UMTRI-88-47

THE OCCUPANT PLOTTING PACKAGE (PLOTCS)

for MVMA 2-D CVS

Users' Manual

R. O. Bennett, Senior Research Associate
B. M. Bowman, Research Scientist

The University of Michigan
Transportation Research Institute
2901 Baxter Road
Ann Arbor, Michigan 48109-2150

January 18, 1989

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
UMTRI-88-47		

4. Title and Subtitle
The Occupant Plotting Package (PLOTCS) for MVMA 2-D CVS: User's Manual

5. Report Date
January 18, 1989

6. Performing Organization Code

7. Author(s)
R. O. Bennett and B. M. Bowman

8. Performing Organization Report No.
UMTRI-88-47

9. Performing Organization Name and Address
Transportation Research Institute
University of Michigan
2901 Baxter Road
Ann Arbor, Michigan

10. Work Unit No. (TRAIS)
302364

11. Contract or Grant No.

12. Sponsoring Agency Name and Address
Allied Signal, Bendix Safety Restraint Division
Chrysler Motors Corporation/Detroit
Industrial Engineering
Failure Analysis Associates

13. Type of Report and Period Covered
Final Report

14. Sponsoring Agency Code

16. Abstract

The MVMA 2-D Crash Victim Simulation model is a computer program used for simulating occupant motion in an automobile crash. This manual is a user's guide for a graphics plotting program that has been developed for use with the MVMA 2-D CVS.

The plotting program is called the Occupant Plotting Package (PLOTCS). It makes graphics plots of the occupant and the vehicle interior and restraint systems for each time point from recorded model data. Separate plots for different time values can be obtained, and overlay plots that show the envelope of occupant motion can be obtained as well. The user has control through input data of many plot options.

Section 2 of this manual presents the control card layout (input data) for the PLOTCS program. Section 3 discusses how to specify the relationship between a selected model run coordinate system and the PLOTCS Plot Space coordinate system (the standard transformation) and the specification of a viewing system. Section 4 presents a summary of the analysis used to achieve necessary coordinate transformations. Section 5 presents numerous example plots produced by the program.

Appendix A contains a specification of the information recorded by the models for use by the Occupant Plotting Package. Appendix B contains a discussion of the dependencies of PLOTCS on the CALCOMP Standard Subroutines.

17. Key Words	18. Distribution Statement
Design Automotive Safety Graphics Occupant Dynamics Plotting Restraint Systems	UNLIMITED

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	165	

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 Introduction to PLOTCS

A graphics plotting routine has been developed at UMTRI for use with the MVMA 2-D Crash Victim Simulation model (and with an early UMTRI version of the CAL 3-D model). [1,2] This post-processor program is called the Occupant Plotting Package (PLOTCS). It makes up to three plots (views) of the occupant and the vehicle interior and restraint systems for each time point from recorded model data. The views are each a user-specified region of an orthographic projection of the three-dimensional occupant and vehicle interior onto a user-specified plane.

Section 2 presents the control card layout (input data) for the PLOTCS program. Section 3 discusses how to specify the relationship between a selected model run coordinate system and the PLOTCS Plot Space coordinate system (the standard transformation) and the specification of each viewing system. Section 4 presents a summary of the analysis used to achieve the necessary coordinate transformations and the orthographic projection. Section 5 presents numerous example plots produced by the program.

Appendix A contains a specification of the information recorded by the models for use by the Occupant Plotting Package. Appendix B contains a discussion of the dependencies of PLOTCS on the CALCOMP Standard Subroutines.

2.0 PLOTCS Input Description

2.1 Introduction. The PLOTCS program produces plots of orthographic projections, or shadows, on the X-Z plane of each of the user-specified viewing systems at each of the user-specified time points. For each such viewing system, the Y-axis is the line-of-sight for the corresponding plot.

The user must specify each of the viewing systems with respect to the PLOTCS Plot Space coordinate system. The user must also relate the PLOTCS Plot Space coordinate system (in which positive X is forward in the model run, positive Y is leftward in the model run, and positive Z is upward in the model run) in terms of any one of the general segment systems of the model run. If the chosen model run coordinate system is different from the PLOTCS Plot Space coordinate system, the user must set the switch "LNORM" positive and supply the corresponding control cards. All general segment systems of the model run must be orthogonal but may be left-handed.

The PLOTCS plotter program expects as input both a deck of control cards and a character hold file of recorded data. The control deck is read from logical device number 5 in the form of formatted lines; the hold file data are read from logical device number 1 in the form of formatted records. The control cards must be made up by the user of the plotter program and contain information on the specific plots to be made. They are further described in Section 2.2. The character data file must have been previously written by a run of a crash simulation program and contains the information that the plotter program will use to make the plots. This is known as the PLOTCS Hold File and is further described in Appendix A.

Groups of special points to be plotted can be specified through either this control card input or through the model recorded PLOTCS Hold File. Up to a total of 50 such groups can be processed. This total includes all those groups specified by both sources. A total of 400 points can be processed which make up all of the groups of special points. Each group of special points is plotted as a broken line in three-dimensional space.

MVMA 2-D CVS Version 6.1 (and higher) as resident on the Michigan Terminal System (MTS) at the University of Michigan is able to write the PLOTCS Hold File. The MVMA 2-D CVS "GO" Processor supplements MVMA 2-D two-dimensional data (X-Z) with Y-coordinate data for writing to the ("three-dimensional") PLOTCS Hold File.

2.2 PLOTCS User Input. The plotter program expects to find a formatted line file, previously set up by the user, attached to logical device number 5. This should contain a number of lines (also referred to as cards) that describe the views to be plotted and the times at which they should be plotted. The layouts of these cards, including card formats, program variable names, descriptions, and default values (if any) are described in Table 1.

As a general rule, if any field in the PLOTCS Control Card input deck is left blank or put in as zero, the value given in the Default Column will be used. Sets of direction cosines are the basic exceptions to this rule. Direction cosines are dealt with in terms of triads. The defaults for each such triad are used only when the whole triad is blank or zero.

TABLE 1. PLOTCS CONTROL CARD LAYOUT (1 of 12)

Card 1 -- SWITCHES

Col	Item	Description	Default
01-02	ICGSWT	Plot C.G. symbol if positive.	1
03-04	IJNT	Plot joints and centerlines if positive.	1
05-06	IJTSYM	No joint symbol if negative; solid circle for joints if 1; hollow circle for joints if 2.	2
07-08	INECK	Plot special neck if positive. Magnitude is joint number of the neck joint in the joint specifications below.	1
09-10	IHEAD	Plot upper neck joint offsets from head c.g. in head system if positive. Magnitude is the joint end number of the neck joint specified by the magnitude of INECK in the joint specifications below.	1
11-12	-	Blanks	-
13-14	IELL	Plot contact ellipsoids if positive.	1
15-16	IPNL	Plot contact panels if positive.	1
17-18	IBAG	Plot airbag ellipsoidal outlines if positive.	1
19-20	IABP	Plot panel ellipsoids if positive.	1
21-22	-	Blanks	-
23-24	IBELT	Plot belts if positive.	1
25-26	IBLTIC	Plot belts as tick marks if positive; plot belts as outline lines if negative.	1
27-28	IRINGS	Plot belt rings if positive.	1
29-30	ISCPTS	Plot special points from model run.	1
31-32	JSCPTS	Plot special points specified with control cards	1
33-34	INPSGP	Number of groups of special points described as part of this control card deck.	0

TABLE 1. PLOTCS CONTROL CARD LAYOUT (2 of 12)

Card 1 -- SWITCHES (continued)

Col	Item	Description	Default
35-36	-	Blanks	-
37-38	LVIEW	Model Run Coordinate system used as basis for Plot Space. (Set -1 for inertial, set 0 for principal vehicle, or set to any general segment number.)	0
39-40	LNORM	If the model run is MVMA 2-D, set to -1; otherwise if model run is different from Plot Space, set positive and provide Cards 4-7.	-1
41-42	IVIEWS	Number of views (different viewing systems) shown for each time (max 3).	1
43-44	-	Blanks	-
45-46	LEGEND	Plot legend of symbols used if positive.	-1
47-48	IOVER	Plot all times on one plot if positive.	-1
49-50	IFACE	Plot facial features if positive.	-1
51-52	-	Blanks	-
53-54	IDB	Auxiliary Printout Control Switch (Values 0-3 inclusive downward).	0
55-56	INCZDB	Frequency Control for PLOT subroutine auxiliary printout (Values 0-10).	0
57-58	ITWOD	Recorded data can be treated as effectively two-dimensional if positive.	1

TABLE 1. PLOTCS CONTROL CARD LAYOUT (3 of 12)

Card 2 -- PLOT LAYOUT PARAMETERS

Col	Item	Description	Default
01-08	BLTSPC	Distance between tick marks for belts (Model run units)	1.
09-16	BLTICK	Half-width of tick marks for belts (Plot inches)	.1125
17-24	RINGMX	Radius of maximum slip ring circle (Plot inches)	.1
25-32	RINGMN	Radius of minimum slip ring circle (Plot inches)	.08
33-40	ATTMAX	Radius of maximum belt attachment circle (Plot inches)	.1
41-48	ATTMIN	Radius of minimum belt attachment circle (Plot inches)	.05
49-56	ANCHLG	Length of anchor symbol (Plot inches)	.15
57-64	ANCHDP	Depth of anchor symbol (Plot inches)	.07
65-72	RADJNT	Radius of joint circle (Plot inches)	.045

TABLE 1. PLOTCS CONTROL CARD LAYOUT (4 of 12)

Card 3 -- PLOT TIMES AND PLOT LAYOUT PARAMETERS

Col	Item	Description	Default
01-08	T1	Beginning time to be plotted (msec)	0.
09-16	T2	Last time to be plotted (msec)	200.
17-24	DELTAT	Time increment between plots (msec) (Negative increment means do all recorded plots within the time interval)	40.
25-32	RADCG	Radius of C.G. symbol (Plot inches)	0.10
33-40	WIDNEK	Half-width of tick mark for neck (Plot inches)	0.15
41-48	TCKNNO	Number of tick marks equispaced along neck	6.

TABLE 1. PLOTCS CONTROL CARD LAYOUT (5 of 12)

Cards 4 to 7: MODEL RUN TRANSFORMATION SPECIFICATION CARDS
(These cards must be present if LNORM is not zero.)

Card 4 -- PLOT SPACE ORIGIN (Set Up Card 1)

Col	Item	Description	Default
01-08	ORGNRM(1)	X-coordinate of Plot Space origin (*)	0.
09-16	ORGNRM(2)	Y-coordinate of Plot Space origin (*)	0.
17-24	ORGNRM(3)	Z-coordinate of Plot Space origin (*)	0.

Card 5 -- FORWARD DIRECTION (Set Up Card 2)

Col	Item	Description	Default
01-08	FORWRD(1)	Direction cosine of forward from X	1.
09-16	FORWRD(2)	Direction cosine of forward from Y	0.
17-24	FORWRD(3)	Direction cosine of forward from Z	0.

(*) Appropriate model run linear units.

TABLE 1. PLOTCS CONTROL CARD LAYOUT (6 of 12)

Cards 4 to 7: MODEL RUN TRANSFORMATION SPECIFICATION CARDS (cont.)
(These cards must be present if LNORM is not zero.)

Card 6 -- LEFT DIRECTION (Set Up Card 3)

Col	Item	Description	Default
01-08	GAUCHE(1)	Direction cosine of left from X	0.
09-16	GAUCHE(2)	Direction cosine of left from Y	1.
17-24	GAUCHE(3)	Direction cosine of left from Z	0.

Card 7 -- UPWARD DIRECTION (Set Up Card 4)

Col	Item	Description	Default
01-08	UP(1)	Direction cosine of up from X	0.
09-16	UP(2)	Direction cosine of up from Y	0.
17-24	UP(3)	Direction cosine of up from Z	1.

TABLE 1. PLOTCS CONTROL CARD LAYOUT (7 of 12)

SPECIAL POINTS SECTION OF RECORDS:
(This section occurs only if INPSGP > 0 and consists of one card with INPSGP fields followed by one record for each special point specified on the first card.)

Card 8 -- GROUP LAYOUT CARD FOR SPECIAL POINTS

Columns	Description
6j-5 to 6j	NSPTGP(1,j), Number of points in group j (>=0).

for j = 1, INPSGP

Card m+8 -- SPECIAL POINTS TO CONNECT IN GROUPS
(There are exactly INPSPP of these cards where INPSPP is the sum of NSPTGP(j),j=1,INPSGP.)

Columns	Description
01 to 06	j, Group number (1 to INPSGP).
07 to 12	Point number (1 to NSPTGP(1,j)).
13 to 20	General segment attachment number (1 to NGRD).
21 to 40	X-coordinate of current special point.
41 to 60	Y-coordinate of current special point.
61 to 80	Z-coordinate of current special point.

for m = 1, INPSPP

Note: Let M = 8 if INPSGP = 0 or M = INPSPP + 9 if INPSGP > 0.

TABLE 1. PLOTCS CONTROL CARD LAYOUT (8 of 12)

PLOT VIEW SPECIFICATION SECTION OF RECORDS:
(IVIEWS sets of these 7 cards are required.)

Card 7*K+M -- THE PLOT SPACE X-AXIS W.R.T. THE VIEWING SYSTEM
(Viewing system specification, 1st card)

Col	Item	Description	Default
01-08	AMAT(1,1,K)	Direction cosine from the Plot Space X-axis to the Viewing X-axis	1., 0., 1
09-16	AMAT(1,2,K)	Direction cosine from the Plot Space X-axis to the Viewing Y-axis	0., -1., 0
17-24	AMAT(1,3,K)	Direction cosine from the Plot Space X-axis to the Viewing Z-axis	0., 0., 0

Card 7*K+M+1 -- THE PLOT SPACE Y-AXIS W.R.T. THE VIEWING SYSTEM
(Viewing system specification, 2nd card)

Col	Item	Description	Default
01-08	AMAT(2,1,K)	Direction cosine from the Plot Space Y-axis to the Viewing X-axis	0., 1., 0.
09-16	AMAT(2,2,K)	Direction cosine from the Plot Space Y-axis to the Viewing Y-axis	1., 0., 0
17-24	AMAT(2,3,K)	Direction cosine from the Plot Space Y-axis to the Viewing Z-axis	0., 0., 1

Note: Where the Default Column contains a triad of numbers, the number is used corresponding to the value of K = 1, 2, or 3 for the current set of viewing system specification cards.

TABLE 1. PLOTCS CONTROL CARD LAYOUT (9 of 12)

PLOT VIEW SPECIFICATIONS SECTION (continued)
(IVIEWS sets of these 7 cards are required.)

Card 7*K+M+2 -- THE PLOT SPACE Z-AXIS W.R.T. THE VIEWING SYSTEM
(View system specification, 3rd card)

Col	Item	Description	Default
01-08	AMAT(3,1,K)	Direction cosine from the Plot Space Z-axis to the Viewing X-axis	0., 0., 0.
09-16	AMAT(3,2,K)	Direction cosine from the Plot Space Z-axis to the Viewing Y-axis	0., 0., -1.
17-24	AMAT(3,3,K)	Direction cosine from the Plot Space Z-axis to the Viewing Z-axis	1., 1., 0.

Card 7*K+M+3 -- PHYSICAL SPECIFICATION OF THE VIEW PLOT AREA
(View system specification, 4th card)

Col	Item	Description	Default
01-08	XPLTLL(K)	Distance along paper of view plot area from left edge of plot paper (Plot inches).	.5
09-16	ZPLTLL(K)	Distance across paper of view plot area from bottom of plot paper (Plot inches).	.5, 9., 17.5
17-24	XPLTLG(K)	Length of plot area in X-direction (Plot inches)	11.
25-32	ZPLTLG(K)	Length of plot area in Z-direction (Plot inches)	8.5

TABLE 1. PLOTCS CONTROL CARD LAYOUT (10 of 12)

PLOT VIEW SPECIFICATIONS SECTION OF RECORDS: (continued)
(IVIEWS sets of these 7 cards are required.)

Card 7*K+M+4 -- PHYSICAL SPECIFICATION OF PLOT REFERENCE FRAME
(View system specification, 5th card)

Col	Item	Description	Default
01-08	XVULLC(K)	Distance in x-direction of plot reference frame origin from left edge of plot area (Plot inches)	.5
09-16	ZVULLC(K)	Distance in z-direction of plot reference frame origin from bottom edge of plot area (Plot inches)	.5
17-24	XAXSLG(K)	Length of plot reference frame x-axis (Plot inches)	10.
25-32	ZAXSLG(K)	Length of plot reference frame z-axis (Plot inches)	7.

(Note: At the University of Michigan plots can be a maximum of 360 inches along paper where the Viewing X-direction is plotted and a maximum of 30 inches wide across paper where the Viewing Z-direction is plotted.)

TABLE 1. PLOTCS CONTROL CARD LAYOUT (11 of 12)

PLOT VIEW SPECIFICATIONS SECTION OF RECORDS: (continued)
(IVIEWS sets of these 7 cards are required.)

Card 7*K+M+5 -- SCALING SPECIFICATION OF PLOT REFERENCE FRAME
(View system specification, 6th card)

Col	Item	Description	Default
01-08	XLEFVL(K)	X-value to be shown in the lower left corner of the plot	-10., -50., -10.
09-16	XRIGHT	X-value to be shown in the upper right corner of the plot	90., 50., 90.
17-24	ZBOTVL(K)	Z-value to be shown in the lower left corner of the plot	0., 0., 35.
25-32	ZTOP	Z-value to be shown in the upper right by plot reference frame x-axis	-70., -70., -35.
33-40	ELLDEL(K)	Plot step size for representing shadow ellipses	1.
41-48	TICKVL(K)	Length represented by spacing between tick marks in plot	10.

Note 1: The lengths of the X and Z axes will be adjusted to show the user-specified plot region with equal scales in both the X and Z directions.

Note 2: If the ITWOD switch of the first control card is positive, Z-values are expected to be positive downward. In this case, the first four parameters of this card are identical in meaning to fields 3 through 6 of Card 1500 in MVMA 2-D CVS data sets. If the ITWOD switch is negative, the Z-values are expected to be positive upward.

Note 3: All parameters on this card are to be specified in appropriate model run position units.

TABLE 1. PLOTCS CONTROL CARD LAYOUT (12 of 12)

PLOT VIEW SPECIFICATIONS SECTION OF RECORDS: (continued)
(IVIEWS sets of these 7 cards are required.)

Card 7*K+M+6 -- SPECIFICATION OF VIEW PLOT TITLE
(Viewing system specification, 7th card)

Col	Item	Description	Default
01-12	VWTTL(1-3,K)	Title for View Plot (12 characters)	X-Z, Y-Z, X-Y

for K = 1, IVIEWS

3.0 Specification of the Standard Transformation and the Viewing Systems

The positional data recorded by the models in the hold files is in terms of model coordinate systems. PLOTCS begins by transforming all the data into the PLOTCS Plot Space System based on one coordinate system of the user's choice. The x-axis of the PLOTCS Plot Space System will be shown as the forward direction on the plots, the y-axis is shown to the left, and the z-axis is shown upward. After transformation into the PLOTCS Plot Space system the data are stored in internal tables. This process is called the Standard Transformation and is the subject of Section 3.1.

The viewing systems are specified in terms of the PLOTCS Plot Space system and the plots are made of the orthographic projection, or the shadow, of the model run configuration onto the x-z plane of each specified viewing system with the viewing y-axis being the line of sight of each such plot. Specification of these viewing systems is the subject of Section 3.2.

3.1 The Standard Transformation. Consider a seated occupant seen in an MVMA 2-D representation in the vehicle coordinate system. Without the standard transformation, PLOTCS would show this occupant upside down since z is positive downward in the model system while PLOTCS Plot Space has z positive upward. The purpose of the Standard Transformation is to put the x, y, and z values from the simulation into the Plot Space coordinate system illustrated at the bottom of Figure 1. The LNORM = -1 option should normally be selected for plotting MVMA 2-D results.

The relationship between the specified model system and the PLOTCS Plot Space system is defined by the user in the PLOTCS Control Cards by specifying the direction cosines of the "forward" direction, the "leftward" direction, and the "upward" direction in terms of the chosen model run coordinate system. Figure 1 illustrates the standard MVMA 2-D case.

