subjected to a 27.5 ft/sec vertical impact velocity crash condition are presented.

Included in this report are the math model description, pertinent data from the test, a comparison of analysis versus test results and the results of a limited parameter sensitivity study using program KRASH.

The substructure is modeled symmetrically in KRASH with 32 masses, 57 member elements and 44 nonlinear beam element degrees of freedom. Floor and occupant pelvis vertical acceleration responses obtained from test measurements are compared to corresponding analytical results. Occupant chest, substructure roof, and window-ledge motions are also compared. Variations in external spring (crushable structure) load-deflection behavior, seat stiffness, occupant representation, analytical filter frequency cutoff and model size are included to ascertain their effect on dynamic behavior for the particular substructure and impact condition being evaluated. Conclusions are presented based on the results of the effort.

Pertinent math model and computer output data are presented in Appendices A and B.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF TABLES

SECTION 1

INTRODUCTION

Program KRASH has been validated with several sets of full-scale aircraft crash test data (References 1 and 2). The availability of crash test data for a twin-engine, low-wing, light-airplane substructure and an additional impact condition provided another opportunity to demonstrate KRASH's capability to represent the significant dynamic response characteristics of a survivable crash condition. In addition to KRASH, the twin-engine airplane substructure is to be modeled using two other digital computer programs, DYCAST and ACTION, designed for a structural crash dynamics evaluation. The modeling of a particular structure for a defined impact condition using three different current crash dynamics computer programs provides an opportunity to compare the requirements for: model size, input data, ease of modeling, output data, analysis versus test results, machine costs and machine time. This report concerns itself solely with the KRASH modeling results and comparison with the substructure test results.

SECTION 2

MODEL AND TEST DATA

2.1 KRASH MODEL

The substructure representing F.S. 135 to F.S. 181 for a typical twin-engine low-wing airplane (Figure 2-1) is shown in Figure 2-2.

The substructure including occupants is modeled symmetrically (about B.L. 0.0) in program KRASH. The KRASH substructure and occupant representations are shown in Figures 2-3 and 2-4. The floor masses at locations 2 through 6 and 8 through 12 have external springs to represent ground contact and crushing of the underside structure. Only half the structure is shown in Figure 2-3 since the model and impact conditions are treated symmetrically. The dash lines jutting laterally from 14 and 18 are tension-only members to represent the lateral tie rods (see Figures 2-5 and 2-6). For clarity, tension-only members representing occupant seat belts connecting mass 5 to mass 30 and mass 11 to mass 30 are not shown in Figure 2-4. Compression-only members representing the seat cushion and pan connect mass 30 to mass 29. Masses 29, 30, 31 and 32 represent the seat, occupant lower torso, occupant upper torso, and DRI, respectively. Details of the modeling including sample calculations are shown in Appendix A. Computer program input and output data are provided in Appendix B.

- KRASH Substructure model size:

  Total number of masses - 32

  Total number of beam elements - 57

  Number of nonlinear degrees of freedom associated with beam elements - 44

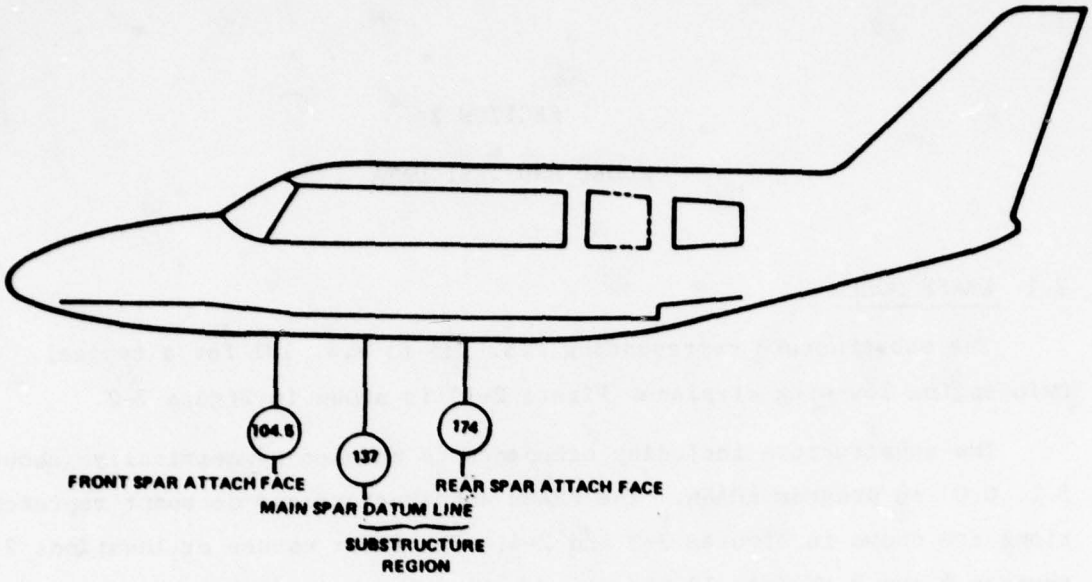


Figure 2-1. - Twin-engine, low-wing airplane.

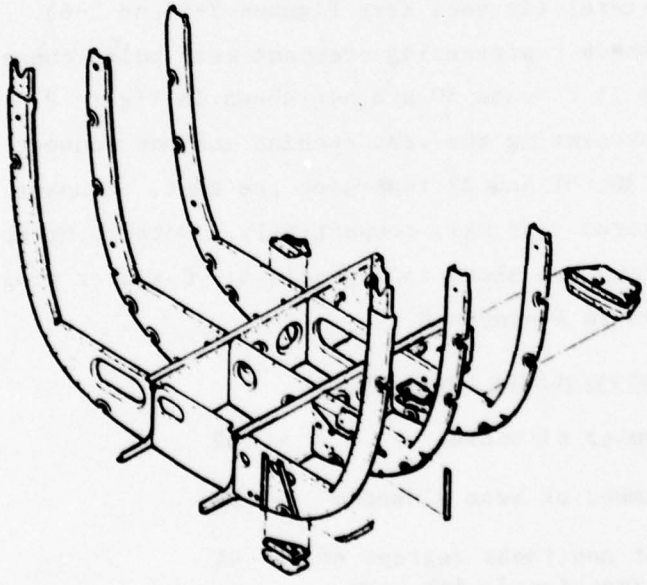


Figure 2-2. - Lower fuselage structure for twin-engine, low-wing airplane (F.S. 135 - F.S. 181).

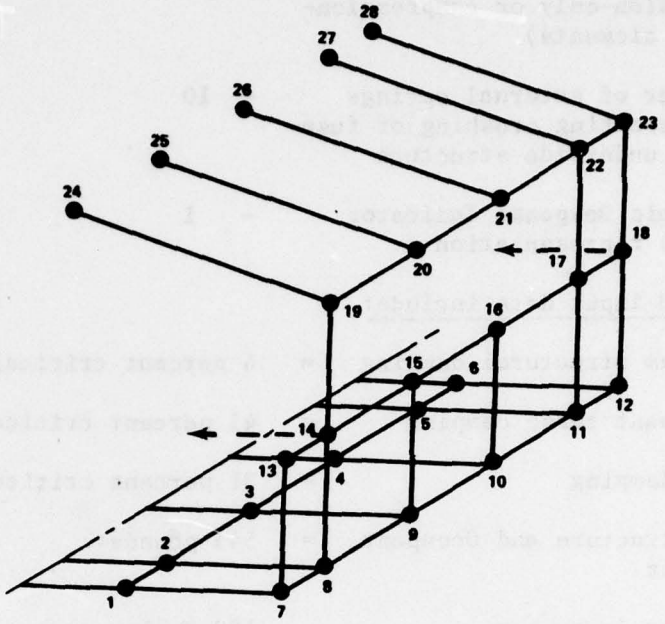


Figure 2-3. - KRASH fuselage model.

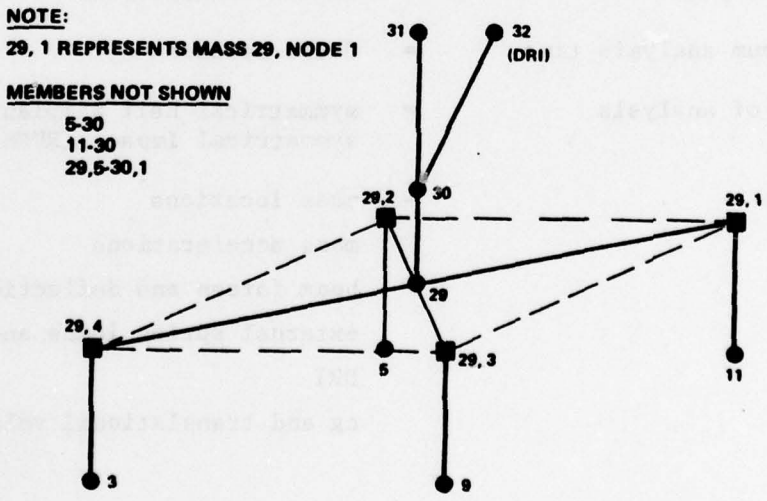


Figure 2-4. - KRASH floor-seat-occupant model.

LOCKHEED
CALIFORNIA COMPANY

- **Impact conditions**

  Velocity = 27.5 ft/sec vertical

  Pitch angle = 3/4° pitch-up

  Yaw-angle = 0°

  Roll angle = 0°

Table 2-1 shows the location of the test and analysis data points.

The nonlinear deflection values used as input into the KRASH model were obtained directly from KRASH calculations. The deflection values are contained as part of the 'Model Parameter Data' print, provided in Appendix B.

2.2 TEST DATA

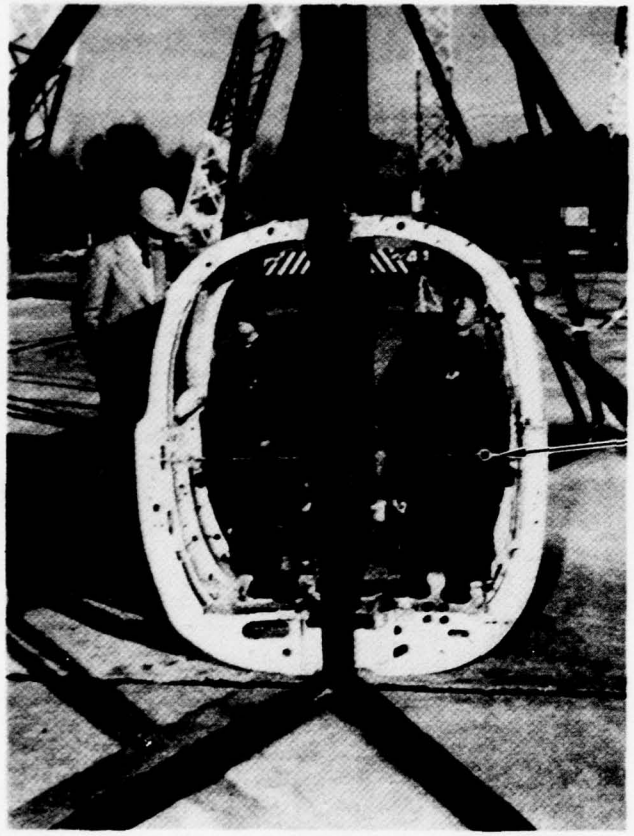
The substructure crash test data and film analyses were provided by the NASA-Langley Impact Dynamics Research Facility. Figures 2-5 and 2-6 show the front and rear views, respectively, of the post-crash test condition of the substructure. Figures 2-7 and 2-8 show the floor structure and a portion of the roof structure, respectively. The summary of NASA-provided test data is presented in Table 2-2. Figure 2-9 shows the motion histories obtained from high-speed film analysis, performed by NASA-Langley, for the occupant chest, roof, and window-ledge locations. Figure 2-10 shows the reduced test data accelerometer histories for four floor locations and the two occupant (left and right side) pelvis locations. The channels record D.C. data. The reduced data are obtained by NASA using a least-square fit (LSF) filtering technique. All the test data are for vertical response channels and motions since this direction represents the predominant mode of response for this type of impact condition. Correspondingly, all correlation with analysis is limited to responses in the vertical direction.

The substructure test was previously performed by NASA as part of a joint general aviation crash test program initiated by the FAA and NASA. The impact dynamics test facility and test procedures are described in Reference 3.

TABLE 2-1. - LOCATION OF TEST AND ANALYSIS DATA POINTS

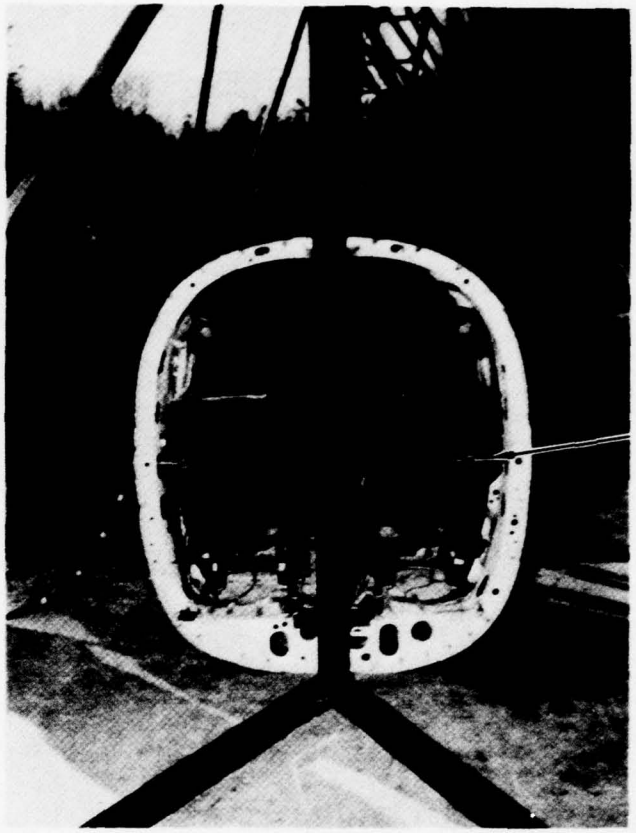
Test Data Points				
Channel	Location	F.S.	W.L.	B.L.
A1	Floor	140.	-16.	6L
A2	Floor	151.	-16.	24L
B2	Floor	151.	-16.	6L
D1	Floor	162.	-16.	24L
D9	Left Pelvic	-	-	-
D10	Right Pelvic	-	-	-
Analysis Data Points[(a)]				
Mass	Location	F.S.	W.L.	B.L.
2	Floor	140.	-16.	6L
3	Floor	151.	-16.	6L
9	Floor	151.	-16.	20L
10	Floor	163.	-16.	20L
30	Lower Torso	-	-	-

(a) Analysis is performed with symmetrical half model, thus left side = right side.



TIE ROD

Figure 2-5. - Post-crash condition of substructure, front view



TIE ROD

Figure 2-6. - Post-crash condition of substructure, rear view

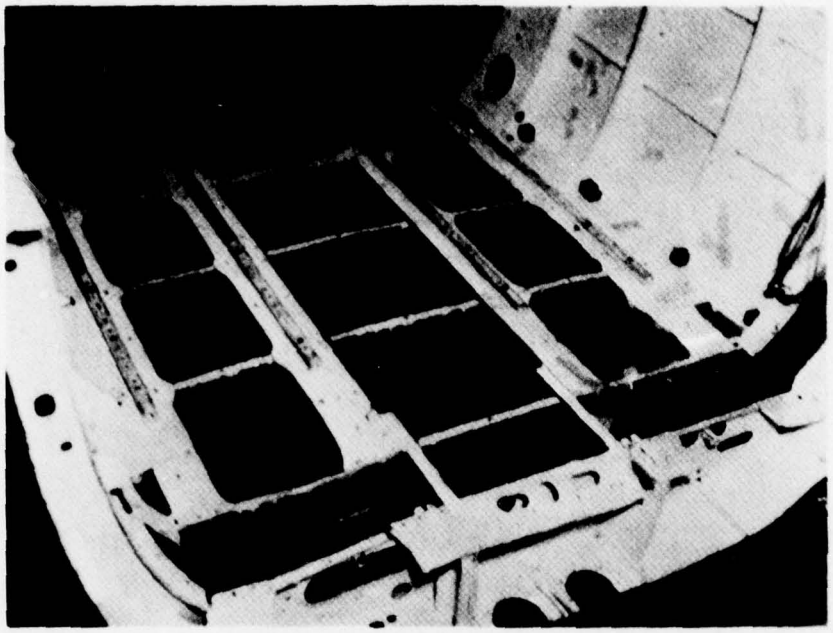


Figure 2-7. - Post-crash condition of substructure, floor

Figure 2-8. - Post-crash condition of substructure, partial of roof

TABLE 2-2. - SUMMARY OF SUBSTRUCTURE TEST DATA

	Magnitude
Impact velocity[a]	330 in/sec; 27.5 ft/sec
Rebound height [a]	5 inches
Rebound velocity[a]	62.1 in/sec; 5.2 ft/sec
Duration of ground contact[a]	0.058 $\pm$ 0.0015 sec.
Attitude at impact[a][d]	0.75 degrees pitch-up
Window ledge: peak motion[a]	1.64 in.
final deflection[e]	0.65 in.
Roof center: peak motion[a]	3.65 in.
final deflection[e]	0.99 in.

Plots[a]

- Occupant chest motion vs. time
- Roof motion vs. time
- Window-ledge motion vs. time

Accelerometer traces[b][c]

Floor structure - A1, A2, B2, D1

Occupant pelvis - D9, D10

[a] Obtained from high speed film analysis

[b] Least Square Fit (LSF) filtered data

[c] D.C. Accelerometers

[d] No significant roll or yaw motion obtained from the film analysis

[e] Post-test measurement

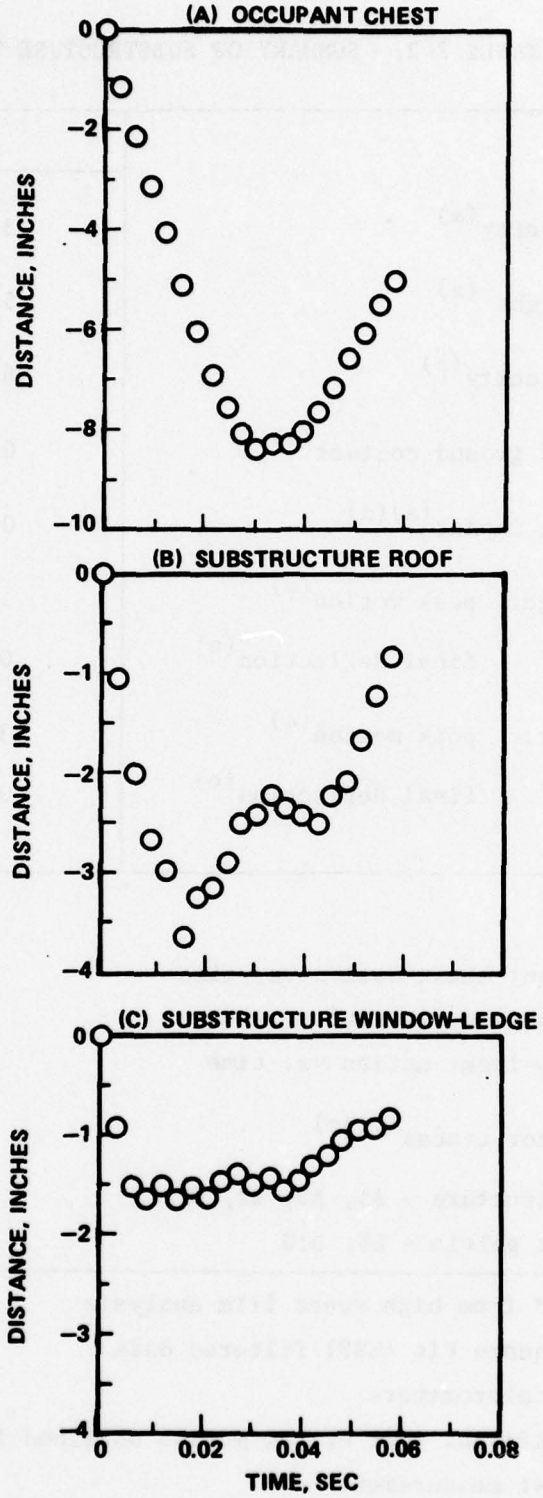


Figure 2-9. - Motion histories obtained from high-speed film analysis

LOCKHEED
CALIFORNIA COMPANY

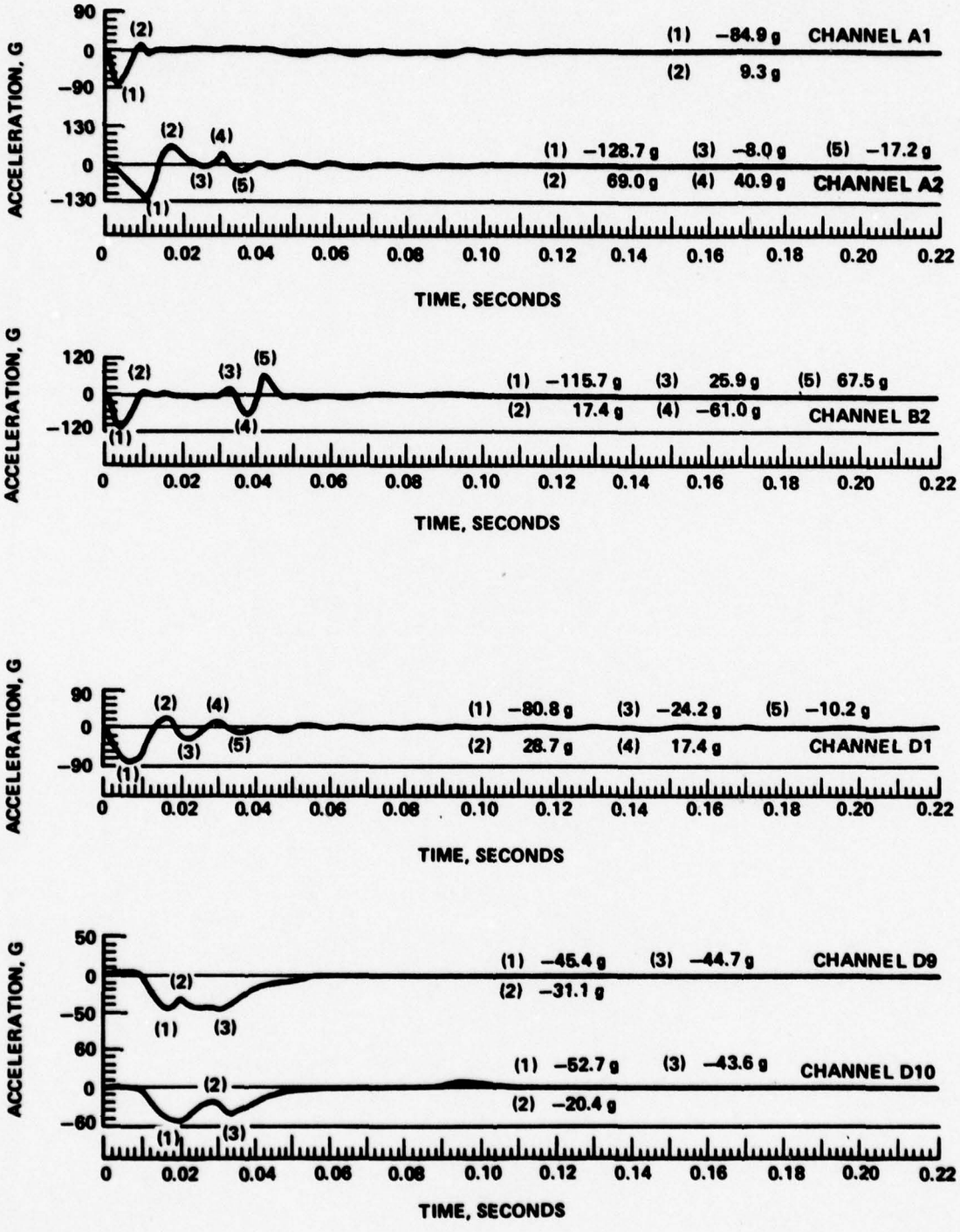


Figure 2-10. - Accelerometer traces

SECTION 3

KRASH RESULTS AND COMPARISON WITH TEST DATA

3.1 ACCELERATIONS

Table 3-1 shows a comparison of the analysis and test peak accelerations for the occupant pelvis and floor responses. Figures 3-1, 3-2 and 3-3 present the analysis and test response histories for the occupant pelvis and floor locations. The data in Table 3-1 show that the analytically obtained occupant pelvis peak accelerations agree within 19 percent for the initial peak and 6.8 percent for the second peak, when compared to the average of the left and right side occupant test measured responses. It is noteworthy that the left and right side measured test responses for a "symmetrical" impact condition differ by 16 percent and 2.5 percent, respectively, for the primary and secondary peaks. The difference between test results is nearly the same magnitude as the difference between the analysis and test results. The analytical data (Figure 3-1) show the same "camel hump" response phenomenon as that which is exhibited in the test data. In addition the two peaks obtained by analysis occur within 4 to 6 milliseconds of the time at which they occur during the test. The test and analysis results show a decay to zero acceleration after the secondary peak is reached. The decay rate is approximately the same for the analysis and test data, with the analytical data preceding the test data by several milliseconds. The analytical results for the occupant pelvis response presented in Table 3-1 and Figure 3-1 are based on a low-pass filter frequency cutoff of 100 Hz as noted in Section 2. The use of a higher frequency cutoff value will result in analytical results which will be higher and consequently closer to the test results. For example, a 150 Hz frequency cutoff in the analysis will increase the primary and secondary occupant response by 5 percent and 2 percent, respectively. This change will

TABLE 3-1. COMPARISON OF ANALYSIS AND TEST PEAK ACCELERATIONS

	Test Accel (Time)[a]	Analysis Accel (Time)[a]	Percent[b] Differences (Time)
Pelvis	(D9)[d]	(Mass 30)[e]	
1st Peak	-45.4 (.018)	-39.7 (.017)	-12.6 (.001)
2nd Peak	-44.7 (.030)	-41.1 (.026)	- 8.1 (.004)
Pelvis	(D10)	(Mass 30)	
1st Peak	-52.7 (.020)	-39.7 (.017)	-24.7 (.003)
2nd Peak	-43.6 (.032)	-41.1 (.026)	- 5.7 (.006)
Pelvis	(Avg. of D9 & D10)	(Mass 30)	
1st Peak	-49.0 (.018-.020)	-39.7 (.017)	-19.0 (.001-.003)
2nd Peak	-44.1 (.030-.032)	-41.1 (.026)	- 6.8 (.004-.006)
Floor	(A1)	(Mass 2)	
Forward Inboard	-84.9 (.004)	-89.0 (.004)	4.8 (0)
	9.3 (.010)	43.9 (.028)	(c)
	(A2)	(Mass 9)	
Forward Outboard	-128.7 (.010)	-101.0 (.011)	-21.5 (.001)
	69.0 (.018)	61.8 (.025)	-10.4 (.007)
	(B2)	(Mass 3)	
Forward Inboard	-115.7 (.004)	-90.7 (.004)	-21.6 (0)
	25.9 (.032)	34.9 (.026)	34.0 (.006)
	(D1)	(Mass 10)	
Aft Outboard	-80.8 (.008)	-99.2 (.007)	22.8 (.001)
	28.7 (.017)	37.1 (.018)[f]	29.3 (.002)

a) Accelerations in G's, time in seconds after impact

b) Percent difference = $\left(\frac{\text{analysis value-test value}}{\text{test value}}\right) \times 100$

c) Test trace shows no response after .012 seconds

d) Test channel numbers in parenthesis

e) Analysis mass numbers in parenthesis

f) Peak at .026 msec = 53.7 g

NOTE: Difference between test results for right (D10) versus left (D9) side ≈16.1% (1st peak) and 2.5% (2nd peak).

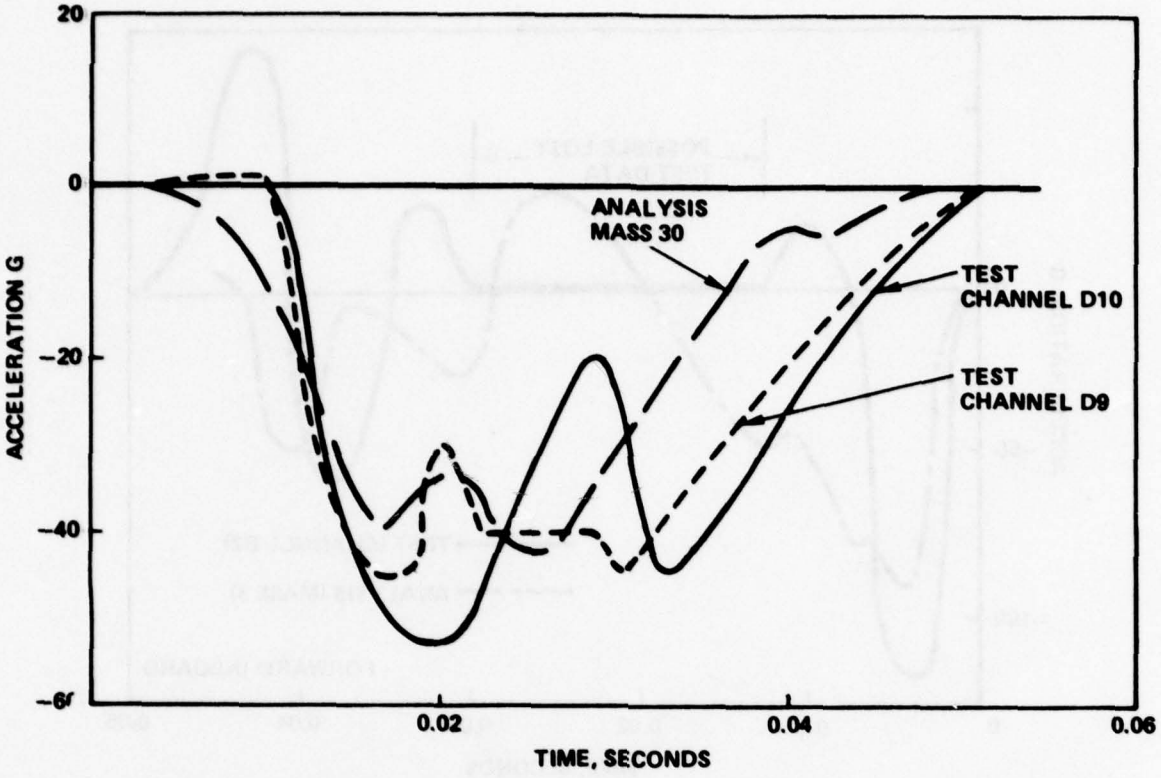


Figure 3-1. - Comparison of occupant pelvis vertical acceleration, test versus analysis.

result in closer correlation agreement with test data. A discussion of the sensitivity of analysis results to the selection of an analytical filter cut-off frequency is discussed in Section 4.4.

From Table 3-1 it can be seen that the analysis initial peak acceleration values agree within approximately $\pm$22 percent with measured test data obtained from the four floor dc channel accelerometer locations which were chosen for comparison by NASA-Langley. NASA considers dc accelerometers to be overall more reliable than ac accelerometers, particularly the behavior after the initial peak response. The time of occurrence of the initial peak values obtained by analysis agrees with the test data peak value occurrences within one (1) millisecond. Figures 3-2 and 3-3 show the similarity in response shapes for the test and analysis results, particularly in the initial response

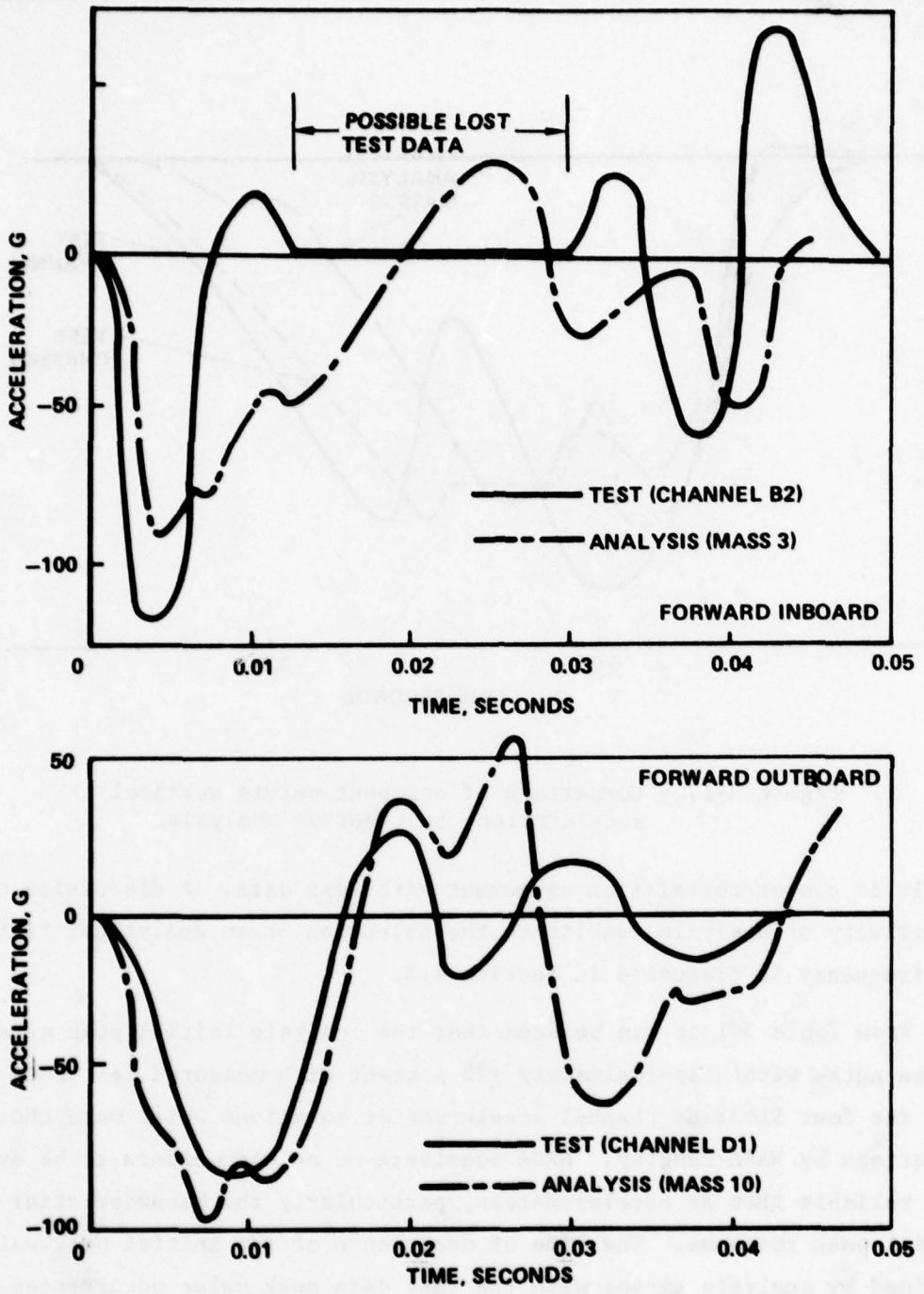


Figure 3-2. - Comparison of fuselage floor vertical acceleration, test versus analysis.

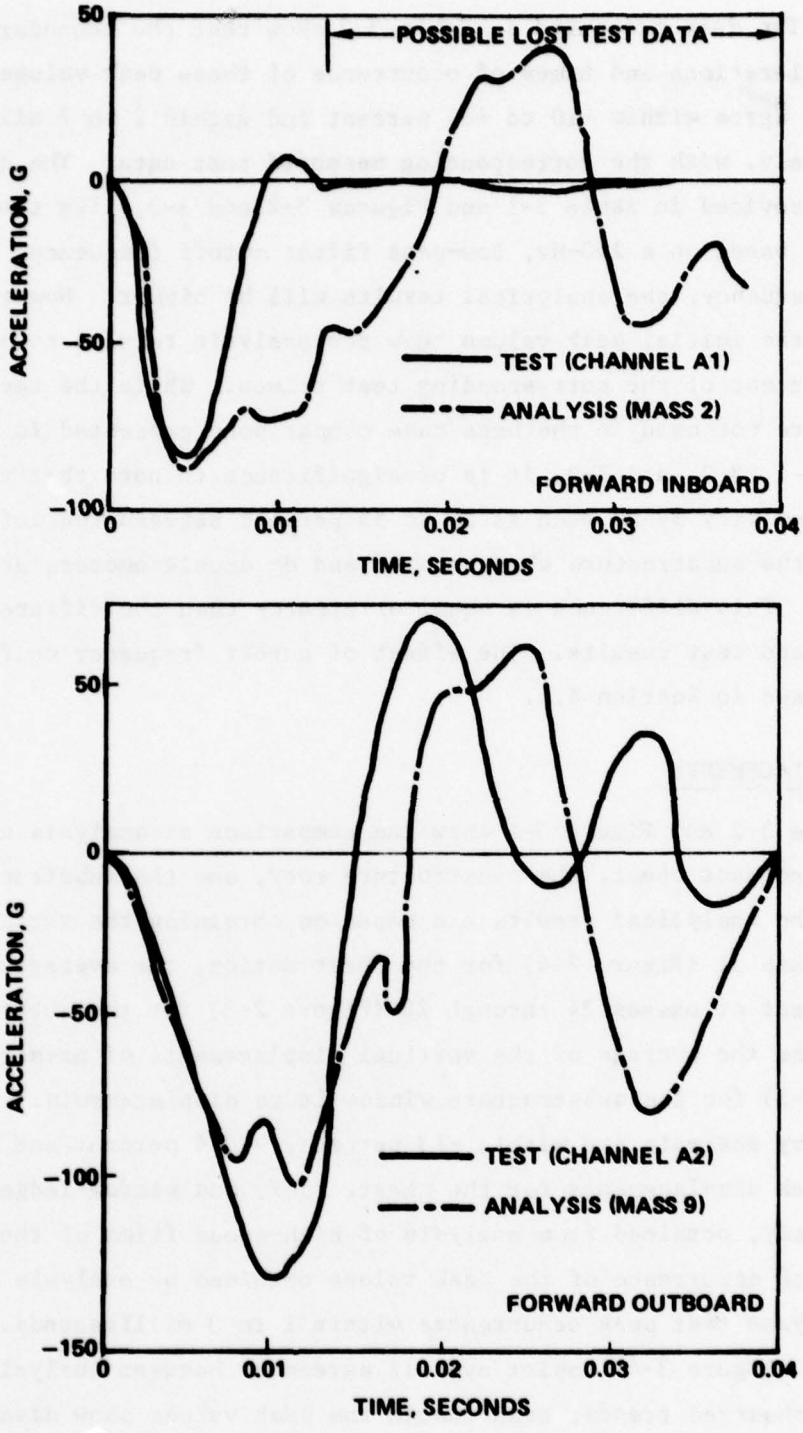


Figure 3-3. - Comparison of fuselage floor vertical acceleration, test versus analysis

regime. The data presented in Table 3-2 show that the secondary (rebound) peak accelerations and times of occurrence of these peak values, obtained by analysis, agree within -10 to +34 percent and within 2 to 7 milliseconds, respectively, with the corresponding measured test data. The analytical floor results provided in Table 3-1 and Figures 3-2 and 3-3, like the occupant pelvis data, are based on a 100-Hz, low-pass filter cutoff frequency. For a 150-Hz cutoff frequency, the analytical results will be higher. However, the comparisons for the initial peak values show the analysis results to be within -11.7 to +34 percent of the corresponding test values. While the test ac accelerometers are not used in the base case comparisons presented in Table 3-1 and Figures 3-1, 3-2, and 3-3, it is of significance to note that the measured test values vary by as much as 16 to 55 percent between the left and right sides of the substructure when both ac and dc accelerometers are included in the data. This difference is equal or greater than the difference between analysis and test results. The effect of cutoff frequency on floor responses is discussed in Section 4.4.

3.2 DISPLACEMENTS

Table 3-2 and Figure 3-4 show the comparison of analysis and test motions for the occupant chest, the substructure roof, and the substructure window-ledge. The analytical results are based on obtaining the vertical displacement of mass 31 (Figure 2-4) for the chest motion, the average of the vertical displacement of masses 24 through 28 (Figure 2-3) for the substructure roof motion, and the average of the vertical displacements of masses 14 through 17 (Figure 2-3) for the substructure window-ledge displacements. The peak values obtained by analysis are within -13 percent, -27.4 percent and +43.3 percent of the peak displacements for the chest, roof, and window-ledge motions, respectively, obtained from analysis of high-speed films of the crash test. The time of occurrence of the peak values obtained by analysis agree with the film-analyzed test peak occurrences within 1 to 3 milliseconds. The motion histories (Figure 3-4) depict overall agreement between analysis determined and test-observed trends, even though the peak values show disagreements of between 13 and 43 percent.

TABLE 3-2. - COMPARISON OF ANALYSIS AND TEST PEAK MOTIONS

	Test Displacement (time)[a]	Analysis Displacement (time)[a]	Percent Difference (time)[b]
Occupant Chest	8.40 (.030)	7.30 (.033)	-13.1 (.003)
Roof	3.65 (.015)	2.65 (.013)	-27.4 (.002)
Window Ledge	1.64 (.01-.015)	2.35 (.012)	43.3 (.002-.003)

[a] Displacement in inches, time in seconds after impact

[b] Percent difference $= \frac{\text{analysis value - test value}}{\text{test value}} \times 100$

The analytical results indicate that lower fuselage deformation of up to 1.4 inches occurs, which appears to be approximately twice as high as the average deformation observed in the test high-speed film review. A review of the post-crash test condition of the structure indicates that overall deformation of the structure may not have exceeded 0.6 inches based on the average of the front and rear deformation.