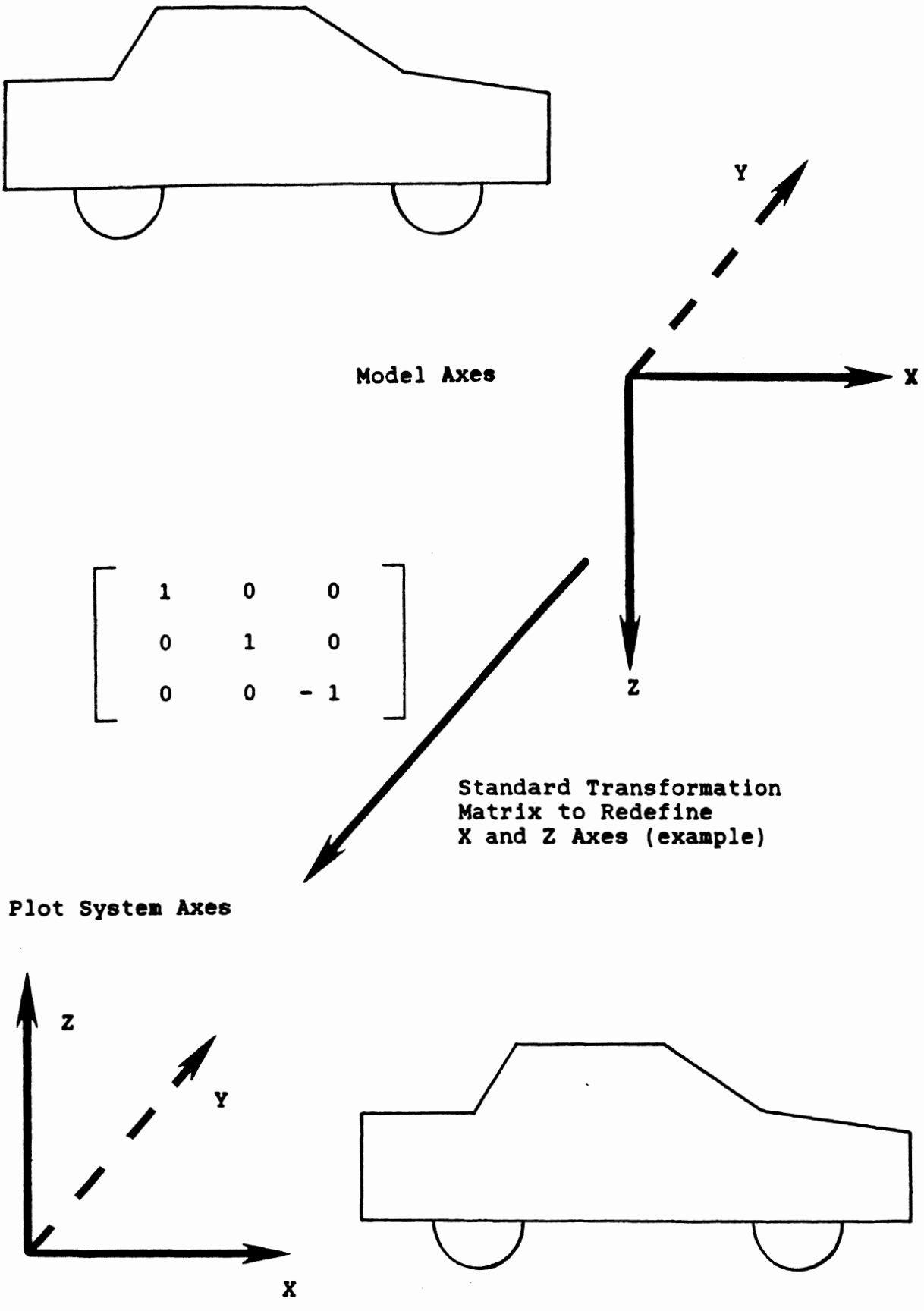
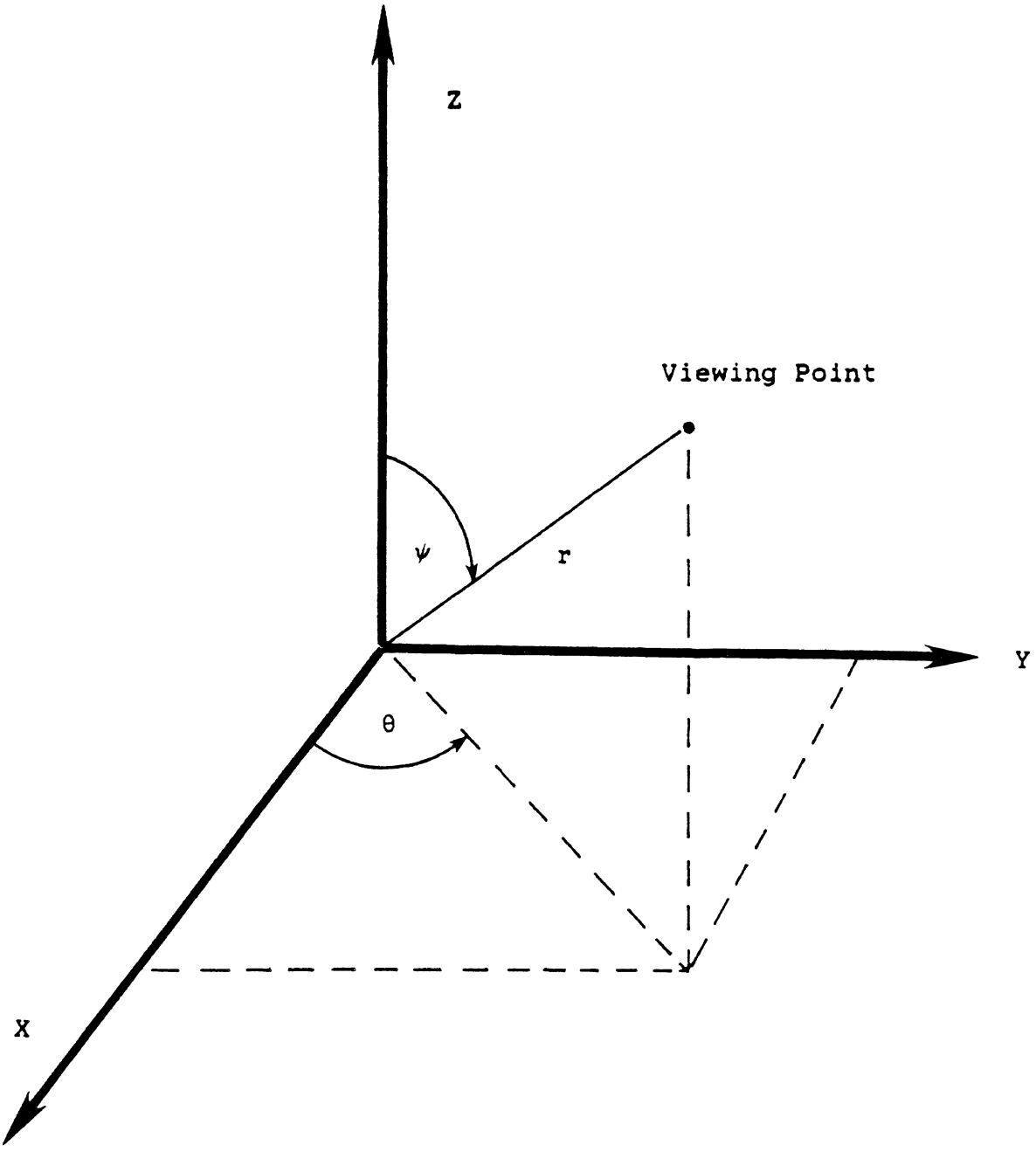


Figure 1. Effect of Standard Transformation

3.2 Viewing Matrix Selection. In the general three-dimensional case, the second step in setting up plots is determining the proper viewing matrix. Each of a possible three views are specified with respect to the PLOTCS Plot Space system.

One simple way is to choose a viewing point and imagine drawing a line to the origin of the plot view system. The plane upon which the orthographic projection is made is the plane perpendicular to this line through the plot view system origin. In fact, the line-of-sight thus established is the Y-axis of the plot view system. If the viewing point is represented in spherical coordinates in the PLOTCS Plot Space system (see Figure 2), then a proper viewing matrix is:

$$\begin{bmatrix} -\sin\theta & \cos\theta & 0 \\ -\sin\psi\cos\theta & -\sin\psi\sin\theta & -\cos\psi \\ -\cos\psi\cos\theta & -\cos\psi\sin\theta & -\sin\psi \end{bmatrix} \qquad (1)$$



Notes: 1. $0 \leq \psi \leq 180°$

2. $0 \leq \theta \leq 360°$

3. (The magnitude of r is irrelevant.)

Figure 2. The Viewing Point in Spherical Coordinates Relative to the Standard System

An alternative approach is to use the direction cosines ($\cos\alpha$, $\cos\beta$, $\cos\gamma$) of the line-of-sight. The direction cosines of the line-of-sight are related to the coordinates of the viewing point (Xp,Yp,Zp) by

$$\cos\alpha = Xp / D , \quad \cos\beta = Yp / D, \quad \cos\gamma = Zp / D \tag{2}$$

where

$$D = \pm\sqrt{Xp^2 + Yp^2 + Zp^2} \tag{3}$$

and a proper viewing matrix is:

$$\begin{bmatrix} \cos\beta / \sin\gamma & -\cos\alpha / \sin\gamma & 0 \\ \cos\alpha & \cos\beta & \cos\gamma \\ -\cos\alpha / \tan\gamma & -\cos\beta / \tan\gamma & \sin\gamma \end{bmatrix} \tag{4}$$

if $\cos^2\gamma \neq 1$

or

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix} \tag{5}$$

if $\cos\gamma = \pm 1$

4.0 Summary of Analysis

The analysis is summarized in two parts. The first subsection deals with the various coordinate system transformations and the second subsection deals with the orthographic projection of a general ellipsoid upon the specified viewing plane.

4.1 Coordinate Transformations. Model run information is expressed in terms of several coordinate systems. PLOTCS first transforms the descriptions of all these coordinate systems to correct for the directions of the base underlying unit vectors. This coordinate system is called the Standard Transformation.

The Standard Transformation is defined in three steps:

1. selection of one of the model run coordinate systems as a basis for relating the PLOTCS Plot Space system to the model run systems

2. specification of a new origin with respect to the "base" system

3. specification of a direction cosine matrix about the new origin which relates the "base" system to the PLOTCS Plot Space system.

The Standard Transformation is applied to all positional data recorded by the simulation model. One or more viewing systems are then defined with respect to the PLOTCS Plot Space system. All of these transformations can be described in terms of a general rotation and a general translation. We will use the following index correspondences. The index "N" is for any of the model coordinate systems, the index "S" is for the PLOTCS Plot Space system, and the index "I" is for the model inertial system (with respect to which all the other model coordinate systems are related). Also, the index "M" will stand for the model coordinate system with respect to which the PLOTCS Plot Space system is defined, and the index "V" will be for any of the viewing coordinate systems. The indices "K" and "J" are general and can stand for any of these coordinate systems.

We will let R(K) stand for any positional vector given with respect to any coordinate system K. R'(K,J) will be the positional vector to the origin of any coordinate system K given with respect to any other coordinate system J. D(K,J) is the direction cosine matrix of any coordinate system K given with respect to any other coordinate system J, and D/(K,J) will stand for the inverse of the direction cosine matrix D(K,J).

Since all of the coordinate systems are orthonormal, we have that

$$D/(K,J) = D(J,K) \quad . \tag{6}$$

Also, by definition of the direction cosines,

$$R(K) = R'(K,J) + D(K,J) * R(J) \text{ for any K and J} \tag{7}$$

Equation 7 serves as the basis for the necessary conversion equations for any model vector R(N) into any viewing system V:

$$R(V) = R'(V,S) + D(V,S) * R(S) \tag{8}$$

where R(V) is needed for the actual plotting of points, R'(V,S) and D(V,S) are obtained from control card input, and

$$R(S) = R'(S,M) + D(S,M) * R(M) \tag{9}$$

where R'(S,M) and D(S,M) are also obtained from control card input. (This equation holds even if D(S,M) represents a redefinition from a left-handed system to a right-handed system.) Also, for equation 9, we use

$$R(M) = D(M,I) * (D/(N,I) * R(N) + R'(N,I) - R'(M,I)) \tag{10}$$

where

D(M,I), D(N,I), R'(M,I), and R'(N,I)

are all recorded in the model data hold file.

Figure 3 illustrates the relationship between these various coordinate systems.

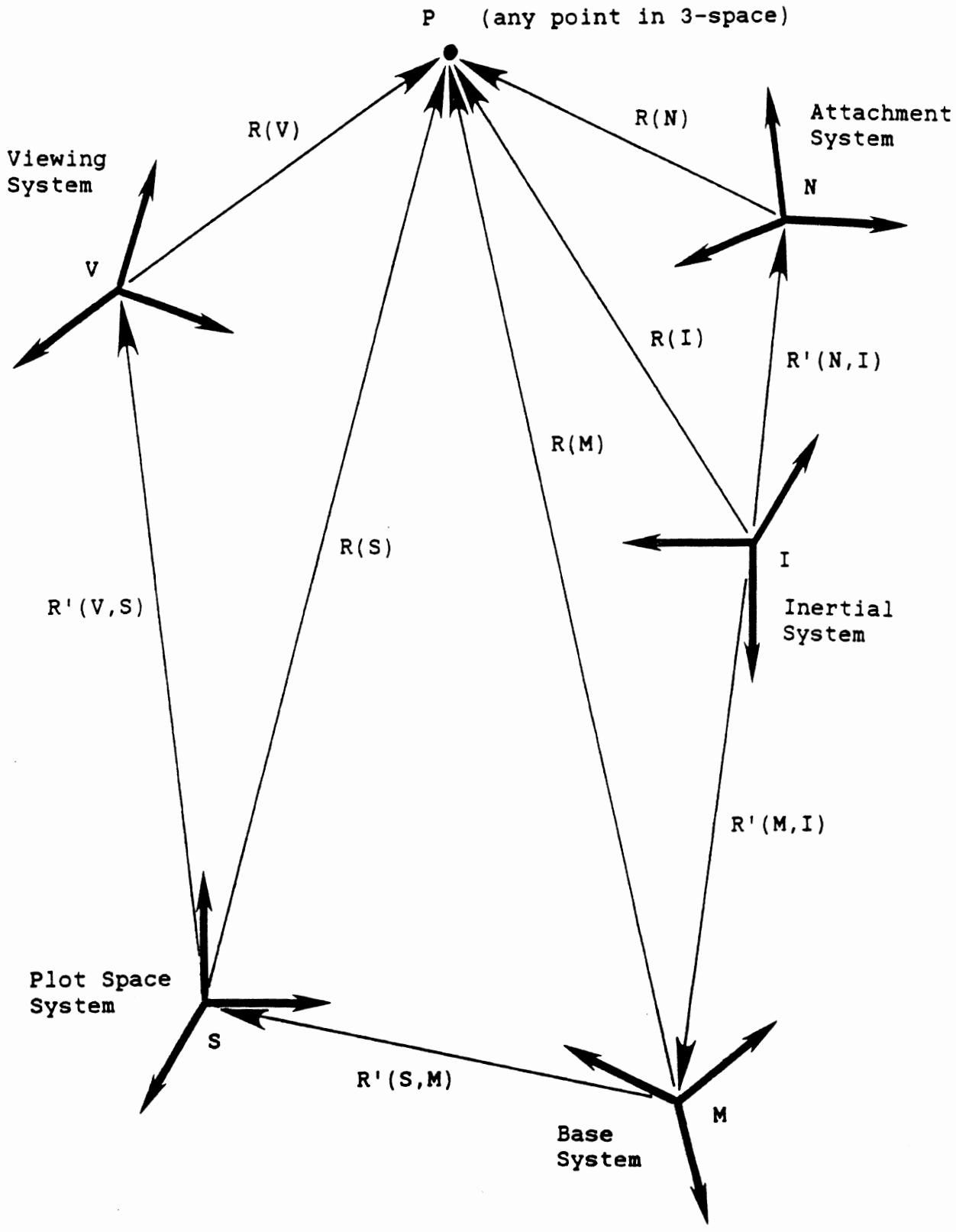


Figure 3. Relationships Between Coordinate Systems

4.2 The Orthographic Projection of an Ellipsoid. The general equation of an ellipsoid in any viewing system is:

$$\alpha x^2 + \beta y^2 + \gamma z^2 + 2 (\gamma xy + \epsilon xz + \lambda yz) = 1 \qquad (11)$$

where

$$\alpha = \frac{D_{11}^2}{a^2} + \frac{D_{21}^2}{b^2} + \frac{D_{31}^2}{c^2} , \qquad (12)$$

$$\beta = \frac{D_{12}^2}{a^2} + \frac{D_{22}^2}{b^2} + \frac{D_{32}^2}{c^2} , \qquad (13)$$

$$\gamma = \frac{D_{11} D_{12}}{a^2} + \frac{D_{21} D_{22}}{b^2} + \frac{D_{31} D_{32}}{c^2} , \qquad (14)$$

$$\delta = \frac{D_{13}^2}{a^2} + \frac{D_{23}^2}{b^2} + \frac{D_{33}^2}{c^2} , \qquad (15)$$

$$\epsilon = \frac{D_{11} D_{13}}{a^2} + \frac{D_{21} D_{23}}{b^2} + \frac{D_{31} D_{33}}{c^2} , \qquad (16)$$

$$\lambda = \frac{D_{12} D_{13}}{a^2} + \frac{D_{22} D_{23}}{b^2} + \frac{D_{32} D_{33}}{c^2} . \qquad (17)$$

In equations 12 through 17:

a, b, c — are the semiaxes of the ellipsoid, and

D_{ij} — is the i-th row and j-th column element of the direction cosine matrix for the ellipsoid relative to the viewing system.

In the nomenclature of the last section, equation 18 gives the relationship between the direction cosine matrix D with respect to the viewing system and the model system N to which the ellipsoid is attached:

$$D = D(V,S) * D(S,M) * D(M,I) * D/(N,I) * De \qquad (18)$$

where

De is the direction cosine matrix which defines the relationship of the ellipsoid to the model system N; this matrix is recorded in the model hold file.

In the viewing system, the y-axis is the line-of-sight viewing axis and the x-z plane is the viewing plane. The orthographic projection, or shadow ellipse, is the shadow of the ellipsoid on the viewing plane which results from a light source parallel to the y-axis on the other side of the ellipsoid and shining on the plane. Equation 11 is solved for y to get equation 19 below. The edge of the shadow is made up of those points in the x-z plane for which a unique solution exists for y or where the discriminant equals zero.

$$y = \frac{-(\gamma x + \lambda z) \pm \sqrt{(\gamma - \alpha\beta)x^2 + (\lambda - \beta\delta)z^2 + 2(\gamma\lambda - \beta\epsilon)xz - \beta}}{\beta} \qquad (19)$$

so

$$(\gamma - \alpha\beta)x^2 + (\lambda - \beta\delta)z^2 + 2(\gamma\lambda - \beta\epsilon)xz - \beta = 0 \qquad (20)$$

Equation 20 is the equation of an ellipse in the x-z plane. In order to simplify plotting, we will use a general parametric form of the equation of an ellipse:

$$x = A \cos\phi \cos\theta - B \sin\phi \sin\theta \tag{21}$$

$$z = A \sin\phi \cos\theta + B \cos\phi \sin\theta \tag{22}$$

where

A, B are the semiaxes of the shadow ellipse

ϕ is the angle of the A-axis of the ellipse with respect to the x-axis

and

θ is the parametric variable.

Figure 4 shows the ellipse obtained by letting the parameter θ vary from 0 degrees to 360 degrees for a particular set of A, B, and ϕ .

If equations 21 and 22 are substituted into equation 20, the following equation results:

$$\begin{aligned} & A^2 [(\gamma - \alpha \beta) \cos^2\phi + (\lambda - \beta \delta) \sin^2\phi + 2 (\gamma \lambda - \beta \epsilon) \sin\phi \cos\phi] \cos^2\theta \\ & + B^2 [(\gamma - \alpha \beta) \sin^2\phi + (\lambda - \beta \delta) \cos^2\phi - 2 (\gamma \lambda - \beta \epsilon) \sin\phi \cos\phi] \sin^2\theta \\ & - \beta \\ & + 2 A B [(\gamma \lambda - \beta \epsilon) (\cos^2\phi - \sin^2\phi) + (\lambda - \gamma - \beta \delta + \alpha \beta) \sin\phi \cos\phi] \sin\theta \cos\theta \\ & = 0 \end{aligned} \tag{23}$$

Since each point on the ellipse is represented by a value of the parameter θ , this equation must be satisified for all values of θ . Three of the four terms in this equation include sin θ and cos θ factors. Since, while θ is an independent variable, sin θ and cos θ are not independent of each other, equation 23 can be written arbitrarily as two grouped terms, each having the value zero. Specifically, we can satisfy equation 23 by choosing a relationship between A, B, and β such that the first three terms sum to zero, provided that the fourth term is separately zero. From setting the coefficient of the fourth term to zero we get equation 24:

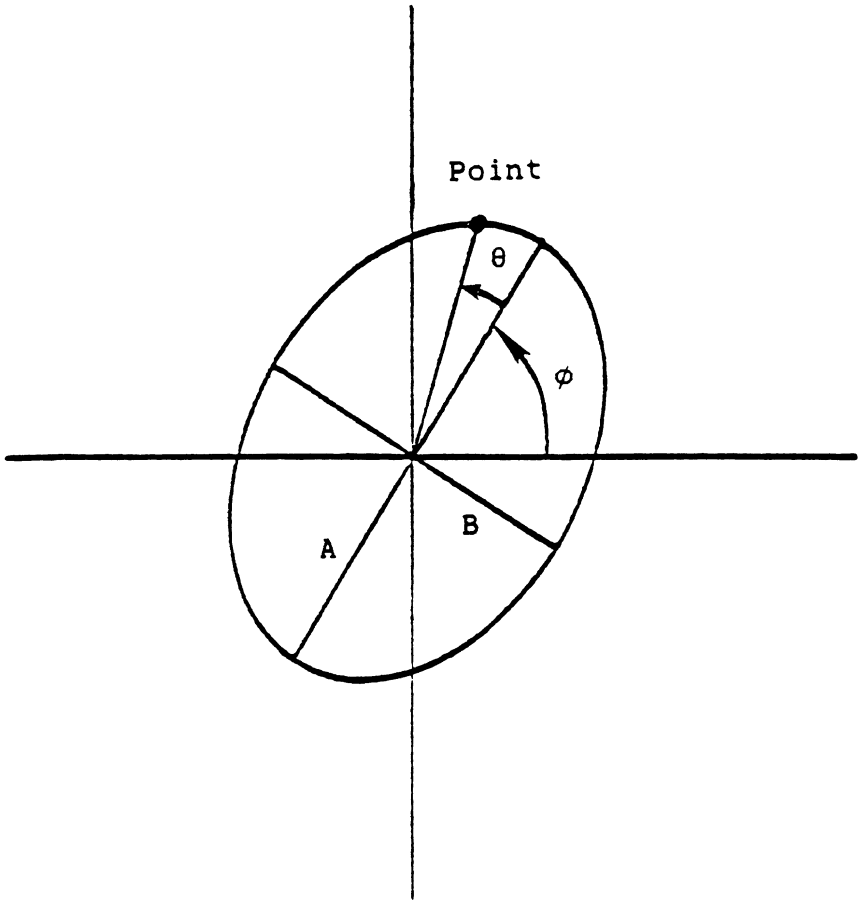


Figure 4. The Shadow Ellipse in the Viewing Plane

$$\frac{\sin \phi \cos \phi}{\cos^2 \phi - \sin^2 \phi} = \frac{\gamma \lambda - \beta \epsilon}{\gamma - \lambda - \alpha \beta + \beta \delta} \qquad (24)$$

and since

$$\tan 2\phi = \frac{\sin \phi \cos \phi}{\cos^2 \phi - \sin^2 \phi} \qquad (25)$$

we get

$$\phi = \frac{1}{2} \tan^{-1} [2 (\gamma \lambda - \beta \epsilon) / (\gamma - \lambda - \alpha \beta + \beta \delta)] \qquad (26)$$

The first three terms of equation 23 will sum to zero if we set the coefficients of the first two terms separately equal to β since $\sin^2 \theta + \cos^2 \theta = 1$.

Hence

$$A^2 [(\gamma - \alpha \beta) \cos^2 \phi + (\lambda - \beta \delta) \sin^2 \phi + 2 (\gamma \lambda - \beta \epsilon) \sin \phi \cos \phi] = \beta \qquad (27)$$

and

$$B^2 \left[\left(\gamma - \alpha \beta \right) \sin^2 \phi + \left(\lambda - \beta \delta \right) \cos^2 \phi - 2 \left(\gamma \lambda - \beta \epsilon \right) \sin \phi \cos \phi \right] = \beta \tag{28}$$

We can solve equation 27 for A and equation 28 for B in terms of the value ϕ determined in equation 26. This then represents a valid solution for equation 23. The values of A and B are presented as equations 29 and 30.

$$A = \frac{\sqrt{\beta}}{\sqrt{\left(\gamma - \alpha \beta \right) \cos^2 \phi + \left(\lambda - \beta \delta \right) \sin^2 \phi + 2 \left(\gamma \lambda - \beta \epsilon \right) \sin \phi \cos \phi}} \tag{29}$$

$$B = \frac{\sqrt{\beta}}{\sqrt{\left(\gamma - \alpha \beta \right) \sin^2 \phi + \left(\lambda - \beta \delta \right) \cos^2 \phi - 2 \left(\gamma \lambda - \beta \epsilon \right) \sin \phi \cos \phi}} \tag{30}$$

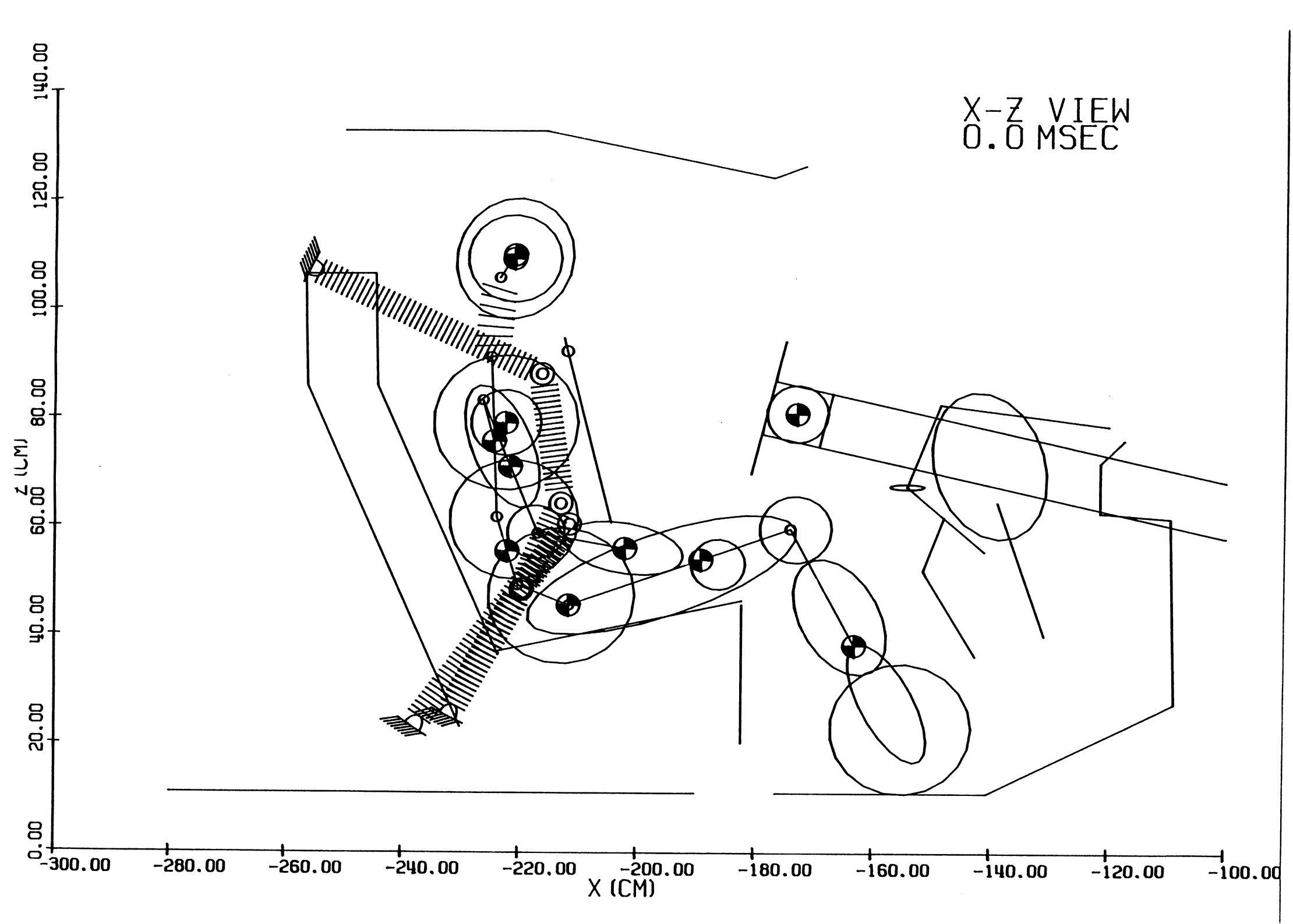
5.0 Example Plots Produced by PLOTCS

This section contains examples of plots produced by PLOTCS. Subsections are for separate runs of MVMA 2-D, and each subsection in general has several illustrative plots.

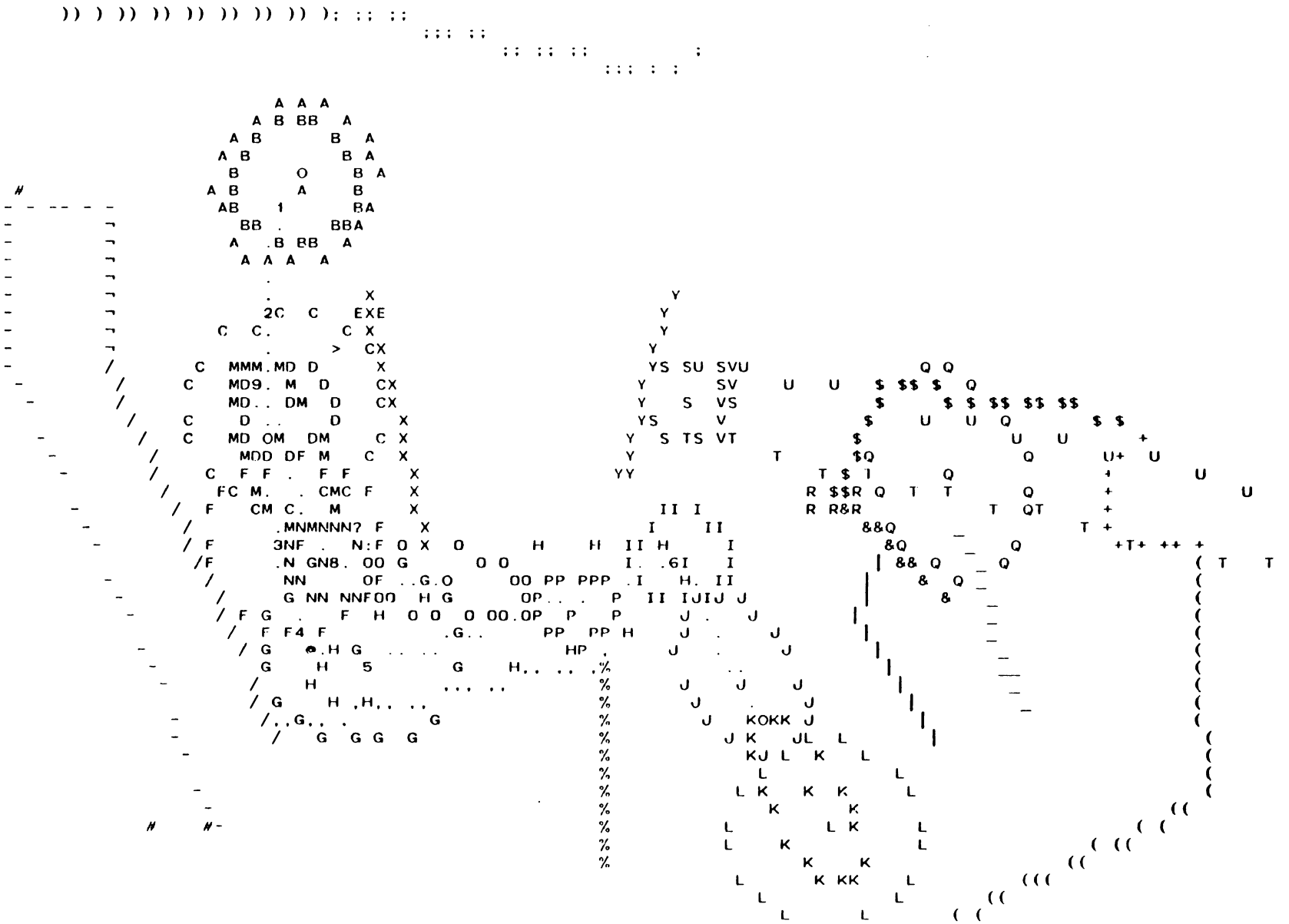
Each subsection is organized in the following manner. The data set for the PLOTCS post-processor (see Section 2.2) is first shown; the MVMA 2-D Input Processor data set is not shown except for the pertinent control in Field 2 of Card 101. The first plot shown is the time zero plot produced from the PLOTCS output. The time zero Stick Figure Printer Plot (Category 45) produced by the model run is presented next for comparison. The printed output from the PLOTCS program then follows if there is a particular point to be illustrated. Some of any remaining plots produced by the run are then presented. Finally, a printout of the PLOTCS hold file (see Appendix A) produced by the corresponding model run is appended to the first example, Sec 5.1.

5.1 Occupant Restrained by 3-Point Belt System. The data set used for this run is the DEMOBELT data set which is included on release tapes of the MVMA 2-D model. The run was made with Field 2 of Card 101 set to -20. and the run duration set to 0 to 160 msec. The plots are produced every 40 msec over the whole duration.

```
2000      1 1 2 1-1   1 1 1 1   1 1 1 1 1 0   0-1 1  -1-1-1   0 0 1
2001     1.       .1125    .1       .08      .1       .05      .15      .07      .045
2002     0.       160.     40.      .10      .15      6.
2003     1.       0.       0.
2004     0.       1.       0.
2005     0.       0.       1.
2006     .5       .5       11.      8.5
2007     .5       .5       10.      7.
2008     -300.    -100.    0.       -140.    5.       20.
2009        X-Z VIEW
```


X-Z VIEW
0.0 MSEC
Z (CM)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
-300.00
-280.00
-260.00
-240.00
-220.00
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00
X (CM)

STICK FIGURE PRINTER PLOT FRAME FOR TIME= 0.0 MSEC.

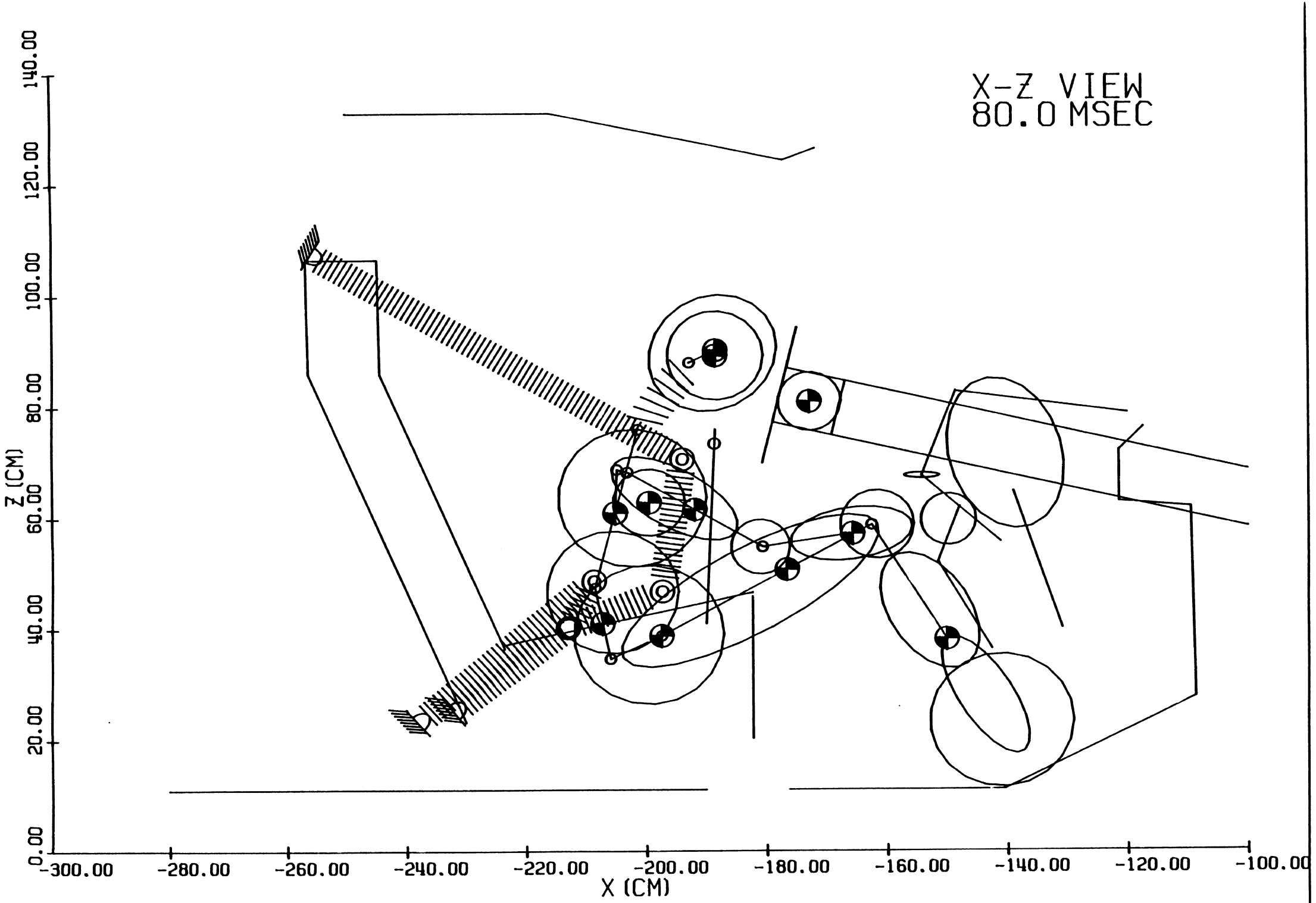


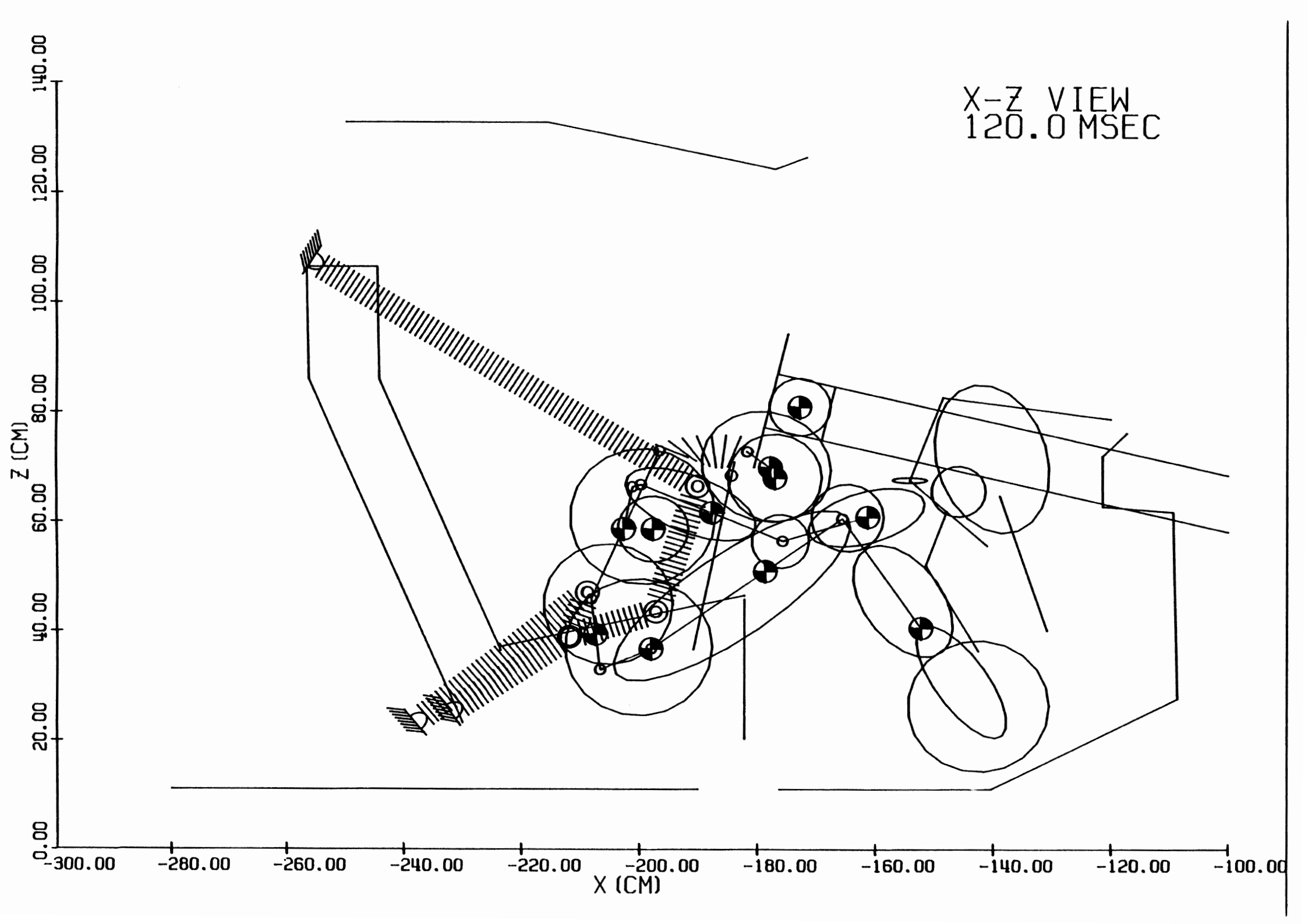
COORDINATE RANGES FOR PLOT ARE X=-282.25 (AT LEFT) TO -99.75 (AT RIGHT) AND Z= -10.00 (AT BOTTOM) TO-134.00 (AT TOP)
SCALE FACTOR IS (CM) = 7.516 (CM) , X AND Z POINT RESOLUTION ERRORS EQUAL RESPECTIVELY 0.702 AND 1.170 (CM) IN SCALE.

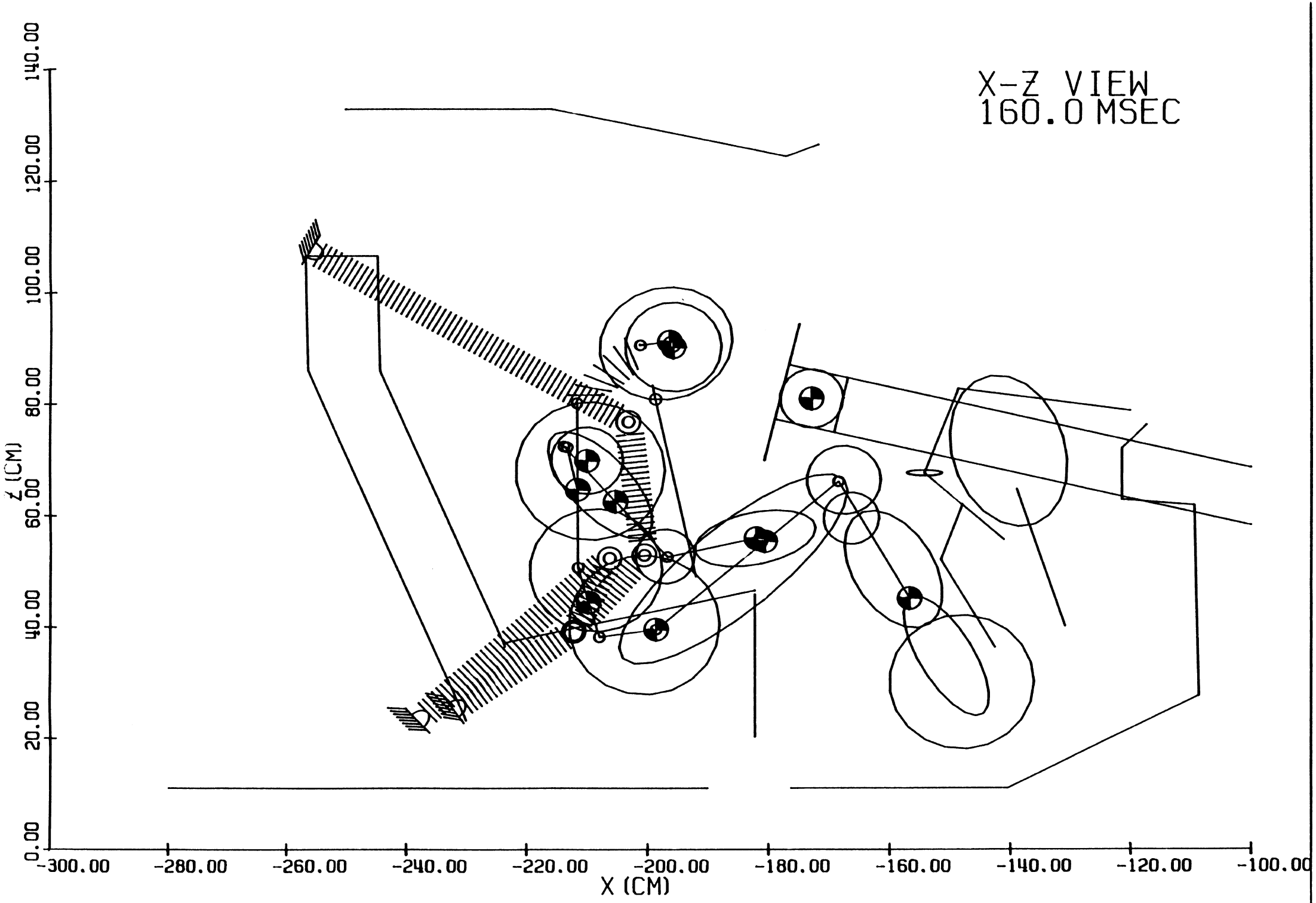
```
BEGIN 2-D OCCUPANT KINEMATICS POST PROCESSOR
BELTS WILL BE DRAWN, IF PRESENT.
PANELS WILL BE DRAWN, IF PRESENT.
JOINTS AND CENTERLINES WILL BE DRAWN, IF PRESENT.
ELLIPSOIDS WILL BE DRAWN, IF PRESENT.
AIRBAG OUTLINES WILL BE DRAWN, IF PRESENT.
```

```
PLOT START TIME (MSEC)    0.0
PLOT END TIME (MSEC)    160.0000
PLOT INTERVAL (MSEC)     40.0000

PLOTTING PARAMETERS
PLOT #                     1        2        3


  ORGNRM:        0.0          0.0          0.0
  FORWRD:        1.0000       0.0          0.0
  GAUCHE:        0.0         -1.0000       0.0
     UP:         0.0          0.0         -1.0000
PLOT X ORIGIN (IN)          0.50     0.0      0.0
PLOT Z ORIGIN (IN)          0.50     0.0      0.0
PLOT X LENGTH (IN)         11.00     0.0      0.0
PLOT Z LENGTH (IN)          8.50     0.0      0.0

AXIS X ORIGIN (IN)          0.50     0.0      0.0
AXIS Z ORIGIN (IN)          0.75     0.0      0.0
AXIS X LENGTH (IN)         10.00     0.0      0.0
AXIS Z LENGTH (IN)          7.00     0.0      0.0

VIEWING SYSTEM PARAMETERS
POS'N ORIGIN X (IN)      -300.00     0.0      0.0
POS'N ORIGIN Z (IN)        -0.0      0.0      0.0
MAXIMUM X (IN)            200.00     0.0      0.0
MAXIMUM Z (IN)            140.00     0.0      0.0

ELLIPSE STEP FACTOR         5.00     0.0      0.0

VIEWING ROTATION MATRIX                VIEW 1
                          1.0000000  0.0        0.0
                          0.0        1.0000000  0.0
                          0.0        0.0        1.0000000

END OF TIME PLOT NO.     1

END OF TIME PLOT NO.     2

END OF TIME PLOT NO.     3

END OF TIME PLOT NO.     4

END OF TIME PLOT NO.     5

END OF ALL PLOTS, TOTAL NUMBER =     5
```

Z (CM)
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
X (CM)
-300.00
-280.00
-260.00
-240.00
-220.00
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00
X-Z VIEW
40.0 MSEC


X-Z VIEW
80.0 MSEC
Z (CM)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
-300.00
-280.00
-260.00
-240.00
-220.00
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00
X (CM)


X-Z VIEW
120.0 MSEC
Z (CM)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
-300.00
-280.00
-260.00
-240.00
-220.00
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00
X (CM)