The analysis shows that all the elements of the structure behave linearly, except for the seat cushion and pan, the fuselage underside and several elements of the shell structure (beams 7-13, 8-14, 9-15, 10-16, 11-17 and 12-18, Figure 2-3). The postcrash condition of the substructure indicates little in the way of permanent structural deformation. The analysis results show a Dynamic Response Index (DRI) value of 28. A DRI magnitude of 28 indicates a high potential ($\gg$50 percent) for a spinal vertebrae compression-type injury to occur. The available test data do not allow for an assessment of this type of injury potential.

Variation of the analytical filter cutoff frequency has no effect on the motion results since filtering is a post-processing procedure in KRASH and does not alter any of the basic results.

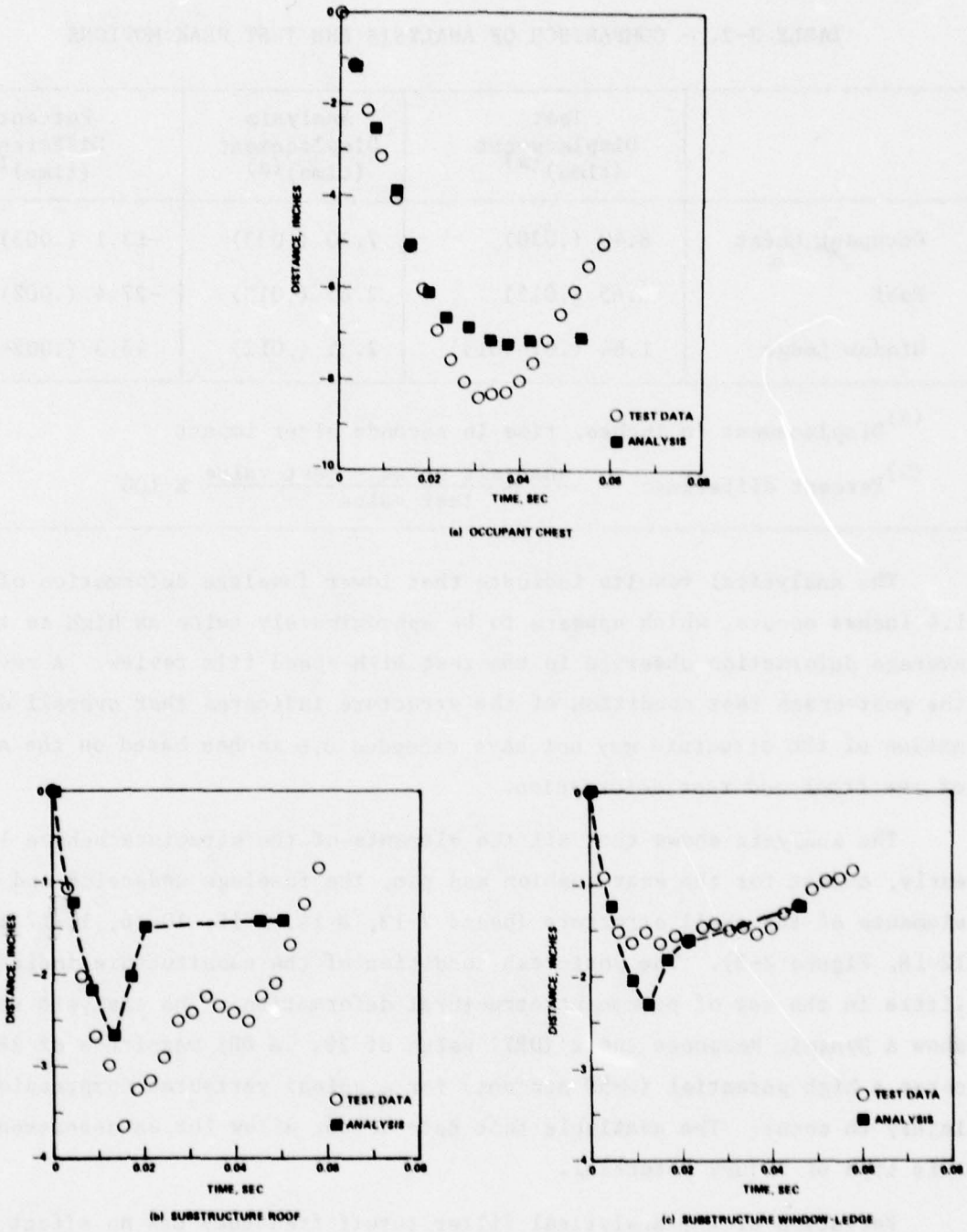


Figure 3-4. - Comparison of analysis and test motions.

LOCKHEED
CALIFORNIA COMPANY

3.3 COMPUTER COST AND PERFORMANCES

The KRASH analysis was performed on an IBM 370-3330 digital computer. For the size case and impact condition analyzed (see Section 2.0) the approximate cost per computer run is $135. The analysis (machine) time, including all printed and plotted data, is 6.9 minutes per run.

SECTION 4

KRASH SENSITIVITY STUDY RESULTS

An analysis using program KRASH is based on the premises that:

- Nonlinear load-deflection behavior can be approximated
- Only a portion of the major structural elements need be modeled nonlinearly for post-failure behavior.

Since the use of KRASH is designed to obtain overall responses, depict significant dynamic phenomenon, and represent response trends using approximate modeling techniques, it is understandable that different users might model aircraft structure or select input data which varies in some respects. To determine the consequence, insofar as dynamic response results are concerned, of establishing a model and an analysis which might vary, a limited sensitivity investigation was performed. The base case results which best represent the estimated properties of the structure and occupant are described in Section 3.0. In this section the results of varying the following parameters are discussed:

- External spring load-deflection representation
- Occupant axial stiffness
- Seat maximum force level
- Analytical filter cutoff frequency selection
- Math model size

There was little in the way of nonlinear behavior, other than in the crushable lower fuselage, occupant seat cushion and pan deflection, and several elements in the airframe shell, noted in the analysis of the substructure for the defined impact condition. Consequently, the above noted parameters are considered representative of areas wherein different users may have differences of opinion with regard to modeling representations.

4.1 EXTERNAL SPRING LOAD-DEFLECTION REPRESENTATION

The representation of the crushable lower fuselage structure within the framework of KRASH's external spring input requirements is perhaps the most sensitive and critical concern for modeling. The data for the base case representation were obtained following the procedures outlined in References 4 and 5. A sample calculation is shown in Appendix A. The most likely area of variation in a user's thinking would be in the representation of the slope of the load-deflection curve in the nonlinear region. The base case assumes a constant load in the nonlinear region until bottoming occurs. This curve (condition A) is shown in Figure 4-1, along with possible user input variations. Condition B provides for a constant 20-percent increase in the assumed maximum forces associated with the crushable structure. Conditions C and D represent sloping 20-percent force changes (increasing and decreasing, respectively) up until bottoming occurs. All the curves are based on a 0.1-inch initial linear region and a 3-inch deflection before bottoming occurs. Both values are determined following the procedure outlined in References 4 and 5. The results would not be altered to any significant degree if the linear deflection value were in the range of 0.01 to as much as 0.3 inch, which leaves significant margin for modeling variation. Since the maximum deflection of the crushable structure in the base analysis does not exceed 1.6 inches the selection of 3 inches for bottoming to occur, is also of little consequence in this analysis. Thus, it is reasonable to assume that the selection of the peak force and the rate at which force varies with deflection will be most influential on the results for this analysis. The results of this parameter sensitivity investigation are shown in Figure 4-2. The 20-percent constant increase in external spring force maximum load results in an approximately 15 to 20-percent increase in peak floor accelerations at the four floor dc channel accelerometer locations. Changing the slope (conditions C and D) has a substantially less effect on the peak responses. The sloping ±20 percent change results in a variation of the peak floor accelerations of between ±3 to ±11 percent. The occupant pelvis responses are not affected by these changes because in this model and under the defined impact conditions the pelvis responses are influenced primarily by the seat and occupant

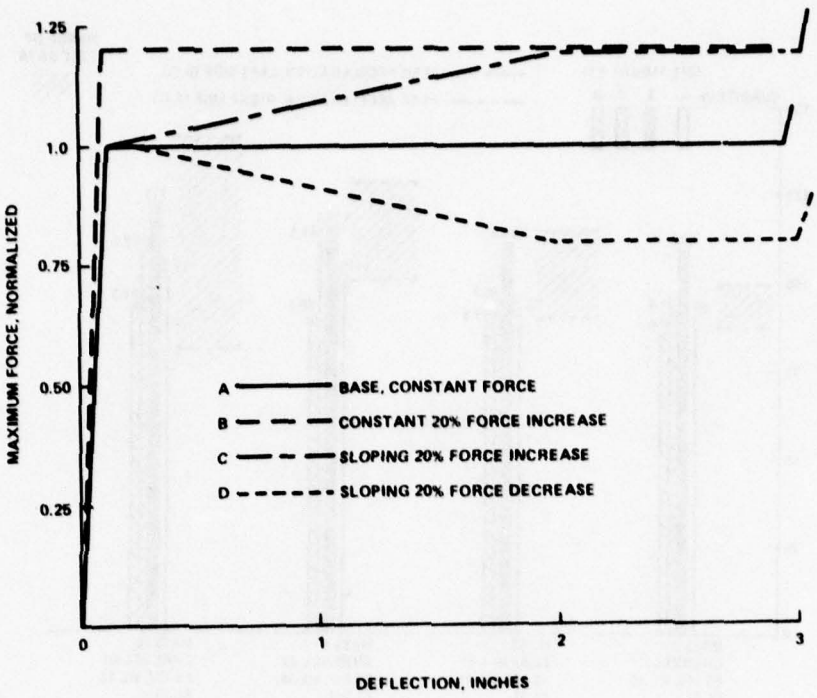


Figure 4-1. - Normalized force versus external spring load-deflection characteristics.

characteristics. As can be anticipated, the maximum deflection of the external spring decreases as the force level increases and vice versa. For the range of external spring characteristics investigated, the average floor deformation ranges from 1 to 1.5 inches. The range of test-measured peak accelerations is also shown in Figure 4-2. The analysis results for the range of load-deflection behavior investigated are within the range of the measured ac and dc accelerometer data. When considering dc accelerometer data alone the analysis peak values are no more than 30 percent different than the test peak values except at the aft outboard floor location where the difference is 50 percent and the ac and dc accelerometers differ by 75 percent (using dc accelerometer values as base values). The results presented in Figure 4-2 indicate that the sensitivity of the analysis results are comparable to the sensitivity of the test measurements. The results further indicate that all four external spring

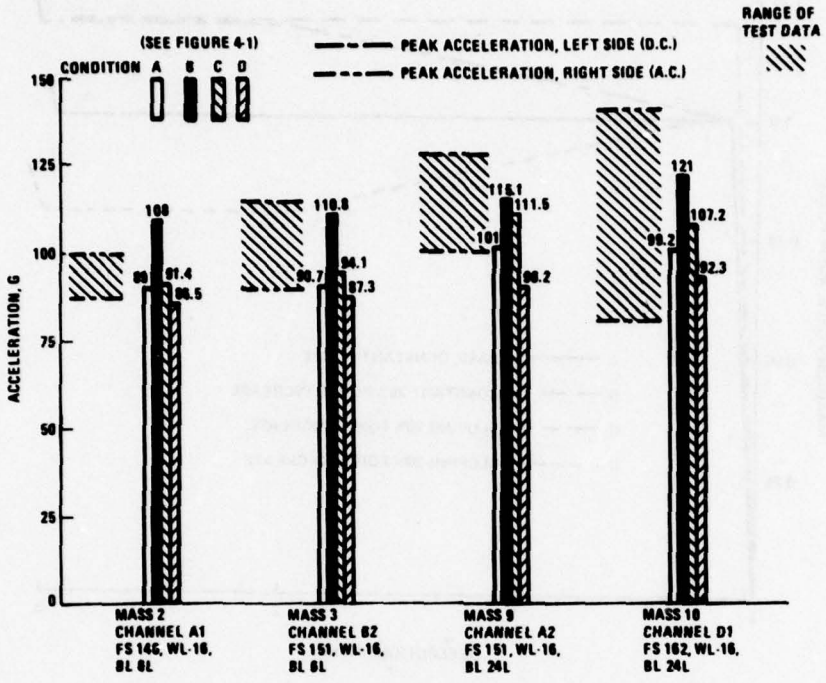


Figure 4-2. - Peak acceleration as a function of external spring load-deflection characteristics.

load-deflection curves, which can be considered to represent four different users, "on the average" represent the dynamic behavior of the structure reasonably well.

4.2 OCCUPANT AXIAL STIFFNESS REPRESENTATION

The representation of the occupant is controlled by the user in program KRASH by the selection of mass, area, and damping properties assigned to the corresponding masses and beam elements. The lower and upper torso masses (30 to 31 in Figure 2-4) are assigned mass weight and inertia properties as described in References 5 and 6 and in Appendix A. The connecting link between masses 31 and 32 represents the properties of the upper spine. The axial stiffness of this element is determined from the area, modulus of elasticity, and length properties assigned to this element. The data in Reference 7 suggest that the human upper torso has specific frequency and damping values.

Translated into KRASH data this requires the axial frequency and the damping of the human spine to be 14 Hz and 41 percent of critical, respectively. Depending on the actual properties of the anthropomorphic dummy used in a particular test it is possible that the frequency and/or the damping can be different than the values suggested for humans. In this particular case the spinal axial stiffness is not defined for the dummies used in the test.

For the human properties defined in Reference 7, KRASH is coded to compute the desired frequency and damping. For all other spinal stiffness, the user can easily determine the proper values to input. Knowing the desired frequency, the input mass values, and the length of the spinal element, combinations of modulus of elasticity and cross section area may be determined for input into KRASH. Damping, as a percent of critical, can be user selected for any individual element.

To evaluate the consequence of different spinal axial properties on the response of the structure and occupant, a variation in upper torso axial frequency from 14 to 61 Hz was examined. The results of this investigation are presented in Figure 4-3. As shown in Figure 4-3, as the axial frequency increases the analytical results tend to reproduce the two peaks (camel hump) effect exhibited in the test data for the occupant lower torso. Using an axial frequency, of 61 Hz., a maximum seat force of 5570 pounds and 0.41 damping the analysis results are 20 to 30 percent lower than the test data. For a higher seat force, the occupant lower torso acceleration values increase. For a lower axial stiffness the occupant lower torso initial peak value increases while the second peak value decreases, until it actually goes negative at 14 Hz. Changing the damping value while holding all other parameters constant tends to affect the second peak value more than the initial peak value. During a separate study using a simplified 5-mass system, changing damping from 0.31 to 0.04 increased the occupant lower torso first peak value by 2.5 percent and the second peak value by 29 percent.

The parameter sensitivity analyses involving the occupant representation illustrates the importance of providing input data representative of the elements being modeled. It may well be that the properties of test dummies

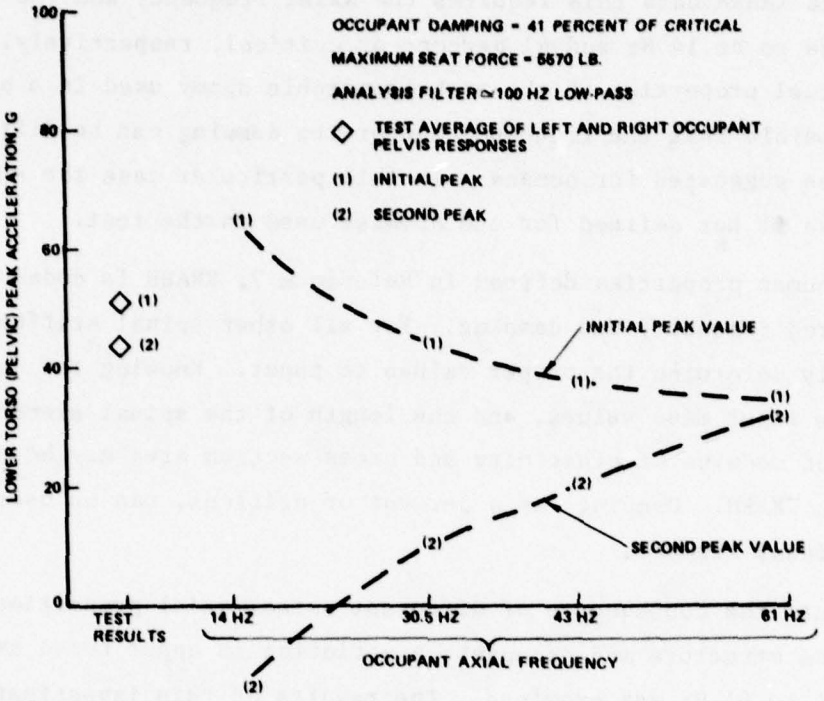


Figure 4-3. - Lower torso (pelvis) response as a function of occupant axial stiffness

differ from the corresponding human properties. It appears from the results of this investigation that the "camel hump" effect noted in the test data means that the dummy spine is stiffer than originally anticipated in setting up a representation based on Reference 7 data. The fact that the occupant upper torso responses follow very closely the occupant lower torso responses in both magnitude and time of occurrence, supports the contention that the spinal connection of the dummies used in the substructure test are relatively stiff.

4.3 SEAT MAXIMUM FORCE

The seat-cushion and pan-stiffness properties used in the analysis are representative of those installed in the particular type of airplane used in the substructure test. Figure 4-4 shows a general force-deflection curve for a light aircraft passenger seat. Since the curve provided in Figure 4-4

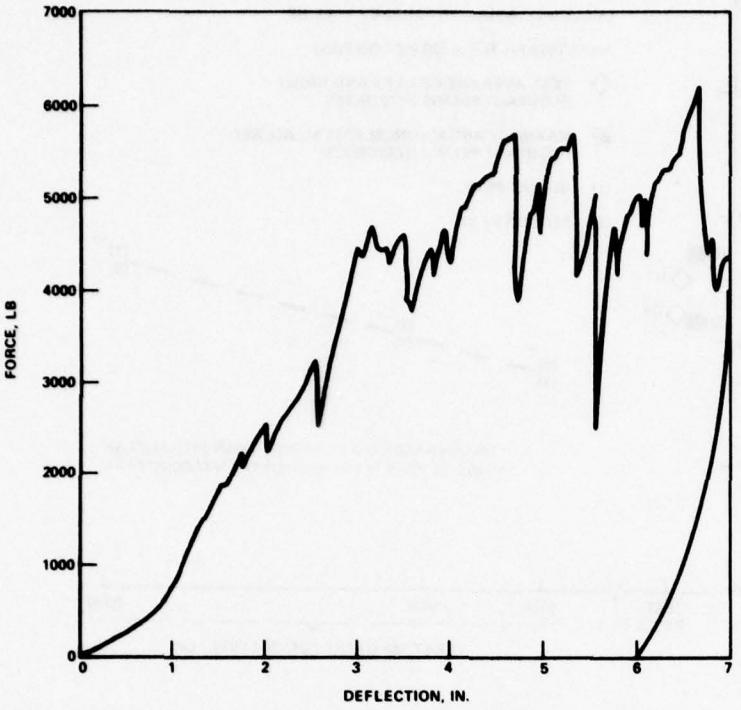


Figure 4-4. - Typical force-deflection curve for a light-aircraft passenger seat.

is not the actual load-deflection for the seat installation in the substructure test, an investigation into the effect of the variation in maximum seat force on occupant response was performed. The change in cushion and pan stiffness effects the occupant response to a lesser extent than the force cutoff value in this particular situation and was not fully explored. Figure 4-5 shows the results of the force cutoff changes. The occupant pelvis responses increase as the maximum force level increases. For a maximum cutoff force of 5570 pounds the analysis results are approximately 30 to 19 percent lower than the average of the measured responses for the two peak accelerations. For the 6455 pounds used in the base analysis the analytical results are approximately 19 and 7 percent lower than the average of the measured responses for the two peak accelerations. If the cutoff force was as high as 9000 pounds, the analytical results would be 8 and 18 percent higher than the average of the

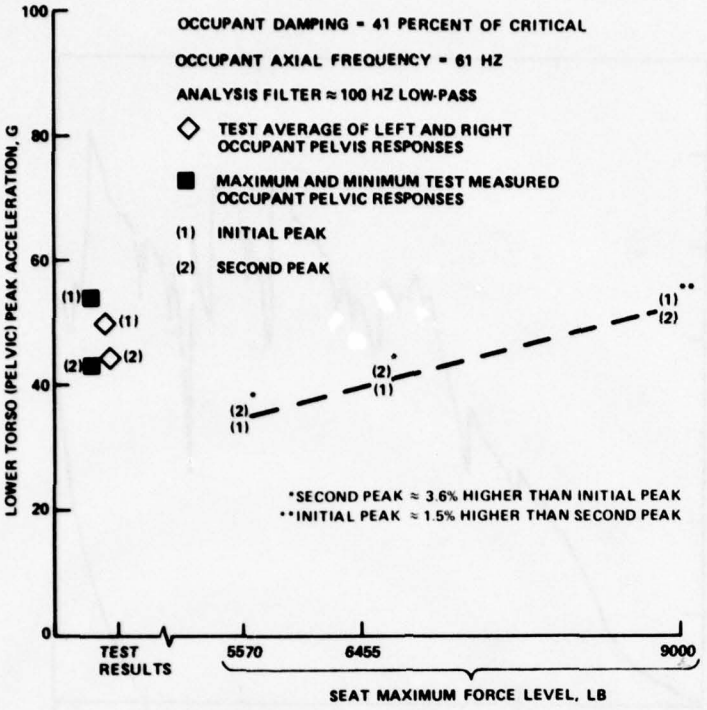


Figure 4-5. - Lower torso (pelvis) response as a function of seat maximum force level.

measured responses. The ranges investigated represent a deviation of approximately -15 to +28 percent from the nominal 6455 pounds used. For the three force levels evaluated (5570, 6455, and 9000 pounds), the initial peak acceleration level obtained by analysis for the occupant upper torso is approximately 6 percent, 17.4 percent, and 58 percent higher, respectively, than the corresponding average of the head and chest measured values. The upper torso response is more akin to the DRI value than the lower torso response. Consequently, the analysis may show a more conservative DRI value than is indicated by test response data. User-selected values of between 5500 and 6500 pounds appear to provide reasonable representations of the seat load-deflection characteristics.

4.4 ANALYTICAL FILTER CUTOFF FREQUENCY

Analysis of the current substructure test data indicated that a 100-Hz, low-pass digital filter is approximately equivalent to the least-square-fit (LSF) filtering performed by NASA-Langley. The LSF data were used for the tabulation of test results. Previous NASA evaluation of equivalent filtering

indicated that 180 Hz, low-pass filtering could be equivalent to the LSF data. Recognizing that equivalent filtering is difficult to define because of the different data reduction processes that are used and the wide range of types of structures or elements being considered, an evaluation was performed to ascertain the effects of the analytical results and subsequent correlation with test results of different analytical filter cutoff frequencies. As noted earlier, KRASH filtering is a post-processing technique and doesn't change any computed values.

Figure 4-6 shows the result of the analysis for a cutoff frequency range from 100 to 150 Hz. For the floor responses the analytically obtained peak values increase by approximately 4 to 18 percent in changing from a 100-Hz to 150-Hz cutoff frequency. However, as can be observed in Figure 4-6, the results are for the most part still within the range of recorded test values at the respective locations. The analytical responses for the occupant lower torso are less sensitive to the cutoff frequency change. The data in Figure 4-6 shows a variation of less than 5 percent for the initial lower torso peak value and less than 2 percent for the second peak value. The occupant responses exhibit lower frequency (broader response) characteristics than the floor responses and consequently are not expected to be as sensitive to the higher cutoff frequencies.

4.5 MODEL SIZE VARIATION

The base 32 mass, 57 member symmetrical math model shown in Figures 2-3 and 2-4 provides an adequate representation of the substructure and impact condition evaluated, as attested to by the close agreement with available test data. The results, analytical and test, indicate that the airframe shell structure, which accounts for approximately 28 percent of the total substructure airframe weight, did not deform appreciably, due in part to the stabilizing effect of the end closures (tension rods), during the 27.5 ft/sec vertical impact. Consequently, the occupant responses may not be altered very much from that which would be expected if the upper shell structure flexibility were ignored and the mass and inertia effects were accounted for. This situation is particularly significant since the 32 mass, 57 member model and test results show that the shell structure motion does not pose any lethal threat to the

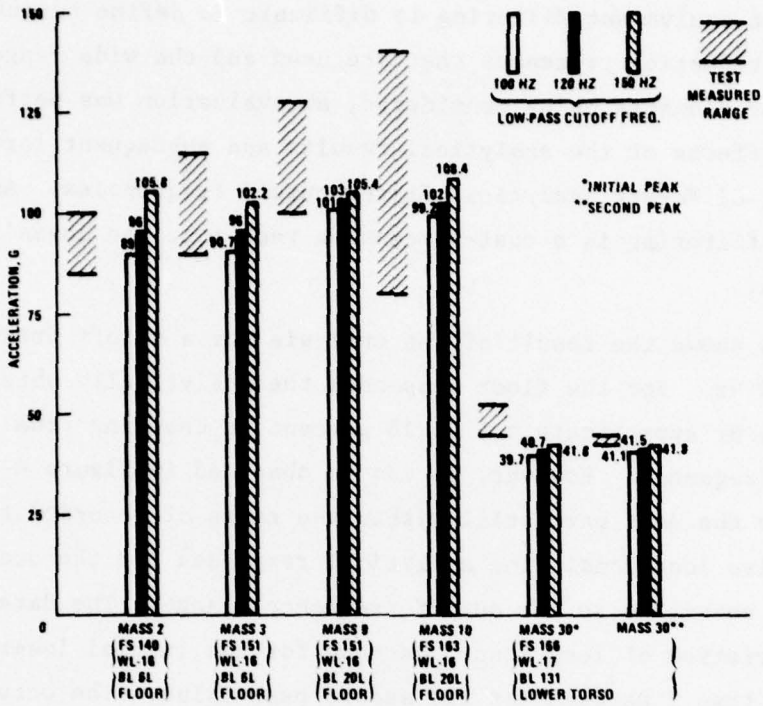
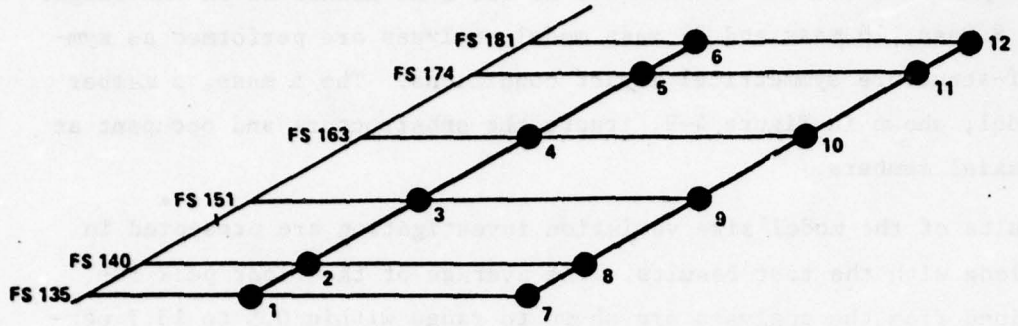


Figure 4-6. Floor and occupant peak responses as a function of analysis filter cutoff frequency.

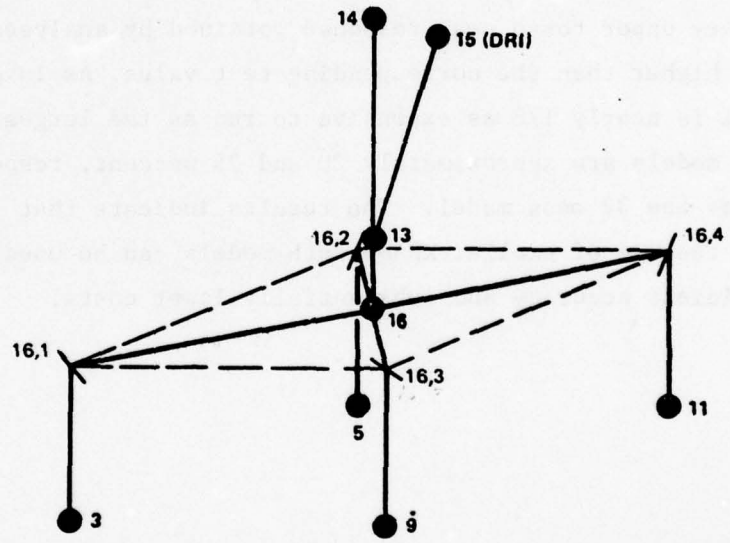
occupants either through failure or excessive motion. If prior to or during the analysis, the user can establish that the representation of the shell structure is not critical, insofar as the occupant and floor responses are concerned, a smaller more economical math model can be pursued. To assess the tradeoff between accuracy and model analysis cost for the substructure and impact condition described in this report the following KRASH math models were investigated:

- 16 mass, 32 member symmetrical half structure (runmod=1)
- 6 mass, 8 member symmetrical half structure (runmod=1)
- 5 mass, 5 member full structure (runmod=0)

The 16 mass, 32 member model is shown in Figure 4-7. The model is the same as the base 32 mass, 57 member model except that the mass associated with the shell structure is distributed among the floor masses. The 6 mass,



FUSELAGE



FLOOR-SEAT-OCCUPANT

Figure 4-7. 16 mass, 32 member symmetrical math model.

LOCKHEED
CALIFORNIA COMPANY

8 member model, shown in Figure 4-8, lumps half the airframe weight at mass locations 1 and 2. The stiffness of the seat is represented by 2 members instead of 4 as in the larger 16 mass and 32 mass models. The seat cushion, seat pan, occupant and DRI are represented in the same manner as in the larger models. The 8 mass, 16 mass and 32 mass model analyses are performed as symmetrical half-structure symmetrical impact conditions. The 5 mass, 5 member full math model, shown in Figure 4-9, treats the substructure and occupant as a series of axial members.

The results of the model size variation investigation are presented in Table 4-1, along with the test results. The average of the floor peak responses obtained from the analyses are shown to range within 0.5 to 13.7 percent of the average of the test peak values. The analytical occupant lower torso responses are within 19 to 22 percent of the test value for the first peak and between 3 and 7 percent of the test values for the second peak. The primary upper torso peak response obtained by analyses are from 15 to 24 percent higher than the corresponding test value. As is anticipated the smallest model is nearly 1/8 as expensive to run as the largest model. The 6 and 16 mass models are approximately 20 and 75 percent, respectively, as expensive to run as the 32 mass model. The results indicate that for this particular situation the use of smaller KRASH math models can be used to assess trends with sufficient accuracy and substantially lower costs.

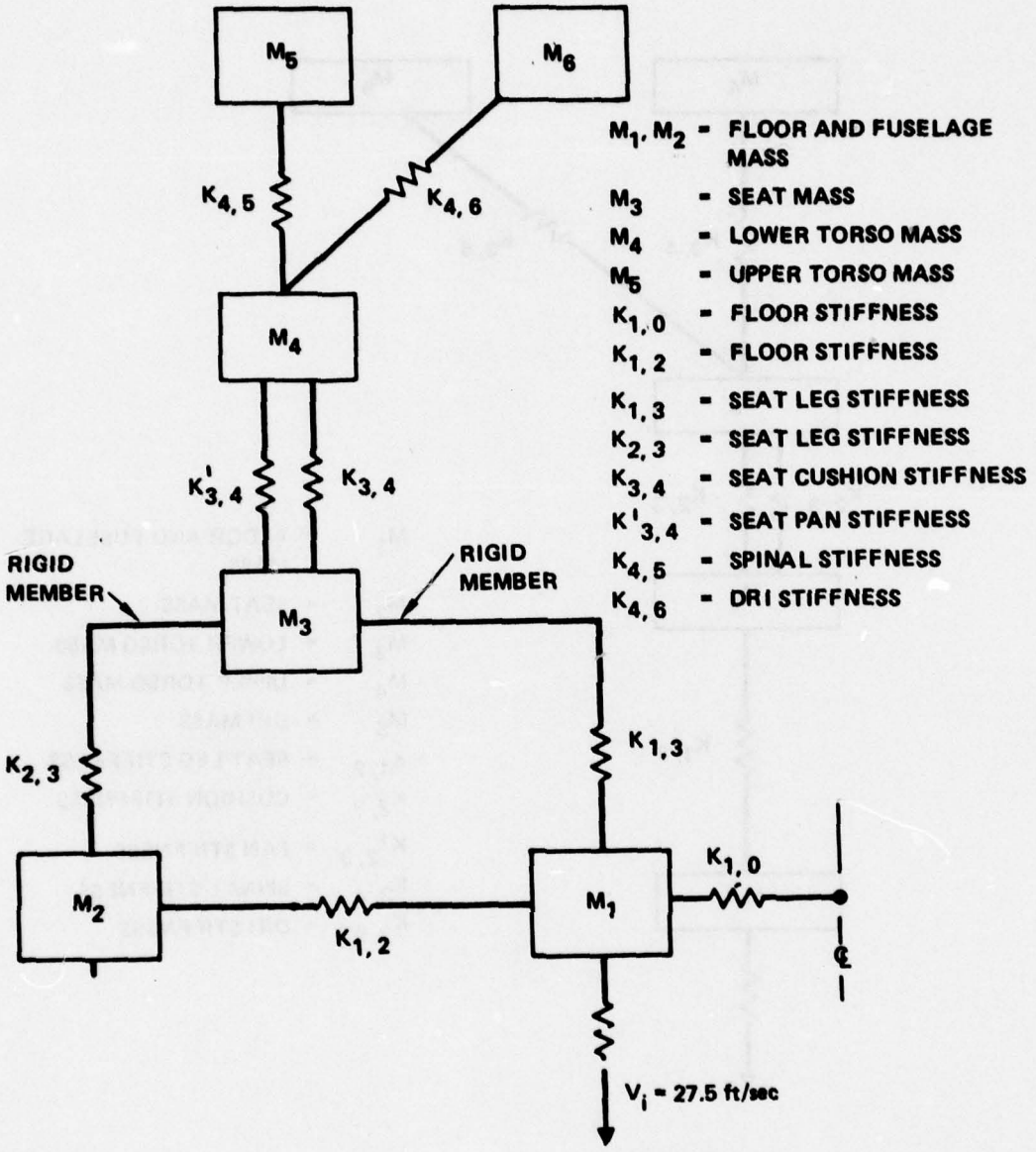


Figure 4-8. 6 mass, 8 member symmetrical math model.

LOCKHEED
CALIFORNIA COMPANY

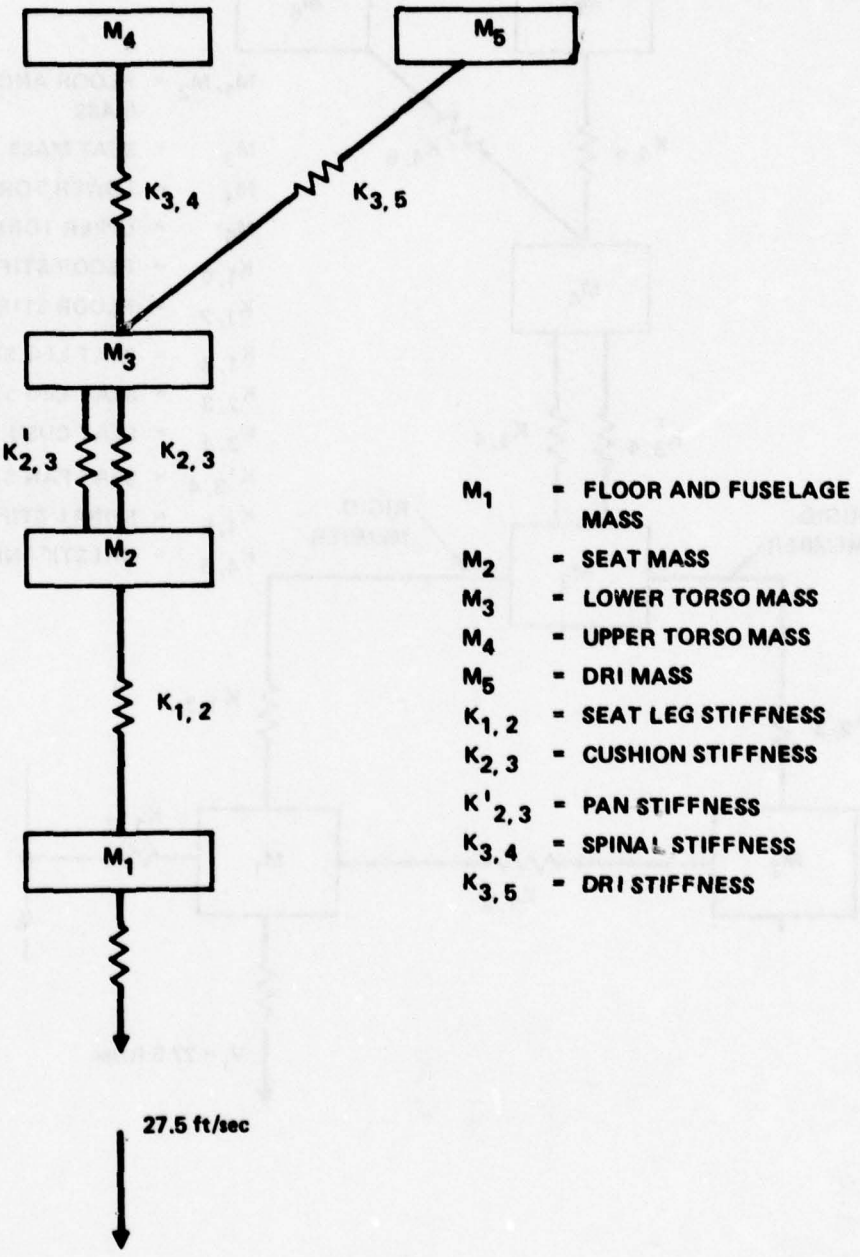


Figure 4-9. 5 mass, 5 member full math model.

LOCKHEED
CALIFORNIA COMPANY

TABLE 4-1. COMPARISON OF RESULTS FOR DIFFERENT SIZE MATH MODELS[a]

Location	Analysis Results (Peak Acceleration - g)[b]				Test Results (Peak Acceleration - g)[b]
	Masses Beams	32 57	16 32	6 8	5 5	
Floor		89(.004) 90.7(.004) 101(.011) 99.2(.004)	91.2(.005) 92.6(.007) 94(.011) 98.5(.007)	99(.005) 105(.008)	88.5(.008)	84.9(.004) 128.7(.010) 115.7(.004) 80.8(.008)
Average (Time Range)		95(.004-.011)	94(.005-.011)	102(.005-.008)	88.5(.008)	102.5(.004-.010)
Lower Torso		39.7(.017) 41.1(.026)	38.4(.018) 38.4(.027)	39.8(.017) 42. (.028)	39.7(.017) 45.4(.030)	49(.018-.020) 44.1(.030-.032)
Upper Torso		50.5(.022)	49.5(.022)	50.8(.022)	53.5(.019)	43(.020)[c]
Analysis Time (Machine Minutes)[d]		6.9	4.75	1.1	.67	---
Approximate Cost[d]		$135	$91	$26	$17	---

(a) Analysis results are based on 85 Hz low-pass filter, 27.5 ft/sec vertical velocity, 0.131 radian nose-up pitch, ≈6500 pound seat force cutoff, and integration interval = .00001 seconds

(b) Time of occurrence in seconds after impact is shown in parenthesis

(c) Averaging of head and chest values

(d) Based on IBM 370-3330 digital computer

SECTION 5

CONCLUSIONS

The analysis of a twin-engine, low-wing airplane substructure subjected to a 27.5 ft/sec vertical impact has demonstrated program KRASH's capability to quantitatively represent the significant dynamic response phenomena, namely:

- Primary floor acceleration magnitudes and times of occurrence
- Occupant response magnitudes, time of occurrence and response shape, particularly the "camel-hump" effect
- Occupant and structure motion trends

The results of the sensitivity investigation using program KRASH indicate that for the parameters varied, the structure, and the impact condition evaluated, user-selected data for input into KRASH can vary as much as 20 percent and still provide a reasonable assessment of overall dynamic behavior. Furthermore, the range of dynamic response peak values obtained from variations in KRASH user selected input data is comparable to the spread in the measured test data between the left and right sides.

The results of the test and analysis correlation and sensitivity studies provide valuable information which can be used to enhance future modeling of crash impact conditions.

For some structural configurations and impact conditions simple approximate models are a cost-effective method of representing large structural segments with acceptable accuracy for qualitatively assessing dynamic behavior and response trends.

REFERENCES

1. Wittlin, G., Gamon, M.A."Experimental Program for the Development of Improved Helicopter Structural Crashworthiness Analytical and Design Techniques," Lockheed-California Company, USAAMRDL-TR-72, U.S. Army Air Mobility Research and Development Laboratory, Ft. Eustis, Va., May 1973.