X-Z VIEW
160.0 MSEC
Z (CM)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
-300.00
-280.00
-260.00
-240.00
-220.00
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00
X (CM)

```
1PLOTCS      0    19    11     7     6     1     0    29    19    13    12     0
 TITLE    MVMA 2-D CVS DEMONSTRATION RUN FOR A BELTED DRIVER  (UNTESTED DATA)
 SUBTITLE   THREE-POINT BELT SYSTEM WITH LOWER TORSO BELT AND INBOARD LAP BELT S
        EGMENTS MEETING AT A SLIP RING AT THE END OF RING STRAP   AUG88
 DATE,TIME, JOB DEC 14, 1988            06:05:24
 BELT     1 UPPER TORSO BELT            5       2       12       0       0       2
               -12.04300          1.999997          -8.490000
               -255.9000          22.10000          -107.4000
 BELT     2 LOWER TORSO BELT            6       2        0       12      0       0
                11.80699         -14.70000          -10.98000
               0.0                0.0                0.0
 BELT     3 INBOARD LAP BELT            4       0        0       4       12      1
               0.0                0.0                0.0
               0.0                0.0                0.0
 BELT     4 OUTBOARDLAP BELT            1       12       0       4       0       0
               -238.1000          27.89999          -23.10001
               0.0                0.0                0.0
 BELT     5 LOWER RING STRAP            1       12       0       12      0       1
               -232.1000          -33.20000          -25.10001
               0.0                0.0                0.0
 BELT     6 CONECTN OF TORS BLTS        5       2        2       0       0       3
               -12.04300          1.999997          -8.490000
                11.80699         -14.70000          -10.98000
 PLANES    1 BOTTOMCOLUMN          2 TOPCOLUMN             3 ENDCOLUMN
 PLANES    4 WHEELCOLUMN           5 FRONTTORSO            6 UPPERRIM.MOVE
 PLANES    7 ASEG.FLOORPAN         8 ASEG.REAR             9 ASEG.FRT_DASH
 PLANES   10 BSEG.FRT_DASH        11 ASEG.COWLBAR         12 BSEG.COWLBAR
 PLANES   13 CSEG.COWLBAR         14 ASEG.LOWERIP         15 BSEG.LOWERIP
 PLANES   16 ASEG.MIDDLIP         17 ASEG.UPPERIP         18 BSEG.UPPERIP
 PLANES   19 ASEG.ROOFPAN         20 ASEG.ROOFHDR         21 BSEG.ROOFHDR
 PLANES   22 ASEG.HDRS            23 HEADRESTTOP          24 HEADRESTBACK
 PLANES   25 BACKOFSEATLINE       26 ASEG.SEBK            27 ASEG.SECU
 PLANES   28 ASEG.EDGE            29 ASEG.HVACPA_N
 GSEG   1 1  HEAD   GSO1HEAD FXDSEGMENT          2 2  UTOR   GSO2UPPER TORSO SEG
 GSEG   3 3  MTOR   GSO3MIDDLE TORSO SEG         4 4  LTOR   GSO4LOWER TORSO SEG
 GSEG   5 5  ULEG   GSO5UPPER LEG SEGMNT         6 G  LLEG   GSO6LOWER LEG SEGMNT
 GSEG   7 7  UARM   GSO7UPPER ARM SEGMNT         8 8  LARM   GSO8LOWER ARM SEGMNT
 GSEG   9 A  GS11   GS11BRAIN                   10 B  GS12   GS12HEART
 GSEG  11 C  GS13   GS13COLUMNELLIPSE           12 @  VHCL   GSO9VEHICLE SEGMENT
 GSEG  13 &  GRND   GS10INERTIAL SEGMENT
 ELL    1 HEAD                    1.000000          0.0                0.0
        1          11.17500      0.0                1.000000          0.0
                   9.925000      0.0                0.0                1.000000
                   9.925000      0.7000000          0.0               -0.1000000
 ELL    2 BRAIN                   1.000000          0.0                0.0
        9          8.000000      0.0                1.000000          0.0
                   8.000000      0.0                0.0                1.000000
                   8.000000      0.0                0.0                0.0
 ELL    3 CHEST                   1.000000          0.0                0.0
        2          12.37500      0.0                1.000000          0.0
                   12.37500      0.0                0.0                1.000000
                   12.37500      -3.300000          0.0               -2.100000
 ELL    4 HEART                   1.000000          0.0                0.0
       10          6.000000      0.0                1.000000          0.0
                   6.000000      0.0                0.0                1.000000
                   6.000000      0.0                0.0                0.0
 ELL    5 STERNUM                 1.000000          0.0                0.0
        2          1.000000      0.0                1.000000          0.0
```

```
 59                      1.000000        0.0             0.0             1.000000
 60                      1.000000       -16.05901        0.0            -12.97700
 61      ELL    6 MIDTORSO               1.000000        0.0             0.0
 62             3        11.00000        0.0             1.000000        0.0
 63                      11.00000        0.0             0.0             1.000000
 64                      11.00000       -5.200000        0.0            -2.700000
 65      ELL    7 HIP                    1.000000        0.0             0.0
 66             4        12.50000        0.0             1.000000        0.0
 67                      12.50000        0.0             0.0             1.000000
 68                      12.50000       -1.800000        0.0            -1.100000
 69      ELL    8 UPPERLEG               1.000000        0.0             0.0
 70             5        24.30000        0.0             1.000000        0.0
 71                      7.500000        0.0             0.0             1.000000
 72                      7.500000       -7.200000        0.0             0.3000000
 73      ELL    9 KNEE                   1.000000        0.0             0.0
 74             5        6.150000        0.0             1.000000        0.0
 75                      6.150000        0.0             0.0             1.000000
 76                      6.150000        17.00000        0.0             0.4000000
 77      ELL   10 SHIN                   1.000000        0.0             0.0
 78             6        11.45000        0.0             1.000000        0.0
 79                      6.750000        0.0             0.0             1.000000
 80                      6.750000       -5.800000        0.0            -0.2000000
 81      ELL   11 SHIN2                  1.000000        0.0             0.0
 82             6        12.00000        0.0             1.000000        0.0
 83                      4.500000        0.0             0.0             1.000000
 84                      4.500000        12.00000        0.0            -0.2000000
 85      ELL   12 FOOT                   1.000000        0.0             0.0
 86             6        12.00000        0.0             1.000000        0.0
 87                      12.00000        0.0             0.0             1.000000
 88                      12.00000        17.30000        0.0            -0.1400000
 89      ELL   13 UPPERARM               1.000000        0.0             0.0
 90             7        11.85000        0.0             1.000000        0.0
 91                      5.149999        0.0             0.0             1.000000
 92                      5.149999       -3.900000        0.0             0.0
 93      ELL   14 ELBOW                  1.000000        0.0             0.0
 94             7        4.900000        0.0             1.000000        0.0
 95                      4.900000        0.0             0.0             1.000000
 96                      4.900000        12.80000        0.0             0.2000000
 97      ELL   15 LOWERARM               1.000000        0.0             0.0
 98             8        10.25000        0.0             1.000000        0.0
 99                      4.625000        0.0             0.0             1.000000
100                      4.625000       -0.2000000       0.0             0.0
101     ELL   16 HAND                   1.000000        0.0             0.0
102            8        4.625000        0.0             1.000000        0.0
103                     4.625000        0.0             0.0             1.000000
104                     4.625000        16.10001        0.0             0.0
105     ELL   17 CURVEDPANEL            0.2689199       0.0             0.9631625
106            12       13.80000        0.0             1.000000        0.0
107                     9.399999       -0.9631625       0.0             0.2689199
108                     9.399999       -140.2400        0.0            -71.36099
109     ELL   18 KNOB                   1.000000        0.0             0.0
110            12       3.000000        0.0             1.000000        0.0
111                    0.5000000        0.0             0.0             1.000000
112                    0.5000000       -154.2500        0.0            -67.45000
113     ELL   19 COLUMNELLIPSE          1.000000        0.0             0.0
114            11       5.250000        0.0             1.000000        0.0
115                     5.250000        0.0             0.0             1.000000
116                     5.250000        0.0             0.0             0.0
```

```
117      JOINTS     1 NECK |     1     2      4.784000          0.0              1.211000
118                                           -15.45300          0.0              0.0
119      JOINTS     2 USPN *     2     3      13.94300          0.0              0.0
120                                           -6.477000          0.0              0.0
121      JOINTS     3 LSPN $     3     4      6.499000          0.0              0.0
122                                           -9.453000          0.0              0.0
123      JOINTS     4 HIP  <     4     5      0.0               0.0              0.0
124                                           -23.99001          0.0              0.0
125      JOINTS     5 KNEE >     5     6      16.17900          0.0              0.0
126                                           -24.00301          0.0              0.0
127      JOINTS     6 SHDR /     2     7     -7.602000          0.0              1.668000
128                                           -13.06400          0.0              0.0
129      JOINTS     7 ELBW +     7     8      13.09800          0.0              0.0
130                                           -15.11300          0.0              0.0
131     OFOR TIME=    0.0
132      SEG     1    -220.9099          0.0              -109.8300
133                  -0.3090170         0.0              0.9510565
134                   0.0                1.000000        0.0
135                  -0.9510565         0.0              -0.3090170
136      SEG     2    -224.4000          0.0              -75.67799
137                   0.3489950E-01      0.0              0.9993908
138                   0.0                1.000000        0.0
139                  -0.9993908         0.0              0.3489950E-01
140      SEG     3    -222.1313          0.0              -55.51647
141                   0.2751340          0.0              0.9614059
142                   0.0                1.000000        0.0
143                  -0.9614059         0.0              0.2751340
144      SEG     4    -211.6391          0.0              -45.58078
145                   0.9207774          0.0              0.3900885
146                   0.0                1.000000        0.0
147                  -0.3900885         0.0              0.9207774
148      SEG     5    -189.1615          0.0              -53.96382
149                   0.9369591          0.0              -0.3494390
150                   0.0                1.000000        0.0
151                   0.3494390          0.0              0.9369591
152      SEG     6    -163.1083          0.0              -38.22904
153                   0.4538662          0.0              0.8910699
154                   0.0                1.000000        0.0
155                  -0.8910699         0.0              0.4538662
156      SEG     7    -221.6506          0.0              -71.02086
157                   0.3583679          0.0              0.9335804
158                   0.0                1.000000        0.0
159                  -0.9335804         0.0              0.3583679
160      SEG     8    -202.0967          0.0              -56.03869
161                   0.9832549          0.0              0.1822355
162                   0.0                1.000000        0.0
163                  -0.1822355         0.0              0.9832549
164      SEG     9    -221.0311          0.0              -109.1334
165                  -0.3090170         0.0              0.9510565
166                   0.0                1.000000        0.0
167                  -0.9510565         0.0              -0.3090170
168      SEG    10    -222.4164          0.0              -79.04927
169                   0.3489950E-01      0.0              0.9993908
170                   0.0                1.000000        0.0
171                  -0.9993908         0.0              0.3489950E-01
172      SEG    11    -172.8870          0.0              -80.76550
173                    1.000000          0.0              -0.0
174                   0.0                1.000000        0.0
```

175			0.0	0.0	1.000000	
176	SEG	12	0.0	0.0	0.0	
177			1.000000	0.0	-0.0	
178			0.0	1.000000	0.0	
179			0.0	0.0	1.000000	
180	SEG	13	0.0	0.0	0.0	
181			1.000000	0.0	0.0	
182			0.0	1.000000	0.0	
183			0.0	0.0	1.000000	
184	PL	1	-67.09300	-67.09300	-178.9160	-178.9160
185			2000.000	-2000.000	-2000.000	2000.000
186			-50.22501	-50.22501	-77.07120	-77.07120
187	PL	2	-64.75900	-64.75900	-176.5820	-176.5820
188			2000.000	-2000.000	-2000.000	2000.000
189			-59.94901	-59.94901	-86.79520	-86.79520
190	PL	3	-166.8580	-166.8580	-169.1920	-169.1920
191			2000.000	-2000.000	-2000.000	2000.000
192			-84.46080	-84.46080	-74.73680	-74.73680
193	PL	4	-180.6670	-180.6670	-174.8310	-174.8310
194			2000.000	-2000.000	-2000.000	2000.000
195			-69.77840	-69.77840	-94.08800	-94.08800
196	PL	5	-212.5782	-212.5782	-204.3648	-204.3648
197			2000.000	-2000.000	-2000.000	2000.000
198			-94.60210	-94.60210	-60.69308	-60.69308
199	PL	6	-180.6670	-180.6670	-174.8310	-174.8310
200			2000.000	-2000.000	-2000.000	2000.000
201			-69.77840	-69.77840	-94.08800	-94.08800
202	PL	7	-140.5000	-140.5000	-176.4000	-176.4000
203			2000.000	-2000.000	-2000.000	2000.000
204			-11.00000	-11.00000	-11.00000	-11.00000
205	PL	8	-280.0000	-280.0000	-190.0000	-190.0000
206			2000.000	-2000.000	-2000.000	2000.000
207			-11.00000	-11.00000	-11.00000	-11.00000
208	PL	9	-108.6500	-108.6500	-140.5000	-140.5000
209			2000.000	-2000.000	-2000.000	2000.000
210			-27.60001	-27.60001	-11.00000	-11.00000
211	PL	10	-109.4000	-109.4000	-108.6500	-108.6500
212			2000.000	-2000.000	-2000.000	2000.000
213			-61.70000	-61.70000	-27.60001	-27.60001
214	PL	11	-121.4000	-121.4000	-109.4000	-109.4000
215			2000.000	-2000.000	-2000.000	2000.000
216			-62.70000	-62.70000	-61.70000	-61.70000
217	PL	12	-121.4500	-121.4500	-121.4000	-121.4000
218			2000.000	-2000.000	-2000.000	2000.000
219			-71.89999	-71.89999	-62.70000	-62.70000
220	PL	13	-117.3000	-117.3000	-121.4500	-121.4500
221			2000.000	-2000.000	-2000.000	2000.000
222			-76.10001	-76.10001	-71.89999	-71.89999
223	PL	14	-151.5000	-151.5000	-142.5000	-142.5000
224			2000.000	-2000.000	-2000.000	2000.000
225			-51.95000	-51.95000	-36.25000	-36.25000
226	PL	15	-147.9000	-147.9000	-151.5000	-151.5000
227			2000.000	-2000.000	-2000.000	2000.000
228			-61.85001	-61.85001	-51.95000	-51.95000
229	PL	16	-154.2500	-154.2500	-141.0000	-141.0000
230			2000.000	-2000.000	-2000.000	2000.000
231			-67.45000	-67.45000	-55.50000	-55.50000
232	PL	17	-148.5500	-148.5500	-154.2500	-154.2500

```
233                    2000.000       -2000.000       -2000.000       2000.000
234                   -82.55000       -82.55000       -67.45000      -67.45000
235      PL    18      -120.0000       -120.0000       -148.5500      -148.5500
236                    2000.000       -2000.000       -2000.000       2000.000
237                   -78.64999       -78.64999       -82.55000      -82.55000
238      PL    19      -250.0000       -250.0000       -215.9000      -215.9000
239                    2000.000       -2000.000       -2000.000       2000.000
240                   -132.6000       -132.6000       -132.6000      -132.6000
241      PL    20      -177.1000       -177.1000       -171.6000      -171.6000
242                    2000.000       -2000.000       -2000.000       2000.000
243                   -124.1000       -124.1000       -126.2500      -126.2500
244      PL    21      -215.9000       -215.9000       -177.1000      -177.1000
245                    2000.000       -2000.000       -2000.000       2000.000
246                   -132.6000       -132.6000       -124.1000      -124.1000
247      PL    22      -244.3600       -244.3600       -244.7600      -244.7600
248                    2000.000       -2000.000       -2000.000       2000.000
249                   -85.83000       -85.83000       -106.3300      -106.3300
250      PL    23      -256.7600       -256.7600       -244.7600      -244.7600
251                    2000.000       -2000.000       -2000.000       2000.000
252                   -106.3300       -106.3300       -106.3300      -106.3300
253      PL    24      -256.3601       -256.3601       -256.7600      -256.7600
254                    2000.000       -2000.000       -2000.000       2000.000
255                   -85.83000       -85.83000       -106.3300      -106.3300
256      PL    25      -230.0000       -230.0000       -256.3601      -256.3601
257                    2000.000       -2000.000       -2000.000       2000.000
258                   -23.16000       -23.16000       -85.83000      -85.83000
259      PL    26      -223.5600       -223.5600       -244.3600      -244.3600
260                    2000.000       -2000.000       -2000.000       2000.000
261                   -36.38000       -36.38000       -85.83000      -85.83000
262      PL    27      -182.2100       -182.2100       -223.5600      -223.5600
263                    2000.000       -2000.000       -2000.000       2000.000
264                   -46.43600       -46.43600       -37.08600      -37.08600
265      PL    28      -182.2100       -182.2100       -182.2100      -182.2100
266                    2000.000       -2000.000       -2000.000       2000.000
267                   -20.23000       -20.23000       -45.73000      -45.73000
268      PL    29      -138.9000       -138.9000       -130.8000      -130.8000
269                    2000.000       -2000.000       -2000.000       2000.000
270                   -64.60001       -64.60001       -40.00000      -40.00000
271      RING      1                -219.6714        -33.20000      -48.45660
272      BLT     1                  0.0              0.0            0.0
273                                 0.0              0.0            0.0
274      BLT     2                  -219.6714        -33.20000      -48.45660
275                                 0.0              0.0            0.0
276      BLT     3                  -5.703000        -10.50000      -13.76000
277                                 -219.6714        -33.20000      -48.45660
278      BLT     4                  -5.703000         10.50000      -13.76000
279                                 0.0              0.0            0.0
280      BLT     5                  -219.6714        -33.20000      -48.45660
281                                 0.0              0.0            0.0
282      BLT     6                  0.0              0.0            0.0
283                                 0.0              0.0            0.0
284     OFOR TIME=     20.00000
285      SEG     1    -220.8719          0.0           -109.8157
286                  -0.3126089         0.0            0.9498819
287                   0.0                1.000000      0.0
288                  -0.9498819         0.0           -0.3126089
289      SEG     2    -224.4853         0.0            -75.72068
290                   0.3074851E-01     0.0            0.9995272
```

291			0.0	1.000000	0.0	
292			-0.9995272	0.0	0.3074851E-01	
293	SEG	3	-222.2974	0.0	-55.55073	
294			0.2715918	0.0	0.9624125	
295			0.0	1.000000	0.0	
296			-0.9624125	0.0	0.2715918	
297	SEG	4	-211.8267	0.0	-45.61228	
298			0.9209466	0.0	0.3896888	
299			0.0	1.000000	0.0	
300			-0.3896888	0.0	0.9209466	
301	SEG	5	-189.3078	0.0	-53.88398	
302			0.9386770	0.0	-0.3447978	
303			0.0	1.000000	0.0	
304			0.3447978	0.0	0.9386770	
305	SEG	6	-163.1880	0.0	-38.09392	
306			0.4554826	0.0	0.8902447	
307			0.0	1.000000	0.0	
308			-0.8902447	0.0	0.4554826	
309	SEG	7	-221.6865	0.0	-70.98807	
310			0.3562540	0.0	0.9343892	
311			0.0	1.000000	0.0	
312			-0.9343892	0.0	0.3562540	
313	SEG	8	-202.1724	0.0	-55.93090	
314			0.9824554	0.0	0.1864976	
315			0.0	1.000000	0.0	
316			-0.1864976	0.0	0.9824554	
317	SEG	9	-221.0077	0.0	-109.0659	
318			-0.3117205	0.0	0.9501738	
319			0.0	1.000000	0.0	
320			-0.9501738	0.0	-0.3117205	
321	SEG	10	-222.4654	0.0	-79.00296	
322			0.3313268E-01	0.0	0.9994510	
323			0.0	1.000000	0.0	
324			-0.9994510	0.0	0.3313268E-01	
325	SEG	11	-173.9076	0.0	-80.76347	
326			1.000000	0.0	-0.5943518E-06	
327			0.0	1.000000	0.0	
328			0.5943518E-06	0.0	1.000000	
329	SEG	12	-1.072015	0.0	0.0	
330			1.000000	0.0	-0.0	
331			0.0	1.000000	0.0	
332			0.0	0.0	1.000000	
333	SEG	13	0.0	0.0	0.0	
334			1.000000	0.0	0.0	
335			0.0	1.000000	0.0	
336			0.0	0.0	1.000000	
337	PL	1	-68.16502	-68.16502	-179.9880	-179.9880
338			2000.000	-2000.000	-2000.000	2000.000
339			-50.22501	-50.22501	-77.07120	-77.07120
340	PL	2	-65.83102	-65.83102	-177.6540	-177.6540
341			2000.000	-2000.000	-2000.000	2000.000
342			-59.94901	-59.94901	-86.79520	-86.79520
343	PL	3	-167.9300	-167.9300	-170.2640	-170.2640
344			2000.000	-2000.000	-2000.000	2000.000
345			-84.46080	-84.46080	-74.73680	-74.73680
346	PL	4	-181.7390	-181.7390	-175.9030	-175.9030
347			2000.000	-2000.000	-2000.000	2000.000
348			-69.77840	-69.77840	-94.08800	-94.08800