2. Wittlin, G., Gamon, M.A., LaBarge, W.L.,"Full Scale Crash Test Experimental Verification of a Method of Analysis for General Aviation Airplane Structural Crashworthiness," Lockheed-California Company, FAA-RD-77-188, U.S. Dept. of Transportation, Federal Aviation Administration, System Research and Development, Wash., D.C., February 1978.

3. Vaughan, V., Jr., Alfaro, Bou E.,"Impact Dynamics Research Facility for Full Scale Aircraft Crash Testing," NASA TN D-8179, April 1976.

4. Wittlin, G., Park, K.C.,"Development and Experimental Verification of Procedures to Determine Nonlinear Load-Deflection Characteristics of Helicopter Substructures Subjected to Crash Forces," Lockheed-California Company, USAAMRDL TR 74-12, U.S. Army Air Mobility Research and Development Laboratory, Ft. Eustis, Va., May 1974.

5. Gamon, M.A., Wittlin, G., LaBarge, W.L.,"General Aviation Airplane Structural Crashworthiness User's Manual, Input-Output Techniques and Applications," VOLUME II, Lockheed-California Co., FAA-RD-77-189II, Federal Aviation Administration, Wash., D.C., February 1978.

6. Laananen, D.H.,"Development of a Scientific Basis for Analysis of Aircraft Seating Systems," FAA-RD-74-130, U.S. Dept. of Transportation, Federal Aviation Administration, Systems Research and Development Services, Wash., D.C., 1975.

7. Turnbow, J.W., et al,"Crash Survival Design Guide," USAAMRDL-TR-71-22 Eustis Directorate, U.S. Army Air Mobility Research and Development Laboratory, Fort Eustis, Va., Oct. 1971.

APPENDIX A
KRASH MODEL CALCULATIONS

This appendix provides the sample calculations for determining the structure and occupant mass locations, mass properties, beam properties, and the external spring load-deflection characteristics.

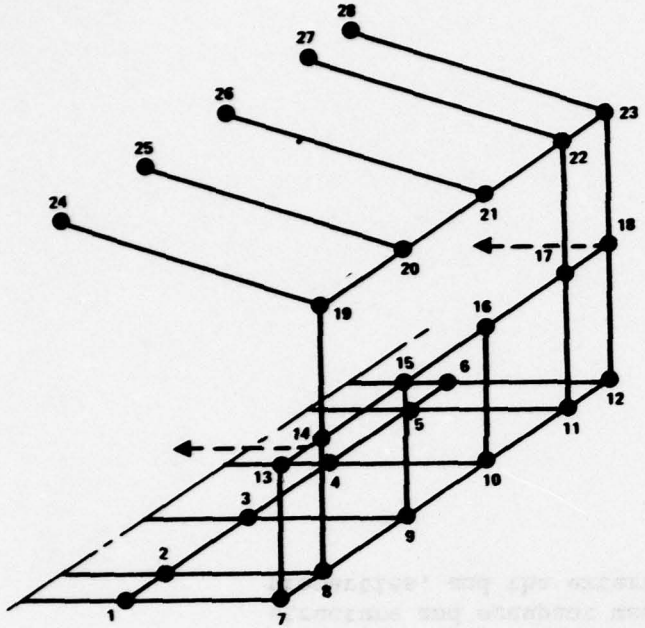


Figure A-1. – Fuselage model.

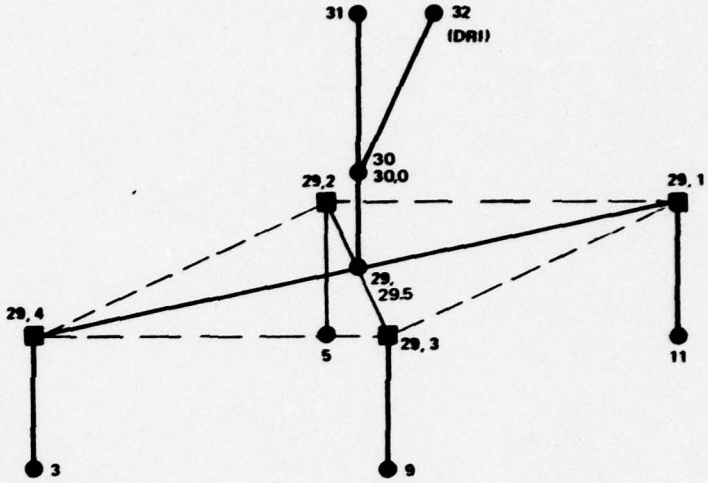


Figure A-2. – Floor seat-occupant model.

SEAT-OCCUPANT-REPRESENTATION

MASS REPRESENTATIONS

Mass	Representation	Weight (lb)	$\bar{X}$ ③
3, 5, 9, 11	Seat leg attachment at floor	①	0
29,1, 29,2, 29,3, 29,4	Seat leg attachment at pan	20.86	14.3
30	Lower torso pelvis region	72.86 ②	21.8
31	Upper torso chest region	72.86 ②	36.9
32	DRI	72.86 ②	36.9

Notes

① Distributed weight from floor structure ~~16~~ percent of occupant weight at each of the forward floor seat leg attachment locations.

② 44 percent of occupant weight

③ Height in inches above the floor

MEMBER REPRESENTATIONS

i^{th} - j^{th} Masses	Representation
3 - 29,1	Seat legs
5 - 29,2	
9 - 29,3	
11 - 29,4	
29 - 30	Seat cushion, compression only member
29,5 - 30,1	Seat pan
30 - 31	Upper torso (spine)
30 - 32	DRI
11 - 30	Seat belt, tension only member
5 - 30	Seat belt, tension only member

MASS MOMENT OF INERTIA OF 50-PERCENTILE MAN, 161.5 lb (Reference 6)

Element	Fraction of Total Mass (m/m_T)	Weight (lb)	Mass lb sec^2 in.	Mass Moment of Inertia (lb - sec^2 - in.) Roll I_x	Pitch I_y	Yaw I_z
Lower Torso	0.2778	44.86	0.1162	8.703	4.331	8.703
Upper Torso	0.2264	36.56	0.09471	3.357	2.623	2.623
Head & Neck	0.0792	12.79	0.03313	0.311	0.311	0.201
Upper Arm	0.0264	4.26 (2)	0.01104	0.164	0.164	0.0241
Forearm & Hand	0.0214	3.46 (2)	0.00896	0.0241	0.218	0.218
Thigh	0.1001	16.17 (2)	0.04189	0.307	1.270	1.270
Leg & Foot	0.0604	9.75 (2)	0.02526	1.192	1.192	0.120
Total		161.5	0.41334			

UPPER TORSO 50-PERCENTILE MAN, 161.5 lb (Reference 6)

$$I_x = 3.357 + 2\left\{.164 + .01104\left[(5.81 - 5.24)^2 + (6.34)^2\right]\right\} + 2\left\{.0241 + .00896\left[(11.99 - 5.81)^2 + (6.34)^2\right]\right\}$$

$$+ .311 + .03313\left[(5.81 + 6.06)^2\right] = 3.357 + 1.2227 + 1.4529 + 4.9789 = \underline{11.0115}$$

$$I_y = 2.623 + 2\left\{.164 + .01104\left[(5.81 - 5.24)^2\right]\right\} + 2\left\{.218 + .00896\left[(11.99 - 5.81)^2 + (8.95)^2\right]\right\}$$

$$+ .311 + .03313\left[(5.81 + 6.06)^2 + (.75)^2\right] = 2.623 + .3352 + 2.5559 + 4.9976 = \underline{10.5117}$$

$$I_z = 2.623 + 2\left\{.0241 + .01104\left[(6.34)^2\right]\right\} + 2\left\{.218 + .00896\left[(6.34)^2 + (8.95)^2\right]\right\} + .201 + .03313\,(75)^2$$

$$= 2.623 + .93572 + 2.59174 + .21964 = \underline{6.3701}$$

For 165.6 # MAN

$I_x = 11.2946$

$I_y = 10.7785$

$I_z = 6.5318$

LOWER TORSO 50-PERCENTILE MAN, 161.5 lb

$$I_x = 8.703 + .1162\ (5.35)^2 + 2\left\{.307 + .04189\ (3.39)^2\right\} = 8.703 + 3.3259 + 1.57681 = \underline{13.6057}$$

$$I_y = 4.331 + .1162\ (5.35)^2 + 2\left\{1.270 + .04189\ (7.09)^2\right\} = 4.331 + 3.3259 + 6.7515 = \underline{14.4084}$$

$$I_z = 8.703 + .1162\ (0) + 2\left\{1.270 + .04189\ \left[(3.39)^2 + (7.09)^2\right]\right\} = 8.703 + 0 + 7.71427 = \underline{16.4173}$$

For 165.6 lb Man

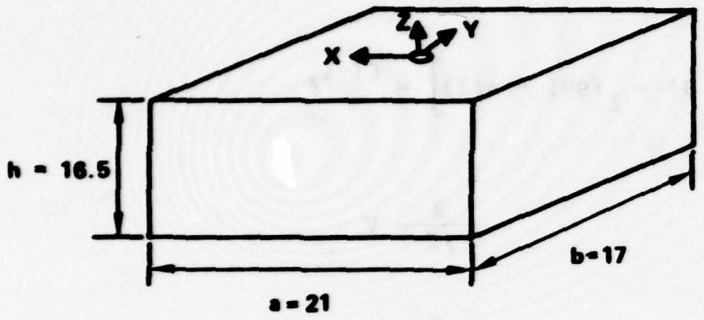
$I_x = \underline{13.9511}$

$I_y = \underline{14.7742}$

$I_z = \underline{16.8341}$

MASS MOMENT OF INERTIA OF SEAT (MASS 29)

Mass = 20/386



$$I_x' = \frac{20}{12(386)} (17^2 + 16.5^2) = 2.4234$$

$$I_y' = \frac{20}{12(386)} (21^2 + 16.5^2) = 3.0797$$

$$I_z' = \frac{20}{12(386)} (21^2 + 17^2) = 3.1520$$

About Top Center

$$I_x = 2.4234 + \frac{20}{386} \left(\frac{16.5}{2}\right)^2 = 5.9500$$

$$I_y = 3.0797 + \frac{20}{386} \left(\frac{16.5}{2}\right)^2 = 6.6062$$

$$I_z = 3.1520$$

SEAT BELT

Seat Belt Attaches from Mass 30 to Mass 11 and from Mass 30 to Mass 5

Estimated stiffness of seat belt = 1000 lb/in.

For the purpose of seat belt calculations assume the seat belt material to be aluminum - material #4

$$E = 10.5 \times 10^6$$

$$K = \frac{AE}{\ell}$$

$$A = \frac{K\ell}{E}$$

$$\ell_{5-13} = \left[(174 - 166)^2 + (6 - 13)^2 + (-16 - 4)^2\right]^{1/2} = 22.6495$$

$$\ell_{11-13} = \left[(174 - 166)^2 + (20 - 13)^2 + (-16 - 4)^2\right]^{1/2} = 22.6495$$

$$A = \frac{(1 \times 10^3)(22.6495)}{10.5 \times 10^6} = .0021571$$

SEAT CUSHION

Estimated seat cushion stiffness = 500 lb/in.

For the purpose of seat cushion calculations assume the cushion material to be aluminum - material #4 $E = 10.5 \times 10^6$.

$$K = \frac{AE}{\ell} \qquad A = \frac{K\ell}{E}$$

Assume thickness of cushion to be 4"

$$A = \frac{(500)(4)}{(10.5 \times 10^6)} = .00019 \ (in^2)$$

Estimated seat pan stiffness = 2000 lb/in.

$$A = \frac{K\ell}{E} = \frac{(2000)(4)}{(10.5 \times 10^6)} = .0007619 \ (in^2)$$

EXTERNAL SPRING REPRESENTATION

STIFFENER AREA - MASSES 2 THROUGH 6

$$\text{AREA} = (12)(.032) + (a + b)(.032)$$

$$= (12 + a + b)(.032)$$

$$\Delta = \text{AREA/REF AREA}^*$$

$$\text{REF. AREA} = 3.376\ (\text{in}^2)$$

F.S.	a	b	A	Δ	Peak Load at Deflection = 0.1 inch
135	0	2.5	0.464	0.137	1644
140	2.5	0.65	0.645	0.191	2292
151.3	5.65	5.65	0.746	0.221	2652
162.6	5.65	5.7	0.747	0.221	2652
174	5.7	3.5	0.678	0.201	2412
184	3.5	0	0.496	0.147	1764

BULKHEAD AREA - MASSES 8 THROUGH 12

Reference Area = .956 *

Area = (14 - 6) (.032) = .256

Δ = .268

Peak load = 670 lb at a deflection = .05 inches

*Reference Area based on USAAMRDL TR 74-12 TEST SPECIMEN DATA. See Reference FAA-RD-77-188II, page 4-62.

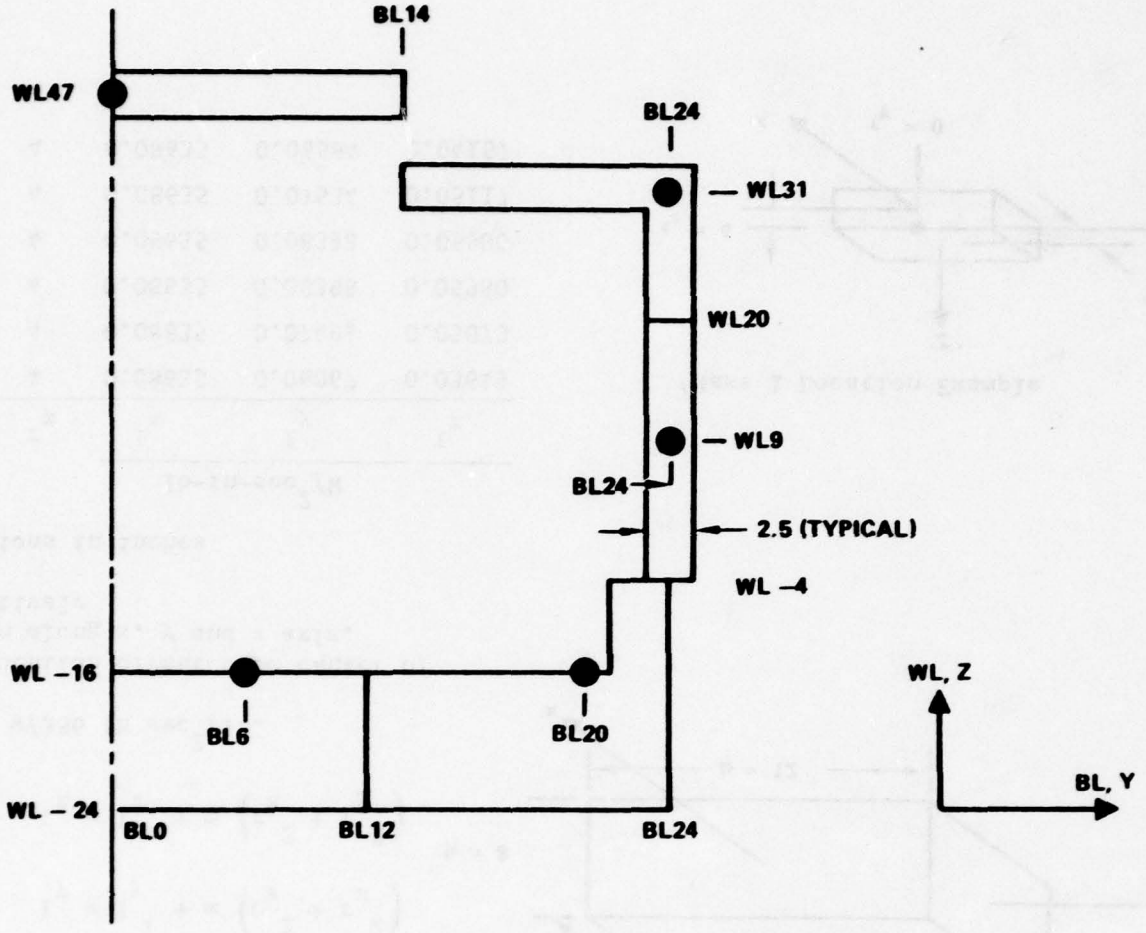


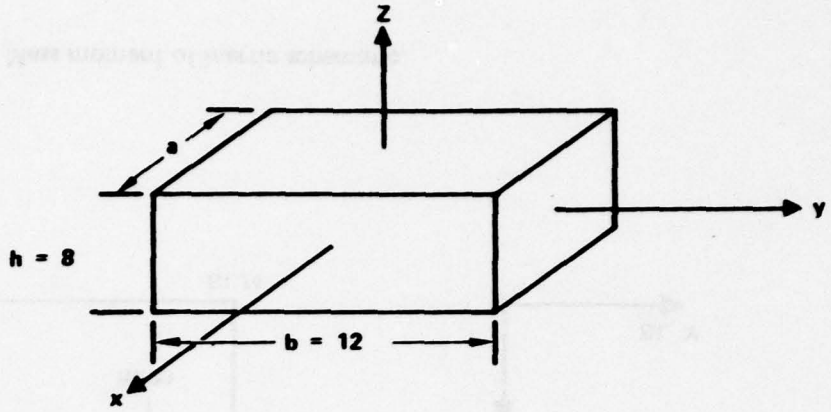
Figure A-3. – Mass moment of inertia schematic.

MASSES 1-6

$$I_x' = \frac{m}{12}\left(b^2 + h^2\right) \qquad I_x = I_x' + m\left(r_z^2 + r_y^2\right)$$

$$I_y' = \frac{m}{12}\left(a^2 + h^2\right) \qquad I_y = I_y' + m\left(r_x^2 + r_z^2\right)$$

$$I_z' = \frac{m}{12}\left(b^2 + a^2\right) \qquad I_z = I_z' + m\left(r_x^2 + r_y^2\right)$$



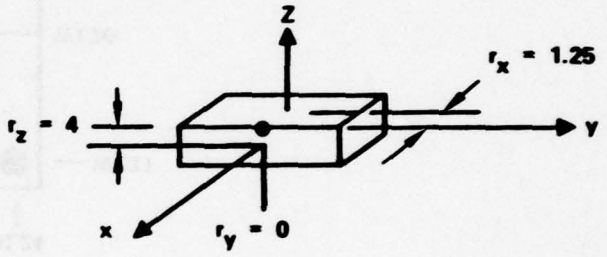
m = mass = w/386 lb sec^2/in.

r_x, r_y, r_z = mass location offset from center of section along x, y and z axis, respectively

a, b, h = dimensions in inches

					lb-in-sec^2/W		
Mass	a	r_x	r_y	r_z	I_x	I_y	I_z
*1	2.5	1.25	0	4	0.08635	0.06067	0.03649
2	8.0	1.5	0	4	0.08635	0.07491	0.05073
3	11.5	0.25	0	4	0.08635	0.08398	0.05980
4	11.5	0.25	0	4	0.08635	0.08398	0.05980
5	9	1.	0	4	0.08635	0.07534	0.05117
6	3.5	1.75	0	4	0.08635	0.06584	0.04167

*Mass 1 Location Example



MASSES 7-12

$$I_{1x}' = \frac{m}{12}\left(b_1^2 + h_1^2\right) \qquad I_{2x}' = \frac{m}{12}\left(b_2^2 + h_2^2\right)$$

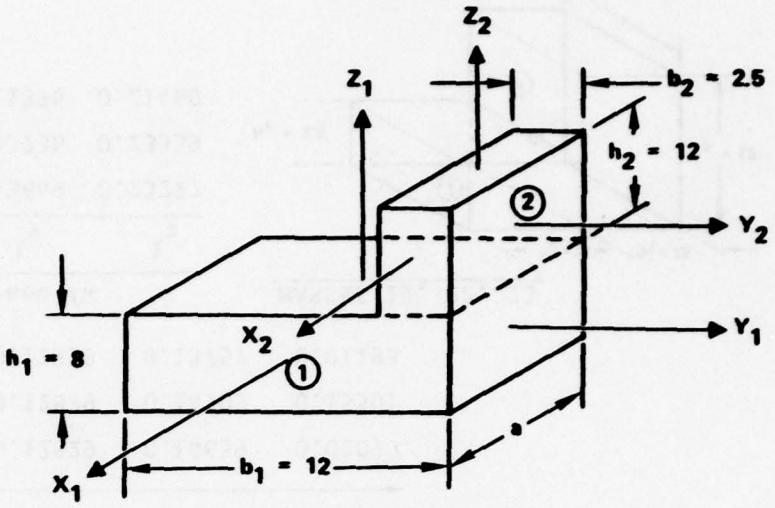
$$I_{1y}' = \frac{m}{12}\left(a^2 + h_1^2\right) \qquad I_{2y}' = \frac{m}{12}\left(a^2 + h_2^2\right)$$

$$I_{1z}' = \frac{m}{12}\left(a^2 + b_1^2\right) \qquad I_{2z}' = \frac{m}{12}\left(a^2 + b_2^2\right)$$

$$I_x = I_{1x}' + m\left(r_{1z}^2 + r_{1y}^2\right) + I_{2x}' + m\left(r_{1z}^2 + r_{1y}^2\right)$$

$$I_y = I_{1y}' + m\left(r_{1x}^2 + r_{1z}^2\right) + I_{2y}' + m\left(r_{1x}^2 + r_{1z}^2\right)$$

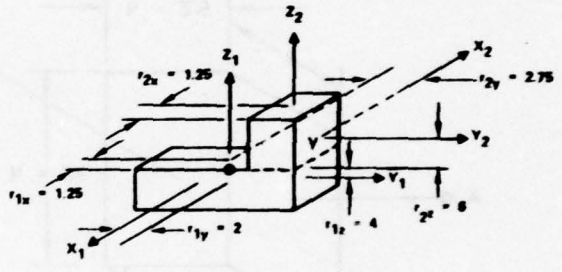
$$I_z = I_{1z}' + m\left(r_{1x}^2 + r_{1y}^2\right) + I_{2z}' + m\left(r_{1x}^2 + r_{1y}^2\right)$$



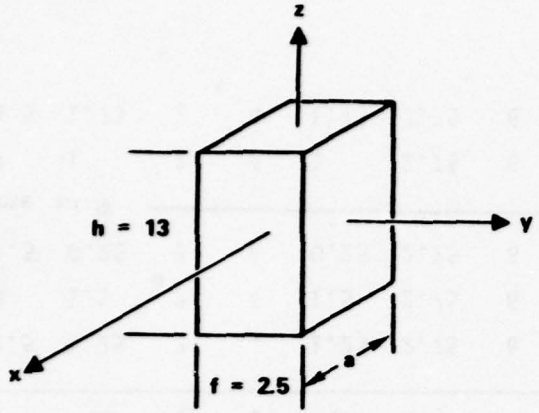
SKETCH B

Mass	a	r_{1x}	r_{1y}	r_{1z}	r_{2x}	r_{2y}	r_{2z}	lb-in-sec^2/W I_x	I_y	I_z
* 7	2.5	1.25	2	4	1.25	2.75	6	0.245	0.19042	0.0732
8	8	1.5	2	4	1.5	2.75	6	0.242	0.2189	0.13808
9	11.5	0.25	2	4	0.25	2.75	6	0.242	0.23705	0.11982
10	Same as 9	→								
11	9	1	2	4	1	2.75	6	0.245	0.21974	0.10255
12	3.5	1.75	2	4	1.75	2.75	6	0.245	0.20077	0.08356

*Mass 7 Location Example

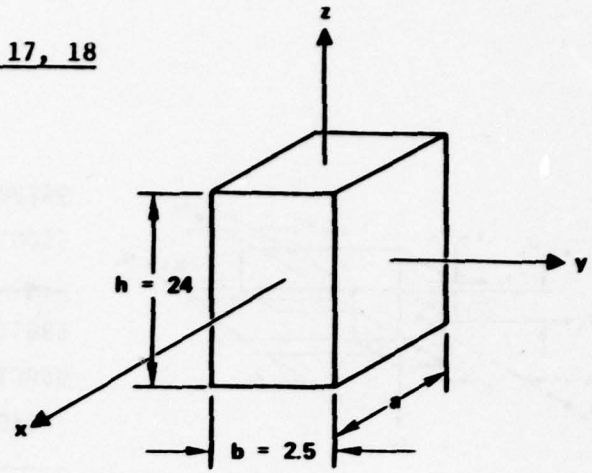


MASSES 13, 15, 16



SKETCH C

MASSES 14, 17, 18

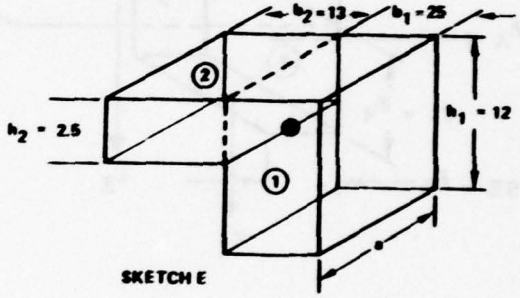


SKETCH D

Mass	a	r_x	r_y	r_z	I_x (lb-in-sec^2/W)	I_y (lb-in-sec^2/W)	I_z (lb-in-sec^2/W)
13	2.5	1.25	0	6.5	0.14728	0.15134	0.00675
15	11.5	0.25	0	6.5	0.14728	0.17465	0.03006
16	Same as 15 →						
14	8	1.5	0	1	0.12829	0.14659	0.02099
17	9	1	0	1	0.12829	0.14702	0.15501
18	3.5	1.75	0	1	0.12829	0.13752	0.01193

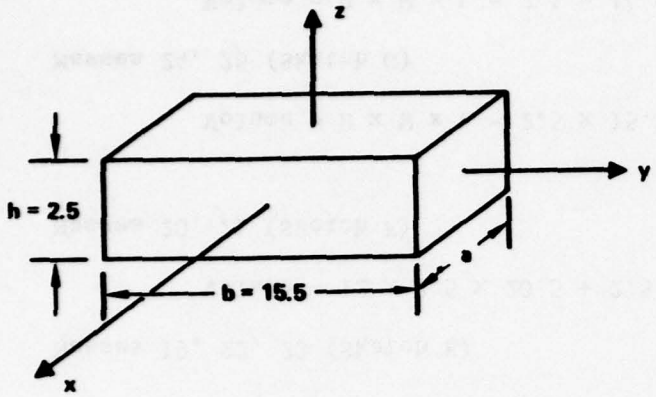
MASSES 19, 22, 23

MASS	a	r_{1x}	r_{1y}	r_{1z}	r_{2x}	r_{2y}	r_{2z}	I_x (lb-in-sec^2/W)	I_y (lb-in-sec^2/W)	I_z (lb-in-sec^2/W)
19	8	1.5	0	5	1.5	7.75	0	0.29064	0.13649	0.23272
22	9	1.0	0	5	1	7.75	0	0.29064	0.13736	0.23359
23	3.5	1.75	0	5	1.75	7.75	0	0.29064	0.11836	0.21460



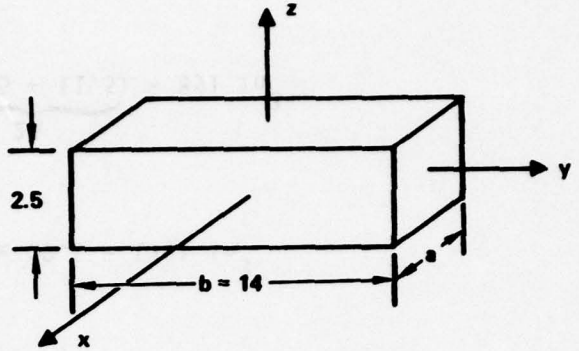
SKETCH E

MASSES 20, 21



SKETCH F

MASSES 24-28



SKETCH G

Mass	a	r_x	r_y	r_z	I_x (lb-in sec^2/W)	I_y (lb-in sec^2/W)	I_z (lb-in sec^2/W)
20	11.5	0.25	6.5	0	0.16267	0.08058	0.13952
21	Same as 20 →						
24	8	1.5	7	0	0.17061	0.021	0.1889
25	11.5	0.25	7	0	0.17061	0.03006	0.19797
26	Same as 25 →						
27	9	1	7	0	0.17061	0.2143	0.18933
28	3.5	1.75	7	0	0.17061	0.01193	0.17983

MASS DISTRIBUTION BASED ON VOLUME

Masses 1-6 (Sketch A)

$$\text{Volume} = H \times W \times L = 8 \times 12 \times \overbrace{(2.5 + 8 + 11.5 + 11.5 + 9 + 3.5)}^{46} = 4416 \text{ in}^3$$

Masses 7-12 (Sketch B)

$$\text{Volume} = 8 \times 12 \times 46 + 2.5 \times 12 \times 46 = 5796 \text{ in}^3$$

Masses 13, 15, 16 (Sketch C)

$$\text{Volume} = H \times W \times L = 13 \times 2.5 \times \overbrace{(2.5 + 11.5 + 11.5)}^{25.5} = 828.75 \text{ in}^3$$

Masses 14, 17, 18 (Sketch D)

$$\text{Volume} = H \times W \times L = 24 \times 2.5 \times \underbrace{(8 + 9 + 3.5)}_{20.5} = 1230 \text{ in}^3$$

Masses 19, 22, 23 (Sketch E)

$$\text{Volume} = 12 \times 2.5 \times 20.5 + 2.5 \times 13 \times 20.5 = 1281 \text{ in}^3$$

Masses 20, 21 (Sketch F)

$$\text{Volume} = H \times W \times L = 2.5 \times 15.5 \overbrace{(11.5 + 11.5)}^{23} = 891 \text{ in}^3$$

Masses 24, 28 (Sketch G)

$$\text{Volume} = H \times W \times L = 2.5 \times 14 \times 46 = 1610 \text{ in}^3$$

Total Volume = 16053.25 in^3

Density of Aluminum = 0.1 lb/in^3

Assume 5% of volume is structure

Weight = 16053.25 x 0.1 x 0.05 = 80.265 lb

Actual Weight = 86.5 lb for half

Δ Weight = 86.5 - 80.265 = 6.235 lb

Assume weight on floor is slightly heavier

Volume of floor structure masses 1-12 = 0.05 $[(8 \times 12 \times 46)2] = 441.6\ in^3$

Δ Density = 6.235/441.6 = 0.014119 lb/in^3

Weight Calculations

Masses 1-6

Weight = (8)(12)(0.05)(0.1 + 0.04119)a = 0.54768a

Masses 7-12

Weight = (8)(12)(0.05)(0.1 + 0.04119)a + 12(2.5)(0.5)(0.1)a = 0.69768a

Masses 13, 15, 16

Weight = 13 (0.25)(0.05)(0.1)a = 0.1625a

Masses 14, 17, 18

Weight = 2.5 (24)(0.05)(0.1)a = 0.3a

Masses 19, 22, 23

Weight = 2.5(12)(0.05) 0.1a + 13 (2.5)(0.05)(0.1)a = 0.3125a

Masses 20, 21

Weight = (15.5)(2.5)(0.05)(0.1)a = 0.19375a

Masses 24-28

Weight = 14(2.5)(0.05)(0.1)a = 0.175a

See Table V-1 for appropriate mass "a" values (lengths) and weights

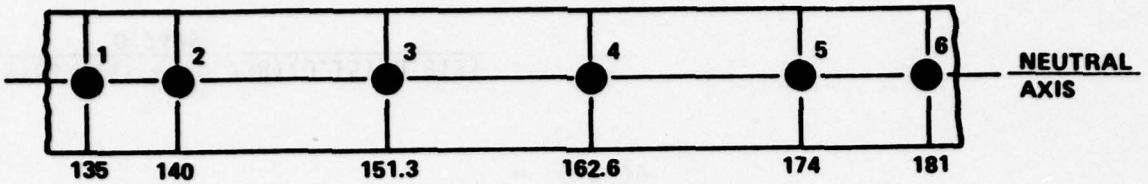
TABLE V-1. – MASS LOCATIONS AND PROPERTIES

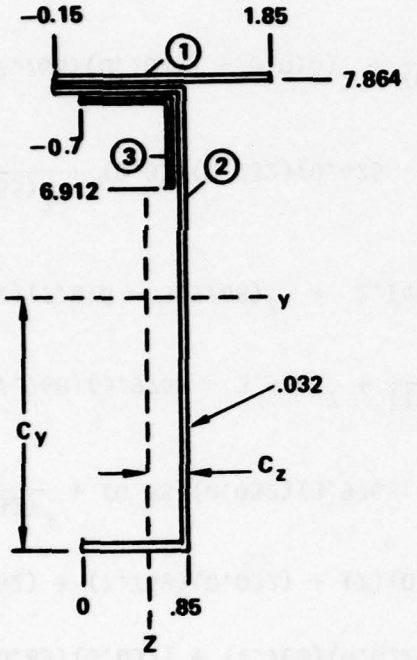
Mass No.	a in.	x (in.)	y (in.)	z (in.)	WT LB.	I_x	I_y (lb-in-sec^2)	I_z
1	2.5	135	6	-16	1.37	0.1183	0.0831	0.05
2	8	140	6	-16	4.38	0.3782	0.328	0.222
3*	11.5	151	6	-16	16.3	4.34	4.4	0.5
4	11.5	163	6	-16	6.3	0.544	0.529	0.377
5	9.	174	6	-16	4.93	0.426	0.371	0.252
6	3.5	181	6	-16	1.91	0.165	0.126	0.0796
7	2.5	135	20	-16	1.75	0.429	0.333	0.128
8	8	140	20	-16	5.58	1.35	1.22	0.771
9*	11.5	151	20	-16	18.03	5.72	5.68	1.09
10	11.5	163	20	-16	8.02	1.94	1.9	0.961
11	9	174	20	-16	6.28	1.54	1.38	0.644
12	3.5	181	20	-16	2.44	0.598	0.49	0.204
13	2.5	135	28	9	0.41	0.06	0.062	0.0028
14	8	140	28	9	2.4	0.308	0.352	0.0504
15	11.5	151	28	9	1.87	0.275	0.326	0.0562
16	11.5	163	28	9	1.87	0.275	0.326	0.0562
17	9	174	28	9	2.7	0.346	0.397	0.4185
18	3.5	181	28	9	1.05	0.134	0.144	0.0125
19	8	140	28	31	2.05	0.595	0.2798	0.477
20	11.5	151	28	31	2.23	0.362	0.1797	0.311
21	11.5	163	28	31	2.23	0.362	0.1797	0.311
22	9	174	28	31	2.81	0.8167	0.386	0.656
23	3.5	181	28	31	1.1	0.319	0.13	0.236
24	8	140	0	47.0	2.8	0.477	0.059	0.529
25	11.5	151	0	47.0	4.02	0.686	0.1206	0.796
26	11.5	163	0	47.0	4.02	0.686	0.1206	0.796
27	9	174	0	47.0	3.15	0.537	0.0675	0.596
28	3.5	181	0	47.0	1.23	0.21	0.0147	0.221
29	-	166	13	-1.7		Seat		
30	-	166	13	5.7		Cushion - Lower Torso		
31	-	166	13	20.89		Upper Torso		
32	-	166	13	20.89		DRI		

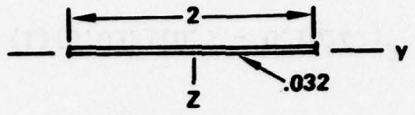
*Includes weight and inertia for occupant legs

BEAM PROPERTIES

LONGITUDINAL BEAM ASSEMBLY AREA PROPERTIES - MEMBERS 1-2, 2-3, 3-4, 4-5, 5-6

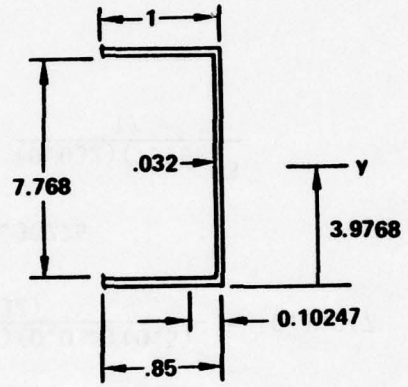




① 

$$I_y = \frac{(2)(0.032)^3}{12} = 5.4613 \times 10^{-6}$$

$$I_z = \frac{(0.032)(2)^3}{12} = 0.021333$$

② 

② $C_y = \dfrac{(0.85)(0.032)(0.016) + (7.768)(0.032)(3.916) + (0.032)(1)(7.816)}{(0.85)(0.032) + (7.768)(0.032) + (1)(0.032)} = 3.9768$

$C_z = \dfrac{(0.85)(0.032)(0.425) + (7.768)(0.032)(0.016) + (1)(0.032)(0.5)}{(0.85)(0.032) + (7.768)(0.032) + (1)(0.032)} = 0.10247$

$A = (0.85)(0.032) + (7.768)(0.032) + (1)(0.032) = 0.30776$

$I_y = \dfrac{(0.85)(0.032)^3}{12} + (0.85)(0.032)(3.9768 - 0.016)^2 + \dfrac{(0.032)(7.768)^3}{12}$

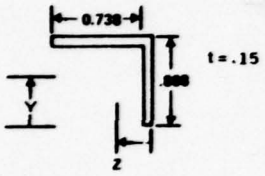
$+ (0.032)(7.768)(3.9768 - 3.916)^2 + \dfrac{(1)(0.032)^3}{12}$

$+ (1)(0.032)(7.816 - 3.9768)^2 = 2.14926$

$I_z = \dfrac{(0.032)(0.85)^3}{12} + (0.85)(0.032)(0.425 - 0.10247)^2 + \dfrac{(7.768)(0.032)^2}{12}$

$+ (0.032)(7.768)(0.1024) - 0.016)^2 + \dfrac{(0.032)(1)^3}{12} + (1)(0.032)(0.5 - 0.10247)^2 = 0.0140706$

③



$A = (0.888)(0.15) + (0.738)(0.15)$

$= 0.2439$

$C_y = \dfrac{(0.888)(0.15)(0.444) + (0.738)(0.15)(0.813)}{0.2439}$

$C_y = 0.61148$

$C_z = 0.27652$

$$I_y = \frac{(0.15)(0.855)^2}{12} + (0.888)(0.15)(0.61148 - 0.444)^2 + \frac{(0.738)(0.15)^3}{12} + (0.738)(0.15)(0.813 - 0.61148)^2$$

$$= 0.017192$$

$$I_z = \frac{(0.885)(0.15)^3}{12} + (0.888)(0.15)(0.27652 - 0.075)^2 + \frac{(0.15)(0.738)^3}{12} + (0.738)(0.15)(0.519 - 0.27652)^2$$

$$= 0.017192$$

Total

$$A_T = 0.064 + 0.307776 + 0.2439 = 0.615674$$

$$C_y = \frac{(0.064)(7.848) + (0.307776)(3.9768) + (0.2439)(7.52348)}{0.615674} = 5.78425$$

$$C_z = \frac{(0.064)(0) + (0.307776)(0.10247) + (0.2439)(0.30852)}{0.615674} = 0.27740$$

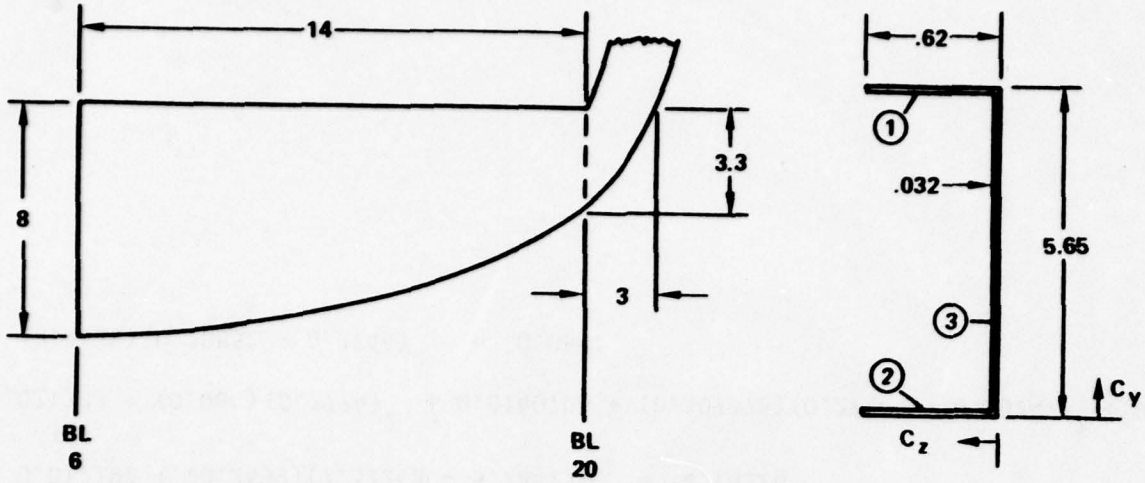
$$I_y = 5.4613 \times 10^{-6} + (0.064)(7.848 - 5.78425)^2 + 2.14926 + (0.307776)(5.78425 - 3.9768)^2$$

$$+ 0.017192 + (0.2439)(7.52348 - 5.78425)^2 = 4.18228$$

$$I_z = 0.021333 + (0.064)(0.2774)^2 + 0.0140706 + (0.307776)(0.2744 - 0.10247)^2 + 0.017192$$

$$+ (0.2439)(0.30852 - 0.2744)^2 = 0.0671$$

FUSELAGE STATION 135 - 181 - MEMBERS 1-7, 2-8, 3-9, 4-10, 5-11, 6-12



Average Section Height = $\frac{8 + 3.3}{2}$ = 5.65

Area = 2(0.62)(0.032) + (5.686)(0.032)
= 0.21843

① and ② A = 0.01984

C_y = 0.016

C_z = 0.31

$I_y = \frac{0.62(0.032)^3}{12} = 1.693 \times 10^{-6}$

$I_z = \frac{0.032(0.62)^3}{12} = 6.3554 \times 10^{-4}$

③ $A = (5.586)(0.032) = 0.17875$

$C_y = 2.793$

$C_z = 0.016$

$$I_y = \frac{0.032(5.586)^3}{12} = 0.46481$$

$$I_z = \frac{5.586(0.032)^3}{12} = 1.5254 \times 10^{-5}$$

Total Section

$A = 0.21843$

$$C_y = \frac{(0.01984)(5.634) + (0.01984)(0.016) + (0.17875)(2.825)}{0.21843} = 2.825$$

$$C_z = \frac{(2)(0.01984)(0.31) + (0.17875)(0.016)}{0.21843} = 0.06941$$

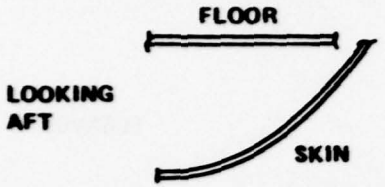
$$I_y = 1.693 \times 10^{-6} + (0.01984)(5.634 - 2.825)^2 + 0.46481 + (0.17875)(0) + 1.693 \times 10^{-6}$$