349	PL	5	-212.5850	-212.5850	-204.5125	-204.5125
350			2000.000	-2000.000	-2000.000	2000.000
351			-94.59551	-94.59551	-60.65268	-60.65268
352	PL	6	-181.6875	-181.6875	-175.8516	-175.8516
353			2000.000	-2000.000	-2000.000	2000.000
354			-69.77637	-69.77637	-94.08597	-94.08597
355	PL	7	-141.5720	-141.5720	-177.4720	-177.4720
356			2000.000	-2000.000	-2000.000	2000.000
357			-11.00000	-11.00000	-11.00000	-11.00000
358	PL	8	-281.0720	-281.0720	-191.0720	-191.0720
359			2000.000	-2000.000	-2000.000	2000.000
360			-11.00000	-11.00000	-11.00000	-11.00000
361	PL	9	-109.7220	-109.7220	-141.5720	-141.5720
362			2000.000	-2000.000	-2000.000	2000.000
363			-27.60001	-27.60001	-11.00000	-11.00000
364	PL	10	-110.4720	-110.4720	-109.7220	-109.7220
365			2000.000	-2000.000	-2000.000	2000.000
366			-61.70000	-61.70000	-27.60001	-27.60001
367	PL	11	-122.4720	-122.4720	-110.4720	-110.4720
368			2000.000	-2000.000	-2000.000	2000.000
369			-62.70000	-62.70000	-61.70000	-61.70000
370	PL	12	-122.5220	-122.5220	-122.4720	-122.4720
371			2000.000	-2000.000	-2000.000	2000.000
372			-71.89999	-71.89999	-62.70000	-62.70000
373	PL	13	-118.3720	-118.3720	-122.5220	-122.5220
374			2000.000	-2000.000	-2000.000	2000.000
375			-76.10001	-76.10001	-71.89999	-71.89999
376	PL	14	-152.5720	-152.5720	-143.5720	-143.5720
377			2000.000	-2000.000	-2000.000	2000.000
378			-51.95000	-51.95000	-36.25000	-36.25000
379	PL	15	-148.9720	-148.9720	-152.5720	-152.5720
380			2000.000	-2000.000	-2000.000	2000.000
381			-61.85001	-61.85001	-51.95000	-51.95000
382	PL	16	-155.3220	-155.3220	-142.0720	-142.0720
383			2000.000	-2000.000	-2000.000	2000.000
384			-67.45000	-67.45000	-55.50000	-55.50000
385	PL	17	-149.6220	-149.6220	-155.3220	-155.3220
386			2000.000	-2000.000	-2000.000	2000.000
387			-82.55000	-82.55000	-67.45000	-67.45000
388	PL	18	-121.0720	-121.0720	-149.6220	-149.6220
389			2000.000	-2000.000	-2000.000	2000.000
390			-78.64999	-78.64999	-82.55000	-82.55000
391	PL	19	-251.0720	-251.0720	-216.9720	-216.9720
392			2000.000	-2000.000	-2000.000	2000.000
393			-132.6000	-132.6000	-132.6000	-132.6000
394	PL	20	-178.1720	-178.1720	-172.6720	-172.6720
395			2000.000	-2000.000	-2000.000	2000.000
396			-124.1000	-124.1000	-126.2500	-126.2500
397	PL	21	-216.9720	-216.9720	-178.1720	-178.1720
398			2000.000	-2000.000	-2000.000	2000.000
399			-132.6000	-132.6000	-124.1000	-124.1000
400	PL	22	-245.4320	-245.4320	-245.8320	-245.8320
401			2000.000	-2000.000	-2000.000	2000.000
402			-85.83000	-85.83000	-106.3300	-106.3300
403	PL	23	-257.8320	-257.8320	-245.8320	-245.8320
404			2000.000	-2000.000	-2000.000	2000.000
405			-106.3300	-106.3300	-106.3300	-106.3300
406	PL	24	-257.4321	-257.4321	-257.8320	-257.8320

```
407                      2000.000        -2000.000        -2000.000        2000.000
408                     -85.83000        -85.83000        -106.3300       -106.3300
409       PL    25      -231.0720        -231.0720        -257.4321       -257.4321
410                      2000.000        -2000.000        -2000.000        2000.000
411                     -23.16000        -23.16000        -85.83000       -85.83000
412       PL    26      -224.6320        -224.6320        -245.4320       -245.4320
413                      2000.000        -2000.000        -2000.000        2000.000
414                     -36.38000        -36.38000        -85.83000       -85.83000
415       PL    27      -183.2820        -183.2820        -224.6320       -224.6320
416                      2000.000        -2000.000        -2000.000        2000.000
417                     -46.43600        -46.43600        -37.08600       -37.08600
418       PL    28      -183.2820        -183.2820        -183.2820       -183.2820
419                      2000.000        -2000.000        -2000.000        2000.000
420                     -20.23000        -20.23000        -45.73000       -45.73000
421       PL    29      -139.9720        -139.9720        -131.8720       -131.8720
422                      2000.000        -2000.000        -2000.000        2000.000
423                     -64.60001        -64.60001        -40.00000       -40.00000
424       RING      1                -219.6714          -33.20000       -48.45660
425       BLT     1                  0.0                0.0             0.0
426                                  0.0                0.0             0.0
427       BLT     2                  -219.6714          -33.20000       -48.45660
428                                  0.0                0.0             0.0
429       BLT     3                  -5.703000          -10.50000       -13.76000
430                                  -219.6714          -33.20000       -48.45660
431       BLT     4                  -5.703000           10.50000       -13.76000
432                                  0.0                0.0             0.0
433       BLT     5                  -219.6714          -33.20000       -48.45660
434                                  0.0                0.0             0.0
435       BLT     6                  0.0                0.0             0.0
436                                  0.0                0.0             0.0
437     OFOR TIME=      40.00000
438       SEG     1     -220.8384          0.0             -109.0750
439                    -0.3122551          0.0              0.9499983
440                     0.0                 1.000000        0.0
441                    -0.9499983          0.0             -0.3122551
442       SEG     2     -225.9382          0.0              -74.91165
443                    -0.1798991E-02      0.0              0.9999984
444                     0.0                 1.000000        0.0
445                    -0.9999984          0.0             -0.1798991E-02
446       SEG     3     -224.2524          0.0              -54.72172
447                     0.2641468          0.0              0.9644825
448                     0.0                 1.000000        0.0
449                    -0.9644825          0.0              0.2641468
450       SEG     4     -213.5984          0.0              -45.37376
451                     0.9454386          0.0              0.3258003
452                     0.0                 1.000000        0.0
453                    -0.3258003          0.0              0.9454386
454       SEG     5     -190.9756          0.0              -53.35662
455                     0.9430124          0.0             -0.3327576
456                     0.0                 1.000000        0.0
457                     0.3327576          0.0              0.9430124
458       SEG     6     -164.5542          0.0              -37.49172
459                     0.4651220          0.0              0.8852466
460                     0.0                 1.000000        0.0
461                    -0.8852466          0.0              0.4651220
462       SEG     7     -222.4627          0.0              -70.81277
463                     0.3807648          0.0              0.9246719
464                     0.0                 1.000000        0.0
```

```
465                    -0.9246719        0.0              0.3807648
466       SEG      8    -202.6354         0.0              -55.84187
467                     0.9819364        0.0              0.1892111
468                     0.0               1.000000        0.0
469                    -0.1892111        0.0              0.9819364
470       SEG      9    -220.8057         0.0              -108.8467
471                    -0.3183062        0.0              0.9479880
472                     0.0               1.000000        0.0
473                    -0.9479880        0.0             -0.3183062
474       SEG     10    -223.1842         0.0              -78.81800
475                     0.1357237E-01    0.0              0.9999079
476                     0.0               1.000000        0.0
477                    -0.9999079        0.0              0.1357237E-01
478       SEG     11    -180.0989         0.0              -80.76262
479                     1.000000         0.0             -0.1261853E-04
480                     0.0               1.000000        0.0
481                     0.1261853E-04    0.0               1.000000
482       SEG     12    -7.283402         0.0              0.0
483                     1.000000         0.0             -0.0
484                     0.0               1.000000        0.0
485                     0.0              0.0               1.000000
486       SEG     13    0.0              0.0              0.0
487                     1.000000         0.0              0.0
488                     0.0               1.000000        0.0
489                     0.0              0.0               1.000000
490       PL       1      -74.37640        -74.37640        -186.1994        -186.1994
491                       2000.000         -2000.000        -2000.000         2000.000
492                      -50.22501        -50.22501        -77.07120        -77.07120
493       PL       2      -72.04240        -72.04240        -183.8654        -183.8654
494                       2000.000         -2000.000        -2000.000         2000.000
495                      -59.94901        -59.94901        -86.79520        -86.79520
496       PL       3      -174.1414        -174.1414        -176.4754        -176.4754
497                       2000.000         -2000.000        -2000.000         2000.000
498                      -84.46080        -84.46080        -74.73680        -74.73680
499       PL       4      -187.9504        -187.9504        -182.1144        -182.1144
500                       2000.000         -2000.000        -2000.000         2000.000
501                      -69.77840        -69.77840        -94.08800        -94.08800
502       PL       5      -213.4299        -213.4299        -206.4664        -206.4664
503                       2000.000         -2000.000        -2000.000         2000.000
504                      -93.38917        -93.38917        -59.20159        -59.20159
505       PL       6      -187.8787        -187.8787        -182.0430        -182.0430
506                       2000.000         -2000.000        -2000.000         2000.000
507                      -69.77543        -69.77543        -94.08510        -94.08510
508       PL       7      -147.7834        -147.7834        -183.6834        -183.6834
509                       2000.000         -2000.000        -2000.000         2000.000
510                      -11.00000        -11.00000        -11.00000        -11.00000
511       PL       8      -287.2834        -287.2834        -197.2834        -197 2834
512                       2000.000         -2000.000        -2000.000         2000.000
513                      -11.00000        -11.00000        -11.00000        -11.00000
514       PL       9      -115.9334        -115.9334        -147.7834        -147.7834
515                       2000.000         -2000.000        -2000.000         2000.000
516                      -27.60001        -27.60001        -11.00000        -11.00000
517       PL      10      -116.6834        -116.6834        -115.9334        -115.9334
518                       2000.000         -2000.000        -2000.000         2000.000
519                      -61.70000        -61.70000        -27.60001        -27.60001
520       PL      11      -128.6834        -128.6834        -116.6834        -116.6834
521                       2000.000         -2000.000        -2000.000         2000.000
522                      -62.70000        -62.70000        -61.70000        -61.70000
```

523	PL	12	-128.7334	-128.7334	-128.6834	-128.6834
524			2000.000	-2000.000	-2000.000	2000.000
525			-71.89999	-71.89999	-62.70000	-62.70000
526	PL	13	-124.5834	-124.5834	-128.7334	-128.7334
527			2000.000	-2000.000	-2000.000	2000.000
528			-76.10001	-76.10001	-71.89999	-71.89999
529	PL	14	-158.7834	-158.7834	-149.7834	-149.7834
530			2000.000	-2000.000	-2000.000	2000.000
531			-51.95000	-51.95000	-36.25000	-36.25000
532	PL	15	-155.1834	-155.1834	-158.7834	-158.7834
533			2000.000	-2000.000	-2000.000	2000.000
534			-61.85001	-61.85001	-51.95000	-51.95000
535	PL	16	-161.5334	-161.5334	-148.2834	-148.2834
536			2000.000	-2000.000	-2000.000	2000.000
537			-67.45000	-67.45000	-55.50000	-55.50000
538	PL	17	-155.8334	-155.8334	-161.5334	-161.5334
539			2000.000	-2000.000	-2000.000	2000.000
540			-82.55000	-82.55000	-67.45000	-67.45000
541	PL	18	-127.2834	-127.2834	-155.8334	-155.8334
542			2000.000	-2000.000	-2000.000	2000.000
543			-78.64999	-78.64999	-82.55000	-82.55000
544	PL	19	-257.2834	-257.2834	-223.1834	-223.1834
545			2000.000	-2000.000	-2000.000	2000.000
546			-132.6000	-132.6000	-132.6000	-132.6000
547	PL	20	-184.3834	-184.3834	-178.8634	-178.8834
548			2000.000	-2000.000	-2000.000	2000.000
549			-124.1000	-124.1000	-126.2500	-126.2500
550	PL	21	-223.1834	-223.1834	-184.3834	-184.3834
551			2000.000	-2000.000	-2000.000	2000.000
552			-132.6000	-132.6000	-124.1000	-124.1000
553	PL	22	-251.6434	-251.6434	-252.0434	-252.0434
554			2000.000	-2000.000	-2000.000	2000.000
555			-85.83000	-85.83000	-106.3300	-106.3300
556	PL	23	-264.0434	-264.0434	-252.0434	-252.0434
557			2000.000	-2000.000	-2000.000	2000.000
558			-106.3300	-106.3300	-106.3300	-106.3300
559	PL	24	-263.6435	-263.6435	-264.0434	-264.0434
560			2000.000	-2000.000	-2000.000	2000.000
561			-85.83000	-85.83000	-106.3300	-106.3300
562	PL	25	-237.2834	-237.2834	-263.6435	-263.6435
563			2000.000	-2000.000	-2000.000	2000.000
564			-23.16000	-23.16000	-85.83000	-85.83000
565	PL	26	-230.8434	-230.8434	-251.6434	-251.6434
566			2000.000	-2000.000	-2000.000	2000.000
567			-36.38000	-36.38000	-85.83000	-85.83000
568	PL	27	-189.4934	-189.4934	-230.8434	-230.8434
569			2000.000	-2000.000	-2000.000	2000.000
570			-46.43600	-46.43600	-37.08600	-37.08600
571	PL	28	-189.4934	-189.4934	-189.4934	-189.4934
572			2000.000	-2000.000	-2000.000	2000.000
573			-20.23000	-20.23000	-45.73000	-45.73000
574	PL	29	-146.1834	-146.1834	-138.0834	-138.0834
575			2000.000	-2000.000	-2000.000	2000.000
576			-64.60001	-64.60001	-40.00000	-40.00000
577	RING	1		-217.9674	-37.42711	-46.21441
578	BLT	1		0.0	0.0	0.0
579				0.0	0.0	0.0
580	BLT	2		-217.9674	-37.42711	-46.21441

```
                                  0.0                 0.0                 0.0
      BLT     3                  -5.703000           -10.50000           -13.76000
                                 -217.9674           -37.42711           -46.21441
      BLT     4                  -5.703000            10.50000           -13.76000
                                  0.0                 0.0                 0.0
      BLT     5                  -217.9674           -37.42711           -46.21441
                                  0.0                 0.0                 0.0
      BLT     6                  0.0                 0.0                 0.0
                                  0.0                 0.0                 0.0
     OFOR TIME=     60.00000
      SEG     1    -224.9663          0.0             -101.0210
                  -0.4497165          0.0              0.8931713
                   0.0                 1.000000        0.0
                  -0.8931713          0.0             -0.4497165
      SEG     2    -234.5882          0.0              -68.45069
                  -0.2237931E-01      0.0              0.9997496
                   0.0                 1.000000        0.0
                  -0.9997496          0.0             -0.2237931E-01
      SEG     3    -233.0947          0.0              -48.29091
                   0.2787520          0.0              0.9603631
                   0.0                 1.000000        0.0
                  -0.9603631          0.0              0.2787520
      SEG     4    -222.0590          0.0              -44.11709
                   0.9757872          0.0             -0.2187220
                   0.0                 1.000000        0.0
                   0.2187220          0.0              0.9757872
      SEG     5    -199.4364          0.0              -52.10071
                   0.9430011          0.0             -0.3327896
                   0.0                 1.000000        0.0
                   0.3327896          0.0              0.9430011
      SEG     6    -171.8607          0.0              -36.88417
                   0.5132206          0.0              0.8582567
                   0.0                 1.000000        0.0
                  -0.8582567          0.0              0.5132206
      SEG     7    -227.1419          0.0              -65.36282
                   0.6424081          0.0              0.7663627
                   0.0                 1.000000        0.0
                  -0.7663627          0.0              0.6424081
      SEG     8    -203.6147          0.0              -55.27869
                   0.9999953          0.0              0.3064111E-02
                   0.0                 1.000000        0.0
                  -0.3064111E-02      0.0              0.9999953
      SEG     9    -224.0213          0.0             -100.5950
                  -0.4004000          0.0              0.9163404
                   0.0                 1.000000        0.0
                  -0.9163404          0.0             -0.4004000
      SEG    10    -230.7105          0.0              -72.66585
                  -0.3778470E-01      0.0              0.9992859
                   0.0                 1.000000        0.0
                  -0.9992859          0.0             -0.3778470E-01
      SEG    11    -195.1306          0.0              -80.75878
                   1.000000           0.0             -0.4065152E-04
                   0.0                 1.000000        0.0
                   0.4065152E-04      0.0              1.000000
      SEG    12    -22.32152          0.0              0.0
                   1.000000           0.0             -0.0
                   0.0                 1.000000        0.0
                   0.0                0.0              1.000000
```

```
639     SEG     13    0.0              0.0              0.0
640                    1.000000         0.0              0.0
641                   0.0               1.000000         0.0
642                   0.0              0.0               1.000000
643     PL      1      -89.41452        -89.41452        -201.2375        -201.2375
644                     2000.000        -2000.000        -2000.000         2000.000
645                    -50.22501        -50.22501        -77.07120        -77.07120
646     PL      2      -87.08052        -87.08052        -198.9035        -198.9035
647                     2000.000        -2000.000        -2000.000         2000.000
648                    -59.94901        -59.94901        -86.79520        -86.79520
649     PL      3      -189.1795        -189.1795        -191.5135        -191.5135
650                     2000.000        -2000.000        -2000.000         2000.000
651                    -84.46080        -84.46080        -74.73680        -74.73680
652     PL      4      -202.9885        -202.9885        -197.1525        -197.1525
653                     2000.000        -2000.000        -2000.000         2000.000
654                    -69.77840        -69.77840        -94.08800        -94.08800
655     PL      5      -221.7023        -221.7023        -215.4438        -215.4438
656                     2000.000        -2000.000        -2000.000         2000.000
657                    -86.66687        -86.66687        -52.34321        -52.34321
658     PL      6      -202.9102        -202.9102        -197.0752        -197.0752
659                     2000.000        -2000.000        -2000.000         2000.000
660                    -69.77136        -69.77136        -94.08120        -94.08120
661     PL      7      -162.8215        -162.8215        -198.7215        -198.7215
662                     2000.000        -2000.000        -2000.000         2000.000
663                    -11.00000        -11.00000        -11.00000        -11.00000
664     PL      8      -302.3215        -302.3215        -212.3215        -212.3215
665                     2000.000        -2000.000        -2000.000         2000.000
666                    -11.00000        -11.00000        -11.00000        -11.00000
667     PL      9      -130.9715        -130.9715        -162.8215        -162.8215
668                     2000.000        -2000.000        -2000.000         2000.000
669                    -27.60001        -27.60001        -11.00000        -11.00000
670     PL      10     -131.7215        -131.7215        -130.9715        -130.9715
671                     2000.000        -2000.000        -2000.000         2000.000
672                    -61.70000        -61.70000        -27.60001        -27.60001
673     PL      11     -143.7215        -143.7215        -131.7215        -131.7215
674                     2000.000        -2000.000        -2000.000         2000.000
675                    -62.70000        -62.70000        -61.70000        -61.70000
676     PL      12     -143.7715        -143.7715        -143.7215        -143.7215
677                     2000.000        -2000.000        -2000.000         2000.000
678                    -71.89999        -71.89999        -62.70000        -62.70000
679     PL      13     -139.6215        -139.6215        -143.7715        -143.7715
680                     2000.000        -2000.000        -2000.000         2000.000
681                    -76.10001        -76.10001        -71.89999        -71.89999
682     PL      14     -173.8215        -173.8215        -164.8215        -164.8215
683                     2000.000        -2000.000        -2000.000         2000.000
684                    -51.95000        -51.95000        -36.25000        -36.25000
685     PL      15     -170.2215        -170.2215        -173.8215        -173.8215
686                     2000.000        -2000.000        -2000.000         2000.000
687                    -61.85001        -61.85001        -51.95000        -51.95000
688     PL      16     -176.5715        -176.5715        -163.3215        -163.3215
689                     2000.000        -2000.000        -2000.000         2000.000
690                    -67.45000        -67.45000        -55.50000        -55.50000
691     PL      17     -170.8715        -170.8715        -176.5715        -176.5715
692                     2000.000        -2000.000        -2000.000         2000.000
693                    -82.55000        -82.55000        -67.45000        -67.45000
694     PL      18     -142.3215        -142.3215        -170.8715        -170.8715
695                     2000.000        -2000.000        -2000.000         2000.000
696                    -78.64999        -78.64999        -82.55000        -82.55000
```

```
 697      PL    19        -272.3215       -272.3215       -238.2215       -238.2215
 698                       2000.000        -2000.000       -2000.000        2000.000
 699                      -132.6000        -132.6000       -132.6000       -132.6000
 700      PL    20        -199.4215        -199.4215       -193.9215       -193.9215
 701                       2000.000        -2000.000       -2000.000        2000.000
 702                      -124.1000        -124.1000       -126.2500       -126.2500
 703      PL    21        -238.2215        -238.2215       -199.4215       -199.4215
 704                       2000.000        -2000.000       -2000.000        2000.000
 705                      -132.6000        -132.6000       -124.1000       -124.1000
 706      PL    22        -266.6815        -266.6815       -267.0815       -267.0815
 707                       2000.000        -2000.000       -2000.000        2000.000
 708                      -85.83000        -85.83000       -106.3300       -106.3300
 709      PL    23        -279.0815        -279.0815       -267.0815       -267.0815
 710                       2000.000        -2000.000       -2000.000        2000.000
 711                      -106.3300        -106.3300       -106.3300       -106.3300
 712      PL    24        -278.6816        -278.6816       -279.0815       -279.0815
 713                       2000.000        -2000.000       -2000.000        2000.000
 714                      -85.83000        -85.83000       -106.3300       -106.3300
 715      PL    25        -252.3215        -252.3215       -278.6816       -278.6816
 716                       2000.000        -2000.000       -2000.000        2000.000
 717                      -23.16000        -23.16000       -85.83000       -85.83000
 718      PL    26        -245.8815        -245.8815       -266.6815       -266.6815
 719                       2000.000        -2000.000       -2000.000        2000.000
 720                      -36.38000        -36.38000       -85.83000       -85.83000
 721      PL    27        -204.5315        -204 5315       -245.8815       -245.8815
 722                       2000.000        -2000.000       -2000.000        2000.000
 723                      -46.43600        -46.43600       -37.08600       -37.08600
 724      PL    28        -204.5315        -204.5315       -204.5315       -204.5315
 725                       2000.000        -2000.000       -2000.000        2000.000
 726                      -20.23000        -20.23000       -45.73000       -45.73000
 727      PL    29        -161.2215        -161.2215       -153.1215       -153.1215
 728                       2000.000        -2000.000       -2000.000        2000.000
 729                      -64.60001        -64.60001       -40.00000       -40.00000
 730      RING      1                    -215.6794        -38.12105       -44.10434
 731      BLT       1                     0.0              0.0             0.0
 732                                     0.0              0.0             0.0
 733      BLT       2                    -215.6794        -38.12105       -44.10434
 734                                     0.0              0.0             0.0
 735      BLT       3                    -5.703000        -10.50000       -13.76000
 736                                    -215.6794        -38.12105       -44.10434
 737      BLT       4                    -5.703000         10.50000       -13.76000
 738                                     0.0              0.0             0.0
 739      BLT       5                    -215.6794        -38.12105       -44.10434
 740                                     0.0              0.0             0.0
 741      BLT       6                     0.0              0.0             0.0
 742                                     0.0              0.0             0.0
 743      OFOR TIME=      80.00000
 744       SEG      1     -234.2610           0.0           -89.98977
 745                     -0.7510503           0.0            0.6602449
 746                      0.0                  1.000000      0.0
 747                     -0.6602449           0.0           -0.7510503
 748       SEG      2     -250.9607           0.0            -60.79330
 749                     -0.2435304           0.0            0.9698933
 750                      0.0                  1.000000      0.0
 751                     -0.9698933           0.0           -0.2435304
 752       SEG      3     -253.0836           0.0            -40.91933
 753                      0.1964792           0.0            0.9805080
 754                      0.0                  1.000000      0.0
```

```
755                    -0.9805080        0.0               0.1964792
756       SEG     4     -243.3199         0.0               -38.71029
757                     0.8977927         0.0              -0.4404184
758                     0.0                1.000000         0.0
759                     0.4404184         0.0               0.8977927
760       SEG     5     -222.4759         0.0               -50.58673
761                     0.8688600         0.0              -0.4950578
762                     0.0                1.000000         0.0
763                     0.4950578         0.0               0.8688600
764       SEG     6     -195.9655         0.0               -38.07643
765                     0.5188158         0.0               0.8548860
766                     0.0                1.000000         0.0
767                    -0.8548860         0.0               0.5188158
768       SEG     7     -237.7362         0.0               -61.38498
769                     0.8585490         0.0               0.5127316
770                     0.0                1.000000         0.0
771                    -0.5127316         0.0               0.8585490
772       SEG     8     -211.5627         0.0               -57.02558
773                     0.9877703         0.0              -0.1559161
774                     0.0                1.000000         0.0
775                     0.1559161         0.0               0.9877703
776       SEG     9     -234.3191         0.0               -89.00962
777                    -0.7864757         0.0               0.6176212
778                     0.0                1.000000         0.0
779                    -0.6176212         0.0              -0.7864757
780       SEG     10    -245.3607         0.0               -62.65260
781                    -0.1424540         0.0               0.9898014
782                     0.0                1.000000         0.0
783                    -0.9898014         0.0              -0.1424540
784       SEG     11    -218.7211         0.0               -80.75872
785                     1.000000          0.0              -0.6095540E-04
786                     0.0                1.000000         0.0
787                     0.6095540E-04     0.0               1.000000
788       SEG     12    -45.89668         0.0               0.0
789                     1.000000          0.0              -0.0
790                     0.0                1.000000         0.0
791                     0.0               0.0               1.000000
792       SEG     13    0.0               0.0               0.0
793                     1.000000          0.0               0.0
794                     0.0                1.000000         0.0
795                     0.0               0.0               1.000000
796       PL      1       -112.9897         -112.9897         -224.8127         -224.8127
797                        2000.000         -2000.000         -2000.000          2000.000
798                       -50.22501         -50.22501         -77.07120         -77.07120
799       PL      2       -110.6557         -110.6557         -222.4787         -222.4787
800                        2000.000         -2000.000         -2000.000          2000.000
801                       -59.94901         -59.94901         -86.79520         -86.79520
802       PL      3       -212.7547         -212.7547         -215.0887         -215.0887
803                        2000.000         -2000.000         -2000.000          2000.000
804                       -84.46080         -84.46080         -74.73680         -74.73680
805       PL      4       -226.5637         -226.5637         -220.7277         -220.7277
806                        2000.000         -2000.000         -2000.000          2000.000
807                       -69.77840         -69.77840         -94.08800         -94.08800
808       PL      5       -234.3560         -234.3560         -235.8651         -235.8651
809                        2000.000         -2000.000         -2000.000          2000.000
810                       -75.69829         -75.69829         -40.84138         -40.84138
811       PL      6       -226.5004         -226.5004         -220.6659         -220.6659
812                        2000.000         -2000.000         -2000.000          2000.000
```

813			-69.77115	-69.77115	-94.08110	-94.08110
814	PL	7	-186.3967	-186.3967	-222.2967	-222.2967
815			2000.000	-2000.000	-2000.000	2000.000
816			-11.00000	-11.00000	-11.00000	-11.00000
817	PL	8	-325.8967	-325.8967	-235.8967	-235.8967
818			2000.000	-2000.000	-2000.000	2000.000
819			-11.00000	-11.00000	-11.00000	-11.00000
820	PL	9	-154.5467	-154.5467	-186.3967	-186.3967
821			2000.000	-2000.000	-2000.000	2000.000
822			-27.60001	-27.60001	-11.00000	-11.00000
823	PL	10	-155.2967	-155.2967	-154.5467	-154.5467
824			2000.000	-2000.000	-2000.000	2000.000
825			-61.70000	-61.70000	-27.60001	-27.60001
826	PL	11	-167.2967	-167.2967	-155.2967	-155.2967
827			2000.000	-2000.000	-2000.000	2000.000
828			-62.70000	-62.70000	-61.70000	-61.70000
829	PL	12	-167.3467	-167.3467	-167.2967	-167.2967
830			2000.000	-2000.000	-2000.000	2000.000
831			-71.89999	-71.89999	-62.70000	-62.70000
832	PL	13	-163.1967	-163.1967	-167.3467	-167.3467
833			2000.000	-2000.000	-2000.000	2000.000
834			-76.10001	-76.10001	-71.89999	-71.89999
835	PL	14	-197.3967	-197.3967	-188.3967	-188.3967
836			2000.000	-2000.000	-2000.000	2000.000
837			-51.95000	-51.95000	-36.25000	-36.25000
838	PL	15	-193.7967	-193.7967	-197.3967	-197.3967
839			2000.000	-2000.000	-2000.000	2000.000
840			-61.85001	-61.85001	-51.95000	-51.95000
841	PL	16	-200.1467	-200.1467	-186.8967	-186.8967
842			2000.000	-2000.000	-2000.000	2000.000
843			-67.45000	-67.45000	-55.50000	-55.50000
844	PL	17	-194.4467	-194.4467	-200.1467	-200.1467
845			2000.000	-2000.000	-2000.000	2000.000
846			-82.55000	-82.55000	-67.45000	-67.45000
847	PL	18	-165.8967	-165.8967	-194.4467	-194.4467
848			2000.000	-2000.000	-2000.000	2000.000
849			-78.64999	-78.64999	-82.55000	-82.55000
850	PL	19	-295.8967	-295.8967	-261.7967	-261.7967
851			2000.000	-2000.000	-2000.000	2000.000
852			-132.6000	-132.6000	-132.6000	-132.6000
853	PL	20	-222.9967	-222.9967	-217.4967	-217.4967
854			2000.000	-2000.000	-2000.000	2000.000
855			-124.1000	-124.1000	-126.2500	-126.2500
856	PL	21	-261.7967	-261.7967	-222.9967	-222.9967
857			2000.000	-2000.000	-2000.000	2000.000
858			-132.6000	-132.6000	-124.1000	-124.1000
859	PL	22	-290.2567	-290.2567	-290.6567	-290.6567
860			2000.000	-2000.000	-2000.000	2000.000
861			-85.83000	-85.83000	-106.3300	-106.3300
862	PL	23	-302.6567	-302.6567	-290.6567	-290.6567
863			2000.000	-2000.000	-2000.000	2000.000
864			-106.3300	-106.3300	-106.3300	-106.3300
865	PL	24	-302.2568	-302.2568	-302.6567	-302.6567
866			2000.000	-2000.000	-2000.000	2000.000
867			-85.83000	-85.83000	-106.3300	-106.3300
868	PL	25	-275.8967	-275.8967	-302.2568	-302.2568
869			2000.000	-2000.000	-2000.000	2000.000
870			-23.16000	-23.16000	-85.83000	-85.83000

```
871      PL   26        -269.4567        -269.4567        -290.2567        -290.2567
872                     2000.000         -2000.000        -2000.000        2000.000
873                    -36.38000        -36.38000        -85.83000        -85.83000
874      PL   27        -228.1067        -228.1067        -269.4567        -269.4567
875                     2000.000         -2000.000        -2000.000        2000.000
876                    -46.43600        -46.43600        -37.08600        -37.08600
877      PL   28        -228.1067        -228.1067        -228.1067        -228.1067
878                     2000.000         -2000.000        -2000.000        2000.000
879                    -20.23000        -20.23000        -45.73000        -45.73000
880      PL   29        -184.7967        -184.7967        -176.6967        -176.6967
881                     2000.000         -2000.000        -2000.000        2000.000
882                    -64.60001        -64.60001        -40.00000        -40.00000
883      RING     1                  -212.9234          -39.53511        -40.14554
884      BLT    1                    0.0                0.0              0.0
885                                   0.0                0.0              0.0
886      BLT    2                    -212.9234          -39.53511        -40.14554
887                                   0.0                0.0              0.0
888      BLT    3                    -5.703000          -10.50000        -13.76000
889                                   -212.9234          -39.53511        -40.14554
890      BLT    4                    -5.703000           10.50000        -13.76000
891                                   0.0                0.0              0.0
892      BLT    5                    -212.9234          -39.53511        -40.14554
893                                   0.0                0.0              0.0
894      BLT    6                    0.0                0.0              0.0
895                                   0.0                0.0              0.0
896     OFOR TIME=      100.0000
897      SEG    1     -251.4775          0.0              -77.19424
898                  -0.9831413          0.0               0.1828477
899                   0.0                 1.000000         0.0
900                  -0.1828477          0.0              -0.9831413
901      SEG    2     -276.7949          0.0              -57.69425
902                  -0.4389043          0.0               0.8985338
903                   0.0                 1.000000         0.0
904                  -0.8985338          0.0              -0.4389043
905      SEG    3     -282.0669          0.0              -38.74469
906                   0.1308646          0.0               0.9914003
907                   0.0                 1.000000         0.0
908                  -0.9914003          0.0               0.1308646
909      SEG    4     -272.8669          0.0              -36.73381
910                   0.8832674          0.0              -0.4688697
911                   0.0                 1.000000         0.0
912                   0.4688697          0.0               0.8832674
913      SEG    5     -252.6114          0.0              -49.58825
914                   0.8443290          0.0              -0.5358250
915                   0.0                 1.000000         0.0
916                   0.5358250          0.0               0.8443290
917      SEG    6     -224.5514          0.0              -39.05334
918                   0.5999098          0.0               0.8000677
919                   0.0                 1.000000         0.0
920                  -0.8000677          0.0               0.5999098
921      SEG    7     -260.3496          0.0              -60.49323
922                   0.9365062          0.0               0.3506510
923                   0.0                 1.000000         0.0
924                  -0.3506510          0.0               0.9365062
925      SEG    8     -233.5047          0.0              -59.88408
926                   0.9646340          0.0              -0.2635931
927                   0.0                 1.000000         0.0
928                   0.2635931          0.0               0.9646340
```

929	SEG	9	-250.5884	0.0	-76.84156	
930			-0.9657817	0.0	0.2593564	
931			0.0	1.000000	0.0	
932			-0.2593564	0.0	-0.9657817	
933	SEG	10	-271.6875	0.0	-56.23040	
934			-0.4925599	0.0	0.8702786	
935			0.0	1.000000	0.0	
936			-0.8702786	0.0	-0.4925599	
937	SEG	11	-248.1839	0.0	-80.76009	
938			1.000000	0.0	-0.6948075E-04	
939			0.0	1.000000	0.0	
940			0.6948075E-04	0.0	1.000000	
941	SEG	12	-75.32472	0.0	0.0	
942			1.000000	0.0	-0.0	
943			0.0	1.000000	0.0	
944			0.0	0.0	1.000000	
945	SEG	13	0.0	0.0	0.0	
946			1.000000	0.0	0.0	
947			0.0	1.000000	0.0	
948			0.0	0.0	1.000000	
949	PL	1	-142.4177	-142.4177	-254.2407	-254.2407
950			2000.000	-2000.000	-2000.000	2000.000
951			-50.22501	-50.22501	-77.07120	-77.07120
952	PL	2	-140.0837	-140.0837	-251.9067	-251.9067
953			2000.000	-2000.000	-2000.000	2000.000
954			-59.94901	-59.94901	-86.79520	-86.79520
955	PL	3	-242.1827	-242.1827	-244.5167	-244.5167
956			2000.000	-2000.000	-2000.000	2000.000
957			-84.46080	-84.46080	-74.73680	-74.73680
958	PL	4	-255.9917	-255.9917	-250.1557	-250.1557
959			2000.000	-2000.000	-2000.000	2000.000
960			-69.77840	-69.77840	-94.08800	-94.08800
961	PL	5	-257.4659	-257.4659	-266.1533	-266.1533
962			2000.000	-2000.000	-2000.000	2000.000
963			-68.84179	-68.84179	-35.05109	-35.05109
964	PL	6	-255.9631	-255.9631	-250.1288	-250.1288
965			2000.000	-2000.000	-2000.000	2000.000
966			-69.77245	-69.77245	-94.08245	-94.08245
967	PL	7	-215.8247	-215.8247	-251.7247	-251.7247
968			2000.000	-2000.000	-2000.000	2000.000
969			-11.00000	-11.00000	-11.00000	-11.00000
970	PL	8	-355.3247	-355.3247	-265.3247	-265.3247
971			2000.000	-2000.000	-2000.000	2000.000
972			-11.00000	-11.00000	-11.00000	-11.00000
973	PL	9	-183.9747	-183.9747	-215.8247	-215.8247
974			2000.000	-2000.000	-2000.000	2000.000
975			-27.60001	-27.60001	-11.00000	-11.00000
976	PL	10	-184.7247	-184.7247	-183.9747	-183.9747
977			2000.000	-2000.000	-2000.000	2000.000
978			-61.70000	-61.70000	-27.60001	-27.60001
979	PL	11	-196.7247	-196.7247	-184.7247	-184.7247
980			2000.000	-2000.000	-2000.000	2000.000
981			-62.70000	-62.70000	-61.70000	-61.70000
982	PL	12	-196.7747	-196.7747	-196.7247	-196.7247
983			2000.000	-2000.000	-2000.000	2000.000
984			-71.89999	-71.89999	-62.70000	-62.70000
985	PL	13	-192.6247	-192.6247	-196.7747	-196.7747
986			2000.000	-2000.000	-2000.000	2000.000

987			-76.10001	-76.10001	-71.89999	-71.89999
988	PL	14	-226.8247	-226.8247	-217.8247	-217.8247
989			2000.000	-2000.000	-2000.000	2000.000
990			-51.95000	-51.95000	-36.25000	-36.25000
991	PL	15	-223.2247	-223.2247	-226.8247	-226.8247
992			2000.000	-2000.000	-2000.000	2000.000
993			-61.85001	-61.85001	-51.95000	-51.95000
994	PL	16	-229.5747	-229.5747	-216.3247	-216.3247
995			2000.000	-2000.000	-2000.000	2000.000
996			-67.45000	-67.45000	-55.50000	-55.50000
997	PL	17	-223.8747	-223.8747	-229.5747	-229.5747
998			2000.000	-2000.000	-2000.000	2000.000
999			-82.55000	-82.55000	-67.45000	-67.45000
1000	PL	18	-195.3247	-195.3247	-223.8747	-223.8747
1001			2000.000	-2000.000	-2000.000	2000.000
1002			-78.64999	-78.64999	-82.55000	-82.55000
1003	PL	19	-325.3247	-325.3247	-291.2247	-291.2247
1004			2000.000	-2000.000	-2000.000	2000.000
1005			-132.6000	-132.6000	-132.6000	-132.6000
1006	PL	20	-252.4247	-252.4247	-246.9247	-246.9247
1007			2000.000	-2000.000	-2000.000	2000.000
1008			-124.1000	-124.1000	-126.2500	-126.2500
1009	PL	21	-291.2247	-291.2247	-252.4247	-252.4247
1010			2000.000	-2000.000	-2000.000	2000.000
1011			-132.6000	-132.6000	-124.1000	-124.1000
1012	PL	22	-319.6847	-319.6847	-320.0847	-320.0847
1013			2000.000	-2000.000	-2000.000	2000.000
1014			-85.83000	-85.83000	-106.3300	-106.3300
1015	PL	23	-332.0847	-332.0847	-320.0847	-320.0847
1016			2000.000	-2000.000	-2000.000	2000.000
1017			-106.3300	-106.3300	-106.3300	-106.3300
1018	PL	24	-331.6848	-331.6848	-332.0847	-332.0847
1019			2000.000	-2000.000	-2000.000	2000.000
1020			-85.83000	-85.83000	-106.3300	-106.3300
1021	PL	25	-305.3247	-305.3247	-331.6848	-331.6848
1022			2000.000	-2000.000	-2000.000	2000.000
1023			-23.16000	-23.16000	-85.83000	-85.83000
1024	PL	26	-298.8847	-298.8847	-319.6847	-319.6847
1025			2000.000	-2000.000	-2000.000	2000.000
1026			-36.38000	-36.38000	-85.83000	-85.83000
1027	PL	27	-257.5347	-257.5347	-298.8847	-298.8847
1028			2000.000	-2000.000	-2000.000	2000.000
1029			-46.43600	-46.43600	-37.08600	-37.08600
1030	PL	28	-257.5347	-257.5347	-257.5347	-257.5347
1031			2000.000	-2000.000	-2000.000	2000.000
1032			-20.23000	-20.23000	-45.73000	-45.73000
1033	PL	29	-214.2247	-214.2247	-206.1247	-206.1247
1034			2000.000	-2000.000	-2000.000	2000.000
1035			-64.60001	-64.60001	-40.00000	-40.00000
1036	RING	1		-211.7134	-39.89477	-38.27629
1037	BLT	1		0.0	0.0	0.0
1038				0.0	0.0	0.0
1039	BLT	2		-211.7134	-39.89477	-38.27629
1040				0.0	0.0	0.0
1041	BLT	3		-5.703000	-10.50000	-13.76000
1042				-211.7134	-39.89477	-38.27629
1043	BLT	4		-5.703000	10.50000	-13.76000
1044				0.0	0.0	0.0

```
1045      BLT    5                -211.7134          -39.89477          -38.27629
1046                                0.0                0.0                0.0
1047      BLT    6                 0.0                0.0                0.0
1048                                0.0                0.0                0.0
1049     OFOR TIME=     120.0000
1050      SEG    1    -284.4154          0.0           -69.72507
1051                  -0.9267992          0.0          -0.3755573
1052                   0.0                1.000000      0.0
1053                   0.3755573          0.0          -0.9267992
1054      SEG    2    -309.2804          0.0           -58.58911
1055                  -0.3917901          0.0           0.9200546
1056                   0.0                1.000000      0.0
1057                  -0.9200546          0.0          -0.3917901
1058      SEG    3    -314.0034          0.0           -39.32616
1059                   0.1141989          0.0           0.9934579
1060                   0.0                1.000000      0.0
1061                  -0.9934579          0.0           0.1141989
1062      SEG    4    -304.6118          0.0           -36.68367
1063                   0.9149933          0.0          -0.4034691
1064                   0.0                1.000000      0.0
1065                   0.4034691          0.0           0.9149933
1066      SEG    5    -285.2588          0.0           -50.86039
1067                   0.8067136          0.0          -0.5909426
1068                   0.0                1.000000      0.0
1069                   0.5909426          0.0           0.8067136
1070      SEG    6    -258.8167          0.0           -40.50024
1071                   0.5578552          0.0           0.8299383
1072                   0.0                1.000000      0.0
1073                  -0.8299383          0.0           0.5578552
1074      SEG    7    -294.3827          0.0           -61.50498
1075                   0.9193806          0.0           0.3933693
1076                   0.0                1.000000      0.0
1077                  -0.3933693          0.0           0.9193806
1078      SEG    8    -267.8785          0.0           -60.73976
1079                   0.9569392          0.0          -0.2902884
1080                   0.0                1.000000      0.0
1081                   0.2902884          0.0           0.9569392
1082      SEG    9    -283.6498          0.0           -67.84450
1083                  -0.8846132          0.0          -0.4663255
1084                   0.0                1.000000      0.0
1085                   0.4663255          0.0          -0.8846132
1086      SEG   10    -304.3032          0.0           -58.50548
1087                  -0.6046619          0.0           0.7964823
1088                   0.0                1.000000      0.0
1089                  -0.7964823          0.0          -0.6046619
1090      SEG   11    -279.4259          0.0           -80.76266
1091                   1.000000          0.0          -0.7229677E-04
1092                   0.0                1.000000      0.0
1093                   0.7229677E-04      0.0           1.000000
1094      SEG   12    -106.5444          0.0           0.0
1095                   1.000000          0.0          -0.0
1096                   0.0                1.000000      0.0
1097                   0.0               0.0            1.000000
1098      SEG   13     0.0               0.0           0.0
1099                   1.000000          0.0           0.0
1100                   0.0                1.000000      0.0
1101                   0.0               0.0            1.000000
1102      PL     1       -173.6375         -173.6375       -285.4604        -285.4604
```

1103			2000.000	-2000.000	-2000.000	2000.000
1104			-50.22501	-50.22501	-77.07120	-77.07120
1105	PL	2	-171.3035	-171.3035	-283.1264	-283.1264
1106			2000.000	-2000.000	-2000.000	2000.000
1107			-59.94901	-59.94901	-86.79520	-86.79520
1108	PL	3	-273.4025	-273.4025	-275.7365	-275.7365
1109			2000.000	-2000.000	-2000.000	2000.000
1110			-84.46080	-84.46080	-74.73680	-74.73680
1111	PL	4	-287.2115	-287.2115	-281.3754	-281.3754
1112			2000.000	-2000.000	-2000.000	2000.000
1113			-69.77840	-69.77840	-94.08800	-94.08800
1114	PL	5	-290.5546	-290.5546	-297.4806	-297.4806
1115			2000.000	-2000.000	-2000.000	2000.000
1116			-70.72254	-70.72254	-36.52734	-36.52734
1117	PL	6	-287.2051	-287.2051	-281.3709	-281.3709
1118			2000.000	-2000.000	-2000.000	2000.000
1119			-69.77500	-69.77500	-94.08502	-94.08502
1120	PL	7	-247.0444	-247.0444	-282.9444	-282.9444
1121			2000.000	-2000.000	-2000.000	2000.000
1122			-11.00000	-11.00000	-11.00000	-11.00000
1123	PL	8	-386.5444	-386.5444	-296.5444	-296.5444
1124			2000.000	-2000.000	-2000.000	2000.000
1125			-11.00000	-11.00000	-11.00000	-11.00000
1126	PL	9	-215.1944	-215.1944	-247.0444	-247.0444
1127			2000.000	-2000.000	-2000.000	2000.000
1128			-27.60001	-27.60001	-11.00000	-11.00000
1129	PL	10	-215.9444	-215.9444	-215.1944	-215.1944
1130			2000.000	-2000.000	-2000.000	2000.000
1131			-61.70000	-61.70000	-27.60001	-27.60001
1132	PL	11	-227.9444	-227.9444	-215.9444	-215.9444
1133			2000.000	-2000.000	-2000.000	2000.000
1134			-62.70000	-62.70000	-61.70000	-61.70000
1135	PL	12	-227.9944	-227.9944	-227.9444	-227.9444
1136			2000.000	-2000.000	-2000.000	2000.000
1137			-71.89999	-71.89999	-62.70000	-62.70000
1138	PL	13	-223.8445	-223.8445	-227.9944	-227.9944
1139			2000.000	-2000.000	-2000.000	2000.000
1140			-76.10001	-76.10001	-71.89999	-71.89999
1141	PL	14	-258.0444	-258.0444	-249.0444	-249.0444
1142			2000.000	-2000.000	-2000.000	2000.000
1143			-51.95000	-51.95000	-36.25000	-36.25000
1144	PL	15	-254.4444	-254.4444	-258.0444	-258.0444
1145			2000.000	-2000.000	-2000.000	2000.000
1146			-61.85001	-61.85001	-51.95000	-51.95000
1147	PL	16	-260.7944	-260.7944	-247.5444	-247.5444
1148			2000.000	-2000.000	-2000.000	2000.000
1149			-67.45000	-67.45000	-55.50000	-55.50000
1150	PL	17	-255.0945	-255.0945	-260.7944	-260.7944
1151			2000.000	-2000.000	-2000.000	2000.000
1152			-82.55000	-82.55000	-67.45000	-67.45000
1153	PL	18	-226.5444	-226.5444	-255.0945	-255.0945
1154			2000.000	-2000.000	-2000.000	2000.000
1155			-78.64999	-78.64999	-82.55000	-82.55000
1156	PL	19	-356.5444	-356.5444	-322.4444	-322.4444
1157			2000.000	-2000.000	-2000.000	2000.000
1158			-132.6000	-132.6000	-132.6000	-132.6000
1159	PL	20	-283.6445	-283.6445	-278.1445	-278.1445
1160			2000.000	-2000.000	-2000.000	2000.000

```
1161                          -124.1000       -124.1000       -126.2500       -126.2500
1162        PL    21          -322.4444       -322.4444       -283.6445       -283 6445
1163                           2000.000        -2000.000       -2000.000        2000.000
1164                          -132.6000       -132.6000       -124.1000       -124.1000
1165        PL    22          -350.9044       -350.9044       -351.3044       -351.3044
1166                           2000.000        -2000.000       -2000.000        2000.000
1167                          -85.83000       -85.83000       -106.3300       -106.3300
1168        PL    23          -363.3045       -363.3045       -351.3044       -351.3044
1169                           2000.000        -2000.000       -2000.000        2000.000
1170                          -106.3300       -106.3300       -106.3300       -106.3300
1171        PL    24          -362.9046       -362.9046       -363.3045       -363.3045
1172                           2000.000        -2000.000       -2000.000        2000.000
1173                          -85.83000       -85.83000       -106.3300       -106.3300
1174        PL    25          -336.5444       -336.5444       -362.9046       -362.9046
1175                           2000.000        -2000.000       -2000.000        2000.000
1176                          -23.16000       -23.16000       -85.83000       -85.83000
1177        PL    26          -330.1044       -330.1044       -350.9044       -350.9044
1178                           2000.000        -2000.000       -2000.000        2000.000
1179                          -36.38000       -36.38000       -85.83000       -85.83000
1180        PL    27          -288.7545       -288.7545       -330.1044       -330.1044
1181                           2000.000        -2000.000       -2000.000        2000.000
1182                          -46.43600       -46.43600       -37.08600       -37.08600
1183        PL    28          -288.7545       -288.7545       -288.7545       -288.7545
1184                           2000.000        -2000.000       -2000.000        2000.000
1185                          -20.23000       -20.23000       -45.73000       -45.73000
1186        PL    29          -245.4444       -245.4444       -237.3445       -237.3445
1187                           2000.000        -2000.000       -2000.000        2000.000
1188                          -64.60001       -64.60001       -40.00000       -40.00000
1189        RING        1                  -211.8988       -39.65561       -38.84622
1190        BLT     1                      0.0             0.0             0.0
1191                                       0.0             0.0             0.0
1192        BLT     2                      -211.8988       -39.65561       -38.84622
1193                                       0.0             0.0             0.0
1194        BLT     3                      -5.703000       -10.50000       -13.76000
1195                                       -211.8988       -39.65561       -38.84622
1196        BLT     4                      -5.703000        10.50000       -13.76000
1197                                       0.0             0.0             0.0
1198        BLT     5                      -211.8988       -39.65561       -38.84622
1199                                       0.0             0.0             0.0
1200        BLT     6                      0.0             0.0             0.0
1201                                       0.0             0.0             0.0
1202        OFOR TIME=       140.0000
1203         SEG       1    -324.2267          0.0           -75.31946
1204                      -0.8962069          0.0          -0.4436363
1205                       0.0                 1.000000     0.0
1206                       0.4436363          0.0          -0.8962069
1207         SEG       2    -344.7553          0.0           -61.80793
1208                      -0.1512851          0.0           0.9884902
1209                       0.0                 1.000000     0.0
1210                      -0.9884902          0.0          -0.1512851
1211         SEG       3    -346.0995          0.0           -41.59378
1212                       0.1181455          0.0           0.9929963
1213                       0.0                 1.000000     0.0
1214                      -0.9929963          0.0           0.1181455
1215         SEG       4    -336.2167          0.0           -37.64552
1216                       0.9642431          0.0          -0.2650192
1217                       0.0                 1.000000     0.0
1218                       0.2650192          0.0           0.9642431
```

```
1219      SEG     5    -317.7885          0.0              -53.00536
1220                   0.7681584          0.0             -0.6402599
1221                   0.0                 1.000000        0.0
1222                   0.6402599          0.0              0.7681584
1223      SEG     6    -293.0775          0.0              -42.74198
1224                   0.5117265          0.0              0.8591484
1225                   0.0                 1.000000        0.0
1226                  -0.8591484          0.0              0.5117265
1227      SEG     7    -333.6986          0.0              -62.50418
1228                   0.8255862          0.0              0.5642760
1229                   0.0                 1.000000        0.0
1230                  -0.5642760          0.0              0.8255862
1231      SEG     8    -308.3487          0.0              -59.24801
1232                   0.9618473          0.0             -0.2735868
1233                   0.0                 1.000000        0.0
1234                   0.2735868          0.0              0.9618473
1235      SEG     9    -326.3609          0.0              -73.88906
1236                  -0.8357705          0.0             -0.5490790
1237                   0.0                 1.000000        0.0
1238                   0.5490790          0.0             -0.8357705
1239      SEG     10   -340.1506          0.0              -64.43945
1240                  -0.3412808          0.0              0.9399614
1241                   0.0                 1.000000        0.0
1242                  -0.9399614          0.0             -0.3412808
1243      SEG     11   -310.8779          0.0              -80.76273
1244                   1.000000           0.0             -0.6879559E-04
1245                   0.0                 1.000000        0.0
1246                   0.6879559E-04       0.0              1.000000
1247      SEG     12   -137.9865          0.0              0.0
1248                   1.000000           0.0             -0.0
1249                   0.0                 1.000000        0.0
1250                   0.0                0.0              1.000000
1251      SEG     13   0.0                0.0              0.0
1252                   1.000000           0.0              0.0
1253                   0.0                 1.000000        0.0
1254                   0.0                0.0              1.000000
1255      PL      1      -205.0795          -205.0795        -316.9025        -316.9025
1256                      2000.000          -2000.000        -2000.000         2000.000
1257                     -50.22501          -50.22501        -77.07120        -77.07120
1258      PL      2      -202.7455          -202.7455        -314.5685        -314.5685
1259                      2000.000          -2000.000        -2000.000         2000.000
1260                     -59.94901          -59.94901        -86.79520        -86.79520
1261      PL      3      -304.8445          -304.8445        -307.1785        -307.1785
1262                      2000.000          -2000.000        -2000.000         2000.000
1263                     -84.46080          -84.46080        -74.73680        -74.73680
1264      PL      4      -318.6535          -318.6535        -312.8175        -312.8175
1265                      2000.000          -2000.000        -2000.000         2000.000
1266                     -69.77840          -69.77840        -94.08800        -94.08800
1267      PL      5      -329.6251          -329.6251        -327.8512        -327.8512
1268                      2000.000          -2000.000        -2000.000         2000.000
1269                     -78.20772          -78.20772        -43.36329        -43.36329
1270      PL      6      -318.6572          -318.6572        -312.8228        -312.8228
1271                      2000.000          -2000.000        -2000.000         2000.000
1272                     -69.77509          -69.77509        -94.08509        -94.08509
1273      PL      7      -278.4865          -278.4865        -314.3865        -314.3865
1274                      2000.000          -2000.000        -2000.000         2000.000
1275                     -11.00000          -11.00000        -11.00000        -11.00000
1276      PL      8      -417.9865          -417.9865        -327.9865        -327.9865
```