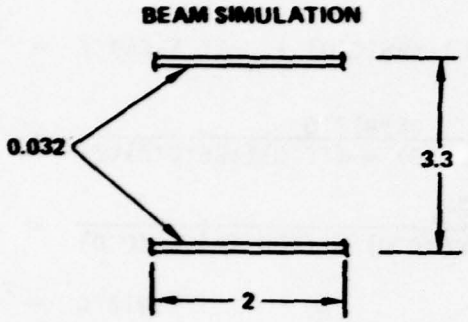
$$+ (0.01984)(2.825 - 0.016)^2 = 0.77791$$

$$I_z = (6.3554 \times 10^{-4})(2) + (2)(0.01984)(0.31 - 0.06941)^2 + 1.5254 \times 10^{-5} + (0.17875)(0.06941 - 0.016)^2$$

$$= 0.0040931$$

STRUCTURE BETWEEN RINGS - MEMBERS - 7-8, 8-9, 9-10, 10-11, 11-12





$$A = (2)(2)(0.032) = 0.128$$

$$C_y = 1.65$$

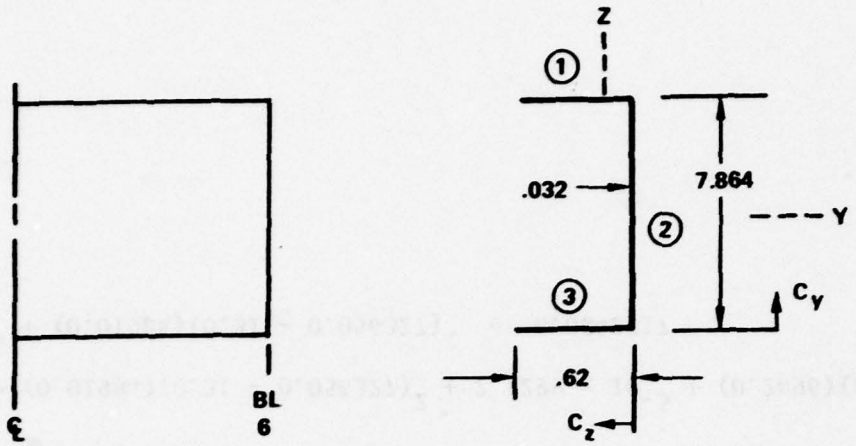
$$C_z = 1.0$$

$$I_y = 2\left[\frac{(2)(0.032)^3}{12} + (0.064)(1.634)^2\right]$$

$$= 0.34176$$

$$I_z = (2)\frac{(0.032)(2)^3}{12} = 0.042667$$

FUSELAGE STATION 135 - 181 - MEMBERS 1-0, 2-0, 3-0, 4-0, 5-0, 6-0



① , ③ $A = (0.62)(0.032) = 0.01984$

$C_y = 0.016$

$C_z = 0.31$

$$I_y = \frac{(0.62)(0.032)^3}{12} = 1.6930 \times 10^{-6}$$

$$I_z = \frac{(0.032)(0.62)^3}{12} = 6.3554 \times 10^{-4}$$

② $A = (7.8)(0.032) = 0.2496$

$C_y = 3.9$

$C_z = 0.016$

$$I_y = \frac{(0.032)(7.8)^3}{12} = 1.2655$$

$$I_z = \frac{(7.8)(0.032)^3}{12} = 2.1299 \times 10^5$$

Total

$$A = 2(0.01984) + 0.2496 = 0.28928$$

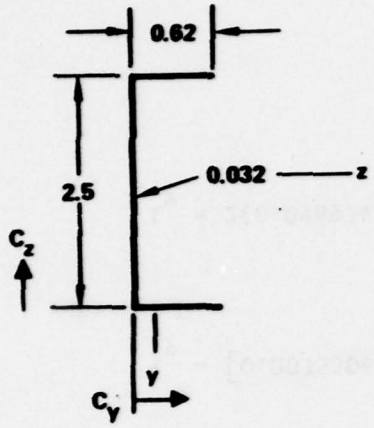
$$C_y = \frac{(0.01984)(0.016) + (0.2456)(3.932) + (0.01984)(7.848)}{0.28928} = 3.932$$

$$C_z = \frac{(2)(0.31)(0.01984) + (0.2496)(0.016)}{0.28928} = 0.056327$$

$$I_y = 1.6930 \times 10^{-6} + (0.01984)(3.932 - 0.016)^2 + 1.2655 + (0.2496)(3.932 - 3.932)^2$$
$$+ 1.6930 \times 10^{-6} + (0.01984)(7.848 - 3.932)^2 = 1.87400$$

$$I_z = 6.3554 \times 10^{-4} + (0.01984)(0.31 - 0.056327)^2 + 2.1299 \times 10^{-5} + (0.2496)(0.056327 - 0.016)^2$$
$$+ 6.3554 \times 10^{-4} + (0.01984)(0.31 - 0.056327)^2 = 0.0042517$$

BEAMS 7-13, 8-14, 9-15, 10-16, 12-18, 17-22, 18-23



$$A = 2\,(0.62)(0.032) + (2.5 - 0.064)(0.032) = 0.11763$$

$$C_z = 1.25$$

$$C_y = \frac{2(0.62)(0.032)(0.31) + (2.5 - 0.064)(0.032)(0.016)}{0.11763} = 0.11517$$

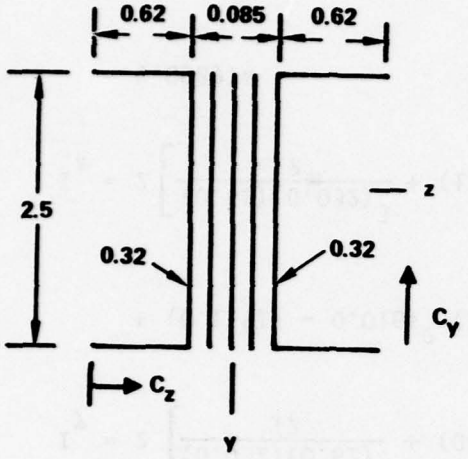
$$I_y = 2\left[\frac{(0.032)(0.62)^3}{12} + (0.31 - 0.11517)^2\,(0.62)(0.032)\right] + \frac{(2.5 - 0.064)(0.032)^3}{12}$$

$$+ (0.11517 - 0.016)^2\,(2.5 - 0.064)(0.032) = 0.0035506$$

$$I_z = 2\left[\frac{(0.62)(0.032)^3}{12} + (1.25 - 0.016)^2\,(0.62)(0.032)\right] + \frac{(0.032)(2.5 - 0.064)^3}{12}$$

$$= 0.098974$$

BEAM 11-17



$$A = 4(0.62)(0.032) + 2(2.5 - 0.064)(0.032) + (0.085)(2.5) = 0.44776$$

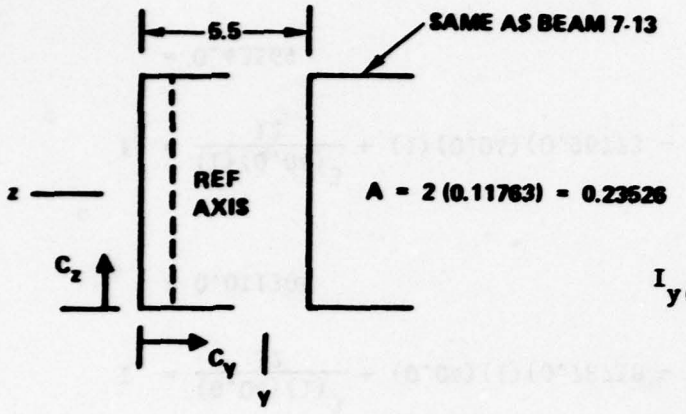
$$C_y = 1.25$$

$$C_z = 0.6625$$

$$I_y = \left[0.0035506 + (0.11517 + 0.0425)^2 \ (0.11763)\right] \ (2) + \frac{(2.5)(0.085)^3}{12} = 0.013077$$

$$I_z = 2(0.098974) + \frac{(0.085)(2.5)^3}{12} = 0.308625$$

BEAM 14-19



$$C_y = \frac{(0.11763)(0.11517) + (0.11763)(0.11517 + 5.5)}{0.23526}$$

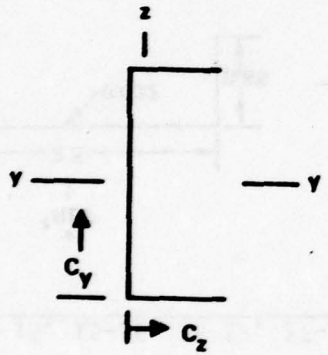
$$= 3.09396$$

$$C_z = 1.25$$

$$I_{y(\text{REF AXIS})} = (0.0035506)(2) + (0.11763)(5.5)^2 = 3.56541$$

$$I_z = 2(0.098974) = 0.197948$$

BEAMS 19-24, 20-25, 21-26, 22-27, 23-28 (See Beam 7-13)



$$A = 0.11763$$

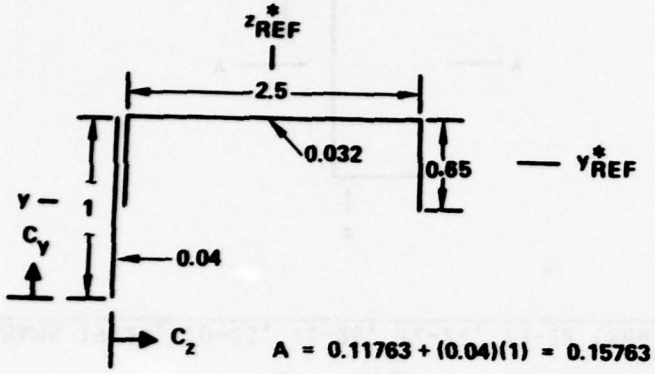
$$C_y = 1.25$$

$$C_z = 0.11517$$

$$I_y = 0.098974$$

$$I_z = 0.0035506$$

BEAMS 13-14, 14-15, 15-16, 16-17, 17-18



$A = 0.11763 + (0.04)(1) = 0.15763$

$^*z_{REF} = 1.25$, $y_{REF} = 0.11517$, FROM BEAM 7-13 DATA

$$C_y = \frac{(1)(0.04)(0.5) + (0.11763)(1 - 0.11517)}{0.11763 + 0.04} = 0.78718$$

$$C_z = \frac{(1)(0.04)(0.02) + (1.25 + 0.04)(0.11763)}{0.15763} = 0.96773$$

$$I_y = \frac{(0.04)(1)^3}{12} + (0.04)(1)(0.78718 - 0.5)^2 + 0.0035506 + (0.11763)(1 - 0.11517 - 0.78718)^2$$

$$= 0.011304$$

$$I_z = \frac{(1)(0.04)^3}{12} + (1)(0.04)(0.96773 - 0.02)^2 + 0.098974 + (0.11763)(2.54 - 0.96773)^2$$

$$= 0.42569$$

APPENDIX B
ANALYSIS COMPUTER PRINT

This section contains the KRASH program print showing the math model input data, model parameter data, mass position plots and selected output data. The math input data consists of the following:

- Echo print
- Program size and control data
- Initial conditions
- Mass, mode point, external spring, and beam data

The model parameter data provides the following:

- Vechicle weight, cg, inertia and initial ground impact position
- Beam loads, deflections, uncoupled frequences, damping terms and Euler angles.

The time-equal-zero data consists of the following:

- Mass accelerations
- Vehicle cg translational velocity
- Energy distribution
- Mass energy deviation

The mass position plots at time = 0.0 are presented for the following:

- xz plane (aft-up)
- yz plane (side-up)

The selected output data consists of the following:

- Rupture/yield summary
- Energy summary
- Position plots at time = 0.054
- History plots of:
  A mass filtered and unfiltered acceleration
  A beam force and deflection
  An external spring
  The DRI element
  The vehicle cg translational velocity

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

      1                SECTION DROP TEST SIMULATION                                 00000010
      2  MODEL NUMBER 3 (9-1-78)  PAN&CUSHION STIFF.PER DATA                        00000020
      3  12345678901234567890123456789012345678901234567890123456789012345678901200000030
      4     32   10   57   44    0    0    0    1    0    0    0    0    0   10100000040
      5                                                                           00000050
      6                                                                           00000060
      7         100 0.00001   0.054     0.0        85.0        0    6 1.0     0  00000070
      8                                                                           00000080
      9      0    0    0    0    0    0    0    6   10   50  100                 00000090
     10     19    0    7   21    0    5    1    5   18                           00000100
     11   0.0         0.0        330.0                                          00000110
     12   0.0         0.0        0.0                                            00000120
     13   0.0         0.0131     0.0        0.0       0.0       0.0             00000130
     14   1.37        135.0      6.0       -16.0      0.11830   0.08312   0.04999 00000140
     15   4.38        140.0      6.0       -16.0      0.37822   0.32811   0.22220 00000150
     16   16.30       151.0      6.0       -16.0      4.34400   4.40000   0.50000 00000160
     17    6.30       163.0      6.0       -16.0      0.54401   0.52910   0.37674 00000170
     18   4.93        174.0      6.0       -16.0      0.42571   0.37143   0.25227 00000180
     19   1.91        181.0      6.0       -16.0      0.16540   0.12610   0.08000 00000190
     20   1.75        135.0      20.0      -16.0      0.42750   0.33230   0.12772 00000200
     21    5.58       140.0      20.0      -16.0      1.35040   1.22150   0.77050 00000210
     22   18.02       151.0      20.0      -16.0      5.72000   5.68000   1.09100 00000220
     23    8.02       163.0      20.0      -16.0      1.94210   1.90233   0.96161 00000230
     24    6.28       174.0      20.0      -16.0      1.54000   1.38000   0.64403 00000240
     25   2.44        181.0      20.0      -16.0      0.59700   0.48990   0.20385 00000250
     26   0.41        135.0      28.0       9.0       0.05960   0.06130   0.00273 00000260
     27   2.40        140.0      28.0       9.0       0.30790   0.35180   0.05038 00000270
     28   1.87        151.0      28.0       9.0       0.27542   0.32660   0.05620 00000280
     29   1.87        163.0      28.0       9.0       0.27542   0.32660   0.05620 00000290
     30   2.70        174.0      28.0       9.0       0.34639   0.39696   0.41853 00000300
     31   1.05        181.0      28.0       9.0       0.13471   0.14440   0.01253 00000310
     32   2.05        140.0      28.0       31.0      0.59560   0.27920   0.47700 00000320
     33   2.23        151.0      28.0       31.0      0.36276   0.17970   0.31113 00000330
     34   2.23        163.0      28.0       31.0      0.36276   0.17970   0.31113 00000340
     35   2.81        174.0      28.0       31.0      0.81670   0.38600   0.65640 00000350
     36   1.10        181.0      28.0       31.0      0.31850   0.12960   0.23500 00000360
     37   2.80        140.0      0.0        47.0      0.47800   0.05880   0.52892 00000370
     38   4.02        151.0      0.0        47.0      0.68585   0.12084   0.79584 00000380
     39   4.02        163.0      0.0        47.0      0.68585   0.12084   0.79584 00000390
     40   3.15        174.0      0.0        47.0      0.53742   0.06704   0.59639 00000400
     41   1.23        181.0      0.0        47.0      0.20985   0.01467   0.22119 00000410
     42   20.5        166.0      13.0       -1.7      5.95      6.6062    3.152   00000420
     43   72.86       166.0      13.0       5.8       13.9511   14.7742   16.8341 00000430
     44   72.86       166.0      13.0       20.89     11.3116   10.7989   6.5318  00000440
     45   72.86       166.0      13.0       20.89     11.3116   10.7989   6.5318  00000450
     46      1   29  151.0      6.0       -1.7                                   00000460
     47      2   29  174.0      6.0       -1.7                                   00000470
     48      3   29  151.0      20.0      -1.7                                   00000480
     49      4   29  174.0      20.0      -1.7                                   00000490
     50      5   29  166.0      13.       -1.7                                   00000500
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                    1         2         3         4         5         6         7         8
CARD NO. 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890

      51      1  30 166.      13.       5.8                                                 00000510
      52      2   3 8.0       0.0       50000.0                                             00000520
      53      3   3 8.0       0.0       50000.0                                             00000530
      54      4   3 8.0       0.0       50000.0                                             00000540
      55      5   3 8.0       0.0       50000.0                                             00000550
      56      6   3 8.0       0.0       50000.0                                             00000560
      57      8   3 3.3       0.0       20000.0                                             00000570
      58      9   3 3.3       0.0       20000.0                                             00000580
      59     10   3 3.3       0.0       20000.0                                             00000590
      60     11   3 3.3       0.0       20000.0                                             00000600
      61     12   3 3.3       0.0       20000.0                                             00000610
      62  0.100     0.700     1.000     2.5       2290.0    2290.0                        00000620
      63  0.100     0.700     1.000     2.5       2650.0    2650.0                        00000630
      64  0.100     0.700     1.000     2.5       2650.0    2650.0                        00000640
      65  0.100     0.700     1.000     2.5       2410.0    2410.0                        00000650
      66  0.100     0.700     1.000     2.5       1760.0    1760.0                        00000660
      67  0.045     0.055     0.15      1.1       1380.     1380.                         00000670
      68  0.045     0.055     0.15      1.1       1380.     1380.                         00000680
      69  0.045     0.055     0.15      1.1       1380.     1380.                         00000690
      70  0.045     0.055     0.15      1.1       1380.     1380.                         00000700
      71  0.045     0.055     0.15      1.1       1380.     1380.                         00000710
      72      1   2 0.615674            4.18228   0.060521                5.78 .667 1.0   400000720
      73      2   3 0.615674            4.18228   0.060521                5.78 .667 1.0   400000730
      74      3   4 0.615674            4.18228   0.060521                5.78 .667 1.0   400000740
      75      4   5 0.615674            4.18228   0.060521                5.78 .667 1.0   400000750
      76      5   6 0.615674            4.18228   0.060521                5.78 .667 1.0   400000760
      77      7   8 0.128               0.34176   0.042667                1.65 1.0  1.0   400000770
      78      8   9 0.128               0.34176   0.042667                1.65 1.0  1.0   400000780
      79      9  10 0.128               0.34176   0.042667                1.65 1.0  1.0   400000790
      80     10  11 0.128               0.34176   0.042667                1.65 1.0  1.0   400000800
      81     11  12 0.128               0.34176   0.042667                1.65 1.0  1.0   400000810
      82      1   0 0.28928             1.874     0.0042517               3.93 .564 1.0   400000820
      83      2   0 0.28928             1.874     0.0042517               3.93 .564 1.0   400000830
      84      3   0 0.28928             1.874     0.0042517               3.93 .564 1.0   400000840
      85      4   0 0.28928             1.874     0.0042517               3.93 .564 1.0   400000850
      86      5   0 0.28928             1.874     0.0042517               3.93 .564 1.0   400000860
      87      6   0 0.28928             1.874     0.0042517               3.93 .564 1.0   400000870
      88      1   7 0.21843             0.77791   0.0040931               2.82 .550 1.0   400000880
      89      2   8 0.21843             0.77791   0.0040931               2.82 .550 1.0   400000890
      90      3   9 0.21843             0.77791   0.0040931               2.82 .550 1.0   400000900
      91      4  10 0.21843             0.77791   0.0040931               2.82 .550 1.0   400000910
      92      5  11 0.21843             0.77791   0.0040931               2.82 .550 1.0   400000920
      93      6  12 0.21843             0.77791   0.0040931               2.82 .550 1.0   400000930
      94      7  13 0.11763             0.003551  0.098974                .115 1.25 1.0   400000940
      95      8  14 0.11763             0.003551  0.098974                .115 1.25 1.0   400000950
      96      9  15 0.11763             0.003551  0.098974                .115 1.25 1.0   400000960
      97     10  16 0.11763             0.003551  0.098974                .115 1.25 1.0   400000970
      98     11  17 0.44776             0.013077  0.308625                .663 1.25 1.0   400000980
      99     12  18 0.11763             0.003551  0.098974                .115 1.25 1.0   400000990
     100     17  22 0.11763             0.003551  0.098974                .115 1.25 1.0   400001000
     101     18  23 0.11763             0.003451  0.098974                .115 1.25 1.0   400001010
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                    1         2         3         4         5         6         7         8
CARD NO. 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890

   102     14   19 0.23526              3.565410  0.197948            3.09 1.25 400001020
   103     19   24 0.11763              0.098974  0.003551            1.25 .115 400001030
   104     20   25 0.11763              0.098974  0.003551            1.25 .115 400001040
   105     21   26 0.11763              0.098974  0.003551            1.25 .115 400001050
   106     22   27 0.11763              0.098974  0.003551            1.25 .115 400001060
   107     23   28 0.11763              0.098974  0.003551            1.25 .115 400001070
   108     13   14 0.15763              0.011304  0.425691            .787 .968 400001080
   109     14   15 0.15763              0.011304  0.425691            .787 .968 400001090
   110     15   16 0.15763              0.011304  0.425691            .787 .968 400001100
   111     16   17 0.15763              0.011304  0.425691            .787 .968 400001110
   112     17   18 0.15763              0.011304  0.425691            .787 .968 400001120
   113     19   25 0.33012              3.798130  17.74063                      400001130
   114     20   25 0.33012              3.798130  17.74063                      400001140
   115     21   25 0.33012              3.798130  17.74063                      400001150
   116     22   25 0.33012              3.798130  17.74063                      400001160
   117      3 1 29 0.188                0.18000   0.54000             0.06 0.06 600001170
   118      5 2 29 0.188                0.18000   0.54000             0.06 0.06 600001180
   119      9 3 29 0.188                0.18000   0.54000             0.06 0.06 600001190
   120     11 4 29 0.188                0.18000   0.54000             0.06 0.06 600001200
   121     30   31 0.02000              0.0075    0.0075                        400001210
   122     30   32 0.009504             0.0048    0.0048                       1000001220
   123      5   30 0.0021571                                                    400001230
   124     11   30 0.0021571                                                    400001240
   125     29   30 0.000381                                                     400001250
   126  5 29 1 30 0.001170                                                     400001260
   127     14    0 0.11045                                                    100001270
   128     18    0 0.11045                                                    100001280
   129      5   30    1                                                        00001290
   130     11   30    1                                                        00001300
   131     29   30   -1                                                        00001310
   132  5 29 1 30   -1      0.00                                               00001320
   133     14    0    1                                                       00001330
   134     18    0    1                                                       00001340
   135   0.04                                                                 00001350
   136     30   31   .41                                                      00001360
   137     29   30    1    8 0.75                                             00001370
   138  5 29 1 30    1   10 0.0                                              00001380
   139     14   19    1    5  .082                                           00001390
   140     14   19    2    5  .48                                            00001391
   141     14   19    3    5  .194                                           00001400
   142     17   22    1    5  .054                                           00001410
   143     17   22    2    5  .48                                            00001411
   144     17   22    3    5 5.2                                             00001420
   145     18   23    1    5  .054                                           00001430
   146     18   23    2    5  .48                                            00001431
   147     18   23    3    5 5.2                                             00001440
   148     19   24    1    5  .037                                           00001450
   149     19   24    2    5 1.03                                            00001451
   150     19   24    3    5 1.03                                            00001460
   151     20   25    1    5  .037                                           00001470
   152     20   25    2    5 1.03                                            00001471
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                    1         2         3         4         5         6         7         8
CARD NO. 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890

     153    20   25    3    5 1.03                                                        00001480
     154    21   26    1    5  .037                                                      00001490
     155    21   26    2    5 1.03                                                      00001491
     156    21   26    3    5 1.030                                                     00001500
     157    22   27    1    5  .037                                                     00001510
     158    22   27    2    5 1.03                                                      00001511
     159    22   27    3    5 1.03                                                      00001520
     160    23   28    1    5  .037                                                     00001530
     161    23   28    2    5 1.03                                                      00001531
     162    23   28    3    5 1.03                                                      00001540
     163     7   13    1    5  .045                                                     00001550
     164     7   13    2    5 .682                                                      00001551
     165     7   13    3    5 1.287                                                     00001560
     166     8   14    1    5  .045                                                     00001570
     167     8   14    2    5  .682                                                     00001571
     168     8   14    3    5 1.287                                                     00001580
     169     9   15    1    5  .045                                                     00001590
     170     9   15    2    5  .682                                                     00001591
     171     9   15    3    5 1.287                                                     00001600
     172    10   16    1    5  .045                                                     00001610
     173    10   16    2    5  .682                                                     00001611
     174    10   16    3    5 1.287                                                     00001620
     175    11   17    1    5  .045                                                     00001630
     176    11   17    2    5  .682                                                     00001631
     177    11   17    3    5 1.287                                                     00001640
     178    12   18    1    5  .045                                                     00001650
     179    12   18    2    5  .682                                                     00001651
     180    12   18    3    5 1.287                                                     00001660
     181    0.       .003                                                             00001661
     182     .75     .003                                                             00001662
     183     .751   1.                                                                00001663
     184    3.5     1.                                                                00001664
     185    3.51    0.                                                                00001665
     186    4.      0.                                                                00001666
     187    5.      0.                                                                00001667
     188    6.      0.                                                                00001668
     189    7.      0.                                                                00001669
     190    20.     0.                                                                00001670
     191    30   32                                                                   00001675
     192     2    6    3       5.0       10.0                                        00001680
     193     2    6    6   24   25   26                                              00001690
     194     2    6    3       5.0       5.0                                         00001700
     195     8   10   12   14   16   18                                              00001710
     196     3    5    3       5.        10.                                         00001720
     197     4   10   16   21   26                                                   00001730
     198     2    5    3       5.0       10.0                                        00001740
     199     3    5   29   30   31                                                   00001750
     200     2    5    3       5.0       10.0                                        00001760
     201     9   12   29   30   31                                                   00001770
     202     2    0    0    0    0    0    1    1    0                              00001780
     203     3    0    0    0    0    0    1    1    0                              00001790
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                    1         2         3         4         5         6         7         8
CARD NO. 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890

  204      5   0   0   0   0   0   1   1   0                                       00001800
  205      9   0   0   0   0   0   1   1   0                                       00001810
  206     10   0   0   0   0   0   1   1   0                                       00001820
  207     11   0   0   0   0   0   1   1   0                                       00001830
  208     14   1                                                                   00001840
  209     19   1                                                                   00001850
  210     21   1                                                                   00001860
  211     15   1                                                                   00001870
  212     20   1                                                                   00001880
  213     25   1                                                                   00001890
  214     17   1                                                                   00001900
  215     22   1                                                                   00001910
  216     27   1                                                                   00001920
  217     29   1   0   0   0   0   1   1   0                                       00001930
  218     30   1   0   0   0   0   1   1   0                                       00001940
  219     31   1   0   0   0   0   1   1   0                                       00001950
  220     32   1   0   0   0   0   1   1   0                                       00001960
  221     46   1   1   1                                                           00001970
  222     49   1   1   1                                                           00001980
  223     50   1   1   1                                                           00001990
  224     54   1   1   1                                                           00002000
  225     55   1   1   1                                                           00002010
  226     56   1                                                                   00002011
  227     57   1                                                                   00002012
  228     46   1   1   1                                                           00002020
  229     49   1   1   1                                                           00002030
  230     50   1   1   1                                                           00002040
  231     54   1   1   1                                                           00002050
  232     55   1   1   1                                                           00002060
  233     56   1                                                                   00002061
  234     57   1                                                                   00002062
  235     23   1                                                                   00002070
  236     24   1                                                                   00002080
  237     25   1                                                                   00002090
  238     26   1                                                                   00002100
  239     27   1                                                                   00002110
  240     28   1                                                                   00002120
  241     29   1                                                                   00002130
  242     30   1                                                                   00002140
  243     31   1                                                                   00002150
  244     32   1                                                                   00002160
  245     33   1                                                                   00002170
  246     34   1                                                                   00002180
  247     35   1                                                                   00002190
  248     36   1                                                                   00002200
  249      2   0   1   1                                                           00002210
  250      3   0   1   1                                                           00002220
  251      4   0   1   1                                                           00002230
  252      5   0   1   1                                                           00002240
  253      6   0   1   1                                                           00002250
  254     32                                                                       00002260
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                1         2         3         4         5         6         7         8
[illegible] 12345678901234567890123456789012345678901234567890123456789012345678901234567890
[illegible] END                                                                    00002270
```

NASA ** NAVAJO SECTION DROP TEST SIMULATION
MODEL NUMBER 3 (9-1-78) PAN&CUSHION STIFF.PER DATA

PROGRAM SIZE AND CONTROL DATA

PROGRAM SIZE DATA

NUMBER OF:

MASSES	SPRINGS	BEAMS	KR TABLES	NON-ZERO HE OR IXY	MASS PENETR.	VOLUME CHANGE	DRI ELEMENTS	MTL TYPES	ACCEL. TABLES	NON-STANDARD MAX. DEFL.	NON-STANDARD MAX. FORCE	NON-ZERO PHI''	NON-STANDARD DAMPING	STIFFNESS MATRICES	NO. NODE PTS.
NM	NSP	NB	NLB	NHI	MVP	NVCH	NDRI	NMTL	NACC	NVBM	NFBM	NPH	ND	NKM	NNP
32	10	57	44	0	0	0	1	0	0	0	0	0	1	0	6

NSC= 0 NIC= 1 !!TOL1= 10% NTOL2= 50% NTOL3= 100%

PROGRAM DATA MANAGEMENT CONTROL DATA

RESTART: TITLE -
CASE - 1
TIME - 0

SAVE: TITLE -
CASE - 0
TIMES - 0 0 0 0 0

VARIABLE INTEGRATION CONTROL DATA

VAR. INT. FLAG = 0 EL = 0.0 EU = 0.0 LOWER RATIO = 0.0 UPPER RATIO = 0.0

PROGRAM CONTROL DATA

PRINT INTERVAL/ INTEGRATION INTERVAL	INTEGRATION INTERVAL	MAX. TIME	PLOW FORCE STARTING TIME	FILTER CUTOFF FREQUENCY	CASE TYPE INDICATOR
DP/DT	DT	TMAX	PLOWT	FCUT	RUNMOD
100	0.000010	0.054000	0.0	85.000	1.000

TIME HISTORY PRINT CONTROL CARDS

STRAIN FORCES	TOTAL FORCES	BEAM DEFLECTIONS	EXT.SPRING DATA	ENERGY DATA	STRESS DATA	ACCEL DATA
0	0	0	0	0	0	0

NO.OF MASS POSITION PLOTS EACH TIME= 5 PLOT PRINT FACTOR = 18

PLANE I.D.	NO. OF POINTS
2	6
2	6
3	5
2	5
2	5

VEHICLE INITIAL CONDITIONS

VEHICLE TRANSLATIONAL VELOCITIES IN GROUND AXES (IN/SEC)
VEHICLE ROTATIONAL VELOCITIES IN VEHICLE AXES (RAD/SEC)
EULER ANGLES OF VEHICLE RELATIVE TO GROUND (RADIANS)

XGDOT P' PHI'	YGDOT Q' THETA'	ZGDOT R' PSI'
0.0	0.0	3.300000 02
0.0	0.0	0.0
0.0	1.310000-02	0.0

GENERALIZED SURFACE DATA

BETA = 0.0 DEGREES
XGIN = 0.0
ZGIN = 0.0

MASS DATA

MASS AND BEAM DATA

I	WEIGHTS W	MASS COORDINATES F.S.,B.L.,W.L. X''	 Y''	 Z''	MASS MOMENTS OF INERTIA (LB-IN-SEC**2) IX	 IY	 IZ	I
1	1.370000 00	1.350000 02	6.000000 00	-1.600000 01	1.183000-01	8.312000-02	4.999000-02	1
2	4.380000 00	1.400000 02	6.000000 00	-1.600000 01	3.782200-01	3.281100-01	2.222000-01	2
3	1.630000 01	1.510000 02	6.000000 00	-1.600000 01	4.344000 00	4.400000 00	5.000000-01	3
4	6.300000 00	1.630000 02	6.000000 00	-1.600000 01	5.440100-01	5.291000-01	3.767400-01	4
5	4.930000 00	1.740000 02	6.000000 00	-1.600000 01	4.257100-01	3.714300-01	2.522700-01	5
6	1.910000 00	1.810000 02	6.000000 00	-1.600000 01	1.654000-01	1.261000-01	8.000000-02	6
7	1.750000 00	1.350000 02	2.000000 01	-1.600000 01	4.275000-01	3.323000-01	1.277200-01	7
8	5.580000 00	1.400000 02	2.000000 01	-1.600000 01	1.350400 00	1.221500 00	7.705000-01	8
9	1.802000 01	1.510000 02	2.000000 01	-1.600000 01	5.720000 00	5.680000 00	1.091000 00	9
10	8.028000 00	1.630000 02	2.000000 01	-1.600000 01	1.942100 00	1.902330 00	9.616100-01	10
11	6.280000 00	1.740000 02	2.000000 01	-1.600000 01	1.540000 00	1.380000 00	6.440300-01	11
12	2.440000 00	1.810000 02	2.000000 01	-1.600000 01	5.970000-01	4.899000-01	2.038500-01	12
13	4.100000-01	1.350000 02	2.800000 01	9.000000 00	5.960000-02	6.130000-02	2.730000-03	13
14	2.400000 00	1.400000 02	2.800000 01	9.000000 00	3.079000-01	3.518000-01	5.038000-02	14
15	1.870000 00	1.510000 02	2.800000 01	9.000000 00	2.754200-01	3.266000-01	5.620000-02	15
16	1.870000 00	1.630000 02	2.800000 01	9.000000 00	2.754200-01	3.266000-01	5.620000-02	16
17	2.700000 00	1.740000 02	2.800000 01	9.000000 00	3.463900-01	3.969600-01	4.185300-01	17
18	1.050000 00	1.810000 02	2.800000 01	9.000000 00	1.347100-01	1.444000-01	1.253000-02	18
19	2.050000 00	1.400000 02	2.800000 01	3.100000 01	5.956000-01	2.792000-01	4.770000-01	19
20	2.230000 00	1.510000 02	2.800000 01	3.100000 01	3.627600-01	1.797000-01	3.111300-01	20
21	2.230000 00	1.630000 02	2.800000 01	3.100000 01	3.627600-01	1.797000-01	3.111300-01	21
22	2.810000 00	1.740000 02	2.800000 01	3.100000 01	8.167000-01	3.860000-01	6.564000-01	22
23	1.100000 00	1.810000 02	2.800000 01	3.100000 01	3.165000-01	1.296000-01	2.350000-01	23
24	2.800000 00	1.400000 02	0.0	4.700000 01	4.780000-01	5.880000-02	5.289200-01	24
25	4.020000 00	1.510000 02	0.0	4.700000 01	6.858500-01	1.208400-01	7.958400-01	25
26	4.020000 00	1.630000 02	0.0	4.700000 01	6.858500-01	1.208400-01	7.958400-01	26
27	3.150000 00	1.740000 02	0.0	4.700000 01	5.374200-01	6.704000-02	5.963900-01	27
28	1.230000 00	1.810000 02	0.0	4.700000 01	2.098500-01	1.467000-02	2.211900-01	28
29	2.050000 01	1.660000 02	1.300000 01	-1.700000 00	5.950000 00	6.606200 00	3.152000 00	29
30	7.296000 01	1.660000 02	1.300000 01	5.800000 00	1.395110 01	1.477420 01	1.683410 01	30
31	7.286000 01	1.660000 02	1.300000 01	2.089000 01	1.131160 01	1.079890 01	6.531800 00	31
32	7.286000 01	1.660000 02	1.300000 01	2.089000 01	1.131160 01	1.079890 01	6.531800 00	32

NODE POINT DATA

MASS I	N.P. M	NODE POINT COORDINATES F.S.,B.L.,W.L. X''	Y''	Z''
29	1	1.51000D 02	6.00000D 00	-1.70000D 00
29	2	1.74000D 02	6.00000D 00	-1.70000D 00
29	3	1.51000D 02	2.00000D 01	-1.70000D 00
29	4	1.74000D 02	2.00000D 01	-1.70000D 00
29	5	1.66000D 02	1.30000D 01	-1.70000D 00
30	1	1.66000D 02	1.30000D 01	5.80000D 00

EXTERNAL SPRING DATA

SPRING I	K	M	FREE LENGTH LBAR(IKM)	FRICTION COEFFICIENT MU(IKM)	BOTTOMING SPRING KE(IKM)	PLOWING FORCE FORCE(IKM)	GROUND FLEXIBILITY GFLEX(IKM)
2	3	0	8.00000D 00	0.0	5.00000D 04	0.0	0.0
3	3	0	8.00000D 00	0.0	5.00000D 04	0.0	0.0
4	3	0	8.00000D 00	0.0	5.00000D 04	0.0	0.0
5	3	0	8.00000D 00	0.0	5.00000D 04	0.0	0.0
6	3	0	8.00000D 00	0.0	5.00000D 04	0.0	0.0
8	3	0	3.30000D 00	0.0	2.00000D 04	0.0	0.0
9	3	0	3.30000D 00	0.0	2.00000D 04	0.0	0.0
10	3	0	3.30000D 00	0.0	2.00000D 04	0.0	0.0
11	3	0	3.30000D 00	0.0	2.00000D 04	0.0	0.0
12	3	0	3.30000D 00	0.0	2.00000D 04	0.0	0.0

SPRING			DEFLECTION COORDINATES			SPRING AXIAL FORCES		
I	K	M	SI(IKM)	SA(IKM)	SB(IKM)	SF(IKM)	FSPOI(IKM)	FSPOF(IKM)
2	3	0	1.00000D-01	7.00000D-01	1.00000D 00	2.50000D 00	2.29000D 03	2.29000D 03
3	3	0	1.00000D-01	7.00000D-01	1.00000D 00	2.50000D 00	2.65000D 03	2.65000D 03
4	3	0	1.00000D-01	7.00000D-01	1.00000D 00	2.50000D 00	2.65000D 03	2.65000D 03
5	3	0	1.00000D-01	7.00000D-01	1.00000D 00	2.50000D 00	2.41000D 03	2.41000D 03
6	3	0	1.00000D-01	7.00000D-01	1.00000D 00	2.50000D 00	1.76000D 03	1.76000D 03
8	3	0	4.50000D-02	5.50000D-02	1.50000D-01	1.10000D 00	1.38000D 03	1.38000D 03
9	3	0	4.50000D-02	5.50000D-02	1.50000D-01	1.10000D 00	1.38000D 03	1.38000D 03
10	3	0	4.50000D-02	5.50000D-02	1.50000D-01	1.10000D 00	1.38000D 03	1.38000D 03
11	3	0	4.50000D-02	5.50000D-02	1.50000D-01	1.10000D 00	1.38000D 03	1.38000D 03
12	3	0	4.50000D-02	5.50000D-02	1.50000D-01	1.10000D 00	1.38000D 03	1.38000D 03

MATERIAL PROPERTIES

MATERIAL NO.	MODULUS OF ELASTICITY	MODULUS OF RIGIDITY	TENSION STRESS	COMPRESS. STRESS	SHEAR STRESS
1	3.0000D 07	1.1000D 07	75000.	75000.	37500.
2	3.0000D 07	1.1000D 07	205000.	205000.	80000.
3	2.8000D 07	1.2500D 07	70000.	46000.	36000.
4	1.0500D 07	4.0000D 06	47000.	39000.	22000.
5	1.0000D 07	3.8000D 06	35000.	34000.	17000.
6	1.0000D 07	3.8000D 06	16000.	16000.	17000.
7	1.0000D 06	3.0000D 05	16000.	16000.	17000.
8	1.0000D 06	0.0	16000.	16000.	17000.
9	1.0000D 06	3.0000D 05	16000.	16000.	17000.

10 1.0000D 06 3.0000D 05 16000. 16000. 17000.

INTERNAL BEAM DATA

BEAM					AREA	MOMENTS OF INERTIA			DISTANCES FROM NEUTRAL AXIS TO EXTREME FIBRES ZBIJ AXIS		YBIJ AXIS TORSION PARAMETER	LENGTH	DAMPING RATIO	MTL	P-CODES				BEAM			
															Y	Z	Y	Z				
IJ	I	J	M	N	A	IYY	IZZ	JX	Z1	Z2	XIQ	XLB	CBAR	MC	I	I	J	J	IJ	I	J	M	N
1	1	2	0	0	6.157D-01	4.182D 00	6.052D-02	4.243D 00	5.780D 00	6.670D-01	0.0	5.000D 00	4.000D-02	4	0	0	0	0	1	1	2	0	0
2	2	3	0	0	6.157D-01	4.182D 00	6.052D-02	4.243D 00	5.780D 00	6.670D-01	0.0	1.100D 01	4.000D-02	4	0	0	0	0	2	2	3	0	0
3	3	4	0	0	6.157D-01	4.182D 00	6.052D-02	4.243D 00	5.780D 00	6.670D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	3	3	4	0	0
4	4	5	0	0	6.157D-01	4.182D 00	6.052D-02	4.243D 00	5.780D 00	6.670D-01	0.0	1.100D 01	4.000D-02	4	0	0	0	0	4	4	5	0	0
5	5	6	0	0	6.157D-01	4.182D 00	6.052D-02	4.243D 00	5.780D 00	6.670D-01	0.0	7.000D 00	4.000D-02	4	0	0	0	0	5	5	6	0	0
6	7	8	0	0	1.280D-01	3.418D-01	4.267D-02	3.844D-01	1.650D 00	1.000D 00	0.0	5.000D 00	4.000D-02	4	0	0	0	0	6	7	8	0	0
7	8	9	0	0	1.280D-01	3.418D-01	4.267D-02	3.844D-01	1.650D 00	1.000D 00	0.0	1.100D 01	4.000D-02	4	0	0	0	0	7	8	9	0	0
8	9	10	0	0	1.280D-01	3.418D-01	4.267D-02	3.844D-01	1.650D 00	1.000D 00	0.0	1.200D 01	4.000D-02	4	0	0	0	0	8	9	10	0	0
9	10	11	0	0	1.280D-01	3.418D-01	4.267D-02	3.844D-01	1.650D 00	1.000D 00	0.0	1.100D 01	4.000D-02	4	0	0	0	0	9	10	11	0	0
10	11	12	0	0	1.280D-01	3.418D-01	4.267D-02	3.844D-01	1.650D 00	1.000D 00	0.0	7.000D 00	4.000D-02	4	0	0	0	0	10	11	12	0	0
11	1	0	0	0	2.893D-01	1.874D 00	4.252D-03	1.878D 00	3.930D 00	5.640D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	11	1	0	0	0
12	2	0	0	0	2.893D-01	1.874D 00	4.252D-03	1.878D 00	3.930D 00	5.640D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	12	2	0	0	0
13	3	0	0	0	2.893D-01	1.874D 00	4.252D-03	1.878D 00	3.930D 00	5.640D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	13	3	0	0	0
14	4	0	0	0	2.893D-01	1.874D 00	4.252D-03	1.878D 00	3.930D 00	5.640D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	14	4	0	0	0
15	5	0	0	0	2.893D-01	1.874D 00	4.252D-03	1.878D 00	3.930D 00	5.640D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	15	5	0	0	0
16	6	0	0	0	2.893D-01	1.874D 00	4.252D-03	1.878D 00	3.930D 00	5.640D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	16	6	0	0	0
17	1	7	0	0	2.184D-01	7.779D-01	4.093D-03	7.820D-01	2.820D 00	5.500D-01	0.0	1.400D 01	4.000D-02	4	0	0	0	0	17	1	7	0	0
18	2	8	0	0	2.184D-01	7.779D-01	4.093D-03	7.820D-01	2.820D 00	5.500D-01	0.0	1.400D 01	4.000D-02	4	0	0	0	0	18	2	8	0	0
19	3	9	0	0	2.184D-01	7.779D-01	4.093D-03	7.820D-01	2.820D 00	5.500D-01	0.0	1.400D 01	4.000D-02	4	0	0	0	0	19	3	9	0	0
20	4	10	0	0	2.184D-01	7.779D-01	4.093D-03	7.820D-01	2.820D 00	5.500D-01	0.0	1.400D 01	4.000D-02	4	0	0	0	0	20	4	10	0	0
21	5	11	0	0	2.184D-01	7.779D-01	4.093D-03	7.820D-01	2.820D 00	5.500D-01	0.0	1.400D 01	4.000D-02	4	0	0	0	0	21	5	11	0	0
22	6	12	0	0	2.184D-01	7.779D-01	4.093D-03	7.820D-01	2.820D 00	5.500D-01	0.0	1.400D 01	4.000D-02	4	0	0	0	0	22	6	12	0	0
23	7	13	0	0	1.176D 01	3.551D-03	9.897D-02	1.025D-01	1.150D-01	1.250D 00	0.0	2.625D 01	4.000D-02	4	0	0	0	0	23	7	13	0	0
24	8	14	0	0	1.176D-01	3.551D-03	9.897D-02	1.025D-01	1.150D-01	1.250D 00	0.0	2.625D 01	4.000D-02	4	0	0	0	0	24	8	14	0	0
25	9	15	0	0	1.176D-01	3.551D-03	9.897D-02	1.025D-01	1.150D-01	1.250D 00	0.0	2.625D 01	4.000D-02	4	0	0	0	0	25	9	15	0	0
26	10	16	0	0	1.176D-01	3.551D-03	9.897D-02	1.025D-01	1.150D-01	1.250D 00	0.0	2.625D 01	4.000D-02	4	0	0	0	0	26	10	16	0	0
27	11	17	0	0	4.478D-01	1.308D-02	3.086D-01	3.217D-01	6.630D-01	1.250D 00	0.0	2.625D 01	4.000D-02	4	0	0	0	0	27	11	17	0	0
28	12	18	0	0	1.176D-01	3.551D-03	9.897D-02	1.025D-01	1.150D-01	1.250D 00	0.0	2.625D 01	4.000D-02	4	0	0	0	0	28	12	18	0	0
29	17	22	0	0	1.176D-01	3.551D-03	9.897D-02	1.025D-01	1.150D-01	1.250D 00	0.0	2.200D 01	4.000D-02	4	0	0	0	0	29	17	22	0	0
30	18	23	0	0	1.176D-01	3.551D-03	9.897D-02	1.025D-01	1.150D-01	1.250D 00	0.0	2.200D 01	4.000D-02	4	0	0	0	0	30	18	23	0	0
31	14	19	0	0	2.353D-01	3.565D 00	1.979D-01	3.763D 00	3.090D 00	1.250D 00	0.0	2.200D 01	4.000D-02	4	0	0	0	0	31	14	19	0	0
32	19	24	0	0	1.176D-01	9.897D-02	3.551D-03	1.025D-01	1.250D 00	1.150D-01	0.0	3.225D 01	4.000D-02	4	0	0	0	0	32	19	24	0	0
33	20	25	0	0	1.176D-01	9.897D-02	3.551D-03	1.025D-01	1.250D 00	1.150D-01	0.0	3.225D 01	4.000D-02	4	0	0	0	0	33	20	25	0	0
34	21	26	0	0	1.176D-01	9.897D-02	3.551D-03	1.025D-01	1.250D 00	1.150D-01	0.0	3.225D 01	4.000D-02	4	0	0	0	0	34	21	26	0	0
35	22	27	0	0	1.176D-01	9.897D-02	3.551D-03	1.025D-01	1.250D 00	1.150D-01	0.0	3.225D 01	4.000D-02	4	0	0	0	0	35	22	27	0	0
36	23	28	0	0	1.176D-01	9.897D-02	3.551D-03	1.025D-01	1.250D 00	1.150D-01	0.0	3.225D 01	4.000D-02	4	0	0	0	0	36	23	28	0	0
37	13	14	0	0	1.576D-01	1.130D-02	4.257D-01	4.370D-01	7.870D-01	9.680D-01	0.0	5.000D 00	4.000D-02	4	0	0	0	0	37	13	14	0	0
38	14	15	0	0	1.576D-01	1.130D-02	4.257D-01	4.370D-01	7.870D-01	9.680D-01	0.0	1.100D 01	4.000D-02	4	0	0	0	0	38	14	15	0	0
39	15	16	0	0	1.576D-01	1.130D-02	4.257D-01	4.370D-01	7.870D-01	9.680D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	39	15	16	0	0
40	16	17	0	0	1.576D-01	1.130D-02	4.257D-01	4.370D-01	7.870D-01	9.680D-01	0.0	1.100D 01	4.000D-02	4	0	0	0	0	40	16	17	0	0
41	17	18	0	0	1.576D-01	1.130D-02	4.257D-01	4.370D-01	7.870D-01	9.680D-01	0.0	7.000D 00	4.000D-02	4	0	0	0	0	41	17	18	0	0
42	19	20	0	0	3.301D-01	3.798D 00	1.774D 01	2.154D 01	0.0	0.0	0.0	1.100D 01	4.000D-02	4	0	0	0	0	42	19	20	0	0
43	20	21	0	0	3.301D-01	3.798D 00	1.774D 01	2.154D 01	0.0	0.0	0.0	1.200D 01	4.000D-02	4	0	0	0	0	43	20	21	0	0
44	21	22	0	0	3.301D-01	3.798D 00	1.774D 01	2.154D 01	0.0	0.0	0.0	1.100D 01	4.000D-02	4	0	0	0	0	44	21	22	0	0
45	22	23	0	0	3.301D-01	3.798D 00	1.774D 01	2.154D 01	0.0	0.0	0.0	7.000D 00	4.000D-02	4	0	0	0	0	45	22	23	0	0
46	3	29	0	1	1.880D-01	1.800D-01	5.400D-01	7.200D-01	6.000D-02	6.000D-02	0.0	1.430D 01	4.000D-02	6	0	0	0	0	46	3	29	0	1
47	5	29	0	2	1.880D-01	1.800D-01	5.400D-01	7.200D-01	6.000D-02	6.000D-02	0.0	1.430D 01	4.000D-02	6	0	0	0	0	47	5	29	0	2
48	9	29	0	3	1.880D-01	1.800D-01	5.400D-01	7.200D-01	6.000D-02	6.000D-02	0.0	1.430D 01	4.000D-02	6	0	0	0	0	48	9	29	0	3
49	11	29	0	4	1.880D-01	1.800D-01	5.400D-01	7.200D-01	6.000D-02	6.000D-02	0.0	1.430D 01	4.000D-02	6	0	0	0	0	49	11	29	0	4

50	30	31	0	0	2.000D-02	7.500D-03	7.500D-03	1.500D-02	0.0	0.0	0.0	1.509D 01	4.100D-01	4	0	0	0	0	50	30	31	0	0
51	30	32	0	0	7.197D-03	4.800D-03	4.800D-03	9.600D-03	0.0	0.0	0.0	1.509D 01	3.111D-0110	0	0	0	0	0	51	30	32	0	0
52	5	30	0	0	2.157D-03	0.0	0.0	0.0	0.0	0.0	0.0	2.425D 01	4.000D-02	4	0	0	0	0	52	5	30	0	0
53	11	30	0	0	2.157D-03	0.0	0.0	0.0	0.0	0.0	0.0	2.425D 01	4.000D-02	4	0	0	0	0	53	11	30	0	0
54	29	30	0	0	3.810D-04	0.0	0.0	0.0	0.0	0.0	0.0	7.500D 00	4.000D-02	4	0	0	0	0	54	29	30	0	0
55	29	30	5	1	1.170D-03	0.0	0.0	0.0	0.0	0.0	0.0	7.500D 00	4.000D-02	4	0	0	0	0	55	29	30	5	1
56	14	0	0	0	1.105D-01	0.0	0.0	0.0	0.0	0.0	0.0	5.600D 01	4.000D-02	1	0	0	0	0	56	14	0	0	0
57	18	0	0	0	1.105D-01	0.0	0.0	0.0	0.0	0.0	0.0	5.600D 01	4.000D-02	1	0	0	0	0	57	18	0	0	0

UNSYMMETRICAL BEAM DATA

BEAM					TENSION-COMPRESSION FLAG	DEADBAND
IJ	I	J	M	N	IJUB	DB
52	5	30	0	0	1	0.0
53	11	30	0	0	1	0.0
54	29	30	0	0	-1	0.0
55	29	30	5	1	-1	0.0
56	14	0	0	0	1	0.0
57	18	0	0	0	1	0.0

NONLINEAR BEAM DATA

BEAM					DIRECTION	STANDARD TABLE NO.	LINEAR DEFLECTION	BOTTOMING DEFLECTION
IJ	I	J	M	N	L	NP	LDP	LDP1
54	29	30	0	0	1	8	7.50000E-01	0.0
55	29	30	5	1	1	10	0.0	0.0
31	14	19	0	0	1	5	8.20000E-02	0.0
31	14	19	0	0	2	5	4.80000E-01	0.0
31	14	19	0	0	3	5	1.94000E-01	0.0
29	17	22	0	0	1	5	5.40000E-02	0.0
29	17	22	0	0	2	5	4.80000E-01	0.0
29	17	22	0	0	3	5	5.20000E 00	0.0
30	18	23	0	0	1	5	5.40000E-02	0.0
30	18	23	0	0	2	5	4.80000E-01	0.0
30	18	23	0	0	3	5	5.20000E 00	0.0
32	19	24	0	0	1	5	3.70000E-02	0.0
32	19	24	0	0	2	5	1.03000E 00	0.0
32	19	24	0	0	3	5	1.03000E 00	0.0
33	20	25	0	0	1	5	3.70000E-02	0.0
33	20	25	0	0	2	5	1.03000E 00	0.0
33	20	25	0	0	3	5	1.03000E 00	0.0
34	21	26	0	0	1	5	3.70000E-02	0.0
34	21	26	0	0	2	5	1.03000E 00	0.0
34	21	26	0	0	3	5	1.03000E 00	0.0
35	22	27	0	0	1	5	3.70000E-02	0.0
35	22	27	0	0	2	5	1.03000E 00	0.0
35	22	27	0	0	3	5	1.03000E 00	0.0
36	23	28	0	0	1	5	3.70000E-02	0.0
36	23	28	0	0	2	5	1.03000E 00	0.0
36	23	28	0	0	3	5	1.03000E 00	0.0
23	7	13	0	0	1	5	4.50000E-02	0.0

```
 23   7  13   0   0       2          5       6.82000E-01   0.0
 23   7  13   0   0       3          5       1.28700E 00   0.0
 24   8  14   0   0       1          5       4.50000E-02   0.0
 24   8  14   0   0       2          5       6.82000E-01   0.0
 24   8  14   0   0       3          5       1.28700E 00   0.0
 25   9  15   0   0       1          5       4.50000E-02   0.0
 25   9  15   0   0       2          5       6.82000E-01   0.0
 25   9  15   0   0       3          5       1.28700E 00   0.0
 26  10  16   0   0       1          5       4.50000E-02   0.0
 26  10  16   0   0       2          5       6.82000E-01   0.0
 26  10  16   0   0       3          5       1.28700E 00   0.0
 27  11  17   0   0       1          5       4.50000E-02   0.0
 27  11  17   0   0       2          5       6.82000E-01   0.0
 27  11  17   0   0       3          5       1.28700E 00   0.0
 28  12  18   0   0       1          5       4.50000E-02   0.0
 28  12  18   0   0       2          5       6.82000E-01   0.0
 28  12  18   0   0       3          5       1.28700E 00   0.0

KR TABLE FOR I,J,M,N,L =   29   30    0    0    1
  1    0.0              1.00000E 00
  2    7.50000E-01      1.00000E 00
  3    7.50750E-01     -1.00000E 00
  4    1.50000E 00     -1.00000E 00
  5    1.50075E 00      0.0
  6    7.50000E 00      0.0
  7    1.12500E 01      0.0
  8    1.50000E 01      0.0

KR TABLE FOR I,J,M,N,L =   29   30    5    1    1
  1    0.0              3.00000E-03
  2    7.50000E-01      3.00000E-03
  3    7.51000E-01      1.00000E 00
  4    3.50000E 00      1.00000E 00
  5    3.51000E 00      0.0
  6    4.00000E 00      0.0
  7    5.00000E 00      0.0
  8    6.00000E 00      0.0
  9    7.00000E 00      0.0
 10    2.00000E 01      0.0

KR TABLE FOR I,J,M,N,L =   14   19    0    0    1
  1    0.0              1.00000E 00
  2    8.20000E-02      1.00000E 00
  3    8.20819E-02      0.0
  4    8.20000E-01      0.0
  5    1.64000E 00      0.0

KR TABLE FOR I,J,M,N,L =   14   19    0    0    2
  1    0.0              1.00000E 00
  2    4.80000E-01      1.00000E 00
  3    4.80480E-01      0.0
  4    4.80000E 00      0.0
  5    9.60000E 00      0.0

KR TABLE FOR I,J,M,N,L =   14   19    0    0    3
  1    0.0              1.00000E 00
  2    1.94000E-01      1.00000E 00
  3    1.94194E-01      0.0
  4    1.94000E 00      0.0
  5    3.88000E 00      0.0
```

```
KR TABLE FOR I,J,M,N,L =   17   22    0    0    1
  1    0.0             1.00000E 00
  2    5.40000E-02     1.00000E 00
  3    5.40540E-02     0.0
  4    5.40000E-01     0.0
  5    1.08000E 00     0.0

KR TABLE FOR I,J,M,N,L =   17   22    0    0    2
  1    0.0             1.00000E 00
  2    4.80000E-01     1.00000E 00
  3    4.80480E-01     0.0
  4    4.80000E 00     0.0
  5    9.60000E 00     0.0

KR TABLE FOR I,J,M,N,L =   17   22    0    0    3
  1    0.0             1.00000E 00
  2    5.20000E 00     1.00000E 00
  3    5.20520E 00     0.0
  4    5.20000E 01     0.0
  5    1.04000E 02     0.0

KR TABLE FOR I,J,M,N,L =   18   23    0    0    1
  1    0.0             1.00000E 00
  2    5.40000E-02     1.00000E 00
  3    5.40540E-02     0.0
  4    5.40000E-01     0.0
  5    1.08000E 00     0.0

KR TABLE FOR I,J,M,N,L =   18   23    0    0    2
  1    0.0             1.00000E 00
  2    4.80000E-01     1.00000E 00
  3    4.80480E-01     0.0
  4    4.80000E 00     0.0
  5    9.60000E 00     0.0

KR TABLE FOR I,J,M,N,L =   18   23    0    0    3
  1    0.0             1.00000E 00
  2    5.20000E 00     1.00000E 00
  3    5.20520E 00     0.0
  4    5.20000E 01     0.0
  5    1.04000E 02     0.0

KR TABLE FOR I,J,M,N,L =   19   24    0    0    1
  1    0.0             1.00000E 00
  2    3.70000E-02     1.00000E 00
  3    3.70370E-02     0.0
  4    3.70000E-01     0.0
  5    7.40000E-01     0.0

KR TABLE FOR I,J,M,N,L =   19   24    0    0    2
  1    0.0             1.00000E 00
  2    1.03000E 00     1.00000E 00
  3    1.03103E 00     0.0
  4    1.03000E 01     0.0
  5    2.06000E 01     0.0

KR TABLE FOR I,J,M,N,L =   19   24    0    0    3
  1    0.0             1.00000E 00
  2    1.03000E 00     1.00000E 00
  3    1.03103E 00     0.0
```

```
  4    1.03000E 01    0.0
  5    2.06000E 01    0.0

KR TABLE FOR I,J,M,N,L =   20   25    0    0    1
  1    0.0            1.00000E 00
  2    3.70000E-02    1.00000E 00
  3    3.70370E-02    0.0
  4    3.70000E-01    0.0
  5    7.40000E-01    0.0

KR TABLE FOR I,J,M,N,L =   20   25    0    0    2
  1    0.0            1.00000E 00
  2    1.03000E 00    1.00000E 00
  3    1.03103E 00    0.0
  4    1.03000E 01    0.0
  5    2.06000E 01    0.0

KR TABLE FOR I,J,M,N,L =   20   25    0    0    3
  1    0.0            1.00000E 00
  2    1.03000E 00    1.00000E 00
  3    1.03103E 00    0.0
  4    1.03000E 01    0.0
  5    2.06000E 01    0.0

KR TABLE FOR I,J,M,N,L =   21   26    0    0    1
  1    0.0            1.00000E 00
  2    3.70000E-02    1.00000E 00
  3    3.70370E-02    0.0
  4    3.70000E-01    0.0
  5    7.40000E-01    0.0

KR TABLE FOR I,J,M,N,L =   21   26    0    0    2
  1    0.0            1.00000E 00
  2    1.03000E 00    1.00000E 00
  3    1.03103E 00    0.0
  4    1.03000E 01    0.0
  5    2.06000E 01    0.0

KR TABLE FOR I,J,M,N,L =   21   26    0    0    3
  1    0.0            1.00000E 00
  2    1.03000E 00    1.00000E 00
  3    1.03103E 00    0.0
  4    1.03000E 01    0.0
  5    2.06000E 01    0.0

KR TABLE FOR I,J,M,N,L =   22   27    0    0    1
  1    0.0            1.00000E 00
  2    3.70000E-02    1.00000E 00
  3    3.70370E-02    0.0
  4    3.70000E-01    0.0
  5    7.40000E-01    0.0

KR TABLE FOR I,J,M,N,L =   22   27    0    0    2
  1    0.0            1.00000E 00
  2    1.03000E 00    1.00000E 00
  3    1.03103E 00    0.0
  4    1.03000E 01    0.0
  5    2.06000E 01    0.0

KR TABLE FOR I,J,M,N,L =   22   27    0    0    3
```

```
  1    0.0              1.00000E 00
  2    1.03000E 00      1.00000E 00
  3    1.03103E 00      0.0
  4    1.03000E 01      0.0
  5    2.06000E 01      0.0

KR TABLE FOR I,J,M,N,L =   23   28    0    0    1
  1    0.0              1.00000E 00
  2    3.70000E-02      1.00000E 00
  3    3.70370E-02      0.0
  4    3.70000E-01      0.0
  5    7.40000E-01      0.0

KR TABLE FOR I,J,M,N,L =   23   28    0    0    2
  1    0.0              1.00000E 00
  2    1.03000E 00      1.00000E 00
  3    1.03103E 00      0.0
  4    1.03000E 01      0.0
  5    2.06000E 01      0.0

KR TABLE FOR I,J,M,N,L =   23   28    0    0    3
  1    0.0              1.00000E 00
  2    1.03000E 00      1.00000E 00
  3    1.03103E 00      0.0
  4    1.03000E 01      0.0
  5    2.06000E 01      0.0

KR TABLE FOR I,J,M,N,L =    7   13    0    0    1
  1    0.0              1.00000E 00
  2    4.50000E-02      1.00000E 00
  3    4.50450E-02      0.0
  4    4.50000E-01      0.0
  5    9.00000E-01      0.0

KR TABLE FOR I,J,M,N,L =    7   13    0    0    2
  1    0.0              1.00000E 00
  2    6.82000E-01      1.00000E 00
  3    6.82682E-01      0.0
  4    6.82000E 00      0.0
  5    1.36400E 01      0.0

KR TABLE FOR I,J,M,N,L =    7   13    0    0    3
  1    0.0              1.00000E 00
  2    1.28700E 00      1.00000E 00
  3    1.28829E 00      0.0
  4    1.28700E 01      0.0
  5    2.57400E 01      0.0

KR TABLE FOR I,J,M,N,L =    8   14    0    0    1
  1    0.0              1.00000E 00
  2    4.50000E-02      1.00000E 00
  3    4.50450E-02      0.0
  4    4.50000E-01      0.0
  5    9.00000E-01      0.0

KR TABLE FOR I,J,M,N,L =    8   14    0    0    2
  1    0.0              1.00000E 00
  2    6.82000E-01      1.00000E 00
  3    6.82682E-01      0.0
  4    6.82000E 00      0.0
```

```
  5    1.36400E 01    0.0

KR TABLE FOR I,J,M,N,L =    8   14    0    0    3
  1    0.0            1.00000E 00
  2    1.28700E 00    1.00000E 00
  3    1.28829E 00    0.0
  4    1.28700E 01    0.0
  5    2.57400E 01    0.0

KR TABLE FOR I,J,M,N,L =    9   15    0    0    1
  1    0.0            1.00000E 00
  2    4.50000E-02    1.00000E 00
  3    4.50450E-02    0.0
  4    4.50000E-01    0.0
  5    9.00000E-01    0.0

KR TABLE FOR I,J,M,N,L =    9   15    0    0    2
  1    0.0            1.00000E 00
  2    6.82000E-01    1.00000E 00
  3    6.82682E-01    0.0
  4    6.82000E 00    0.0
  5    1.36400E 01    0.0

KR TABLE FOR I,J,M,N,L =    9   15    0    0    3
  1    0.0            1.00000E 00
  2    1.28700E 00    1.00000E 00
  3    1.28829E 00    0.0
  4    1.28700E 01    0.0
  5    2.57400E 01    0.0

KR TABLE FOR I,J,M,N,L =   10   16    0    0    1
  1    0.0            1.00000E 00
  2    4.50000E-02    1.00000E 00
  3    4.50450E-02    0.0
  4    4.50000E-01    0.0
  5    9.00000E-01    0.0

KR TABLE FOR I,J,M,N,L =   10   16    0    0    2
  1    0.0            1.00000E 00
  2    6.82000E-01    1.00000E 00
  3    6.82682E-01    0.0
  4    6.82000E 00    0.0
  5    1.36400E 01    0.0

KR TABLE FOR I,J,M,N,L =   10   16    0    0    3
  1    0.0            1.00000E 00
  2    1.28700E 00    1.00000E 00
  3    1.28829E 00    0.0
  4    1.28700E 01    0.0
  5    2.57400E 01    0.0

KR TABLE FOR I,J,M,N,L =   11   17    0    0    1
  1    0.0            1.00000E 00
  2    4.50000E-02    1.00000E 00
  3    4.50450E-02    0.0
  4    4.50000E-01    0.0
  5    9.00000E-01    0.0

KR TABLE FOR I,J,M,N,L =   11   17    0    0    2
  1    0.0            1.00000E 00
```

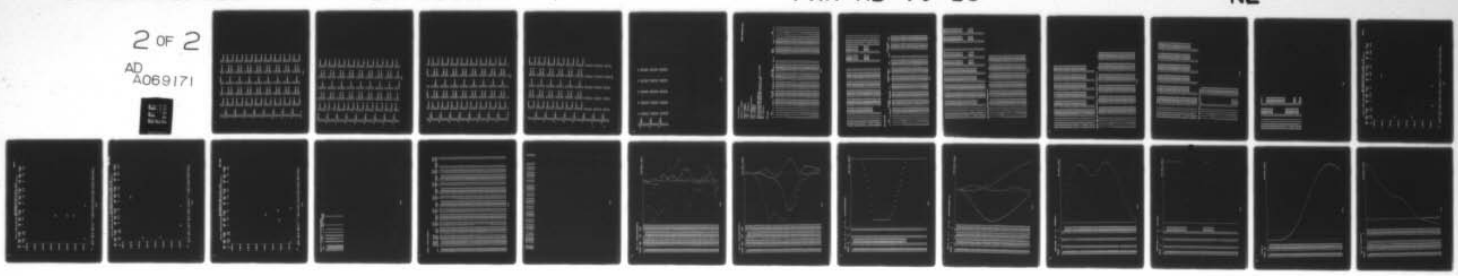
```
  2    6.82000E-01    1.00000E 00
  3    6.82682E-01    0.0
  4    6.82000E 00    0.0
  5    1.36400E 01    0.0

KR TABLE FOR I,J,M,N,L =   11   17    0    0    3
  1    0.0            1.00000E 00
  2    1.28700E 00    1.00000E 00
  3    1.28829E 00    0.0
  4    1.28700E 01    0.0
  5    2.57400E 01    0.0

KR TABLE FOR I,J,M,N,L =   12   18    0    0    1
  1    0.0            1.00000E 00
  2    4.50000E-02    1.00000E 00
  3    4.50450E-02    0.0
  4    4.50000E-01    0.0
  5    9.00000E-01    0.0

KR TABLE FOR I,J,M,N,L =   12   18    0    0    2
  1    0.0            1.00000E 00
  2    6.82000E-01    1.00000E 00
  3    6.82682E-01    0.0
  4    6.82000E 00    0.0
  5    1.36400E 01    0.0

KR TABLE FOR I,J,M,N,L =   12   18    0    0    3
  1    0.0            1.00000E 00
  2    1.28700E 00    1.00000E 00
  3    1.28829E 00    0.0
  4    1.28700E 01    0.0
  5    2.57400E 01    0.0


DRI ELEMENTS

 I  J
30 32



I,J,M,N
K-MATRIX FOR INTERNAL BEAM IJ
  1  2  0  0
    1.29292D 06    0.0            0.0            0.0            0.0            0.0
    0.0            6.10052D 04    0.0            0.0            0.0           -1.52513D 05
    0.0            0.0            4.21574D 06    0.0            1.05393D 07    0.0
    0.0            0.0            0.0            3.39424D 06    0.0            0.0
    0.0            0.0            1.05393D 07    0.0            3.51312D 07    0.0
    0.0           -1.52513D 05    0.0            0.0            0.0            5.08376D 05
  2  3  0  0
    5.87689D 05    0.0            0.0            0.0            0.0            0.0
    0.0            5.72926D 03    0.0            0.0            0.0           -3.15109D 04
    0.0            0.0            3.95918D 05    0.0            2.17755D 06    0.0
    0.0            0.0            0.0            1.54284D 06    0.0            0.0
    0.0            0.0            2.17755D 06    0.0            1.59687D 07    0.0
    0.0           -3.15109D 04    0.0            0.0            0.0            2.31080D 05
  3  4  0  0
    5.38715D 05    0.0            0.0            0.0            0.0            0.0
    0.0            4.41299D 03    0.0            0.0            0.0           -2.64779D 04
```

```
  0.0            0.0            3.04958D 05    0.0            1.82975D 06    0.0
  0.0            0.0            0.0            1.41427D 06    0.0            0.0
  0.0            0.0            1.82975D 06    0.0            1.46380D 07    0.0
  0.0           -2.64779D 04    0.0            0.0            0.0            2.11824D 05
 4  5  0  0
  5.87689D 05    0.0            0.0            0.0            0.0            0.0
  0.0            5.72926D 03    0.0            0.0            0.0           -3.15109D 04
  0.0            0.0            3.95918D 05    0.0            2.17755D 06    0.0
  0.0            0.0            0.0            1.54284D 06    0.0            0.0
  0.0            0.0            2.17755D 06    0.0            1.59687D 07    0.0
  0.0           -3.15109D 04    0.0            0.0            0.0            2.31080D 05
 5  6  0  0
  9.23511D 05    0.0            0.0            0.0            0.0            0.0
  0.0            2.22322D 04    0.0            0.0            0.0           -7.78127D 04
  0.0            0.0            1.53635D 06    0.0            5.37722D 06    0.0
  0.0            0.0            0.0            2.42446D 06    0.0            0.0
  0.0            0.0            5.37722D 06    0.0            2.50937D 07    0.0
  0.0           -7.78127D 04    0.0            0.0            0.0            3.63126D 05
 7  8  0  0
  2.68800D 05    0.0            0.0            0.0            0.0            0.0
  0.0            4.30083D 04    0.0            0.0            0.0           -1.07521D 05
  0.0            0.0            3.44494D 05    0.0            8.61235D 05    0.0
  0.0            0.0            0.0            3.07542D 05    0.0            0.0
  0.0            0.0            8.61235D 05    0.0            2.87078D 06    0.0
  0.0           -1.07521D 05    0.0            0.0            0.0            3.58403D 05
 8  9  0  0
  1.22182D 05    0.0            0.0            0.0            0.0            0.0
  0.0            4.03910D 03    0.0            0.0            0.0           -2.22150D 04
  0.0            0.0            3.23529D 04    0.0            1.77941D 05    0.0
  0.0            0.0            0.0            1.39792D 05    0.0            0.0
  0.0            0.0            1.77941D 05    0.0            1.30490D 06    0.0
  0.0           -2.22150D 04    0.0            0.0            0.0            1.62910D 05
 9 10  0  0
  1.12000D 05    0.0            0.0            0.0            0.0            0.0
  0.0            3.11114D 03    0.0            0.0            0.0           -1.86668D 04
  0.0            0.0            2.49200D 04    0.0            1.49520D 05    0.0
  0.0            0.0            0.0            1.28142D 05    0.0            0.0
  0.0            0.0            1.49520D 05    0.0            1.19616D 06    0.0
  0.0           -1.86668D 04    0.0            0.0            0.0            1.49335D 05
10 11  0  0
  1.22182D 05    0.0            0.0            0.0            0.0            0.0
  0.0            4.03910D 03    0.0            0.0            0.0           -2.22150D 04
  0.0            0.0            3.23529D 04    0.0            1.77941D 05    0.0
  0.0            0.0            0.0            1.39792D 05    0.0            0.0
  0.0            0.0            1.77941D 05    0.0            1.30490D 06    0.0
  0.0           -2.22150D 04    0.0            0.0            0.0            1.62910D 05
11 12  0  0
  1.92000D 05    0.0            0.0            0.0            0.0            0.0
  0.0            1.56736D 04    0.0            0.0            0.0           -5.48576D 04
  0.0            0.0            1.25544D 05    0.0            4.39406D 05    0.0
  0.0            0.0            0.0            2.19673D 05    0.0            0.0
  0.0            0.0            4.39406D 05    0.0            2.05056D 06    0.0
  0.0           -5.48576D 04    0.0            0.0            0.0            2.56002D 05
 1  0  0  0
  2.53120D 05    0.0            0.0            0.0            0.0            0.0
  0.0            3.10020D 02    0.0            0.0            0.0           -1.86012D 03
  0.0            0.0            1.36646D 05    0.0            8.19875D 05    0.0
  0.0            0.0            0.0            6.26084D 05    0.0            0.0
  0.0            0.0            8.19875D 05    0.0            6.55900D 06    0.0
  0.0           -1.86012D 03    0.0            0.0            0.0            1.48810D 04
```

```
2  0  0  0
  2.53120D 05    0.0            0.0            0.0            0.0            0.0
  0.0            3.10020D 02    0.0            0.0            0.0           -1.86012D 03
  0.0            0.0            1.36646D 05    0.0            8.19875D 05    0.0
  0.0            0.0            0.0            6.26084D 05    0.0            0.0
  0.0            0.0            8.19875D 05    0.0            6.55900D 06    0.0
  0.0           -1.86012D 03    0.0            0.0            0.0            1.48810D 04
3  0  0  0
  2.53120D 05    0.0            0.0            0.0            0.0            0.0
  0.0            3.10020D 02    0.0            0.0            0.0           -1.86012D 03
  0.0            0.0            1.36646D 05    0.0            8.19875D 05    0.0
  0.0            0.0            0.0            6.26084D 05    0.0            0.0
  0.0            0.0            8.19875D 05    0.0            6.55900D 06    0.0
  0.0           -1.86012D 03    0.0            0.0            0.0            1.48810D 04
4  0  0  0
  2.53120D 05    0.0            0.0            0.0            0.0            0.0
  0.0            3.10020D 02    0.0            0.0            0.0           -1.86012D 03
  0.0            0.0            1.36646D 05    0.0            8.19875D 05    0.0
  0.0            0.0            0.0            6.26084D 05    0.0            0.0
  0.0            0.0            8.19875D 05    0.0            6.55900D 06    0.0
  0.0           -1.86012D 03    0.0            0.0            0.0            1.48810D 04
5  0  0  0
  2.53120D 05    0.0            0.0            0.0            0.0            0.0
  0.0            3.10020D 02    0.0            0.0            0.0           -1.86012D 03
  0.0            0.0            1.36646D 05    0.0            8.19875D 05    0.0
  0.0            0.0            0.0            6.26084D 05    0.0            0.0
  0.0            0.0            8.19875D 05    0.0            6.55900D 06    0.0
  0.0           -1.86012D 03    0.0            0.0            0.0            1.48810D 04
6  0  0  0
  2.53120D 05    0.0            0.0            0.0            0.0            0.0
  0.0            3.10020D 02    0.0            0.0            0.0           -1.86012D 03
  0.0            0.0            1.36646D 05    0.0            8.19875D 05    0.0
  0.0            0.0            0.0            6.26084D 05    0.0            0.0
  0.0            0.0            8.19875D 05    0.0            6.55900D 06    0.0
  0.0           -1.86012D 03    0.0            0.0            0.0            1.48810D 04
1  7  0  0
  1.63823D 05    0.0            0.0            0.0            0.0            0.0
  0.0            1.87948D 02    0.0            0.0            0.0           -1.31564D 03
  0.0            0.0            3.57204D 04    0.0            2.50043D 05    0.0
  0.0            0.0            0.0            2.23429D 05    0.0            0.0
  0.0            0.0            2.50043D 05    0.0            2.33373D 06    0.0
  0.0           -1.31564D 03    0.0            0.0            0.0            1.22793D 04
2  8  0  0
  1.63823D 05    0.0            0.0            0.0            0.0            0.0
  0.0            1.87948D 02    0.0            0.0            0.0           -1.31564D 03
  0.0            0.0            3.57204D 04    0.0            2.50043D 05    0.0
  0.0            0.0            0.0            2.23429D 05    0.0            0.0
  0.0            0.0            2.50043D 05    0.0            2.33373D 06    0.0
  0.0           -1.31564D 03    0.0            0.0            0.0            1.22793D 04
3  9  0  0
  1.63823D 05    0.0            0.0            0.0            0.0            0.0
  0.0            1.87948D 02    0.0            0.0            0.0           -1.31564D 03
  0.0            0.0            3.57204D 04    0.0            2.50043D 05    0.0
  0.0            0.0            0.0            2.23429D 05    0.0            0.0
  0.0            0.0            2.50043D 05    0.0            2.33373D 06    0.0
  0.0           -1.31564D 03    0.0            0.0            0.0            1.22793D 04
4 10  0  0
  1.63823D 05    0.0            0.0            0.0            0.0            0.0
  0.0            1.87948D 02    0.0            0.0            0.0           -1.31564D 03
  0.0            0.0            3.57204D 04    0.0            2.50043D 05    0.0
```

AD-A069 171 LOCKHEED-CALIFORNIA CO BURBANK F/G 1/3
SUMMARY OF RESULTS FOR A TWIN-ENGINE, LOW-WING AIRPLANE SUBSTRU--ETC(U)
JAN 79 G WITTLIN DOT-FA75WA-3707
UNCLASSIFIED LR-28869 FAA-RD-79-13 NL

2 OF 2
AD A069171



END
DATE FILMED
7-79
DDC

```
   0.0            0.0            0.0            2.23429D 05    0.0            0.0
   0.0            0.0            2.50043D 05    0.0            2.33373D 06    0.0
   0.0           -1.31564D 03    0.0            0.0            0.0            1.22793D 04
 5 11  0  0
   1.63823D 05    0.0            0.0            0.0            0.0            0.0
   0.0            1.87948D 02    0.0            0.0            0.0           -1.31564D 03
   0.0            0.0            3.57204D 04    0.0            2.50043D 05    0.0
   0.0            0.0            0.0            2.23429D 05    0.0            0.0
   0.0            0.0            2.50043D 05    0.0            2.33373D 06    0.0
   0.0           -1.31564D 03    0.0            0.0            0.0            1.22793D 04
 6 12  0  0
   1.63823D 05    0.0            0.0            0.0            0.0            0.0
   0.0            1.87948D 02    0.0            0.0            0.0           -1.31564D 03
   0.0            0.0            3.57204D 04    0.0            2.50043D 05    0.0
   0.0            0.0            0.0            2.23429D 05    0.0            0.0
   0.0            0.0            2.50043D 05    0.0            2.33373D 06    0.0
   0.0           -1.31564D 03    0.0            0.0            0.0            1.22793D 04
 7 13  0  0
   4.70541D 04    0.0            0.0            0.0            0.0            0.0
   0.0            6.89545D 02    0.0            0.0            0.0           -9.04987D 03
   0.0            0.0            2.47396D 01    0.0            3.24692D 02    0.0
   0.0            0.0            0.0            1.56236D 04    0.0            0.0
   0.0            0.0            3.24692D 02    0.0            5.68186D 03    0.0
   0.0           -9.04987D 03    0.0            0.0            0.0            1.58366D 05
 8 14  0  0
   4.70541D 04    0.0            0.0            0.0            0.0            0.0
   0.0            6.89545D 02    0.0            0.0            0.0           -9.04987D 03
   0.0            0.0            2.47396D 01    0.0            3.24692D 02    0.0
   0.0            0.0            0.0            1.56236D 04    0.0            0.0
   0.0            0.0            3.24692D 02    0.0            5.68186D 03    0.0
   0.0           -9.04987D 03    0.0            0.0            0.0            1.58366D 05
 9 15  0  0
   4.70541D 04    0.0            0.0            0.0            0.0            0.0
   0.0            6.89545D 02    0.0            0.0            0.0           -9.04987D 03
   0.0            0.0            2.47396D 01    0.0            3.24692D 02    0.0
   0.0            0.0            0.0            1.56236D 04    0.0            0.0
   0.0            0.0            3.24692D 02    0.0            5.68186D 03    0.0
   0.0           -9.04987D 03    0.0            0.0            0.0            1.58366D 05
10 16  0  0
   4.70541D 04    0.0            0.0            0.0            0.0            0.0
   0.0            6.89545D 02    0.0            0.0            0.0           -9.04987D 03
   0.0            0.0            2.47396D 01    0.0            3.24692D 02    0.0
   0.0            0.0            0.0            1.56236D 04    0.0            0.0
   0.0            0.0            3.24692D 02    0.0            5.68186D 03    0.0
   0.0           -9.04987D 03    0.0            0.0            0.0            1.58366D 05
11 17  0  0
   1.79112D 05    0.0            0.0            0.0            0.0            0.0
   0.0            2.15017D 03    0.0            0.0            0.0           -2.82197D 04
   0.0            0.0            9.11066D 01    0.0            1.19572D 03    0.0
   0.0            0.0            0.0            4.90235D 04    0.0            0.0
   0.0            0.0            1.19572D 03    0.0            2.09241D 04    0.0
   0.0           -2.82197D 04    0.0            0.0            0.0            4.93822D 05
12 18  0  0
   4.70541D 04    0.0            0.0            0.0            0.0            0.0
   0.0            6.89545D 02    0.0            0.0            0.0           -9.04987D 03
   0.0            0.0            2.47396D 01    0.0            3.24692D 02    0.0
   0.0            0.0            0.0            1.56236D 04    0.0            0.0
   0.0            0.0            3.24692D 02    0.0            5.68186D 03    0.0
   0.0           -9.04987D 03    0.0            0.0            0.0            1.58366D 05
17 22  0  0
```