1277			2000.000	-2000.000	-2000.000	2000.000
1278			-11.00000	-11.00000	-11.00000	-11.00000
1279	PL	9	-246.6365	-246.6365	-278.4865	-278.4865
1280			2000.000	-2000.000	-2000.000	2000.000
1281			-27.60001	-27.60001	-11.00000	-11.00000
1282	PL	10	-247.3865	-247.3865	-246.6365	-246.6365
1283			2000.000	-2000.000	-2000.000	2000.000
1284			-61.70000	-61.70000	-27.60001	-27.60001
1285	PL	11	-259.3865	-259.3865	-247.3865	-247.3865
1286			2000.000	-2000.000	-2000.000	2000.000
1287			-62.70000	-62.70000	-61.70000	-61.70000
1288	PL	12	-259.4365	-259.4365	-259.3865	-259.3865
1289			2000.000	-2000.000	-2000.000	2000.000
1290			-71.89999	-71.89999	-62.70000	-62.70000
1291	PL	13	-255.2865	-255.2865	-259.4365	-259.4365
1292			2000.000	-2000.000	-2000.000	2000.000
1293			-76.10001	-76.10001	-71.89999	-71.89999
1294	PL	14	-289.4865	-289.4865	-280.4865	-280.4865
1295			2000.000	-2000.000	-2000.000	2000.000
1296			-51.95000	-51.95000	-36.25000	-36.25000
1297	PL	15	-285.8865	-285.8865	-289.4865	-289.4865
1298			2000.000	-2000.000	-2000.000	2000.000
1299			-61.85001	-61.85001	-51.95000	-51.95000
1300	PL	16	-292.2365	-292.2365	-278.9865	-278.9865
1301			2000.000	-2000.000	-2000.000	2000.000
1302			-67.45000	-67.45000	-55.50000	-55.50000
1303	PL	17	-286.5365	-286.5365	-292.2365	-292.2365
1304			2000.000	-2000.000	-2000.000	2000.000
1305			-82.55000	-82.55000	-67.45000	-67.45000
1306	PL	18	-257.9865	-257.9865	-286.5365	-286.5365
1307			2000.000	-2000.000	-2000.000	2000.000
1308			-78.64999	-78.64999	-82.55000	-82.55000
1309	PL	19	-387.9865	-387.9865	-353.8865	-353.8865
1310			2000.000	-2000.000	-2000.000	2000.000
1311			-132.6000	-132.6000	-132.6000	-132.6000
1312	PL	20	-315.0865	-315.0865	-309.5865	-309.5865
1313			2000.000	-2000.000	-2000.000	2000.000
1314			-124.1000	-124.1000	-126.2500	-126.2500
1315	PL	21	-353.8865	-353.8865	-315.0865	-315.0865
1316			2000.000	-2000.000	-2000.000	2000.000
1317			-132.6000	-132.6000	-124.1000	-124.1000
1318	PL	22	-382.3465	-382.3465	-382.7465	-382.7465
1319			2000.000	-2000.000	-2000.000	2000.000
1320			-85.83000	-85.83000	-106.3300	-106.3300
1321	PL	23	-394.7465	-394.7465	-382.7465	-382.7465
1322			2000.000	-2000.000	-2000.000	2000.000
1323			-106.3300	-106.3300	-106.3300	-106.3300
1324	PL	24	-394.3466	-394.3466	-394.7465	-394.7465
1325			2000.000	-2000.000	-2000.000	2000.000
1326			-85.83000	-85.83000	-106.3300	-106.3300
1327	PL	25	-367.9865	-367.9865	-394.3466	-394.3466
1328			2000.000	-2000.000	-2000.000	2000.000
1329			-23.16000	-23.16000	-85.83000	-85.83000
1330	PL	26	-361.5465	-361.5465	-382.3465	-382.3465
1331			2000.000	-2000.000	-2000.000	2000.000
1332			-36.38000	-36.38000	-85.83000	-85.83000
1333	PL	27	-320.1965	-320.1965	-361.5465	-361.5465
1334			2000.000	-2000.000	-2000.000	2000.000

```
1335                        -46.43600       -46.43600       -37.08600       -37.08600
1336      PL    28          -320.1965       -320.1965       -320.1965       -320.1965
1337                         2000.000        -2000.000       -2000.000        2000.000
1338                        -20.23000       -20.23000       -45.73000       -45.73000
1339      PL    29          -276.8865       -276.8865       -268.7865       -268.7865
1340                         2000.000        -2000.000       -2000.000        2000.000
1341                        -64.60001       -64.60001       -40.00000       -40.00000
1342      RING        1                -212.1793          -39.52387          -39.10704
1343      BLT     1                   0.0                0.0                0.0
1344                                  0.0                0.0                0.0
1345      BLT     2                   -212.1793          -39.52387          -39.10704
1346                                  0.0                0.0                0.0
1347      BLT     3                   -5.703000          -10.50000          -13.76000
1348                                  -212.1793          -39.52387          -39.10704
1349      BLT     4                   -5.703000           10.50000          -13.76000
1350                                  0.0                0.0                0.0
1351      BLT     5                   -212.1793          -39.52387          -39.10704
1352                                  0.0                0.0                0.0
1353      BLT     6                   0.0                0.0                0.0
1354                                  0.0                0.0                0.0
1355      OFOR TIME=      160.0000
1356       SEG      1     -365.0801          0.0             -90.91681
1357                     -0.9299280          0.0              0.3677416
1358                      0.0                 1.000000        0.0
1359                     -0.3677416          0.0             -0.9299280
1360       SEG      2     -380.3396          0.0              -64.47361
1361                      0.5456977E-02      0.0              0.9999851
1362                      0.0                 1.000000        0.0
1363                     -0.9999851          0.0              0.5456977E-02
1364       SEG      3     -378.4980          0.0              -44.29910
1365                      0.2725864          0.0              0.9621313
1366                      0.0                 1.000000        0.0
1367                     -0.9621313          0.0              0.2725864
1368       SEG      4     -367.3740          0.0              -39.42139
1369                      0.9893618          0.0             -0.1454760
1370                      0.0                 1.000000        0.0
1371                      0.1454760          0.0              0.9893618
1372       SEG      5     -349.3514          0.0              -55.25507
1373                      0.7512555          0.0             -0.6600115
1374                      0.0                 1.000000        0.0
1375                      0.6600115          0.0              0.7512555
1376       SEG      6     -325.4158          0.0              -45.02046
1377                      0.4908158          0.0              0.8712633
1378                      0.0                 1.000000        0.0
1379                     -0.8712633          0.0              0.4908158
1380       SEG      7     -374.0732          0.0              -62.33532
1381                      0.6533744          0.0              0.7570349
1382                      0.0                 1.000000        0.0
1383                     -0.7570349          0.0              0.6533744
1384       SEG      8     -350.7792          0.0              -55.77362
1385                      0.9750639          0.0             -0.2219242
1386                      0.0                 1.000000        0.0
1387                      0.2219242          0.0              0.9750639
1388       SEG      9     -364.4972          0.0              -89.95146
1389                     -0.9719378          0.0              0.2352380
1390                      0.0                 1.000000        0.0
1391                     -0.2352380          0.0             -0.9719378
1392       SEG     10     -378.7939          0.0              -69.66669
```

```
1393                  0.2673094        0.0              0.9636107
1394                  0.0               1.000000        0.0
1395                 -0.9636107        0.0              0.2673094
1396       SEG   11   -341.6419         0.0             -80.76318
1397                   1.000000         0.0             -0.599792GE-04
1398                  0.0               1.000000        0.0
1399                  0.5997926E-04     0.0              1.000000
1400       SEG   12   -168.7517         0.0              0.0
1401                   1.000000         0.0             -0.0
1402                  0.0               1.000000        0.0
1403                  0.0               0.0              1.000000
1404       SEG   13   0.0               0.0              0.0
1405                   1.000000         0.0              0.0
1406                  0.0               1.000000        0.0
1407                  0.0               0.0              1.000000
1408       PL     1     -235.8447         -235.8447        -347.6677       -347.6677
1409                    2000.000         -2000.000        -2000.000        2000.000
1410                   -50.22501         -50.22501        -77.07120       -77.07120
1411       PL     2     -233.5107         -233.5107        -345.3337       -345.3337
1412                    2000.000         -2000.000        -2000.000        2000.000
1413                   -59.94901         -59.94901        -86.79520       -86.79520
1414       PL     3     -335.6097         -335.6097        -337.9437       -337.9437
1415                    2000.000         -2000.000        -2000.000        2000.000
1416                   -84.46080         -84.46080        -74.73680       -74.73680
1417       PL     4     -349.4188         -349.4188        -343.5827       -343.5827
1418                    2000.000         -2000.000        -2000.000        2000.000
1419                   -69.77840         -69.77840        -94.08800       -94.08800
1420       PL     5     -367.9658         -367.9658        -360.7544       -360.7544
1421                    2000.000         -2000.000        -2000.000        2000.000
1422                   -83.04141         -83.04141        -48.90526       -48.90526
1423       PL     6     -349.4212         -349.4212        -343.5867       -343.5867
1424                    2000.000         -2000.000        -2000.000        2000.000
1425                   -69.77562         -69.77562        -94.08557       -94.08557
1426       PL     7     -309.2517         -309.2517        -345.1517       -345.1517
1427                    2000.000         -2000.000        -2000.000        2000.000
1428                   -11.00000         -11.00000        -11.00000       -11.00000
1429       PL     8     -448.7517         -448.7517        -358.7517       -358.7517
1430                    2000.000         -2000.000        -2000.000        2000.000
1431                   -11.00000         -11.00000        -11.00000       -11.00000
1432       PL     9     -277.4017         -277.4017        -309.2517       -309.2517
1433                    2000.000         -2000.000        -2000.000        2000.000
1434                   -27.60001         -27.60001        -11.00000       -11.00000
1435       PL    10     -278.1517         -278.1517        -277.4017       -277.4017
1436                    2000.000         -2000.000        -2000.000        2000.000
1437                   -61.70000         -61.70000        -27.60001       -27.60001
1438       PL    11     -290.1517         -290.1517        -278.1517       -278.1517
1439                    2000.000         -2000.000        -2000.000        2000.000
1440                   -62.70000         -62.70000        -61.70000       -61.70000
1441       PL    12     -290.2017         -290.2017        -290.1517       -290.1517
1442                    2000.000         -2000.000        -2000.000        2000.000
1443                   -71.89999         -71.89999        -62.70000       -62.70000
1444       PL    13     -286.0518         -286.0518        -290.2017       -290.2017
1445                    2000.000         -2000.000        -2000.000        2000.000
1446                   -76.10001         -76.10001        -71.89999       -71.89999
1447       PL    14     -320.2517         -320.2517        -311.2517       -311.2517
1448                    2000.000         -2000.000        -2000.000        2000.000
1449                   -51.95000         -51.95000        -36.25000       -36.25000
1450       PL    15     -316.6517         -316.6517        -320.2517       -320.2517
```

1451			2000.000	-2000.000	-2000.000	2000.000
1452			-61.85001	-61.85001	-51.95000	-51.95000
1453	PL	16	-323.0017	-323.0017	-309.7517	-309.7517
1454			2000.000	-2000.000	-2000.000	2000.000
1455			-67.45000	-67.45000	-55.50000	-55.50000
1456	PL	17	-317.3018	-317.3018	-323.0017	-323.0017
1457			2000.000	-2000.000	-2000.000	2000.000
1458			-82.55000	-82.55000	-67.45000	-67.45000
1459	PL	18	-288.7517	-288.7517	-317.3018	-317.3018
1460			2000.000	-2000.000	-2000.000	2000.000
1461			-78.64999	-78.64999	-82.55000	-82.55000
1462	PL	19	-418.7517	-418.7517	-384.6517	-384.6517
1463			2000.000	-2000.000	-2000.000	2000.000
1464			-132.6000	-132.6000	-132.6000	-132.6000
1465	PL	20	-345.8518	-345.8518	-340.3518	-340.3518
1466			2000.000	-2000.000	-2000.000	2000.000
1467			-124.1000	-124.1000	-126.2500	-126.2500
1468	PL	21	-384.6517	-384.6517	-345.8518	-345.8518
1469			2000.000	-2000.000	-2000.000	2000.000
1470			-132.6000	-132.6000	-124.1000	-124.1000
1471	PL	22	-413.1117	-413.1117	-413.5117	-413.5117
1472			2000.000	-2000.000	-2000.000	2000.000
1473			-85.83000	-85.83000	-106.3300	-106.3300
1474	PL	23	-425.5118	-425.5118	-413.5117	-413.5117
1475			2000.000	-2000.000	-2000.000	2000.000
1476			-106.3300	-106.3300	-106.3300	-106.3300
1477	PL	24	-425.1119	-425.1119	-425.5118	-425.5118
1478			2000.000	-2000.000	-2000.000	2000.000
1479			-85.83000	-85.83000	-106.3300	-106.3300
1480	PL	25	-398.7517	-398.7517	-425.1119	-425.1119
1481			2000.000	-2000.000	-2000.000	2000.000
1482			-23.16000	-23.16000	-85.83000	-85.83000
1483	PL	26	-392.3117	-392.3117	-413.1117	-413.1117
1484			2000.000	-2000.000	-2000.000	2000.000
1485			-36.38000	-36.38000	-85.83000	-85.83000
1486	PL	27	-350.9618	-350.9618	-392.3117	-392.3117
1487			2000.000	-2000.000	-2000.000	2000.000
1488			-46.43600	-46.43600	-37.08600	-37.08600
1489	PL	28	-350.9618	-350.9618	-350.9618	-350.9618
1490			2000.000	-2000.000	-2000.000	2000.000
1491			-20.23000	-20.23000	-45.73000	-45.73000
1492	PL	29	-307.6517	-307.6517	-299.5518	-299.5518
1493			2000.000	-2000.000	-2000.000	2000.000
1494			-64.60001	-64.60001	-40.00000	-40.00000
1495	RING	1		-212.2191	-39.49519	-39.07309
1496	BLT	1		0.0	0.0	0.0
1497				0.0	0.0	0.0
1498	BLT	2		-212.2191	-39.49519	-39.07309
1499				0.0	0.0	0.0
1500	BLT	3		-5.703000	-10.50000	-13.76000
1501				-212.2191	-39.49519	-39.07309
1502	BLT	4		-5.703000	10.50000	-13.76000
1503				0.0	0.0	0.0
1504	BLT	5		-212.2191	-39.49519	-39.07309
1505				0.0	0.0	0.0
1506	BLT	6		0.0	0.0	0.0
1507				0.0	0.0	0.0
1508	OFOR TIME=		160.0000			

```
1509      SEG     1    -365.0801          0.0              -90.91681
1510                   -0.9299280         0.0               0.3677416
1511                    0.0                1.000000         0.0
1512                   -0.3677416         0.0              -0.9299280
1513      SEG     2    -380.3396          0.0              -64.47361
1514                    0.5456977E-02     0.0               0.9999851
1515                    0.0                1.000000         0.0
1516                   -0.9999851         0.0               0.5456977E-02
1517      SEG     3    -378.4980          0.0              -44.29910
1518                    0.2725864         0.0               0.9621313
1519                    0.0                1.000000         0.0
1520                   -0.9621313         0.0               0.2725864
1521      SEG     4    -367.3740          0.0              -39.42139
1522                    0.9893618         0.0              -0.1454760
1523                    0.0                1.000000         0.0
1524                    0.1454760         0.0               0.9893618
1525      SEG     5    -349.3514          0.0              -55.25507
1526                    0.7512555         0.0              -0.6600115
1527                    0.0                1.000000         0.0
1528                    0.6600115         0.0               0.7512555
1529      SEG     6    -325.4158          0.0              -45.02046
1530                    0.4908158         0.0               0.8712633
1531                    0.0                1.000000         0.0
1532                   -0.8712633         0.0               0.4908158
1533      SEG     7    -374.0732          0.0              -62.33532
1534                    0.6533744         0.0               0.7570349
1535                    0.0                1.000000         0.0
1536                   -0.7570349         0.0               0.6533744
1537      SEG     8    -350.7792          0.0              -55.77362
1538                    0.9750639         0.0              -0.2219242
1539                    0.0                1.000000         0.0
1540                    0.2219242         0.0               0.9750639
1541      SEG     9    -364.4972          0.0              -89.95146
1542                   -0.9719378         0.0               0.2352380
1543                    0.0                1.000000         0.0
1544                   -0.2352380         0.0              -0.9719378
1545      SEG    10    -378.7939          0.0              -69.66669
1546                    0.2673094         0.0               0.9636107
1547                    0.0                1.000000         0.0
1548                   -0.9636107         0.0               0.2673094
1549      SEG    11    -341.6419          0.0              -80.76318
1550                     1.000000         0.0              -0.5997926E-04
1551                    0.0                1.000000         0.0
1552                    0.5997926E-04     0.0                1.000000
1553      SEG    12    -168.7517          0.0               0.0
1554                     1.000000         0.0              -0.0
1555                    0.0                1.000000         0.0
1556                    0.0                0.0               1.000000
1557      SEG    13     0.0               0.0               0.0
1558                     1.000000         0.0               0.0
1559                    0.0                1.000000         0.0
1560                    0.0               0.0               1.000000
1561      PL     1        -235.8447          -235.8447        -347.6677        -347.6677
1562                        2000.000         -2000.000        -2000.000         2000.000
1563                      -50.22501          -50.22501        -77.07120        -77.07120
1564      PL     2        -233.5107          -233.5107        -345.3337        -345.3337
1565                        2000.000         -2000.000        -2000.000         2000.000
1566                      -59.94901          -59.94901        -86.79520        -86.79520
```