```
   5.61416D 04    0.0            0.0            0.0            0.0            0.0
   0.0            1.17118D 03    0.0            0.0            0.0           -1.28830D 04
   0.0            0.0            4.20197D 01    0.0            4.62217D 02    0.0
   0.0            0.0            0.0            1.86409D 04    0.0            0.0
   0.0            0.0            4.62217D 02    0.0            6.77918D 03    0.0
   0.0           -1.28830D 04    0.0            0.0            0.0            1.88950D 05
18 23  0  0
   5.61416D 04    0.0            0.0            0.0            0.0            0.0
   0.0            1.17118D 03    0.0            0.0            0.0           -1.28830D 04
   0.0            0.0            4.20197D 01    0.0            4.62217D 02    0.0
   0.0            0.0            0.0            1.86409D 04    0.0            0.0
   0.0            0.0            4.62217D 02    0.0            6.77918D 03    0.0
   0.0           -1.28830D 04    0.0            0.0            0.0            1.88950D 05
14 19  0  0
   1.12283D 05    0.0            0.0            0.0            0.0            0.0
   0.0            2.34236D 03    0.0            0.0            0.0           -2.57660D 04
   0.0            0.0            4.21902D 04    0.0            4.64093D 05    0.0
   0.0            0.0            0.0            6.84247D 05    0.0            0.0
   0.0            0.0            4.64093D 05    0.0            6.80669D 06    0.0
   0.0           -2.57660D 04    0.0            0.0            0.0            3.77901D 05
19 24  0  0
   3.82993D 04    0.0            0.0            0.0            0.0            0.0
   0.0            1.33405D 01    0.0            0.0            0.0           -2.15109D 02
   0.0            0.0            3.71828D 02    0.0            5.99554D 03    0.0
   0.0            0.0            0.0            1.27167D 04    0.0            0.0
   0.0            0.0            5.99554D 03    0.0            1.28900D 05    0.0
   0.0           -2.15109D 02    0.0            0.0            0.0            4.62470D 03
20 25  0  0
   3.82993D 04    0.0            0.0            0.0            0.0            0.0
   0.0            1.33405D 01    0.0            0.0            0.0           -2.15109D 02
   0.0            0.0            3.71828D 02    0.0            5.99554D 03    0.0
   0.0            0.0            0.0            1.27167D 04    0.0            0.0
   0.0            0.0            5.99554D 03    0.0            1.28900D 05    0.0
   0.0           -2.15109D 02    0.0            0.0            0.0            4.62470D 03
21 26  0  0
   3.82993D 04    0.0            0.0            0.0            0.0            0.0
   0.0            1.33405D 01    0.0            0.0            0.0           -2.15109D 02
   0.0            0.0            3.71828D 02    0.0            5.99554D 03    0.0
   0.0            0.0            0.0            1.27167D 04    0.0            0.0
   0.0            0.0            5.99554D 03    0.0            1.28900D 05    0.0
   0.0           -2.15109D 02    0.0            0.0            0.0            4.62470D 03
22 27  0  0
   3.82993D 04    0.0            0.0            0.0            0.0            0.0
   0.0            1.33405D 01    0.0            0.0            0.0           -2.15109D 02
   0.0            0.0            3.71828D 02    0.0            5.99554D 03    0.0
   0.0            0.0            0.0            1.27167D 04    0.0            0.0
   0.0            0.0            5.99554D 03    0.0            1.28900D 05    0.0
   0.0           -2.15109D 02    0.0            0.0            0.0            4.62470D 03
23 28  0  0
   3.82993D 04    0.0            0.0            0.0            0.0            0.0
   0.0            1.33405D 01    0.0            0.0            0.0           -2.15109D 02
   0.0            0.0            3.71828D 02    0.0            5.99554D 03    0.0
   0.0            0.0            0.0            1.27167D 04    0.0            0.0
   0.0            0.0            5.99554D 03    0.0            1.28900D 05    0.0
   0.0           -2.15109D 02    0.0            0.0            0.0            4.62470D 03
13 14  0  0
   3.31023D 05    0.0            0.0            0.0            0.0            0.0
   0.0            4.29097D 05    0.0            0.0            0.0           -1.07274D 06
   0.0            0.0            1.13944D 04    0.0            2.84861D 04    0.0
   0.0            0.0            0.0            3.49596D 05    0.0            0.0
```

```
   0.0            0.0            2.84861D 04    0.0            9.49536D 04    0.0
   0.0           -1.07274D 06    0.0            0.0            0.0            3.57560D 06
14 15  0  0
   1.50465D 05    0.0            0.0            0.0            0.0            0.0
   0.0            4.02983D 04    0.0            0.0            0.0           -2.21641D 05
   0.0            0.0            1.07010D 03    0.0            5.88555D 03    0.0
   0.0            0.0            0.0            1.58907D 05    0.0            0.0
   0.0            0.0            5.88555D 03    0.0            4.31607D 04    0.0
   0.0           -2.21641D 05    0.0            0.0            0.0            1.62537D 06
15 16  0  0
   1.37926D 05    0.0            0.0            0.0            0.0            0.0
   0.0            3.10400D 04    0.0            0.0            0.0           -1.86240D 05
   0.0            0.0            8.24250D 02    0.0            4.94550D 03    0.0
   0.0            0.0            0.0            1.45665D 05    0.0            0.0
   0.0            0.0            4.94550D 03    0.0            3.95640D 04    0.0
   0.0           -1.86240D 05    0.0            0.0            0.0            1.48992D 06
16 17  0  0
   1.50465D 05    0.0            0.0            0.0            0.0            0.0
   0.0            4.02983D 04    0.0            0.0            0.0           -2.21641D 05
   0.0            0.0            1.07010D 03    0.0            5.88555D 03    0.0
   0.0            0.0            0.0            1.58907D 05    0.0            0.0
   0.0            0.0            5.88555D 03    0.0            4.31607D 04    0.0
   0.0           -2.21641D 05    0.0            0.0            0.0            1.62537D 06
17 18  0  0
   2.36445D 05    0.0            0.0            0.0            0.0            0.0
   0.0            1.54376D 05    0.0            0.0            0.0           -5.47317D 05
   0.0            0.0            4.15249D 03    0.0            1.45337D 04    0.0
   0.0            0 0            0.0            2.49711D 05    0.0            0.0
   0.0            0.0            1.45337D 04    0.0            6.78240D 04    0.0
   0.0           -5.47317D 05    0.0            0.0            0.0            2.55415D 06
19 20  0  0
   3.15115D 05    0.0            0.0            0.0            0.0            0.0
   0.0            1.67943D 06    0.0            0.0            0.0           -9.23686D 06
   0.0            0.0            3.59553D 05    0.0            1.97754D 06    0.0
   0.0            0.0            0.0            7.83228D 06    0.0            0.0
   0.0            0.0            1.97754D 06    0.0            1.45020D 07    0.0
   0.0           -9.23686D 06    0.0            0.0            0.0            6.77370D 07
20 21  0  0
   2.88855D 05    0.0            0.0            0.0            0.0            0.0
   0.0            1.29359D 06    0.0            0.0            0.0           -7.76153D 06
   0.0            0.0            2.76947D 05    0.0            1.66168D 06    0.0
   0.0            0.0            0.0            7.17959D 06    0.0            0.0
   0.0            0.0            1.66168D 06    0.0            1.32935D 07    0.0
   0.0           -7.76153D 06    0.0            0.0            0.0            6.20922D 07
21 22  0  0
   3.15115D 05    0.0            0.0            0.0            0.0            0.0
   0.0            1.67943D 06    0.0            0.0            0.0           -9.23686D 06
   0.0            0.0            3.59553D 05    0.0            1.97754D 06    0.0
   0.0            0.0            0.0            7.83228D 06    0.0            0.0
   0.0            0.0            1.97754D 06    0.0            1.45020D 07    0.0
   0.0           -9.23686D 06    0.0            0.0            0.0            6.77370D 07
22 23  0  0
   4.95180D 05    0.0            0.0            0.0            0.0            0.0
   0.0            6.51697D 06    0.0            0.0            0.0           -2.28094D 07
   0.0            0.0            1.39523D 06    0.0            4.88331D 06    0.0
   0.0            0.0            0.0            1.23079D 07    0.0            0.0
   0.0            0.0            4.88331D 06    0.0            2.27888D 07    0.0
   0.0           -2.28094D 07    0.0            0.0            0.0            1.06444D 08
 3 29  0  1
   1.31490 05     0.0            0.0            0.0            0.0            0.0
```

```
   0.0            2.21599D 04    0.0            0.0            0.0           -1.58443D 05
   0.0            0.0            7.38662D 03    0.0            5.28143D 04    0.0
   0.0            0.0            0.0            1.91329D 05    0.0            0.0
   0.0            0.0            5.28143D 04    0.0            5.03497D 05    0.0
   0.0           -1.58443D 05    0.0            0.0            0.0            1.51049D 06
 5 29  0  2
   1.31469D 05    0.0            0.0            0.0            0.0            0.0
   0.0            2.21599D 04    0.0            0.0            0.0           -1.58443D 05
   0.0            0.0            7.38662D 03    0.0            5.28143D 04    0.0
   0.0            0.0            0.0            1.91329D 05    0.0            0.0
   0.0            0.0            5.28143D 04    0.0            5.03497D 05    0.0
   0.0           -1.58443D 05    0.0            0.0            0.0            1.51049D 06
 9 29  0  3
   1.31469D 05    0.0            0.0            0.0            0.0            0.0
   0.0            2.21599D 04    0.0            0.0            0.0           -1.58443D 05
   0.0            0.0            7.38662D 03    0.0            5.28143D 04    0.0
   0.0            0.0            0.0            1.91329D 05    0.0            0.0
   0.0            0.0            5.28143D 04    0.0            5.03497D 05    0.0
   0.0           -1.58443D 05    0.0            0.0            0.0            1.51049D 06
11 29  0  4
   1.31469D 05    0.0            0.0            0.0            0.0            0.0
   0.0            2.21599D 04    0.0            0.0            0.0           -1.58443D 05
   0.0            0.0            7.38662D 03    0.0            5.28143D 04    0.0
   0.0            0.0            0.0            1.91329D 05    0.0            0.0
   0.0            0.0            5.28143D 04    0.0            5.03497D 05    0.0
   0.0           -1.58443D 05    0.0            0.0            0.0            1.51049D 06
30 31  0  0
   1.39165D 04    0.0            0.0            0.0            0.0            0.0
   0.0            2.75020D 02    0.0            0.0            0.0           -2.07502D 03
   0.0            0.0            2.75020D 02    0.0            2.07502D 03    0.0
   0.0            0.0            0.0            3.97614D 03    0.0            0.0
   0.0            0.0            2.07502D 03    0.0            2.08748D 04    0.0
   0.0           -2.07502D 03    0.0            0.0            0.0            2.08748D 04
30 32  0  0
   4.76912D 02    0.0            0.0            0.0            0.0            0.0
   0.0            1.67631D 01    0.0            0.0            0.0           -1.26478D 02
   0.0            0.0            1.67631D 01    0.0            1.26478D 02    0.0
   0.0            0.0            0.0            1.90855D 02    0.0            0.0
   0.0            0.0            1.26478D 02    0.0            1.27237D 03    0.0
   0.0           -1.26478D 02    0.0            0.0            0.0            1.27237D 03
 5 30  0  0
   9.33861D 02    0.0            0.0            0.0            0.0            0.0
   0.0            0.0            0.0            0.0            0.0            0.0
   0.0            0.0            0.0            0.0            0.0            0.0
   0.0            0.0            0.0            0.0            0.0            0.0
   0.0            0.0            0.0            0.0            0.0            0.0
   0.0            0.0            0.0            0.0            0.0            0.0
11 30  0  0
   9.33861D 02    0.0            0.0            0.0            0.0            0.0
   0.0            0.0            0.0            0.0            0.0            0.0
   0.0            0.0            0.0            0.0            0.0            0.0
   0.0            0.0            0.0            0.0            0.0            0.0
   0.0            0.0            0.0            0.0            0.0            0.0
   0.0            0.0            0.0            0.0            0.0            0.0
29 30  0  0
   5.33400D 02    0.0            0.0            0.0            0.0            0.0
   0.0            0.0            0.0            0.0            0.0            0.0
   0.0            0.0            0.0            0.0            0.0            0.0
   0.0            0.0            0.0            0.0            0.0            0.0
   0.0            0.0            0.0            0.0            0.0            0.0
```

```
   0.0              0.0             0.0             0.0             0.0             0.0
29 30  5  1
   1.638000 03      0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
14  0  0  0
   5.916960 04      0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
18  0  0  0
   5.916960 04      0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
   0.0              0.0             0.0             0.0             0.0             0.0
```

MODEL PARAMETERS

VEHICLE WT = 5.436600D 02

VEHICLE CG POSITION
X (FS) = 1.62560D 02
Y (BL) = 0.0
Z (WL) = 5.32205D 00

VEHICLE INERTIAS (IN-LB-SEC**2)
I(XX) = 8.15026D 02
I(YY) = 6.06355D 02
I(ZZ) = 5.13955D 02

VEHICLE CG INITIAL GROUND COORDINATES
XCG IS THE DISTANCE FROM SLOPE/GROUND INTERSECTION TO VEHICLE CG,+FORWARD
ZCG IS THE DISTANCE FROM GROUND PLANE TO VEHICLE CG,+DOWN
XCG = 0.0
ZCG = -2.95621D 01

BEAM LOADS

	BEAM				AXIAL LOAD			SHEAR FORCE			MOMENT			BEAM			
IJ	I	J	M	N	BUCKLING	TENSION	COMPRESSION	LATERAL(Y)	VERTICAL(Z)	ROLL(X)	PITCH(Y)	YAW(Z)	IJ	I	J	M	N
1	1	2	0	0	1.0035D 06	2.8937D 04	2.4011D 04	9.0750D 03	9.0750D 03	0.0	2.8220D 04	3.5387D 03	1	1	2	0	0
2	2	3	0	0	2.0733D 05	2.8937D 04	2.4011D 04	9.0750D 03	9.0750D 03	0.0	2.8220D 04	3.5387D 03	2	2	3	0	0
3	3	4	0	0	1.7422D 05	2.8937D 04	2.4011D 04	9.0750D 03	9.0750D 03	0.0	2.8220D 04	3.5387D 03	3	3	4	0	0
4	4	5	0	0	2.0733D 05	2.8937D 04	2.4011D 04	9.0750D 03	9.0750D 03	0.0	2.8220D 04	3.5387D 03	4	4	5	0	0
5	5	6	0	0	5.1199D 05	2.8937D 04	2.4011D 04	9.0750D 03	9.0750D 03	0.0	2.8220D 04	3.5387D 03	5	5	6	0	0
6	7	8	0	0	7.0746D 05	6.0160D 03	4.9920D 03	1.8867D 03	1.8867D 03	0.0	8.0780D 03	1.6640D 03	6	7	8	0	0
7	8	9	0	0	1.4617D 05	6.0160D 03	4.9920D 03	1.8867D 03	1.8867D 03	0.0	8.0780D 03	1.6640D 03	7	8	9	0	0
8	9	10	0	0	1.2282D 05	6.0160D 03	4.9920D 03	1.8867D 03	1.8867D 03	0.0	8.0780D 03	1.6640D 03	8	9	10	0	0
9	10	11	0	0	1.4617D 05	6.0160D 03	4.9920D 03	1.8867D 03	1.8867D 03	0.0	8.0780D 03	1.6640D 03	9	10	11	0	0
10	11	12	0	0	3.6095D 05	6.0160D 03	4.9920D 03	1.8867D 03	1.8867D 03	0.0	8.0780D 03	1.6640D 03	10	11	12	0	0
11	1	0	0	0	1.2239D 04	1.3596D 04	1.1282D 04	4.2640D 03	4.2640D 03	0.0	1.8597D 04	2.9400D 02	11	1	0	0	0
12	2	0	0	0	1.2239D 04	1.3596D 04	1.1282D 04	4.2640D 03	4.2640D 03	0.0	1.8597D 04	2.9400D 02	12	2	0	0	0
13	3	0	0	0	1.2239D 04	1.3596D 04	1.1282D 04	4.2640D 03	4.2640D 03	0.0	1.8597D 04	2.9400D 02	13	3	0	0	0
14	4	0	0	0	1.2239D 04	1.3596D 04	1.1282D 04	4.2640D 03	4.2640D 03	0.0	1.8597D 04	2.9400D 02	14	4	0	0	0
15	5	0	0	0	1.2239D 04	1.3596D 04	1.1282D 04	4.2640D 03	4.2640D 03	0.0	1.8597D 04	2.9400D 02	15	5	0	0	0
16	6	0	0	0	1.2239D 04	1.3596D 04	1.1282D 04	4.2640D 03	4.2640D 03	0.0	1.8597D 04	2.9400D 02	16	6	0	0	0
17	1	7	0	0	8.6566D 03	1.0266D 04	8.5188D 03	3.2197D 03	3.2197D 03	0.0	1.0758D 04	2.9024D 02	17	1	7	0	0
18	2	8	0	0	8.6566D 03	1.0266D 04	8.5188D 03	3.2197D 03	3.2197D 03	0.0	1.0758D 04	2.9024D 02	18	2	8	0	0
19	3	9	0	0	8.6566D 03	1.0266D 04	8.5188D 03	3.2197D 03	3.2197D 03	0.0	1.0758D 04	2.9024D 02	19	3	9	0	0
20	4	10	0	0	8.6566D 03	1.0266D 04	8.5188D 03	3.2197D 03	3.2197D 03	0.0	1.0758D 04	2.9024D 02	20	4	10	0	0
21	5	11	0	0	8.6566D 03	1.0266D 04	8.5188D 03	3.2197D 03	3.2197D 03	0.0	1.0758D 04	2.9024D 02	21	5	11	0	0
22	6	12	0	0	8.6566D 03	1.0266D 04	8.5188D 03	3.2197D 03	3.2197D 03	0.0	1.0758D 04	2.9024D 02	22	6	12	0	0
23	7	13	0	0	2.1364D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	1.2043D 03	3.0880D 03	23	7	13	0	0
24	8	14	0	0	2.1364D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	1.2043D 03	3.0880D 03	24	8	14	0	0
25	9	15	0	0	2.1364D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	1.2043D 03	3.0880D 03	25	9	15	0	0
26	10	16	0	0	2.1364D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	1.2043D 03	3.0880D 03	26	10	16	0	0
27	11	17	0	0	7.8675D 03	2.1045D 04	1.7463D 04	6.6000D 03	6.6000D 03	0.0	7.6924D 02	9.6291D 03	27	11	17	0	0
28	12	18	0	0	2.1364D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	1.2043D 03	3.0880D 03	28	12	18	0	0
29	17	22	0	0	3.0413D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	1.2043D 03	3.0880D 03	29	17	22	0	0
30	18	23	0	0	3.0413D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	1.2043D 03	3.0880D 03	30	18	23	0	0
31	14	19	0	0	1.6953D 05	1.1057D 04	9.1751D 03	3.4677D 03	3.4677D 03	0.0	4.5000D 04	6.1760D 03	31	14	19	0	0
32	19	24	0	0	1.4154D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	3.0880D 03	1.2043D 03	32	19	24	0	0

33	20	25	0	0	1.4154D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0		3.0880D 03	1.2043D 03	33	20	25	0	0
34	21	26	0	0	1.4154D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0		3.0880D 03	1.2043D 03	34	21	26	0	0
35	22	27	0	0	1.4154D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0		3.0880D 03	1.2043D 03	35	22	27	0	0
36	23	28	0	0	1.4154D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0		3.0880D 03	1.2043D 03	36	23	28	0	0
37	13	14	0	0	1.8743D 05	7.4086D 03	6.1476D 03	2.3235D 03	2.3235D 03	0.0		5.6017D 02	1.7151D 04	37	13	14	0	0
38	14	15	0	0	3.8725D 04	7.4086D 03	6.1476D 03	2.3235D 03	2.3235D 03	0.0		5.6017D 02	1.7151D 04	38	14	15	0	0
39	15	16	0	0	3.2540D 04	7.4086D 03	6.1476D 03	2.3235D 03	2.3235D 03	0.0		5.6017D 02	1.7151D 04	39	15	16	0	0
40	16	17	0	0	3.8725D 04	7.4086D 03	6.1476D 03	2.3235D 03	2.3235D 03	0.0		5.6017D 02	1.7151D 04	40	16	17	0	0
41	17	18	0	0	9.5628D 04	7.4086D 03	6.1476D 03	2.3235D 03	2.3235D 03	0.0		5.6017D 02	1.7151D 04	41	17	18	0	0
42	19	20	0	0	1.3012D 07	1.5516D 04	1.2875D 04	4.8660D 03	4.8660D 03	0.0		0.0	0.0	42	19	20	0	0
43	20	21	0	0	1.0933D 07	1.5516D 04	1.2875D 04	4.8660D 03	4.8660D 03	0.0		0.0	0.0	43	20	21	0	0
44	21	22	0	0	1.3012D 07	1.5516D 04	1.2875D 04	4.8660D 03	4.8660D 03	0.0		0.0	0.0	44	21	22	0	0
45	22	23	0	0	3.2131D 07	1.5516D 04	1.2875D 04	4.8660D 03	4.8660D 03	0.0		0.0	0.0	45	22	23	0	0
46	3	29	0	1	3.4750D 05	3.0080D 03	3.0080D 03	2.1413D 03	2.1413D 03	0.0		4.8000D 04	1.4400D 05	46	3	29	0	1
47	5	29	0	2	3.4750D 05	3.0080D 03	3.0080D 03	2.1413D 03	2.1413D 03	0.0		4.8000D 04	1.4400D 05	47	5	29	0	2
48	9	29	0	3	3.4750D 05	3.0080D 03	3.0080D 03	2.1413D 03	2.1413D 03	0.0		4.8000D 04	1.4400D 05	48	9	29	0	3
49	11	29	0	4	3.4750D 05	3.0080D 03	3.0080D 03	2.1413D 03	2.1413D 03	0.0		4.8000D 04	1.4400D 05	49	11	29	0	4
50	30	31	0	0	1.3653D 04	9.4000D 02	7.8000D 02	2.9480D 02	2.9480D 02	0.0		0.0	0.0	50	30	31	0	0
51	30	32	0	0	8.3219D 02	1.1515D 02	1.1515D 02	8.1969D 01	8.1969D 01	0.0		0.0	0.0	51	30	32	0	0
52	5	30	0	0	0.0	1.0138D 02	8.4127D 01	3.1796D 01	3.1796D 01	0.0		0.0	0.0	52	5	30	0	0
53	11	30	0	0	0.0	1.0138D 02	8.4127D 01	3.1796D 01	3.1796D 01	0.0		0.0	0.0	53	11	30	0	0
54	29	30	0	0	0.0	1.7907D 01	1.4859D 01	5.6159D 00	5.6159D 00	0.0		0.0	0.0	54	29	30	0	0
55	29	30	5	1	0.0	5.4990D 01	4.5630D 01	1.7246D 01	1.7246D 01	0.0		0.0	0.0	55	29	30	5	1
56	14	0	0	0	0.0	8.2837D 03	8.2837D 03	2.7751D 03	2.7751D 03	0.0		0.0	0.0	56	14	0	0	0
57	18	0	0	0	0.0	8.2837D 03	8.2837D 03	2.7751D 03	2.7751D 03	0.0		0.0	0.0	57	18	0	0	0

BEAM DEFLECTIONS

	BEAM				DEFLECTION			TRANSLATION DUE TO				ROTATION ABOUT		
IJ	I	J	M	N	BUCKLING	TENSION	COMPRESSION	F(Y)	F(Z)	BM(Z)	BM(Y)	X-AXIS	Y-AXIS	Z-AXIS
1	1	2	0	0	7.761D-01	2.238D-02	1.857D-02	1.488D-01	2.153D-03	4.641D-02	5.355D-03	0.0	3.213D-03	2.784D-02
2	2	3	0	0	3.528D-01	4.924D-02	4.086D-02	1.584D 00	2.292D-02	2.246D-01	2.592D-02	0.0	7.069D-03	6.126D-02
3	3	4	0	0	3.234D-01	5.371D-02	4.457D-02	2.056D 00	2.976D-02	2.673D-01	3.085D-02	0.0	7.711D-03	6.682D-02
4	4	5	0	0	3.528D-01	4.924D-02	4.086D-02	1.584D 00	2.292D-02	2.246D-01	2.592D-02	0.0	7.069D-03	6.126D-02
5	5	6	0	0	5.544D-01	3.133D-02	2.600D 02	4.082D-01	5.907D-03	9.095D-02	1.050D-02	0.0	4.498D-03	3.898D-02
6	7	8	0	0	2.632D 00	2.238D-02	1.857D-02	4.387D-02	5.477D-03	3.095D-02	1.876D-02	0.0	1.126D-02	1.857D-02
7	8	9	0	0	1.196D 00	4.924D-02	4.086D-02	4.671D-01	5.832D-02	1.498D-01	9.079D-02	0.0	2.476D-02	4.086D-02
8	9	10	0	0	1.097D 00	5.371D-02	4.457D-02	6.064D-01	7.571D-02	1.783D-01	1.081D-01	0.0	2.701D-02	4.457D-02
9	10	11	0	0	1.196D 00	4.924D-02	4.086D-02	4.671D-01	5.832D-02	1.498D-01	9.079D-02	0.0	2.476D-02	4.086D-02
10	11	12	0	0	1.880D 00	3.133D-02	2.600D-02	1.204D-01	1.503D-02	6.067D-02	3.677D-02	0.0	1.576D-02	2.600D-02
11	1	0	0	0	4.835D-02	5.371D-02	4.457D-02	1.375D 01	3.120D-02	3.161D-01	4.537D-02	0.0	1.134D-02	7.903D-02
12	2	0	0	0	4.835D-02	5.371D-02	4.457D-02	1.375D 01	3.120D-02	3.161D-01	4.537D-02	0.0	1.134D-02	7.903D-02
13	3	0	0	0	4.835D-02	5.371D-02	4.457D-02	1.375D 01	3.120D-02	3.161D-01	4.537D-02	0.0	1.134D-02	7.903D-02
14	4	0	0	0	4.835D-02	5.371D-02	4.457D-02	1.375D 01	3.120D-02	3.161D-01	4.537D-02	0.0	1.134D-02	7.903D-02
15	5	0	0	0	4.835D-02	5.371D-02	4.457D-02	1.375D 01	3.120D-02	3.161D-01	4.537D-02	0.0	1.134D-02	7.903D-02
16	6	0	0	0	4.835D-02	5.371D-02	4.457D-02	1.375D 01	3.120D-02	3.161D-01	4.537D-02	0.0	1.134D-02	7.903D-02
17	1	7	0	0	5.284D-02	6.267D-02	5.200D-02	1.713D 01	9.014D-02	4.412D-01	8.605D-02	0.0	1.844D-02	9.455D-02
18	2	8	0	0	5.284D-02	6.267D-02	5.200D-02	1.713D 01	9.014D-02	4.412D-01	8.605D-02	0.0	1.844D-02	9.455D-02
19	3	9	0	0	5.284D-02	6.267D-02	5.200D-02	1.713D 01	9.014D-02	4.412D-01	8.605D-02	0.0	1.844D-02	9.455D-02
20	4	10	0	0	5.284D-02	6.267D-02	5.200D-02	1.713D 01	9.014D-02	4.412D-01	8.605D-02	0.0	1.844D-02	9.455D-02
21	5	11	0	0	5.284D-02	6.267D-02	5.200D-02	1.713D 01	9.014D-02	4.412D-01	8.605D-02	0.0	1.844D-02	9.455D-02
22	6	12	0	0	5.234D-02	6.267D-02	5.200D-02	1.713D 01	9.014D-02	4.412D-01	8.605D-02	0.0	1.844D-02	9.455D-02
23	7	13	0	0	4.540D-02	1.175D-01	9.750D-02	2.515D 00	7.008D 01	6.824D-01	7.418D 00	0.0	8.478D-01	7.800D-02
24	8	14	0	0	4.540D-02	1.175D-01	9.750D-02	2.515D 00	7.008D 01	6.824D-01	7.418D 00	0.0	8.478D-01	7.800D-02
25	9	15	0	0	4.540D-02	1.175D-01	9.750D-02	2.515D 00	7.008D 01	6.824D-01	7.418D 00	0.0	8.478D-01	7.800D-02
26	10	16	0	0	4.540D-02	1.175D-01	9.750D-02	2.515D 00	7.008D 01	6.824D-01	7.418D 00	0.0	8.478D-01	7.800D-02
27	11	17	0	0	4.393D-02	1.175D-01	9.750D-02	3.070D 00	7.244D 01	6.824D-01	1.287D 00	0.0	1.471D-01	7.800D-02

28	12	18	0	0	4.540D-02	1.175D-01	9.750D-02	2.515D 00	7.008D 01	6.824D-01	7.418D 00	0.0	8.478D-01	7.800D-02
29	17	22	0	0	5.417D-02	9.848D-02	8.171D-02	1.480D 00	4.126D 01	4.794D-01	5.211D 00	0.0	7.106D-01	6.537D-02
30	18	23	0	0	5 417D-02	9.848D-02	8.171D-02	1.480D 00	4.126D 01	4.794D-01	5.211D 00	0.0	7.106D-01	6.537D-02
31	14	19	0	0	1 5100 00	9.848D-02	8.171D-02	1.480D 00	8.219D-02	4.794D-01	1.939D-01	0.0	2.644D-02	6.537D-02
32	19	24	0	0	3 696D-02	1.444D-01	1.198D-01	1.300D 02	4.663D 00	1.120D 01	1.030D 00	0.0	9.583D-02	1.042D 00
33	20	25	0	0	3 696D-02	1.444D-01	1.198D-01	1.300D 02	4.663D 00	1.120D 01	1.030D 00	0.0	9.583D-02	1.042D 00
34	21	26	0	0	3.696D-02	1.444D-01	1.198D-01	1.300D 02	4.663D 00	1.120D 01	1.030D 00	0.0	9.583D-02	1.042D 00
35	22	27	0	0	3.696D-02	1.444D-01	1.198D-01	1.300D 02	4.663D 00	1.120D 01	1.030D 00	0.0	9.583D-02	1.042D 00
36	23	28	0	0	3.696D-02	1.444D-01	1.198D-01	1.300D 02	4.663D 00	1.120D 01	1.030D 00	0.0	9.583D-02	1.042D 00
37	13	14	0	0	5.662D-01	2.238D-02	1.857D-02	5.415D-03	2.039D-01	3.198D-02	3.933D-02	0.0	2.360D-02	1.919D-02
38	14	15	0	0	2.574D-01	4.924D-02	4.086D-02	5.766D-02	2.171D 00	1.548D-01	1.904D-01	0.0	5.192D-02	4.221D-02
39	15	16	0	0	2.359D-01	5.371D-02	4.457D-02	7.485D-02	2.819D 00	1.842D-01	2.265D-01	0.0	5.663D-02	4.604D-02
40	16	17	0	0	2.574D-01	4.924D-02	4.086D-02	5.766D-02	2.171D 00	1.548D-01	1.904D-01	0.0	5.192D-02	4.221D-02
41	17	18	0	0	4.044D-01	3.133D-02	2.600D-02	1.486D-02	5.595D-01	6.267D-02	7.709D-02	0.0	3.304D-02	2.686D-02
42	19	20	0	0	4.129D 01	4.924D-02	4.086D-02	2.897D-03	1.353D-02	0.0	0.0	0.0	0.0	0.0
43	20	21	0	0	3.785D 01	5.371D-02	4.457D-02	3.762D-03	1.757D-02	0.0	0.0	0.0	0.0	0.0
44	21	22	0	0	4.129D 01	4.924D-02	4.086D-02	2.897D-03	1.353D-02	0.0	0.0	0.0	0.0	0.0
45	22	23	0	0	6.489D 01	3.133D-02	2.600D-02	7.467D-04	3.488D-03	0.0	0.0	0.0	0.0	0.0
46	3	29	0	1	2.643D 00	2.288D-02	2.288D-02	9.663D-02	2.899D-01	1.818D 00	1.818D 00	0.0	3.813D-01	3.813D-01
47	5	29	0	2	2.643D 00	2.288D-02	2.288D-02	9.663D-02	2.899D-01	1.818D 00	1.818D 00	0.0	3.813D-01	3.813D-01
48	9	29	0	3	2.643D 00	2.288D-02	2.288D-02	9.663D-02	2.899D-01	1.818D 00	1.818D 00	0.0	3.813D-01	3.813D-01
49	11	29	0	4	2.643D 00	2.288D-02	2.288D-02	9.663D-02	2.899D-01	1.818D 00	1.818D 00	0.0	3.813D-01	3.813D-01
50	30	31	0	0	9.811D-01	6.755D-02	5.605D-02	1.072D 00	1.072D 00	0.0	0.0	0.0	0.0	0.0
51	30	32	0	0	1.745D 00	2.414D-01	2.414D-01	4.890D 00	4.890D 00	0.0	0.0	0.0	0.0	0.0
52	5	30	0	0	0.0	1.086D-01	9.009D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	11	30	0	0	0.0	1.086D-01	9.009D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	29	30	0	0	0.0	3.357D-02	2.786D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	29	30	5	1	0.0	3.357D-02	2.786D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	14	0	0	0	0.0	1.400D-01	1.400D-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	18	0	0	0	0.0	1.400D-01	1.400D-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0

BEAM UNCOUPLED,UNDAMPED FREQUENCIES (CPS)

IJ	I	J	M	N	(1)	(2)	(3)	(4)	(5)	(6)
1	1	2	0	0	3.4805D 03	7.5602D 02	6.2847D 03	9.7678D 02	3.6631D 03	5.6174D 02
2	2	3	0	0	1.2901D 03	1.2738D 02	1.0589D 03	3.3515D 02	1.1510D 03	1.9506D 02
3	3	4	0	0	1.0767D 03	9.7447D 01	8.1007D 02	2.7221D 02	8.8603D 02	1.5803D 02
4	4	5	0	0	1.4414D 03	1.4232D 02	1.1831D 03	4.0452D 02	1.3614D 03	1.9682D 02
5	5	6	0	0	2.5611D 03	3.9737D 02	3.3033D 03	7.1802D 02	2.5985D 03	3.8915D 02
6	7	8	0	0	1.4046D 03	5.6183D 02	1.5901D 03	1.5489D 02	5.2760D 02	2.8786D 02
7	8	9	0	0	5.2952D 02	9.6276D 01	2.7248D 02	5.6932D 01	1.8133D 02	9.5593D 01
8	9	10	0	0	4.4420D 02	7.4034D 01	2.0953D 02	4.7316D 01	1.4581D 02	8.6028D 01
9	10	11	0	0	5.8240D 02	1.0589D 02	2.9969D 02	6.4207D 01	2.0329D 02	1.0343D 02
10	11	12	0	0	1.0336D 03	2.9531D 02	8.3579D 02	1.1373D 02	3.7903D 02	2.0464D 02
11	1	0	0	0	1.9008D 03	6.6522D 01	1.3966D 03	6.1773D 02	1.6760D 03	1.2280D 02
12	2	0	0	0	1.0631D 03	3.7204D 01	7.8107D 02	3.1091D 02	9.3731D 02	5.8248D 01
13	3	0	0	0	5.5106D 02	1.9285D 01	4.0489D 02	8.4903D 01	2.7657D 02	3.8830D 01
14	4	0	0	0	8.8638D 02	3.1021D 01	6.5126D 02	2.4484D 02	7.8154D 02	4.4733D 01
15	5	0	0	0	1.0020D 03	3.5067D 01	7.3621D 02	2.9222D 02	8.8348D 02	5.4666D 01
16	6	0	0	0	1.6098D 03	5.6339D 01	1.1828D 03	5.0153D 02	1.4174D 03	9.7075D 01
17	1	7	0	0	1.4438D 03	4.8903D 01	6.7417D 02	2.9175D 02	7.9873D 02	9.3045D 01
18	2	8	0	0	8.0793D 02	2.7366D 01	3.7727D 02	1.4793D 02	4.4729D 02	4.2468D 01
19	3	9	0	0	4.3262D 02	1.4653D 01	2.0201D 02	4.7777D 01	1.5473D 02	3.0119D 01
20	4	10	0	0	6.7377D 02	2.2822D 01	3.1462D 02	1.1693D 02	3.7296D 02	3.3898D 01
21	5	11	0	0	7.6155D 02	2.5795D 01	3.5561D 02	1.3906D 02	4.2101D 02	4.1424D 01
22	6	12	0	0	1.2227D 03	4.1416D 01	5.7096D 02	2.3756D 02	6.7559D 02	7.3579D 01
23	7	13	0	0	1.1769D 03	1.4247D 02	2.6985D 01	2.2613D 02	5.2455D 01	2.9089D 02
24	8	14	0	0	5.2359D 02	6.3383D 01	1.2006D 01	7.4407D 01	2.3959D 01	1.2566D 02
25	9	15	0	0	5.2111D 02	6.3083D 01	1.1949D 01	7.1607D 01	2.3043D 01	1.1861D 02
26	10	16	0	0	5.5081D 02	6.6678D 01	1.2630D 01	7.2416D 01	2.4427D 01	1.2456D 02
27	11	17	0	0	9.6306D 02	1.0552D 02	2.1720D 01	6.8734D 01	4.3293D 01	2.0221D 02

28	12	18	0	0	7.9165D 02	9.5834D 01	1.81[illegible]2D 01	1.3300D 02	3.6187D 01	1.9752D 02	
29	17	22	0	0	6.3139D 02	[illegible].1194D 01	1.72[illegible]4D 01	4.2983D 01	2.9622D 01	1.4028D 02	
30	18	23	0	0	1.0108D 03	[illegible].4600D 02	2.7655D 01	1.9923D 02	5.0142D 01	2.2485D 02	
31	14	19	0	0	9.9648D 02	[illegible].4393D 02	6.1083D 02	6.1674D 02	1.0524D 03	2.1717D 02	
32	19	24	0	0	5.6250D 02	[illegible].0498D 01	5.5424D 01	5.3180D 01	1.1096D 02	2.3601D 01	
33	20	25	0	0	5.1096D 02	9.5362D 00	5.0345D 01	5.1395D 01	1.1731D 02	2.4622D 01	
34	21	26	0	0	5.1096D 02	[illegible].5362D 00	5.0345D 01	5.1395D 01	1.1731D 02	2.4622D 01	
35	22	27	0	0	5.0214D 02	9.3716D 00	4.9477D 01	4.8415D 01	1.0037D 02	2.1212D 01	
36	23	28	0	0	8.0304D 02	[illegible].4987D 01	7.9125D 01	8.3596D 01	1.6066D 02	3.5327D 01	
37	13	14	0	0	3.0402D 03	3.4614D 03	5.6405D 02	4.2112D 02	2.1465D 02	5.9140D 03	
38	14	15	0	0	1.1831D 03	6.1227D 02	9.9773D 01	1.6640D 02	8.0344D 01	1.2449D 03	
39	15	16	0	0	1.2010D 03	5.6973D 02	9.2840D 01	1.6369D 02	7.8339D 01	1.1589D 03	
40	16	17	0	0	1.1539D 03	5.9719D 02	9.7315D 01	1.6197D 02	7.8112D 01	9.1156D 02	
41	17	18	0	0	1.7487D 03	1.4[illegible]21D 03	2.3174D 02	2.5537D 02	1.2738D 02	2.3061D 03	
42	19	20	0	0	1.6984D 03	3.9209D 03	1.8142D 03	9.3808D 02	1.8330D 03	3.0186D 03	
43	20	21	0	0	1.5915D 03	3.3680D 03	1.5584D 03	1.0013D 03	1.9359D 03	3.1797D 03	
44	21	22	0	0	1.5742D 03	3.6342D 03	1.6815D 03	8.8872D 02	1.7308D 03	2.8511D 03	
45	22	23	0	0	2.4748D 03	8.9779D 03	4.1541D 03	1.1664D 03	2.4392D 03	3.9473D 03	
46	3	29	0	1	3.7425D 02	1.5447D 02	8.9185D 01	1.0597D 02	6.9492D 01	1.2344D 02	
47	5	29	0	2	5.6372D 02	2.3349D 02	1.3481D 02	1.4404D 02	1.9044D 02	3.1033D 02	
48	9	29	0	3	3.6511D 02	1.5031D 02	8.6781D 01	7.7329D 01	6.4622D 01	1.1454D 02	
49	11	29	0	4	5.1710D 02	2.1230D 02	1.2257D 02	9.5198D 01	1.0570D 02	1.7685D 02	
50	30	31	0	0	6.1[illegible]5D 01	8.5914D 00	8.5914D 00	4.6263D 00	9.2062D 00	9.2004D 00	
51	30	32	0	0	1.1514D 01	2.1211D 00	2.1211D 00	1.0136D 00	2.2729D 00	2.2714D 00	
52	5	30	0	0	4.4468D 01	0.0	0.0	0.0	0.0	0.0	
53	11	30	0	0	3.9740D 01	0.0	0.0	0.0	0.0	0.0	
54	29	30	0	0	1.8055D 01	0.0	0.0	0.0	0.0	0.0	
55	29	30	5	1	3.1640D 01	0.0	0.0	0.0	0.0	0.0	
56	14	0	0	0	6.9434D 02	0.0	0.0	0.0	0.0	0.0	
57	18	0	0	0	1.0497D 03	0.0	0.0	0.0	0.0	0.0	

DAMPING TERMS (LB/IN/SEC,TRANSLATIONS (1)-(3) AND LB-IN-SEC,ROTATIONS (4)-(6))

IJ	I	J	M	N	(1)	(2)	(3)	(4)	(5)	(6)
1	1	2	0	0	3.65826D-06	1.68413D-05	2.02592D-06	1.30351D-05	3.47587D-06	2.26660D-05
2	2	3	0	0	9.86912D-06	9.99546D-05	1.20240D-05	3.79904D-05	1.10624D-05	6.52735D-05
3	3	4	0	0	1.18257D-05	1.30659D-04	1.57176D-05	4.67742D-05	1.43701D-05	8.05700D-05
4	4	5	0	0	8.83337D-06	8.94645D-05	1.07621D-05	3.14751D-05	9.35219D-06	6.46895D-05
5	5	6	0	0	4.97150D-06	3.20418D-05	3.85446D-06	1.77326D-05	4.89998D-06	3.27185D-05
6	7	8	0	0	9.06496D-06	2.26623D-05	8.00736D-06	8.22022D-05	2.41326D-05	4.42312D-05
7	8	9	0	0	2.40454D-05	1.32249D-04	4.67281D-05	2.23644D-04	7.02183D-05	1.33193D-04
8	9	10	0	0	2.86636D-05	1.71981D-04	6.07668D-05	2.69094D-04	8.73195D-05	1.48002D-04
9	10	11	0	0	2.18621D-05	1.20241D-04	4.24853D-05	1.98301D-04	6.26314D-05	1.23096D-04
10	11	12	0	0	1.23186D-05	4.31150D-05	1.52340D-05	1.11956D-04	3.35922D-05	6.22171D-05
11	1	0	0	0	6.69851D-06	1.91402D-04	9.11682D-06	2.06116D-05	7.59711D-06	1.03681D-04
12	2	0	0	0	1.19772D-05	3.42234D-04	1.63012D-05	4.09514D-05	1.35840D-05	2.18591D-04
13	3	0	0	0	2.31053D-05	6.60207D-04	3.14468D-05	1.49963D-04	4.60364D-05	3.27902D-04
14	4	0	0	0	1.43644D-05	4.10447D-04	1.95503D-05	5.20029D-05	1.62914D-05	2.84630D-04
15	5	0	0	0	1.27070D-05	3.63086D-04	1.72944D-05	4.35710D-05	1.44116D-05	2.32912D-04
16	6	0	0	0	7.90924D-06	2.25997D-04	1.07646D-05	2.53873D-05	8.98305D-06	1.31161D-04
17	1	7	0	0	8.81884D-06	2.60363D-04	1.88860D-05	4.36409D-05	1.59407D-05	1.36842D-04
18	2	8	0	0	1.57592D-05	4.65266D-04	3.37492D-05	8.60726D-05	2.84655D-05	2.99814D-04
19	3	9	0	0	2.94311D-05	8.68309D-04	6.30284D-05	2.66496D-04	8.22853D-05	4.22732D-04
20	4	10	0	0	1.88971D-05	5.57908D-04	4.04692D-05	1.08893D-04	3.41384D-05	3.75611D-04
21	5	11	0	0	1.67190D-05	4.93603D-04	3.58046D-05	9.15591D-05	3.02428D-05	3.07371D-04
22	6	12	0	0	1.04130D-05	3.07428D-04	2.23000D-05	5.35970D-05	1.88464D-05	1.73045D-04
23	7	13	0	0	1.08189D-05	8.93715D-05	4.71829D-04	5.63062D-05	2.42732D-04	4.37705D-05
24	8	14	0	0	2.43175D-05	2.00880D-04	1.06053D-03	1.71119D-04	5.31434D-04	1.01328D-04
25	9	15	0	0	2.44331D-05	2.01835D-04	1.06557D-03	1.77809D-04	5.44040D-04	1.07343D-04
26	10	16	0	0	2.31157D-05	1.90952D-04	1.00811D-03	1.75824D-04	5.21248D-04	1.02217D-04
27	11	17	0	0	1.32208D-05	1.20666D-04	5.86199D-04	1.85241D-04	2.94099D-04	6.29657D-05

28	12	18	0	0	1.608330-05	1.328590-04	7.014180-04	9.573350-05	3.518540-04	6.446230-05
29	17	22	0	0	2.016570-05	1.396190-04	7.371040-04	2.962200-04	4.298320-04	9.076600-05
30	18	23	0	0	1.259580-05	8.720800-05	4.604070-04	6.390750-05	2.539290-04	5.662670-05
31	14	19	0	0	1.277740-05	8.846510-05	2.064460-05	2.064480-05	1.209800-05	5.862990-05
32	19	24	0	0	2.263530-05	1.212820-03	2.297260-04	2.394210-04	1.147450-04	5.394830-04
33	20	25	0	0	2.491880-05	1.335170-03	2.529010-04	2.477370-04	1.085380-04	5.171130-04
34	21	26	0	0	2.491880-05	1.335170-03	2.529010-04	2.477370-04	1.085380-04	5.171130-04
35	22	27	0	0	2.535630-05	1.358610-03	2.573420-04	2.629830-04	1.268590-04	6.002500-04
36	23	28	0	0	1.585520-05	8.495360-04	1.609150-04	1.523090-04	7.925220-05	3.604140-04
37	13	14	0	0	4.188050-06	3.678440-06	2.257330-05	3.023470-05	5.931780-05	2.152910-06
38	14	15	0	0	1.076200-05	2.079530-05	1.276130-04	7.651860-05	1.584740-04	1.022760-05
39	15	16	0	0	1.060180-05	2.234810-05	1.371430-04	7.778490-05	1.625300-04	1.098660-05
40	16	17	0	0	1.103380-05	2.132050-05	1.308360-04	7.860850-05	1.630010-04	1.396760-05
41	17	18	0	0	7.281020-06	8.953070-06	5.494180-05	4.985810-05	9.995680-05	5.521250-06
42	19	20	0	0	7.496690-06	3.247300-06	7.018150-06	1.357280-05	6.946240-06	4.218020-06
43	20	21	0	0	8.000070-06	3.780380-06	8.170250-06	1.271550-05	6.577030-06	4.004310-06
44	21	22	0	0	8.088210-06	3.503530-06	7.571910-06	1.432670-05	7.356160-06	4.465810-06
45	22	23	0	0	5.144890-06	1.418190-06	3.065030-06	1.091560-05	5.219980-06	3.225610-06
46	3	29	0	1	3.384010-05	8.242510-05	1.427650-04	1.201470-04	1.832210-04	1.031440-04
47	5	29	0	2	2.238790-05	5.453060-05	9.444970-05	8.839220-05	6.685780-05	4.102820-05
48	9	29	0	3	3.477740-05	8.470790-05	1.467180-04	1.646530-04	1.970300-04	1.111610-04
49	11	29	0	4	2.462280-05	5.997420-05	1.038780-04	1.337460-04	1.204580-04	7.199610-05
50	30	31	0	0	2.135430-03	1.519030-02	1.519030-02	2.821000-02	1.417600-02	1.418500-02
51	30	32	0	0	8.753550-03	4.669020-02	4.669020-02	9.770930-02	4.357240-02	4.360010-02
52	5	30	0	0	2.863260-04	0.0	0.0	0.0	0.0	0.0
53	11	30	0	0	3.203920-04	0.0	0.0	0.0	0.0	0.0
54	29	30	0	0	7.051980-04	0.0	0.0	0.0	0.0	0.0
55	29	30	5	1	4.024210-04	0.0	0.0	0.0	0.0	0.0
56	14	0	0	0	1.833740-05	0.0	0.0	0.0	0.0	0.0
57	18	0	0	0	1.212900-05	0.0	0.0	0.0	0.0	0.0

EULER ANGLES, BEAM IJ TO AIRPLANE (RADIANS)

IJ	I	J	M	N	THEIJ0(IJ)	PSIIJ0(IJ)
1	1	2	0	0	0.0	3.141590 00
2	2	3	0	0	0.0	3.141590 00
3	3	4	0	0	0.0	3.141590 00
4	4	5	0	0	0.0	3.141590 00
5	5	6	0	0	0.0	3.141590 00
6	7	8	0	0	0.0	3.141590 00
7	8	9	0	0	0.0	3.141590 00
8	9	10	0	0	0.0	3.141590 00
9	10	11	0	0	0.0	3.141590 00
10	11	12	0	0	0.0	3.141590 00
11	1	0	0	0	0.0	1.570800 00
12	2	0	0	0	0.0	1.570800 00
13	3	0	0	0	0.0	1.570800 00
14	4	0	0	0	0.0	1.570800 00
15	5	0	0	0	0.0	1.570800 00
16	6	0	0	0	0.0	1.570800 00
17	1	7	0	0	0.0	-1.570800 00
18	2	8	0	0	0.0	-1.570800 00
19	3	9	0	0	0.0	-1.570800 00
20	4	10	0	0	0.0	-1.570800 00
21	5	11	0	0	0.0	-1.570800 00
22	6	12	0	0	0.0	-1.570800 00
23	7	13	0	0	1.261090 00	-1.570800 00
24	8	14	0	0	1.261090 00	-1.570800 00
25	9	15	0	0	1.261090 00	-1.570800 00
26	10	16	0	0	1.261090 00	-1.570800 00
27	11	17	0	0	1.261090 00	-1.570800 00

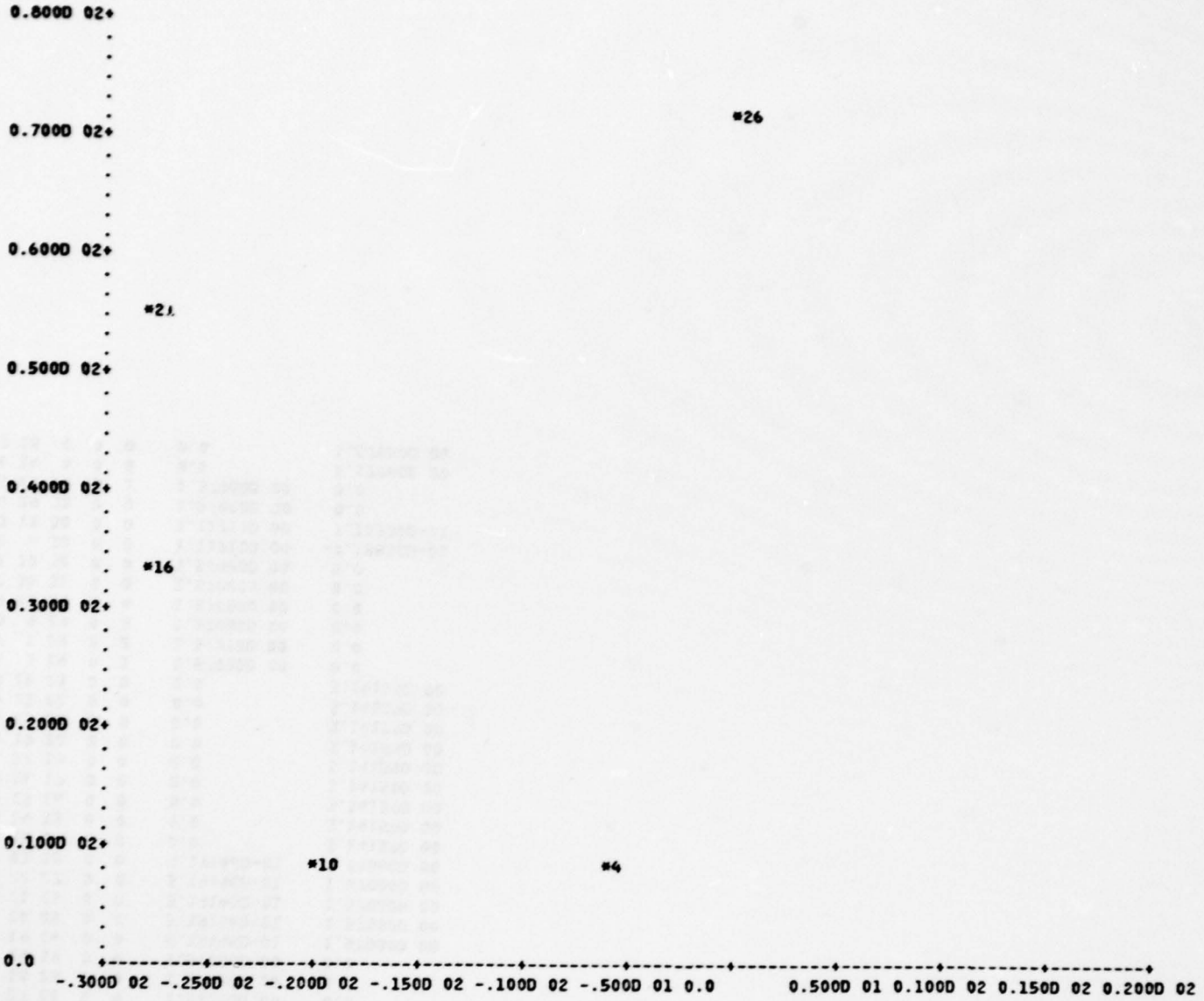
```
28 12 18  0  0    1.261090 00   -1.570800 00
29 17 22  0  0    1.570800 00    0.0
30 18 23  0  0    1.570800 00    0.0
31 14 19  0  0    1.570800 00    0.0
32 19 24  0  0    5.19146D-01    1.570800 00
33 20 25  0  0    5.19146D-01    1.570800 00
34 21 26  0  0    5.19146D-01    1.570800 00
35 22 27  0  0    5.19146D-01    1.570800 00
36 23 28  0  0    5.19146D-01    1.570800 00
37 13 14  0  0    0.0            3.141590 00
38 14 15  0  0    0.0            3.141590 00
39 15 16  0  0    0.0            3.141590 00
40 16 17  0  0    0.0            3.141590 00
41 17 18  0  0    0.0            3.141590 00
42 19 20  0  0    0.0            3.141590 00
43 20 21  0  0    0.0            3.141590 00
44 21 22  0  0    0.0            3.141590 00
45 22 23  0  0    0.0            3.141590 00
46  3 29  0  1    1.570800 00    0.0
47  5 29  0  2    1.570800 00    0.0
48  9 29  0  3    1.570800 00    0.0
49 11 29  0  4    1.570800 00    0.0
50 30 31  0  0    1.570800 00    0.0
51 30 32  0  0    1.570800 00    0.0
52  5 30  0  0    1.117100 00   -7.188300-01
53 11 30  0  0    1.117100 00    7.188300-01
54 29 30  0  0    1.570800 00    0.0
55 29 30  5  1    1.570800 00    0.0
56 14  0  0  0    0.0            1.570800 00
57 18  0  0  0    0.0            1.570800 00
```

MASS POSITION PLOT PLANE ** Y(+RIGHT) - Z(+UP)

NOTE *** A MODIFIED RIGHT HAND GROUND COORDINATE SYSTEM HAS BEEN USED FOR THIS PLOT ***

TIME = 0

MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS
4	-6.00	8.2	10	-20.00	8.24	16	-28.00	33.23	21	-28.00	55.23
26	0.0	71.23									

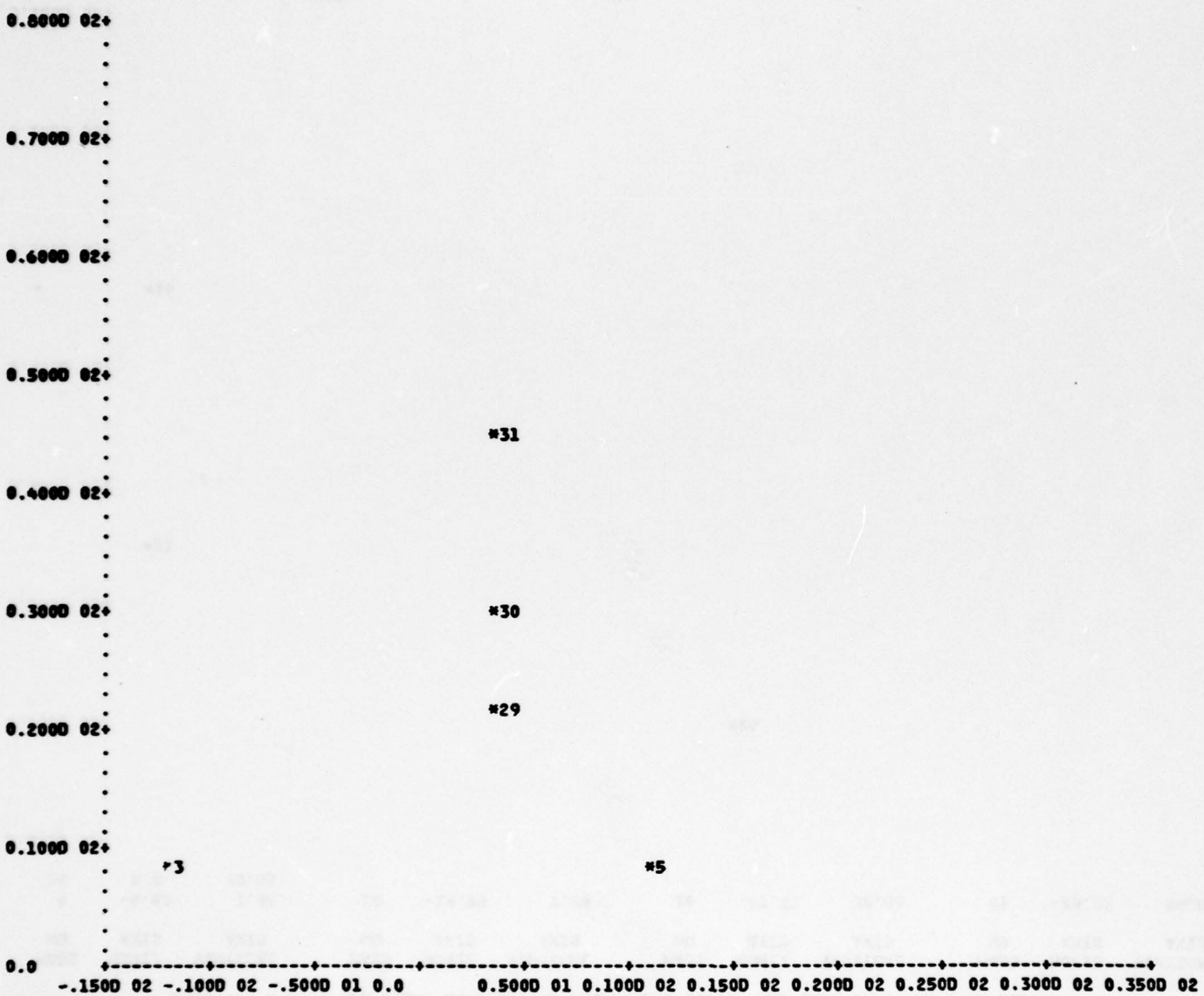


TIME = 0

MASS POSITION PLOT PLANE ** X(+AFT) - Z(+UP)

NOTE *** A MODIFIED RIGHT HAND GROUND COORDINATE SYSTEM HAS BEEN USED FOR THIS PLOT ***

MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS
3	-11.84	8.39	5	11.16	8.09	29	3.35	22.50	30	3.45	29.99
31	3.64	45.08									

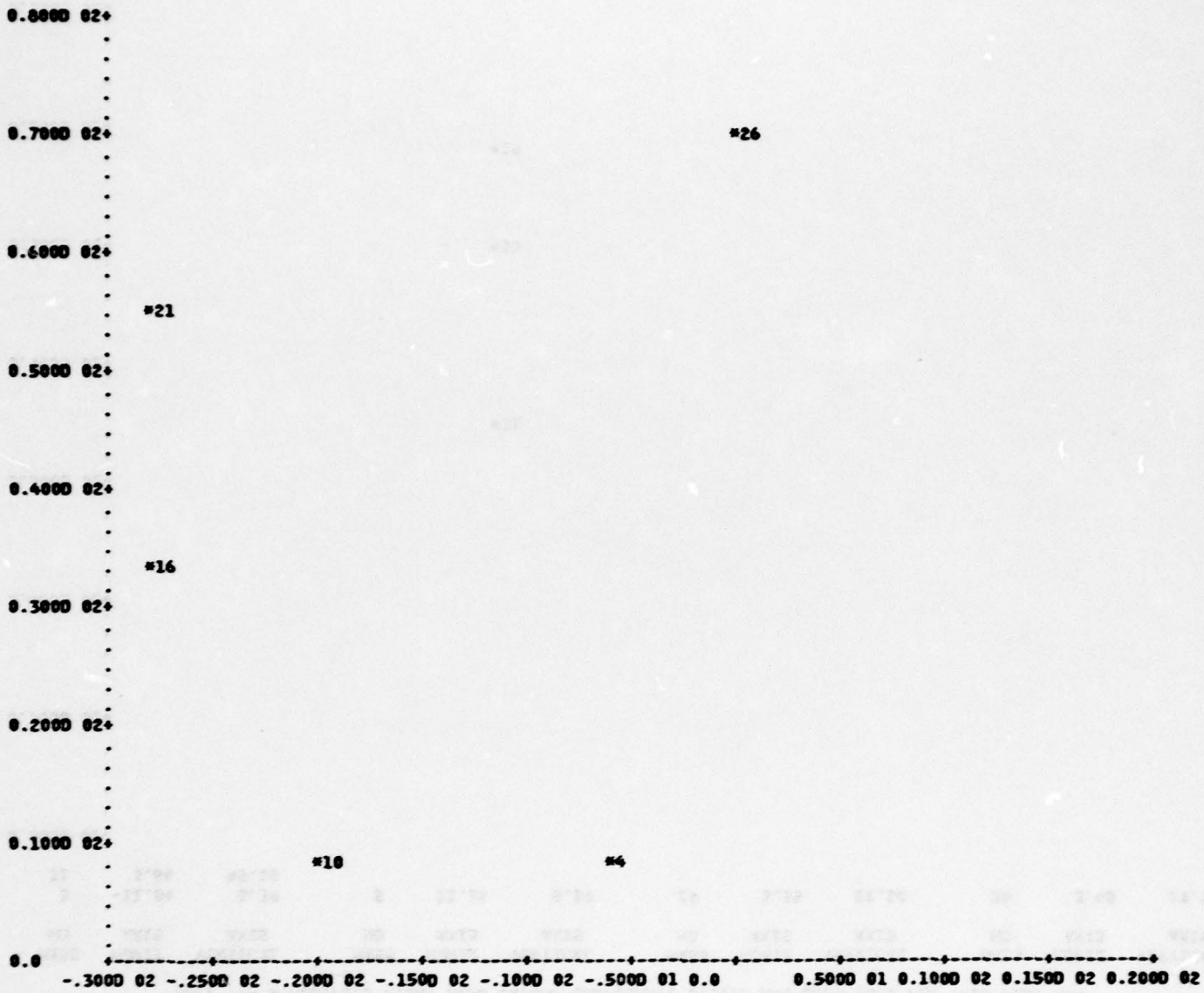


TIME = 0.054

MASS POSITION PLOT PLANE ** Y(+RIGHT) - Z(+UP)

NOTE *** A MODIFIED RIGHT HAND GROUND COORDINATE SYSTEM HAS BEEN USED FOR THIS PLOT ***

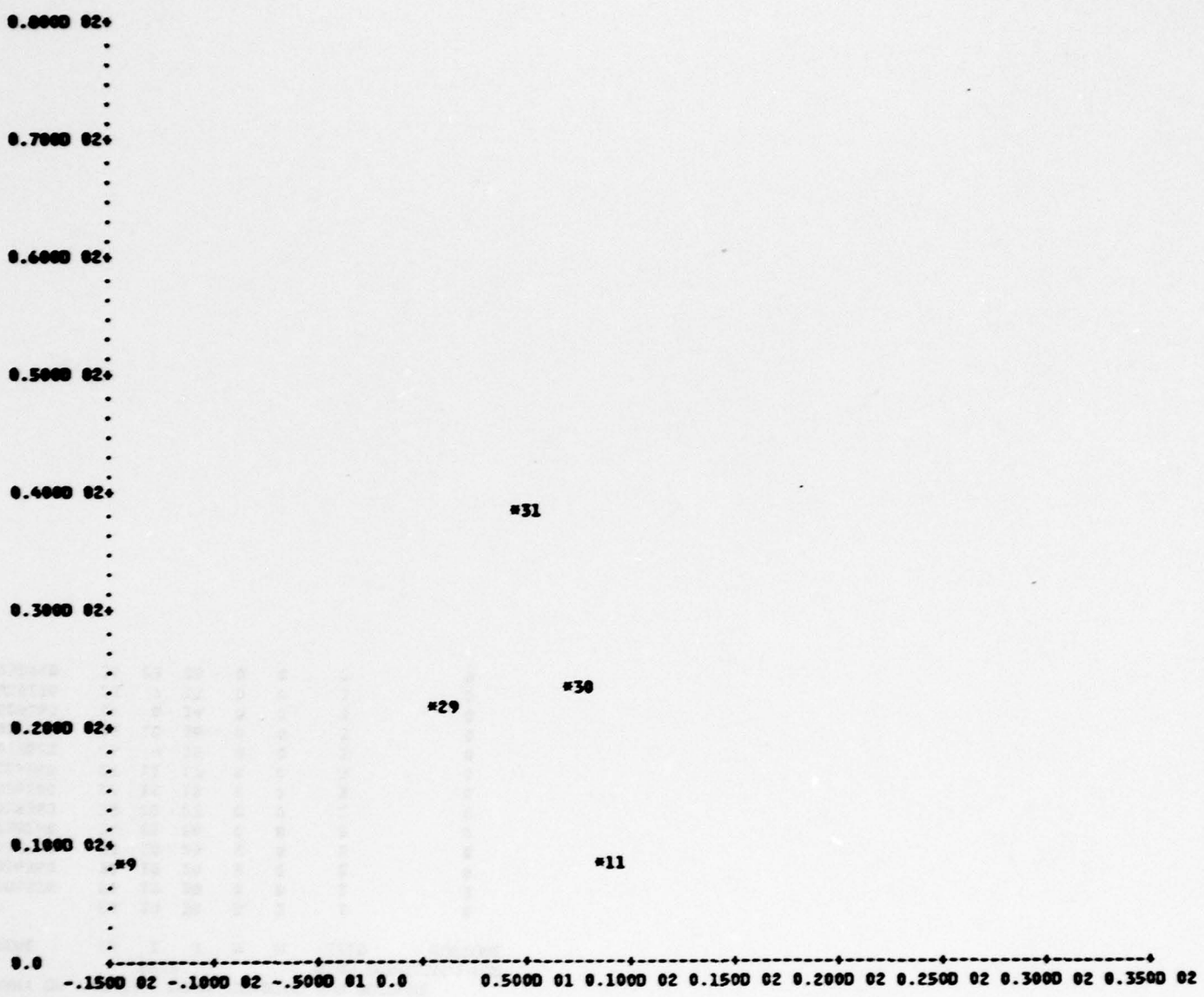
MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS
4	-6.00	7.88	10	-19.99	7.80	16	-27.91	32.81	21	-28.05	54.82
26	0.0	70.65									



MASS POSITION PLOT PLANE ** X(+AFT) - Z(+UP) TIME = 0.064

NOTE *** A MODIFIED RIGHT HAND GROUND COORDINATE SYSTEM HAS BEEN USED FOR THIS PLOT ***

MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS
9	-14.66	7.83	11	8.33	7.75	29	8.35	22.12	30	7.24	23.03
31	4.62	37.85									



SUMMARY OF INTERNAL BEAM YIELDING AND RUPTURE

TIME	BEAM IJ	I	J	M	N	BEAM DIRECTION FOR YIELD	RUPTURE
0.0	55	29	30	5	1	1	0
0.006870	54	29	30	0	0	1	0
0.016960	32	19	24	0	0	2	0
0.017310	33	20	25	0	0	2	0
0.018260	34	21	26	0	0	2	0
0.019360	35	22	27	0	0	2	0
0.026100	28	12	18	0	0	3	0
0.026860	27	11	17	0	0	3	0
0.027620	25	9	15	0	0	3	0
0.027650	26	10	16	0	0	3	0
0.028260	24	8	14	0	0	3	0
0.029190	23	7	13	0	0	3	0
0.032440	36	23	28	0	0	2	0

SUMMARY OF ENERGY DISTRIBUTION

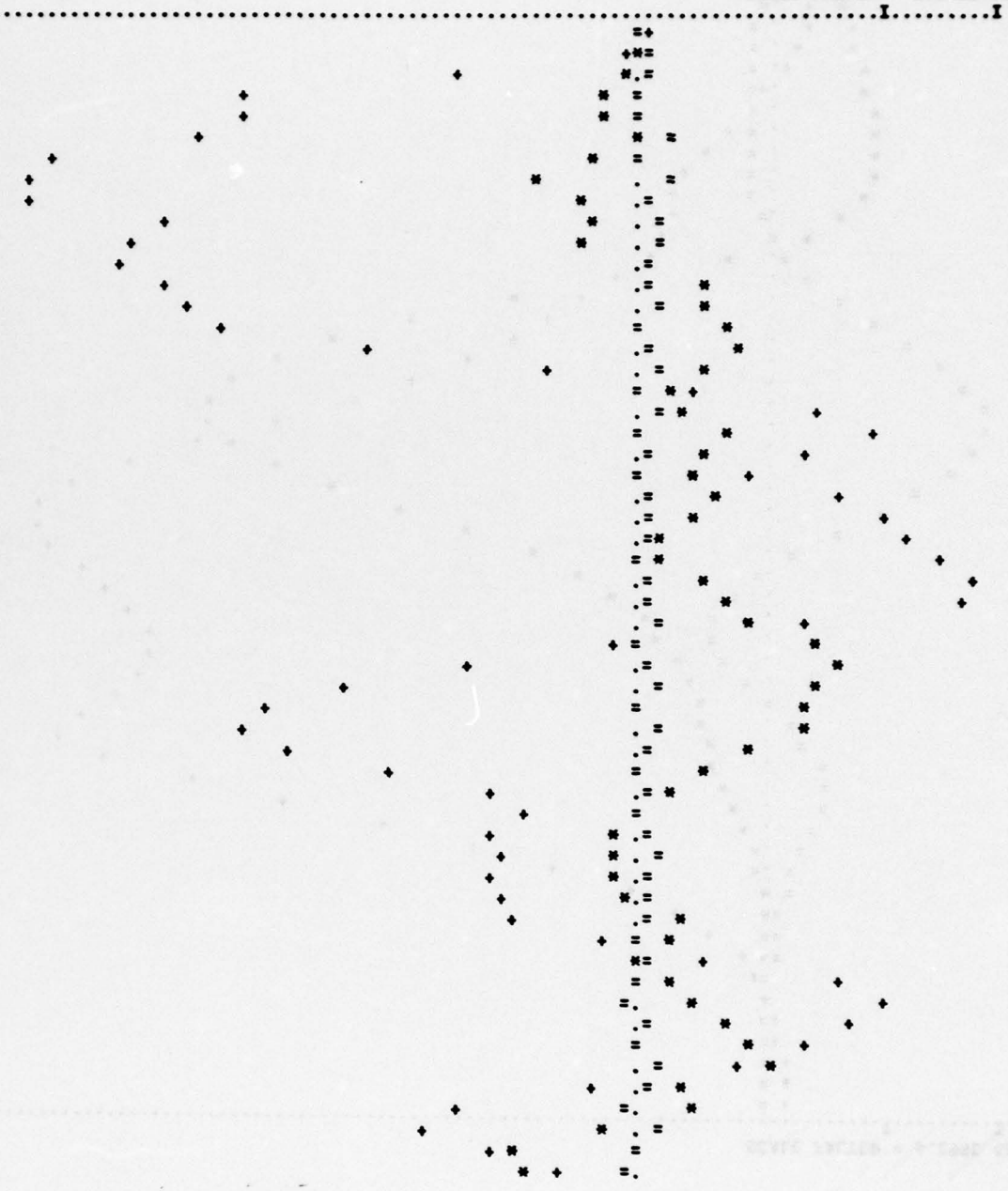
TIME	PERCENT MAXIMUM ENERGY DEVIATION	PERCENT TOTAL SYSTEM ENERGY	KINETIC ENERGY	PERCENT OF CURRENT TOTAL	POTENTIAL ENERGY	PERCENT OF CURRENT TOTAL	STRAIN ENERGY	PERCENT OF CURRENT TOTAL	DAMPING ENERGY	PERCENT OF CURRENT TOTAL	CRUSHING ENERGY	PERCENT OF CURRENT TOTAL	FRICTION ENERGY	PERCENT OF CURRENT TOTAL
.0	0.0	100.00	7.669E 04	82.67	1.607E 04	17.33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.00100	0.253424	100.02	7.495E 04	80.79	1.589E 04	17.13	1.257E 02	0.14	9.968E 00	0.01	1.797E 03	1.94	0.0	0.0
.00200	0.368142	100.04	6.998E 04	75.41	1.572E 04	16.94	3.005E 02	0.32	4.003E 01	0.04	6.757E 03	7.28	0.0	0.0
.00300	0.279686	100.04	6.413E 04	69.11	1.555E 04	16.76	7.714E 02	0.83	7.385E 01	0.08	1.227E 04	13.22	0.0	0.0
.00400	0.281395	100.04	5.911E 04	63.70	1.540E 04	16.59	1.049E 03	1.13	1.115E 02	0.12	1.713E 04	18.46	0.0	0.0
.00500	0.511445	100.03	5.464E 04	58.89	1.525E 04	16.43	1.944E 03	2.09	1.487E 02	0.16	2.081E 04	22.43	0.0	0.0
.00600	0.640265	100.03	5.075E 04	54.70	1.511E 04	16.28	2.959E 03	3.19	1.938E 02	0.21	2.378E 04	25.63	0.0	0.0
.00700	0.677775	100.03	4.728E 04	50.95	1.498E 04	16.14	4.378E 03	4.72	2.365E 02	0.25	2.592E 04	27.93	0.0	0.0
.00800	0.747329	100.03	4.436E 04	47.83	1.486E 04	16.01	5.656E 03	6.09	2.716E 02	0.29	2.763E 04	29.77	0.0	0.0
.00900	0.833982	100.03	4.203E 04	45.29	1.474E 04	15.89	7.029E 03	7.58	3.000E 02	0.32	2.869E 04	30.92	0.0	0.0
.01000	0.959331	100.03	4.035E 04	43.49	1.464E 04	15.78	8.178E 03	8.81	3.208E 02	0.35	2.930E 04	31.58	0.0	0.0
.01100	0.881527	100.03	3.913E 04	42.17	1.454E 04	15.67	9.187E 03	9.90	3.422E 02	0.37	2.959E 04	31.89	0.0	0.0
.01200	0.875477	100.04	3.813E 04	41.09	1.446E 04	15.58	1.013E 04	10.92	3.726E 02	0.40	2.970E 04	32.01	0.0	0.0
.01300	0.833560	100.04	3.712E 04	40.00	1.438E 04	15.49	1.121E 04	12.08	4.201E 02	0.45	2.968E 04	31.98	0.0	0.0
.01400	0.830895	100.04	3.572E 04	38.49	1.430E 04	15.41	1.274E 04	13.72	4.956E 02	0.53	2.955E 04	31.84	0.0	0.0
.01500	0.813562	100.05	3.359E 04	36.19	1.423E 04	15.34	1.502E 04	16.18	5.923E 02	0.64	2.938E 04	31.65	0.0	0.0
.01600	0.808676	100.06	3.046E 04	32.82	1.417E 04	15.27	1.826E 04	19.67	7.098E 02	0.76	2.922E 04	31.48	0.0	0.0
.01700	0.799835	100.06	2.664E 04	28.70	1.411E 04	15.21	2.211E 04	23.82	8.245E 02	0.89	2.913E 04	31.39	0.0	0.0
.01800	0.744471	100.07	2.276E 04	24.52	1.406E 04	15.15	2.596E 04	27.96	9.260E 02	1.00	2.912E 04	31.37	0.0	0.0
.01900	0.686459	100.07	1.904E 04	20.51	1.401E 04	15.09	2.970E 04	31.99	1.001E 03	1.08	2.908E 04	31.33	0.0	0.0
.02000	0.717363	100.07	1.577E 04	16.99	1.396E 04	15.04	3.308E 04	35.63	1.043E 03	1.12	2.898E 04	31.22	0.0	0.0
.02100	0.647712	100.08	1.312E 04	14.14	1.392E 04	14.99	3.582E 04	38.58	1.074E 03	1.16	2.891E 04	31.14	0.0	0.0
.02200	0.673277	100.08	1.109E 04	11.94	1.387E 04	14.94	3.788E 04	40.80	1.108E 03	1.19	2.889E 04	31.12	0.0	0.0
.02300	0.678491	100.09	9.529E 03	10.26	1.382E 04	14.89	3.943E 04	42.47	1.150E 03	1.24	2.890E 04	31.13	0.0	0.0
.02400	0.709935	100.09	8.309E 03	8.95	1.378E 04	14.84	4.064E 04	43.77	1.191E 03	1.28	2.892E 04	31.15	0.0	0.0
.02500	0.830267	100.09	7.525E 03	8.10	1.374E 04	14.79	4.137E 04	44.56	1.238E 03	1.33	2.897E 04	31.21	0.0	0.0
.02600	0.934466	100.10	7.009E 03	7.55	1.369E 04	14.75	4.181E 04	45.02	1.295E 03	1.39	2.905E 04	31.28	0.0	0.0
.02700	0.922010	100.10	6.626E 03	7.14	1.365E 04	14.70	4.204E 04	45.27	1.359E 03	1.46	2.918E 04	31.42	0.0	0.0
.02800	0.918876	100.10	6.336E 03	6.82	1.362E 04	14.66	4.210E 04	45.34	1.424E 03	1.53	2.938E 04	31.64	0.0	0.0
.02900	0.961489	100.11	5.885E 03	6.34	1.359E 04	14.63	4.213E 04	45.36	1.493E 03	1.61	2.977E 04	32.06	0.0	0.0
.03000	1.017785	100.11	5.315E 03	5.72	1.356E 04	14.60	4.219E 04	45.43	1.567E 03	1.69	3.023E 04	32.56	0.0	0.0
.03100	1.050775	100.11	5.087E 03	5.48	1.354E 04	14.58	4.207E 04	45.30	1.645E 03	1.77	3.052E 04	32.87	0.0	0.0
.03200	1.076124	100.11	5.290E 03	5.70	1.353E 04	14.57	4.175E 04	44.96	1.735E 03	1.87	3.055E 04	32.90	0.0	0.0
.03300	1.094804	100.11	6.030E 03	6.49	1.353E 04	14.57	4.109E 04	44.25	1.839E 03	1.98	3.037E 04	32.71	0.0	0.0
.03400	1.101387	100.11	7.232E 03	7.79	1.353E 04	14.57	4.000E 04	43.07	1.963E 03	2.11	3.014E 04	32.46	0.0	0.0
.03500	1.113096	100.12	8.817E 03	9.49	1.354E 04	14.58	3.845E 04	41.40	2.101E 03	2.26	2.996E 04	32.26	0.0	0.0
.03600	1.115771	100.12	1.058E 04	11.39	1.355E 04	14.59	3.659E 04	39.40	2.249E 03	2.42	2.990E 04	32.20	0.0	0.0
.03700	1.126314	100.13	1.227E 04	13.21	1.356E 04	14.60	3.475E 04	37.42	2.404E 03	2.59	2.989E 04	32.18	0.0	0.0
.03800	1.143449	100.13	1.348E 04	14.52	1.358E 04	14.62	3.339E 04	35.95	2.566E 03	2.76	2.987E 04	32.16	0.0	0.0
.03900	1.151624	100.14	1.388E 04	14.95	1.360E 04	14.64	3.288E 04	35.40	2.718E 03	2.93	2.981E 04	32.09	0.0	0.0
.04000	1.168576	100.14	1.362E 04	14.67	1.361E 04	14.66	3.304E 04	35.57	2.842E 03	3.06	2.977E 04	32.05	0.0	0.0
.04100	1.217560	100.15	1.334E 04	14.36	1.363E 04	14.68	3.324E 04	35.78	2.939E 03	3.16	2.975E 04	32.02	0.0	0.0
.04200	1.237304	100.15	1.315E 04	14.16	1.365E 04	14.70	3.334E 04	35.88	3.024E 03	3.25	2.973E 04	32.01	0.0	0.0
.04300	1.258885	100.16	1.292E 04	13.90	1.368E 04	14.72	3.348E 04	36.04	3.097E 03	3.33	2.973E 04	32.00	0.0	0.0
.04400	2.452375	100.17	1.251E 04	13.46	1.370E 04	14.74	3.382E 04	36.40	3.165E 03	3.41	2.973E 04	32.00	0.0	0.0
.04500	3.917643	100.18	1.227E 04	13.20	1.372E 04	14.76	3.398E 04	36.57	3.231E 03	3.48	2.973E 04	31.99	0.0	0.0
.04600	4.318353	100.19	1.235E 04	13.29	1.374E 04	14.78	3.383E 04	36.40	3.299E 03	3.55	2.973E 04	31.99	0.0	0.0
.04700	5.195271	100.21	1.246E 04	13.40	1.375E 04	14.80	3.363E 04	36.18	3.380E 03	3.64	2.973E 04	31.98	0.0	0.0
.04800	5.426345	100.22	1.254E 04	13.49	1.377E 04	14.82	3.346E 04	35.99	3.458E 03	3.72	2.973E 04	31.98	0.0	0.0

.04900	5.568901	100.23	1.226E 04	13.19	1.379E 04	14.84	3.365E 04	36.19	3.539E 03	3.81	2.973E 04	31.98	0.0	0.0
.05000	5.996435	100.23	1.173E 04	12.61	1.381E 04	14.86	3.409E 04	36.66	3.619E 03	3.89	2.973E 04	31.98	0.0	0.0
.05100	6.181212	100.24	1.141E 04	12.28	1.383E 04	14.87	3.433E 04	36.92	3.680E 03	3.96	2.973E 04	31.97	0.0	0.0
.05200	6.342592	100.25	1.154E 04	12.41	1.385E 04	14.89	3.415E 04	36.72	3.728E 03	4.01	2.973E 04	31.97	0.0	0.0
.05300	6.348572	100.25	1.183E 04	12.72	1.387E 04	14.91	3.378E 04	36.32	3.787E 03	4.07	2.973E 04	31.97	0.0	0.0
.05400	6.358683	100.26	1.202E 04	12.92	1.389E 04	14.93	3.351E 04	36.03	3.859E 03	4.15	2.973E 04	31.97	0.0	0.0

MASS 10 FILTERED ACCELERATION(G'S)

TIME(SEC)	XACCF *	YACCF =	ZACCF +
0.0	-1.310E-02	0.0	9.999E-01
0.001	6.035E-02	2.465E-01	-2.620E 00
0.002	-2.392E 00	1.447E 00	-3.013E 01
0.003	-5.835E 00	-5.489E-01	-6.451E 01
0.004	-6.954E 00	-8.188E-01	-6.419E 01
0.005	-9.469E-01	3.939E 00	-7.268E 01
0.006	-8.668E 00	-8.271E-02	-9.649E 01
0.007	-1.748E 01	4.203E 00	-9.922E 01
0.008	-9.377E 00	1.111E 00	-9.892E 01
0.009	-7.232E 00	2.205E 00	-7.696E 01
0.010	-1.032E 01	2.925E 00	-8.349E 01
0.011	9.941E-01	1.072E 00	-8.424E 01
0.012	1.088E 01	1.006E 00	-7.802E 01
0.013	9.819E 00	3.385E 00	-7.424E 01
0.014	1.364E 01	-3.334E-02	-6.836E 01
0.015	1.510E 01	1.764E 00	-4.492E 01
0.016	9.418E 00	1.923E 00	-1.506E 01
0.017	4.194E 00	-3.580E-01	8.785E 00
0.018	5.997E 00	2.157E 00	2.855E 01
0.019	1.314E 01	-1.954E-01	3.713E 01
0.020	9.334E 00	1.734E 00	2.741E 01
0.021	7.837E 00	-7.225E-01	1.753E 01
0.022	1.212E 01	5.158E-01	3.209E 01
0.023	[illegible]061E 00	9.279E-01	4.017E 01
0.024	3.210E 00	1.337E-01	4.278E 01
0.025	[illegible]518E 00	-1.905E-01	4.889E 01
0.026	1.001E 01	8.310E-01	5.384E 01
0.027	1.338E 01	6.145E-01	5.131E 01
0.028	1.683E 01	2.001E 00	2.584E 01
0.029	2.778E 01	-6.908E-01	-3.942E 00
0.030	3.272E 01	6.719E-01	-2.785E 01
0.031	2.766E 01	2.873E 00	-4.855E 01
0.032	2.655E 01	-4.491E-01	-6.094E 01
0.033	2.732E 01	2.846E 00	-6.378E 01
0.034	1.817E 01	1.029E 00	-5.789E 01
0.035	1.026E 01	-7.422E-01	-4.041E 01
0.036	5.515E 00	1.483E 00	-2.415E 01
0.037	-9.549E-01	-4.866E-01	-1.972E 01
0.038	-5.112E 00	6.273E-01	-2.503E 01
0.039	-4.953E 00	1.994E 00	-2.327E 01
0.040	-4.082E 00	1.889E-01	-2.450E 01
0.041	-2.530E 00	1.630E-01	-2.190E 01
0.042	5.941E 00	1.649E 00	-2.049E 01
0.043	4.165E 00	-8.721E-01	-6.031E 00
0.044	-2.429E-01	1.672E 00	1.077E 01
0.045	4.602E 00	-3.081E-01	3.184E 01
0.046	7.883E 00	-2.654E 00	3.922E 01
0.047	1.405E 01	1.746E 00	3.447E 01
0.048	1.680E 01	-1.265E 00	2.583E 01
0.049	2.111E 01	2.591E 00	1.631E 01
0.050	6.513E 00	1.624E 00	-7.674E 00
0.051	7.453E 00	-1.933E 00	-2.914E 01
0.052	-5.733E 00	2.244E 00	-3.608E 01
0.053	-2.129E 01	-3.006E-01	-2.487E 01
0.054	-1.939E 01	-1.871E 00	-1.397E 01

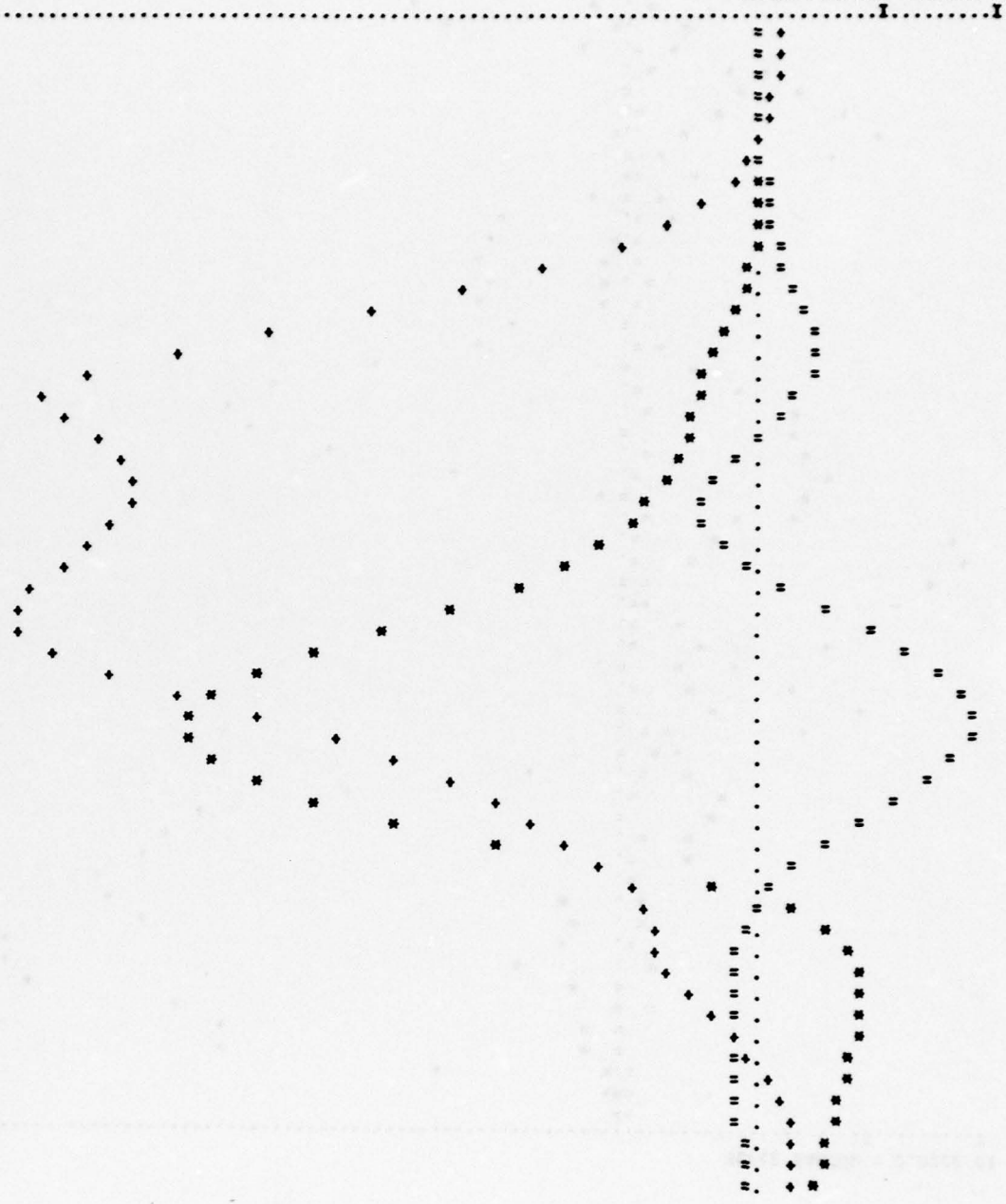
SCALE FACTOR = 1.822E 01



MASS 30 FILTERED ACCELERATION(G'S)

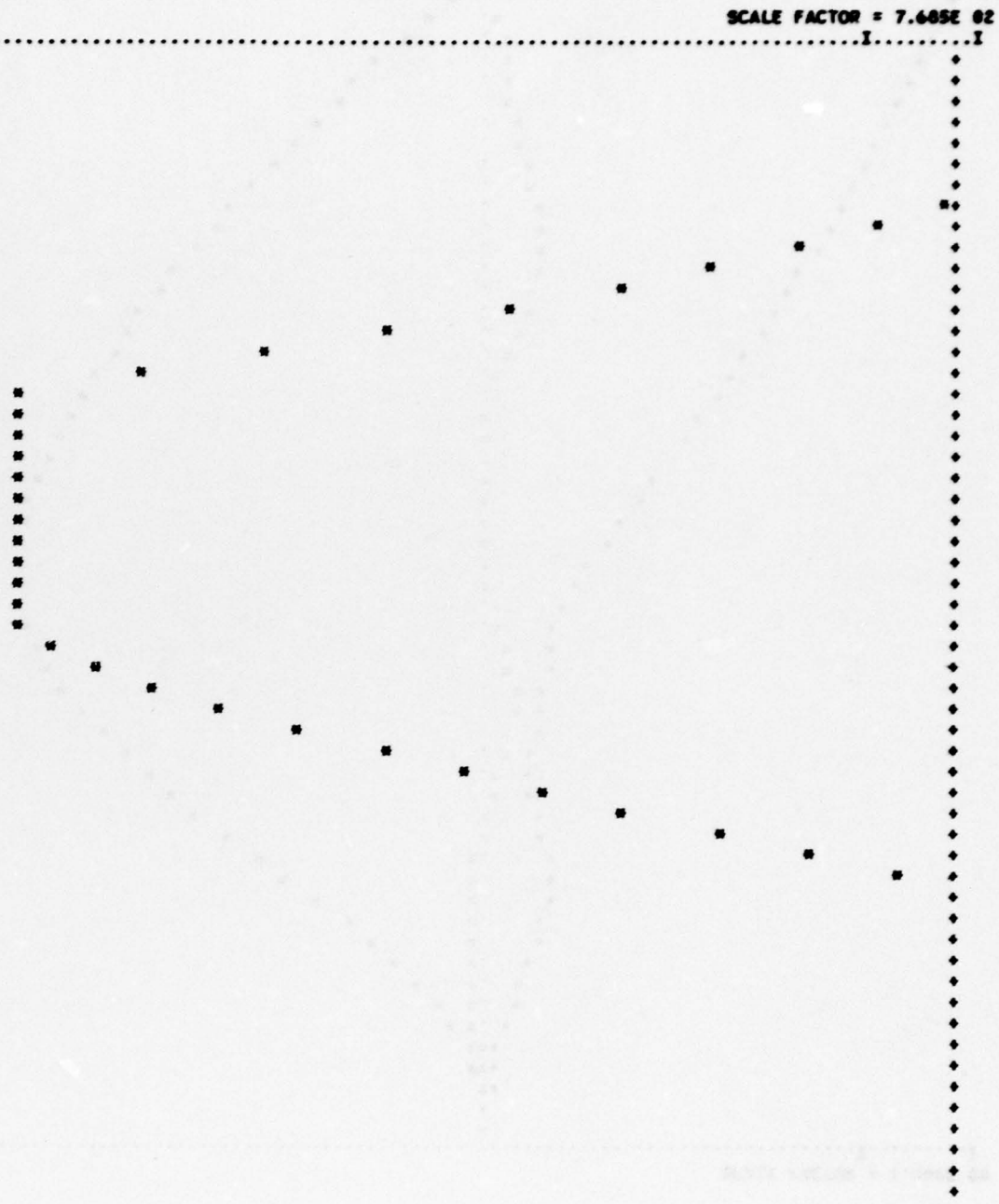
TIME(SEC)	XACCF *	YACCF =	ZACCF +
0.0	-1.310E-02	0.0	9.999E-01
0.001	-1.311E-02	-5.990E-0[illegible]	9.[illegible]47E-01
0.002	-1.313E-02	3.588E-05	9.[illegible]41E-01
0.003	-1.369E-02	8.603E-04	7.193E-01
0.004	-1.694E-02	6.017E-03	3.690E-01
0.005	-2.690E-02	2.240E-02	-1.373E-01
0.006	-4.502E-02	5.700E-02	-7.892E-01
0.007	-7.205E-02	1.185E-01	-1.585E 00
0.008	-1.284E-01	[illegible].462E-01	-3.046E 00
0.009	-2.315E-01	[illegible].663E-01	-5.170E 00
0.010	-3.952E-01	[illegible].995E-01	-7.958E 00
0.011	-6.607E-01	[illegible].[illegible]86E 00	-1.193E 01
0.012	-1.050E 00	1.859E 00	-1.669E 01
0.013	-1.559E 00	2.414E 00	-2.180E 01
0.014	-2.126E 0[illegible]	2.832E 00	-2.707E 01
0.015	-2.666E 00	2.985E 00	-3.235E 01
0.016	-3.159E 00	2.742E 00	-3.755E 01
0.017	-3.478E 00	1.991E 00	-3.968E 01
0.018	-3.697E 00	9.064E-01	-3.880E 01
0.019	-4.064E 00	-3.380E-01	-3.701E 01
0.020	-4.604E 00	-1.625E 00	-3.547E 01
0.021	-5.287E 00	-2.735E 00	-3.472E 01
0.022	-6.189E 00	-3.364E 00	-3.488E 01
0.023	-7.405E 00	-3.274E 00	-3.582E 01
0.024	-8.979E 00	-2.400E 00	-3.725E 01
0.025	-1.096E 01	-8.331E-01	-3.883E 01
0.026	-1.355E 01	1.245E 00	-4.023E 01
0.027	-1.693E 01	3.573E 00	-4.114E 01
0.028	-2.089E 01	5.906E 00	-4.084E 01
0.029	-2.480E 01	8.056E 00	-3.905E 01
0.030	-2.805E 01	9.863E 00	-3.598E 01
0.031	-3.035E 01	1.117E 01	-3.214E 01
0.032	-3.151E 01	1.177E 01	-2.792E 01
0.033	-3.141E 01	1.158E 01	-2.381E 01
0.034	-3.015E 01	1.075E 01	-2.025E 01
0.035	-2.785E 01	9.405E 00	-1.735E 01
0.036	-2.451E 01	7.672E 00	-1.491E 01
0.037	-2.016E 01	5.712E 00	-1.270E 01
0.038	-1.486E 01	3.729E 00	-1.063E 01
0.039	-8.885E 00	1.928E 00	-8.716E 00
0.040	-2.672E 00	4.415E-01	-7.010E 00
0.041	1.520E 00	-5.089E-01	-6.295E 00
0.042	3.866E 00	-1.054E 00	-6.032E 00
0.043	5.094E 00	-1.350E 00	-5.670E 00
0.044	5.641E 00	-1.491E 00	-5.007E 00
0.045	5.771E 00	-1.535E 00	-4.043E 00
0.046	5.652E 00	-1.519E 00	-2.882E 00
0.047	5.390E 00	-1.467E 00	-1.663E 00
0.048	5.053E 00	-1.397E 00	-5.180E-01
0.049	4.686E 00	-1.319E 00	4.517E-01
0.050	4.317E 00	-1.240E 00	1.185E 00
0.051	3.960E 00	-1.164E 00	1.663E 00
0.052	3.624E 00	-1.093E 00	1.898E 00
0.053	3.308E 00	-1.027E 00	1.930E 00
0.054	3.012E 00	-9.655E-01	1.809E 00

SCALE FACTOR = 6.299E 00



BEAM 55 I,M = 29, 5 J,N = 30, 1 AXIAL AND SHEAR FORCES(LB)

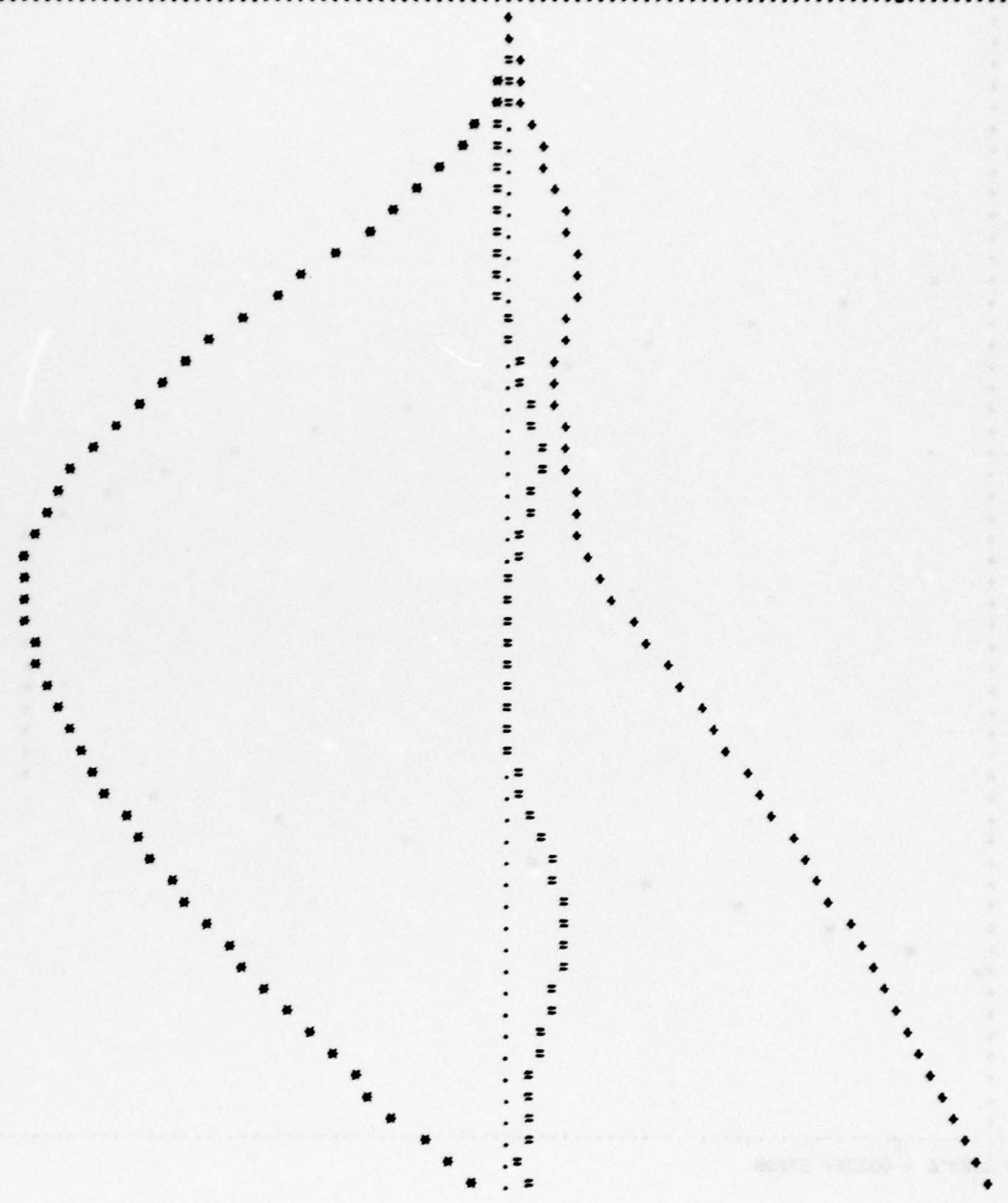
TIME(SEC)	FX *	FY =	FZ +
0.0	0.0	0.0	0.0
0.001	-4.533E-02	0.0	0.0
0.002	2.554E-01	0.0	0.0
0.003	-6.141E-01	0.0	0.0
0.004	-1.198E 00	0.0	0.0
0.005	-1.945E 00	0.0	0.0
0.006	-2.928E 00	0.0	0.0
0.007	-6.282E 01	0.0	0.0
0.008	-5.206E 02	0.0	0.0
0.009	-1.045E 03	0.0	0.0
0.010	-1.657E 03	0.0	0.0
0.011	-2.338E 03	0.0	0.0
0.012	-3.086E 03	0.0	0.0
0.013	-3.896E 03	0.0	0.0
0.014	-4.746E 03	0.0	0.0
0.015	-5.630E 03	0.0	0.0
0.016	-6.455E 03	0.0	0.0
0.017	-6.455E 03	0.0	0.0
0.018	-6.455E 03	0.0	0.0
0.019	-6.455E 03	0.0	0.0
0.020	-6.455E 03	0.0	0.0
0.021	-6.455E 03	0.0	0.0
0.022	-6.455E 03	0.0	0.0
0.023	-6.455E 03	0.0	0.0
0.024	-6.455E 03	0.0	0.0
0.025	-6.455E 03	0.0	0.0
0.026	-6.455E 03	0.0	0.0
0.027	-6.422E 03	0.0	0.0
0.028	-6.236E 03	0.0	0.0
0.029	-5.924E 03	0.0	0.0
0.030	-5.524E 03	0.0	0.0
0.031	-5.051E 03	0.0	0.0
0.032	-4.512E 03	0.0	0.0
0.033	-3.952E 03	0.0	0.0
0.034	-3.415E 03	0.0	0.0
0.035	-2.859E 03	0.0	0.0
0.036	-2.270E 03	0.0	0.0
0.037	-1.646E 03	0.0	0.0
0.038	-1.014E 03	0.0	0.0
0.039	-4.118E 02	0.0	0.0
0.040	0.0	0.0	0.0
0.041	0.0	0.0	0.0
0.042	0.0	0.0	0.0
0.043	0.0	0.0	0.0
0.044	0.0	0.0	0.0
0.045	0.0	0.0	0.0
0.046	0.0	0.0	0.0
0.047	0.0	0.0	0.0
0.048	0.0	0.0	0.0
0.049	0.0	0.0	0.0
0.050	0.0	0.0	0.0
0.051	0.0	0.0	0.0
0.052	0.0	0.0	0.0
0.053	0.0	0.0	0.0
0.054	0.0	0.0	0.0



BEAM 55 I,M = 29, 5 J,N = 30, 1 RELATIVE DEFLECTIONS=J-I=(IN)

TIME(SEC)	X =	Y =	Z +
0.0	0.0	0.0	0.0
0.001	-3.766E-03	-1.008E-03	1.248E-03
0.002	-4.638E-02	-1.558E-02	1.578E-02
0.003	-1.186E-01	-5.472E-02	4.894E-02
0.004	-2.345E-01	-1.055E-01	1.232E-01
0.005	-3.803E-01	-1.453E-01	2.107E-01
0.006	-5.675E-01	-1.869E-01	2.933E-01
0.007	-7.834E-01	-2.187E-01	3.780E-01
0.008	-1.029E 00	-2.332E-01	4.676E-01
0.009	-1.299E 00	-2.382E-01	5.459E-01
0.010	-1.600E 00	-2.338E-01	6.051E-01
0.011	-1.918E 00	-2.130E-01	6.383E-01
0.012	-2.248E 00	-1.749E-01	6.467E-01
0.013	-2.582E 00	-1.300E-01	6.299E-01
0.014	-2.911E 00	-8.444E-02	5.901E-01
0.015	-3.229E 00	-3.003E-02	5.371E-01
0.016	-3.530E 00	4.026E-02	4.897E-01
0.017	-3.810E 00	1.180E-01	4.657E-01
0.018	-4.068E 00	1.867E-01	4.817E-01
0.019	-4.305E 00	2.389E-01	5.260E-01
0.020	-4.529E 00	2.698E-01	5.740E-01
0.021	-4.734E 00	2.715E-01	6.149E-01
0.022	-4.908E 00	2.400E-01	6.510E-01
0.023	-5.054E 00	1.825E-01	6.927E-01
0.024	-5.165E 00	1.122E-01	7.503E-01
0.025	-5.238E 00	4.421E-02	8.354E-01
0.026	-5.273E 00	-8.890E-03	9.534E-01
0.027	-5.271E 00	-4.249E-02	1.101E 00
0.028	-5.237E 00	-6.781E-02	1.270E 00
0.029	-5.179E 00	-9.072E-02	1.445E 00
0.030	-5.102E 00	-1.106E-01	1.624E 00
0.031	-5.008E 00	-1.174E-0	1.809E 00
0.032	-4.896E 00	-1.045E-01	1.995E 00
0.033	-4.775E 00	-7.596E-02	2.172E 00
0.034	-4.653E 00	-3.383E-02	2.341E 00
0.035	-4.521E 00	2.727E-02	2.501E 00
0.036	-4.375E 00	1.089E-01	2.664E 00
0.037	-4.212E 00	2.063E-01	2.832E 00
0.038	-4.039E 00	3.080E-01	2.999E 00
0.039	-3.865E 00	4.007E-01	3.163E 00
0.040	-3.686E 00	4.773E-01	3.322E 00
0.041	-3.489E 00	5.418E-01	3.474E 00
0.042	-3.286E 00	5.862E-01	3.622E 00
0.043	-3.088E 00	5.953E-01	3.759E 00
0.044	-2.889E 00	5.612E-0	3.892E 00
0.045	-2.676E 00	4.909E-01	4.025E 00
0.046	-2.446E 00	4.036E-01	4.163E 00
0.047	-2.205E 00	3.201E-01	4.302E 00
0.048	-1.962E 00	2.571E-01	4.437E 00
0.049	-1.722E 00	2.126E-01	4.573E 00
0.050	-1.489E 00	1.781E-01	4.707E 00
0.051	-1.241E 00	1.504E-01	4.827E 00
0.052	-9.719E-01	1.312E-01	4.943E 00
0.053	-7.052E-01	1.200E-01	5.055E 00
0.054	-4.534E-01	1.[illegible]01E-01	5.160E 00

SCALE FACTOR = 1.242E 00



EXTERNAL SPRING I,M = 2, 8 COMPRESSION(IN)

SCALE FACTOR = 1.875E-01

TIME(SEC)	X	Y	Z	
	*	*	*	
0.0	0.0	0.0	0.0	*
0.001	0.0	0.0	0.0	*
0.002	0.0	0.0	1.126E-01	*
0.003	0.0	0.0	3.864E-01	*
0.004	0.0	0.0	6.269E-01	*
0.005	0.0	0.0	8.212E-01	*
0.006	0.0	0.0	9.949E-01	*
0.007	0.0	0.0	1.142E 00	*
0.008	0.0	0.0	1.266E 00	*
0.009	0.0	0.0	1.361E 00	*
0.010	0.0	0.0	1.426E 00	*
0.011	0.0	0.0	1.469E 00	*
0.012	0.0	0.0	1.495E 00	*
0.013	0.0	0.0	1.506E 00	*
0.014	0.0	0.0	1.498E 00	*
0.015	0.0	0.0	1.478E 00	*
0.016	0.0	0.0	1.445E 00	*
0.017	0.0	0.0	1.406E 00	*
0.018	0.0	0.0	1.355E 00	*
0.019	0.0	0.0	1.305E 00	*
0.020	0.0	0.0	1.263E 00	*
0.021	0.0	0.0	1.235E 00	*
0.022	0.0	0.0	1.212E 00	*
0.023	0.0	0.0	1.208E 00	*
0.024	0.0	0.0	1.216E 00	*
0.025	0.0	0.0	1.230E 00	*
0.026	0.0	0.0	1.276E 00	*
0.027	0.0	0.0	1.326E 00	*
0.028	0.0	0.0	1.390E 00	*
0.029	0.0	0.0	1.460E 00	*
0.030	0.0	0.0	1.526E 00	*
0.031	0.0	0.0	1.565E 00	*
0.032	0.0	0.0	1.575E 00	*
0.033	0.0	0.0	1.565E 00	*
0.034	0.0	0.0	1.542E 00	*
0.035	0.0	0.0	1.513E 00	*
0.036	0.0	0.0	1.481E 00	*
0.037	0.0	0.0	1.440E 00	*
0.038	0.0	0.0	1.390E 00	*
0.039	0.0	0.0	1.332E 00	*
0.040	0.0	0.0	1.262E 00	*
0.041	0.0	0.0	1.169E 00	*
0.042	0.0	0.0	1.062E 00	*
0.043	0.0	0.0	9.445E-01	*
0.044	0.0	0.0	8.226E-01	*
0.045	0.0	0.0	7.051E-01	*
0.046	0.0	0.0	5.950E-01	*
0.047	0.0	0.0	4.877E-01	*
0.048	0.0	0.0	3.956E-01	*
0.049	0.0	0.0	3.177E-01	*
0.050	0.0	0.0	2.556E-01	*
0.051	0.0	0.0	1.990E-01	*
0.052	0.0	0.0	1.495E-01	*
0.053	0.0	0.0	1.074E-01	*
0.054	0.0	0.0	6.121E-02	*

EXTERNAL SPRING I,M = 2, 0 AXIAL LOAD(LB)

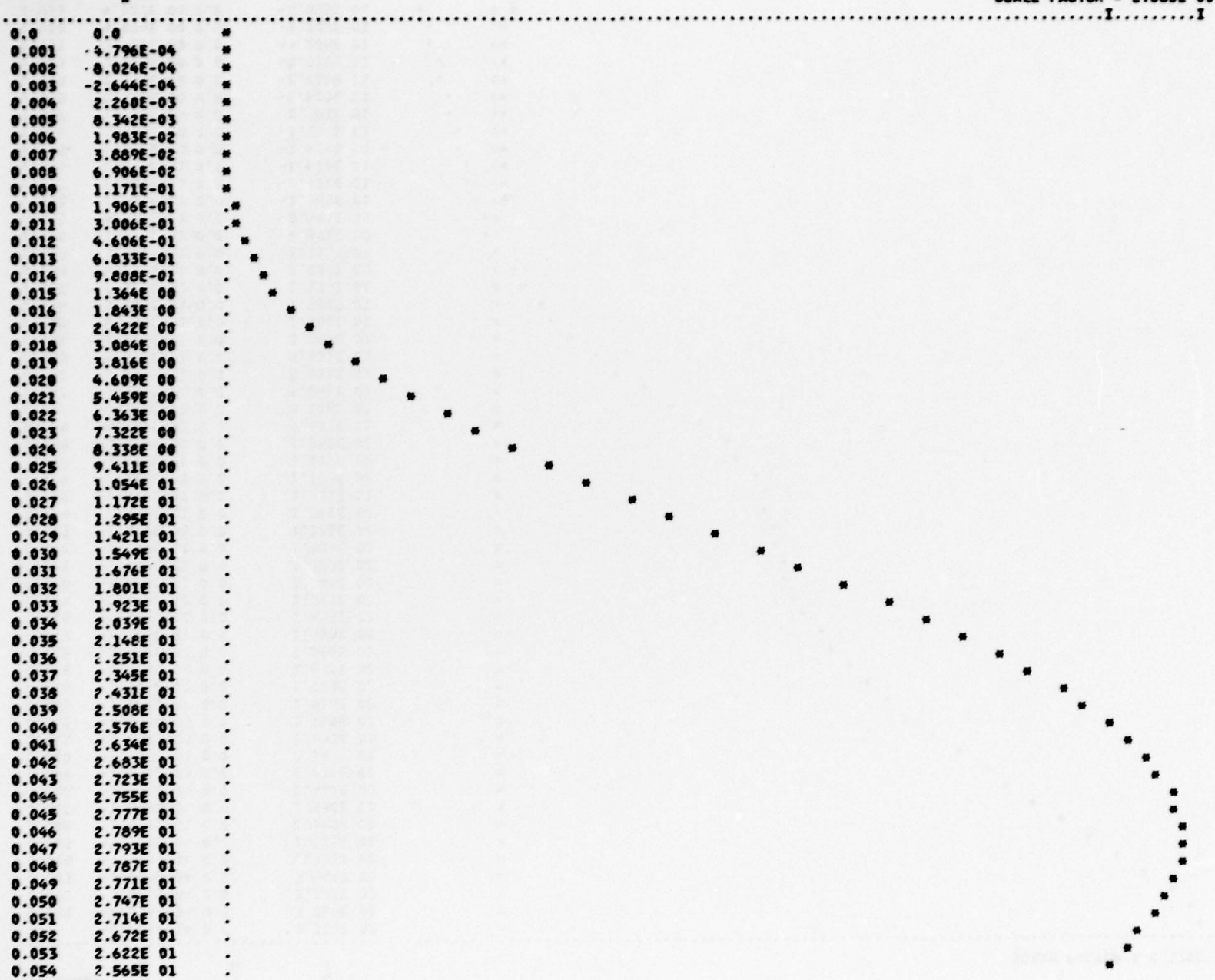
SCALE FACTOR = 2.726E 02

TIME(SEC)	X	Y	Z
	*	=	+
0.0	0.0	0.0	0.0
0.001	0.0	0.0	0.0
0.002	0.0	0.0	2.290E 03
0.003	0.0	0.0	2.290E 03
0.004	0.0	0.0	2.290E 03
0.005	0.0	0.0	2.290E 03
0.006	0.0	0.0	2.290E 03
0.007	0.0	0.0	2.290E 03
0.008	0.0	0.0	2.290E 03
0.009	0.0	0.0	2.290E 03
0.010	0.0	0.0	2.290E 03
0.011	0.0	0.0	2.290E 03
0.012	0.0	0.0	2.290E 03
0.013	0.0	0.0	2.290E 03
0.014	0.0	0.0	2.113E 03
0.015	0.0	0.0	1.643E 03
0.016	0.0	0.0	8.964E 02
0.017	0.0	0.0	0.0
0.018	0.0	0.0	0.0
0.019	0.0	0.0	0.0
0.020	0.0	0.0	0.0
0.021	0.0	0.0	0.0
0.022	0.0	0.0	0.0
0.023	0.0	0.0	0.0
0.024	0.0	0.0	0.0
0.025	0.0	0.0	0.0
0.026	0.0	0.0	0.0
0.027	0.0	0.0	0.0
0.028	0.0	0.0	0.0
0.029	0.0	0.0	1.407E 03
0.030	0.0	0.0	2.290E 03
0.031	0.0	0.0	2.290E 03
0.032	0.0	0.0	2.288E 03
0.033	0.0	0.0	2.043E 03
0.034	0.0	0.0	1.521E 03
0.035	0.0	0.0	8.520E 02
0.036	0.0	0.0	1.215E 02
0.037	0.0	0.0	0.0
0.038	0.0	0.0	0.0
0.039	0.0	0.0	0.0
0.040	0.0	0.0	0.0
0.041	0.0	0.0	0.0
0.042	0.0	0.0	0.0
0.043	0.0	0.0	0.0
0.044	0.0	0.0	0.0
0.045	0.0	0.0	0.0
0.046	0.0	0.0	0.0
0.047	0.0	0.0	0.0
0.048	0.0	0.0	0.0
0.049	0.0	0.0	0.0
0.050	0.0	0.0	0.0
0.051	0.0	0.0	0.0
0.052	0.0	0.0	0.0
0.053	0.0	0.0	0.0
0.054	0.0	0.0	0.0

DRI MASS 32

TIME(SEC)	DRI
0.0	0.0
0.001	-4.796E-04
0.002	-8.024E-04
0.003	-2.644E-04
0.004	2.260E-03
0.005	8.342E-03
0.006	1.983E-02
0.007	3.889E-02
0.008	6.906E-02
0.009	1.171E-01
0.010	1.906E-01
0.011	3.006E-01
0.012	4.606E-01
0.013	6.833E-01
0.014	9.808E-01
0.015	1.364E 00
0.016	1.843E 00
0.017	2.422E 00
0.018	3.084E 00
0.019	3.816E 00
0.020	4.609E 00
0.021	5.459E 00
0.022	6.363E 00
0.023	7.322E 00
0.024	8.338E 00
0.025	9.411E 00
0.026	1.054E 01
0.027	1.172E 01
0.028	1.295E 01
0.029	1.421E 01
0.030	1.549E 01
0.031	1.676E 01
0.032	1.801E 01
0.033	1.923E 01
0.034	2.039E 01
0.035	2.148E 01
0.036	2.251E 01
0.037	2.345E 01
0.038	2.431E 01
0.039	2.508E 01
0.040	2.576E 01
0.041	2.634E 01
0.042	2.683E 01
0.043	2.723E 01
0.044	2.755E 01
0.045	2.777E 01
0.046	2.789E 01
0.047	2.793E 01
0.048	2.787E 01
0.049	2.771E 01
0.050	2.747E 01
0.051	2.714E 01
0.052	2.672E 01
0.053	2.622E 01
0.054	2.565E 01

SCALE FACTOR = 2.685E 00



VEHICLE C.G. VELOCITY(IN/SEC)

TIME(SEC)	X	Y	Z
	*	=	+

SCALE FACTOR = 4.370E 01

0.0	-6.661E-16	0.0	3.300E 02
0.001	-2.604E-04	0.0	3.269E 02
0.002	-5.571E-04	0.0	3.171E 02
0.003	-6.060E-04	0.0	3.044E 02
0.004	-7.714E-04	0.0	2.916E 02
0.005	-9.774E-04	0.0	2.788E 02
0.006	-1.101E-03	0.0	2.660E 02
0.007	-1.377E-03	0.0	2.532E 02
0.008	-1.841E-03	0.0	2.404E 02
0.009	-2.596E-03	0.0	2.276E 02
0.010	-3.763E-03	0.0	2.149E 02
0.011	-5.640E-03	0.0	2.030E 02
0.012	-8.561E-03	0.0	1.919E 02
0.013	-1.288E-02	0.0	1.816E 02
0.014	-1.901E-02	0.0	1.719E 02
0.015	-2.728E-02	0.0	1.632E 02
0.016	-3.797E-02	0.0	1.556E 02
0.017	-5.121E-02	0.0	1.493E 02
0.018	-6.689E-02	0.0	1.439E 02
0.019	-8.490E-02	0.0	1.391E 02
0.020	-1.053E-01	0.0	1.349E 02
0.021	-1.283E-01	0.0	1.323E 02
0.022	-1.538E-01	0.0	1.304E 02
0.023	-1.820E-01	0.0	1.286E 02
0.024	-2.131E-01	0.0	1.262E 02
0.025	-2.472E-01	0.0	1.231E 02
0.026	-2.838E-01	0.0	1.188E 02
0.027	-3.223E-01	0.0	1.129E 02
0.028	-3.630E-01	0.0	1.052E 02
0.029	-4.061E-01	0.0	9.427E 01
0.030	-4.508E-01	0.0	8.126E 01
0.031	-4.951E-01	0.0	6.846E 01
0.032	-5.359E-01	0.0	5.611E 01
0.033	-5.692E-01	0.0	4.431E 01
0.034	-5.906E-01	0.0	3.384E 01
0.035	-5.950E-01	0.0	2.506E 01
0.036	-5.773E-01	0.0	1.768E 01
0.037	-5.323E-01	0.0	1.137E 01
0.038	-4.552E-01	0.0	5.289E 00
0.039	-3.413E-01	0.0	-1.912E-01
0.040	-1.874E-01	0.0	-4.691E 00
0.041	8.207E-03	0.0	-8.441E 00
0.042	2.443E-01	0.0	-1.161E 01
0.043	5.189E-01	0.0	-1.421E 01
0.044	8.293E-01	0.0	-1.670E 01
0.045	1.172E 00	0.0	-1.914E 01
0.046	1.543E 00	0.0	-2.151E 01
0.047	1.938E 00	0.0	-2.381E 01
0.048	2.352E 00	0.0	-2.603E 01
0.049	2.779E 00	0.0	-2.815E 01
0.050	3.216E 00	0.0	-3.017E 01
0.051	3.656E 00	0.0	-3.208E 01
0.052	4.094E 00	0.0	-3.387E 01
0.053	4.527E 00	0.0	-3.555E 01
0.054	4.949E 00	0.0	-3.711E 01