1567	PL	3	-335.6097	-335.6097	-337.9437	-337.9437
1568			2000.000	-2000.000	-2000.000	2000.000
1569			-84.46080	-84.46080	-74.73680	-74.73680
1570	PL	4	-349.4188	-349.4188	-343.5827	-343.5827
1571			2000.000	-2000.000	-2000.000	2000.000
1572			-69.77840	-69.77840	-94.08800	-94.08800
1573	PL	5	-367.9658	-367.9658	-360.7544	-360.7544
1574			2000.000	-2000.000	-2000.000	2000.000
1575			-83.04141	-83.04141	-48.90526	-48.90526
1576	PL	6	-349.4212	-349.4212	-343.5867	-343.5867
1577			2000.000	-2000.000	-2000.000	2000.000
1578			-69.77562	-69.77562	-94.08557	-94.08557
1579	PL	7	-309.2517	-309.2517	-345.1517	-345.1517
1580			2000.000	-2000.000	-2000.000	2000.000
1581			-11.00000	-11.00000	-11.00000	-11.00000
1582	PL	8	-448.7517	-448.7517	-358.7517	-358.7517
1583			2000.000	-2000.000	-2000.000	2000.000
1584			-11.00000	-11.00000	-11.00000	-11.00000
1585	PL	9	-277.4017	-277.4017	-309.2517	-309.2517
1586			2000.000	-2000.000	-2000.000	2000.000
1587			-27.60001	-27.60001	-11.00000	-11.00000
1588	PL	10	-278.1517	-278.1517	-277.4017	-277.4017
1589			2000.000	-2000.000	-2000.000	2000.000
1590			-61.70000	-61.70000	-27.60001	-27.60001
1591	PL	11	-290.1517	-290.1517	-278.1517	-278.1517
1592			2000.000	-2000.000	-2000.000	2000.000
1593			-62.70000	-62.70000	-61.70000	-61.70000
1594	PL	12	-290.2017	-290.2017	-290.1517	-290.1517
1595			2000.000	-2000.000	-2000.000	2000.000
1596			-71.89999	-71.89999	-62.70000	-62.70000
1597	PL	13	-286.0518	-286.0518	-290.2017	-290.2017
1598			2000.000	-2000.000	-2000.000	2000.000
1599			-76.10001	-76.10001	-71.89999	-71.89999
1600	PL	14	-320.2517	-320.2517	-311.2517	-311.2517
1601			2000.000	-2000.000	-2000.000	2000.000
1602			-51.95000	-51.95000	-36.25000	-36.25000
1603	PL	15	-316.6517	-316.6517	-320.2517	-320.2517
1604			2000.000	-2000.000	-2000.000	2000.000
1605			-61.85001	-61.85001	-51.95000	-51.95000
1606	PL	16	-323.0017	-323.0017	-309.7517	-309.7517
1607			2000.000	-2000.000	-2000.000	2000.000
1608			-67.45000	-67.45000	-55.50000	-55.50000
1609	PL	17	-317.3018	-317.3018	-323.0017	-323.0017
1610			2000.000	-2000.000	-2000.000	2000.000
1611			-82.55000	-82.55000	-67.45000	-67.45000
1612	PL	18	-288.7517	-288.7517	-317.3018	-317.3018
1613			2000.000	-2000.000	-2000.000	2000.000
1614			-78.64999	-78.64999	-82.55000	-82.55000
1615	PL	19	-418.7517	-418.7517	-384.6517	-384.6517
1616			2000.000	-2000.000	-2000.000	2000.000
1617			-132.6000	-132.6000	-132.6000	-132.6000
1618	PL	20	-345.8518	-345.8518	-340.3518	-340.3518
1619			2000.000	-2000.000	-2000.000	2000.000
1620			-124.1000	-124.1000	-126.2500	-126.2500
1621	PL	21	-384.6517	-384.6517	-345.8518	-345.8518
1622			2000.000	-2000.000	-2000.000	2000.000
1623			-132.6000	-132.6000	-124.1000	-124.1000
1624	PL	22	-413.1117	-413.1117	-413.5117	-413.5117

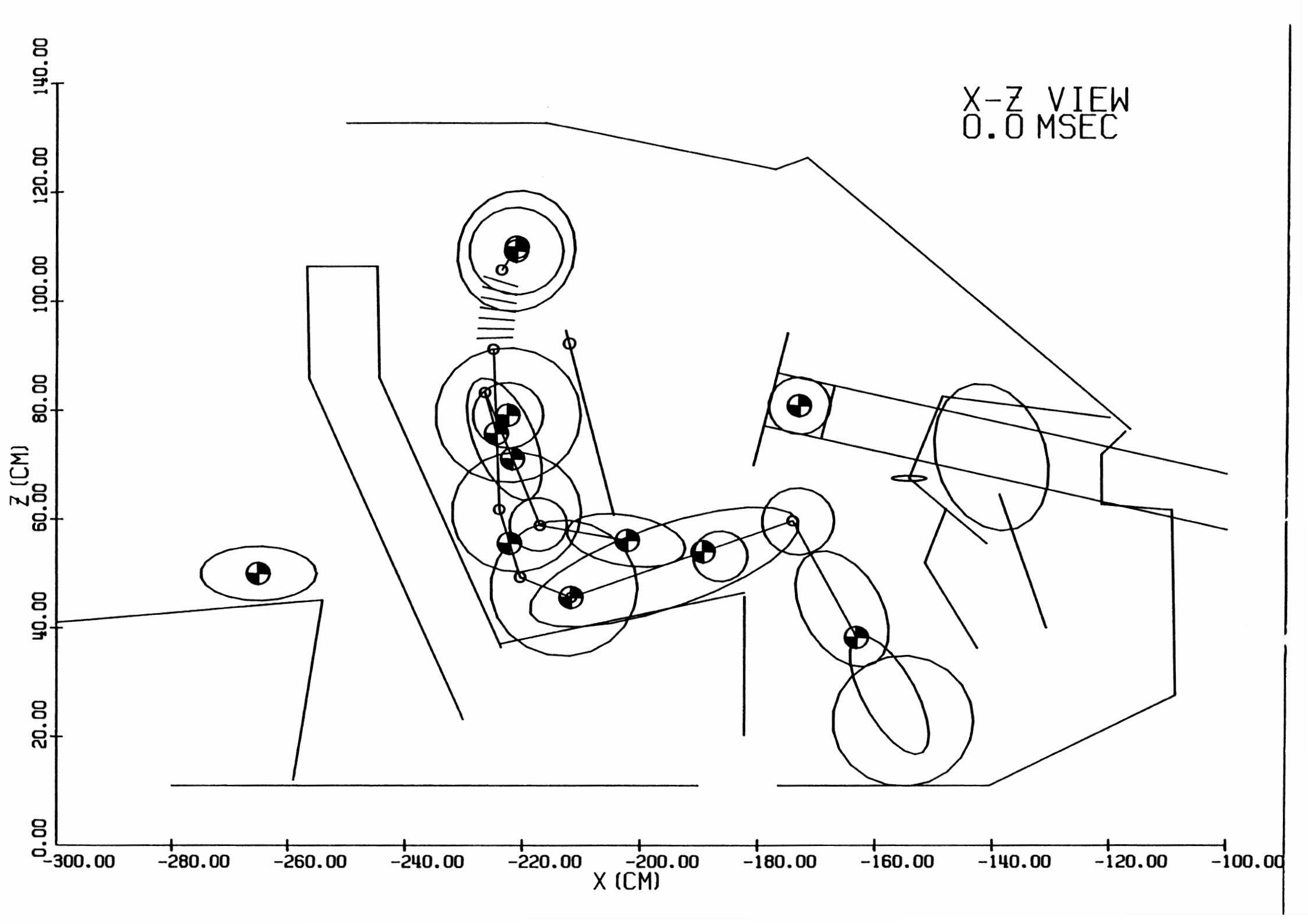
```
1625                          2000.000        -2000.000        -2000.000        2000.000
1626                         -85.83000        -85.83000        -106.3300       -106.3300
1627       PL    23          -425.5118        -425.5118        -413.5117       -413.5117
1628                          2000.000        -2000.000        -2000.000        2000.000
1629                         -106.3300        -106.3300        -106.3300       -106.3300
1630       PL    24          -425.1119        -425.1119        -425.5118       -425.5118
1631                          2000.000        -2000.000        -2000.000        2000.000
1632                         -85.83000        -85.83000        -106.3300       -106.3300
1633       PL    25          -398.7517        -398.7517        -425.1119       -425.1119
1634                          2000.000        -2000.000        -2000.000        2000.000
1635                         -23.16000        -23.16000        -85.83000       -85.83000
1636       PL    26          -392.3117        -392.3117        -413.1117       -413.1117
1637                          2000.000        -2000.000        -2000.000        2000.000
1638                         -36.38000        -36.38000        -85.83000       -85.83000
1639       PL    27          -350.9618        -350.9618        -392.3117       -392.3117
1640                          2000.000        -2000.000        -2000.000        2000.000
1641                         -46.43600        -46.43600        -37.08600       -37.08600
1642       PL    28          -350.9618        -350.9618        -350.9618       -350.9618
1643                          2000.000        -2000.000        -2000.000        2000.000
1644                         -20.23000        -20.23000        -45.73000       -45.73000
1645       PL    29          -307.6517        -307.6517        -299.5518       -299.5518
1646                          2000.000        -2000.000        -2000.000        2000.000
1647                         -64.60001        -64.60001        -40.00000       -40.00000
1648       RING      1                  -212.2191          -39.49519          -39.07309
1649       BLT     1                    0.0                0.0                0.0
1650                                    0.0                0.0                0.0
1651       BLT     2                    -212.2191          -39.49519          -39.07309
1652                                    0.0                0.0                0.0
1653       BLT     3                    -5.703000          -10.50000          -13.76000
1654                                    -212.2191          -39.49519          -39.07309
1655       BLT     4                    -5.703000           10.50000          -13.76000
1656                                    0.0                0.0                0.0
1657       BLT     5                    -212.2191          -39.49519          -39.07309
1658                                    0.0                0.0                0.0
1659       BLT     6                    0.0                0.0                0.0
1660                                    0.0                0.0                0.0
 $.28,  $13.78T
```

72

$SIG

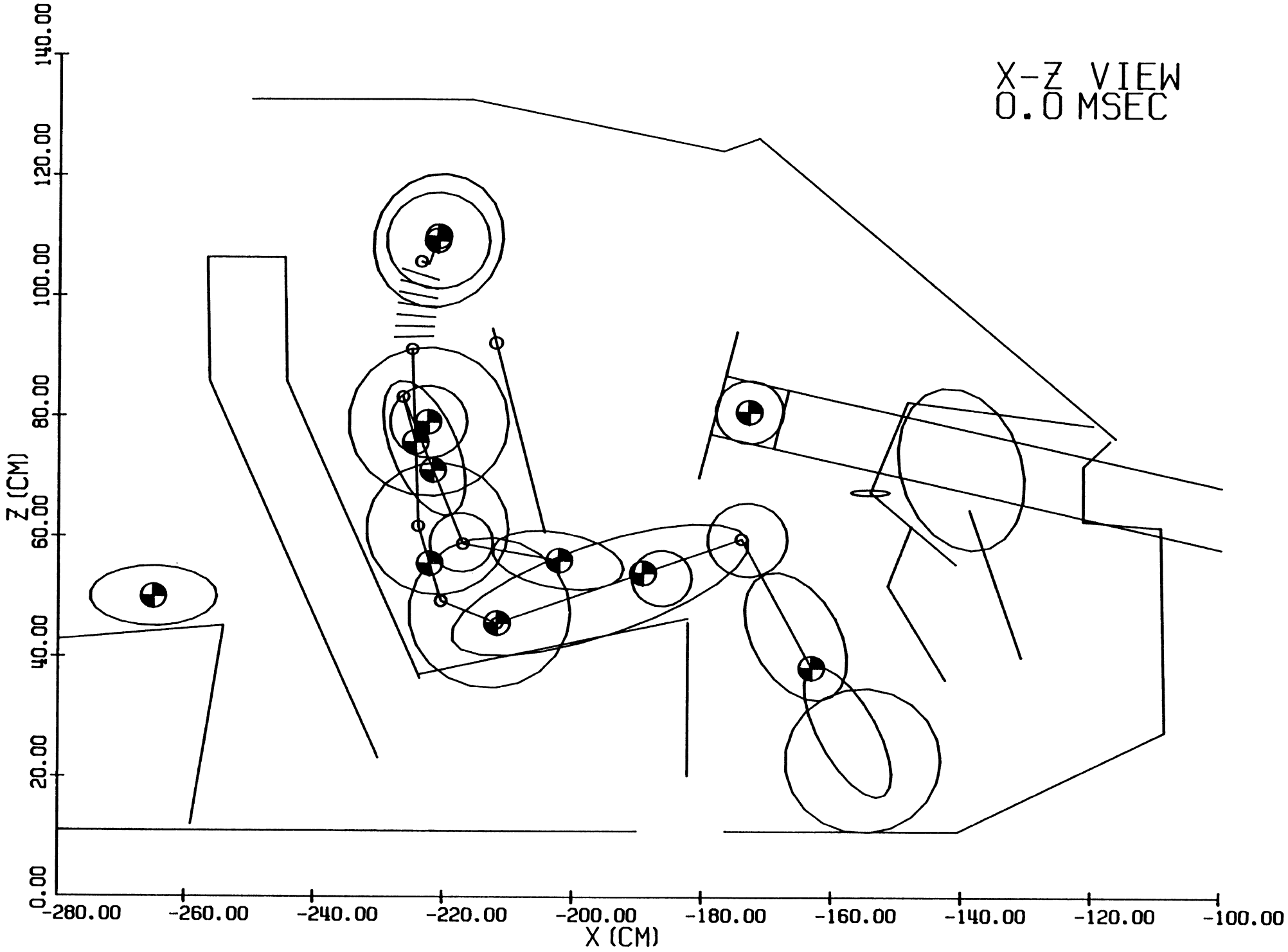
5.2 Overlayed Plots of Unbelted Occupant Restrained By Simulated Steering Column. The data set used for this run is the DEMODAT data set which is included on release tapes of the MVMA 2-D model. The run was made with Field 2 of Card 101 set to -10. and the run duration set to 0 to 80 msec. Four different PLOTCS runs were made with this hold file. The first plot uses the same scale as the plots of the last subsection. The second plot shows a plot region 20 cm smaller and illustrates that the plot axes are adjusted to the proper length for the user-specified region and that the plot is centered while maintaining at least the user-specified left margin. The final two plots illustrate an option for plotting all times in one plot to give an indication of movement.

```
2000      1 1 2 1-1   1 1 1 1   1 1 1 1 1 0   0-1 1  -1-1-1   0 0 1
2001     1.       .1125    .1       .08      .1       .05      .15      .07      .045
2002     0.       20.      20.      .10      .15      6.
2003     1.       0.       0.
2004     0.       1.       0.
2005     0.       0.       1.
2006     .5       .5       11.      8.5
2007     .5       .5       10.      7.
2008     -300.    -100.    0.       -140.    5.       20.
2009        X-Z VIEW
```


X-Z VIEW
0.0 MSEC
Z (CM)
X (CM)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
-300.00
-280.00
-260.00
-240.00
-220.00
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00

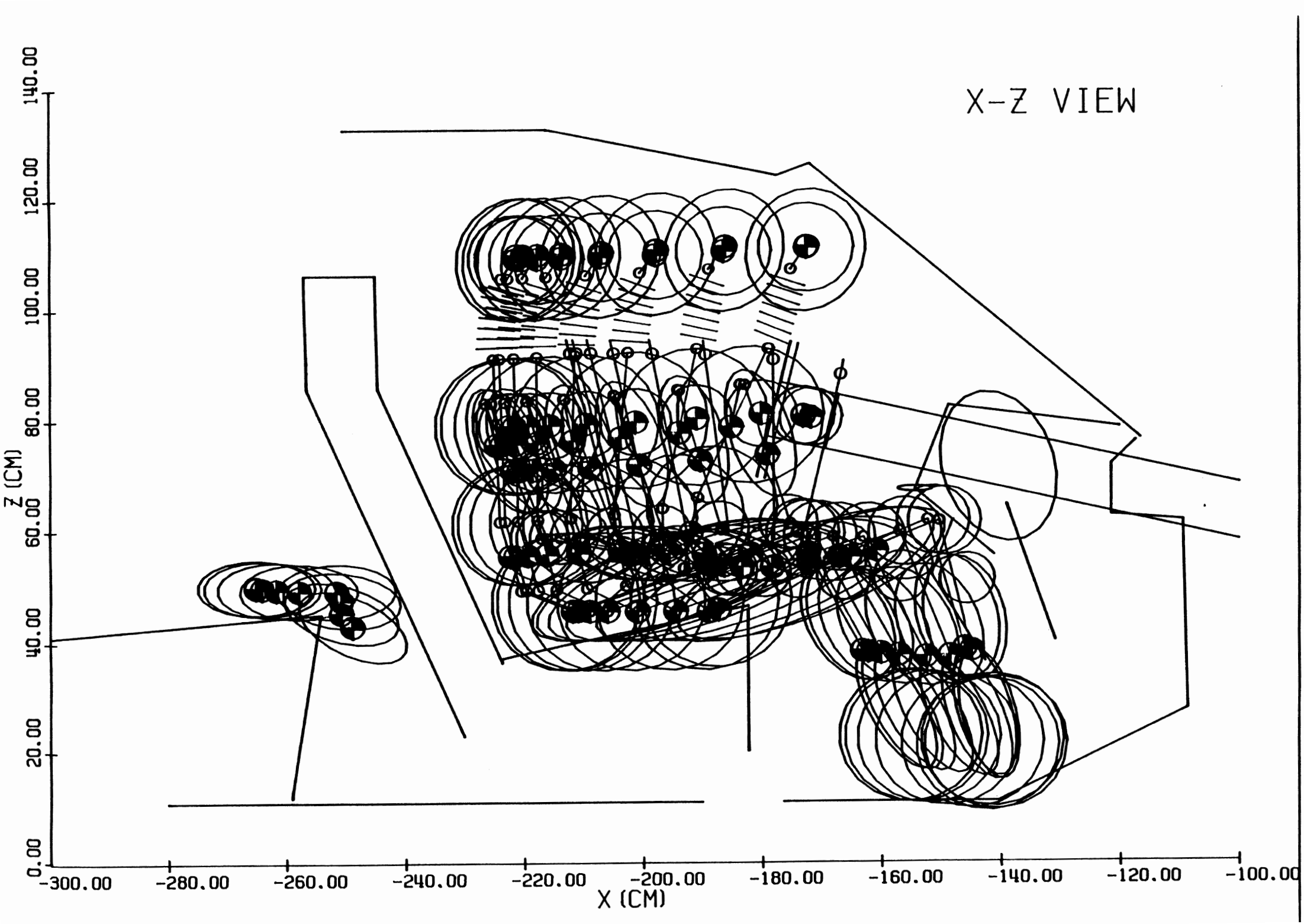
Listing of DEMODAT.SML(2000) at 20:59:04 on JAN 15, 1989 for CCid=SXA3 on UM

```
2000      1 1 2 1 1   1 1 1 1   1 1 1 1 1 1 0   0-1 1  -1-1-1   0 0 1
2001     1.       .1125    .1       .08      .1       .05      .15      .07      .045
2002     0.       20.      20.      .10      .15      6.
2003     1.       0.       0.
2004     0.       1.       0.
2005     0.       0.       1.
2006     .5       .5       11.      8.5
2007     .5       .5       10.      7.
2008     -280.    -100.    0.0      -140.    5.       20.
2009        X-Z VIEW
```


X-Z VIEW
0.0 MSEC
Z (CM)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
-280.00
-260.00
-240.00
-220.00
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00
X (CM)

Listing of OVERLAY.P(2000) at 21:05:07 on JAN 15, 1989 for CCid=SXA3 on UM

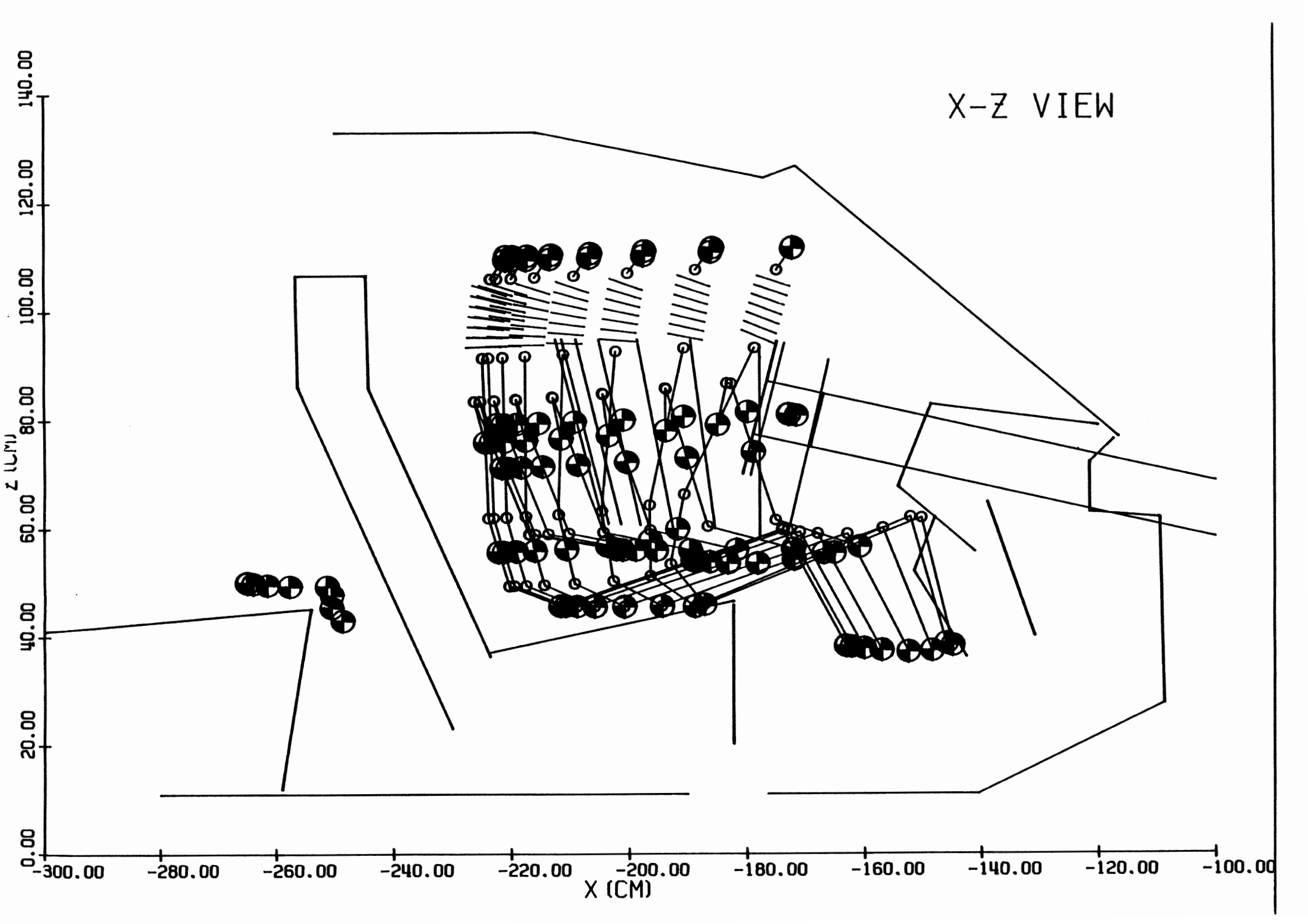
```
2000      1 1 2 1-1   1 1 1 1   1 1 1 1 1 0   0-1 1  -1 1-1   0 0 1
2001    1.       .1125    .1       .08      .1       .05      .15      .07      .045
2002    0.       80.      10.      .10      .15      6.
2003    1.       0.       0.
2004    0.       1.       0.
2005    0.       0.       1.
2006    .5       .5       11       8.5
2007    .5       .5       10.      7.
2008    -300.    -100.    0.       -140.    5.       20.
2009       X-Z VIEW
```


X-Z VIEW
Z (CM)
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
-300.00
-280.00
-260.00
-240.00
-220.00
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00
X (CM)

BEGIN 2-D OCCUPANT KINEMATICS POST PROCESSOR
BELTS WILL BE DRAWN, IF PRESENT.
PANELS WILL BE DRAWN, IF PRESENT.
JOINTS AND CENTERLINES WILL BE DRAWN, IF PRESENT.
ELLIPSOIDS WILL BE DRAWN, IF PRESENT.
AIRBAG OUTLINES WILL BE DRAWN, IF PRESENT.

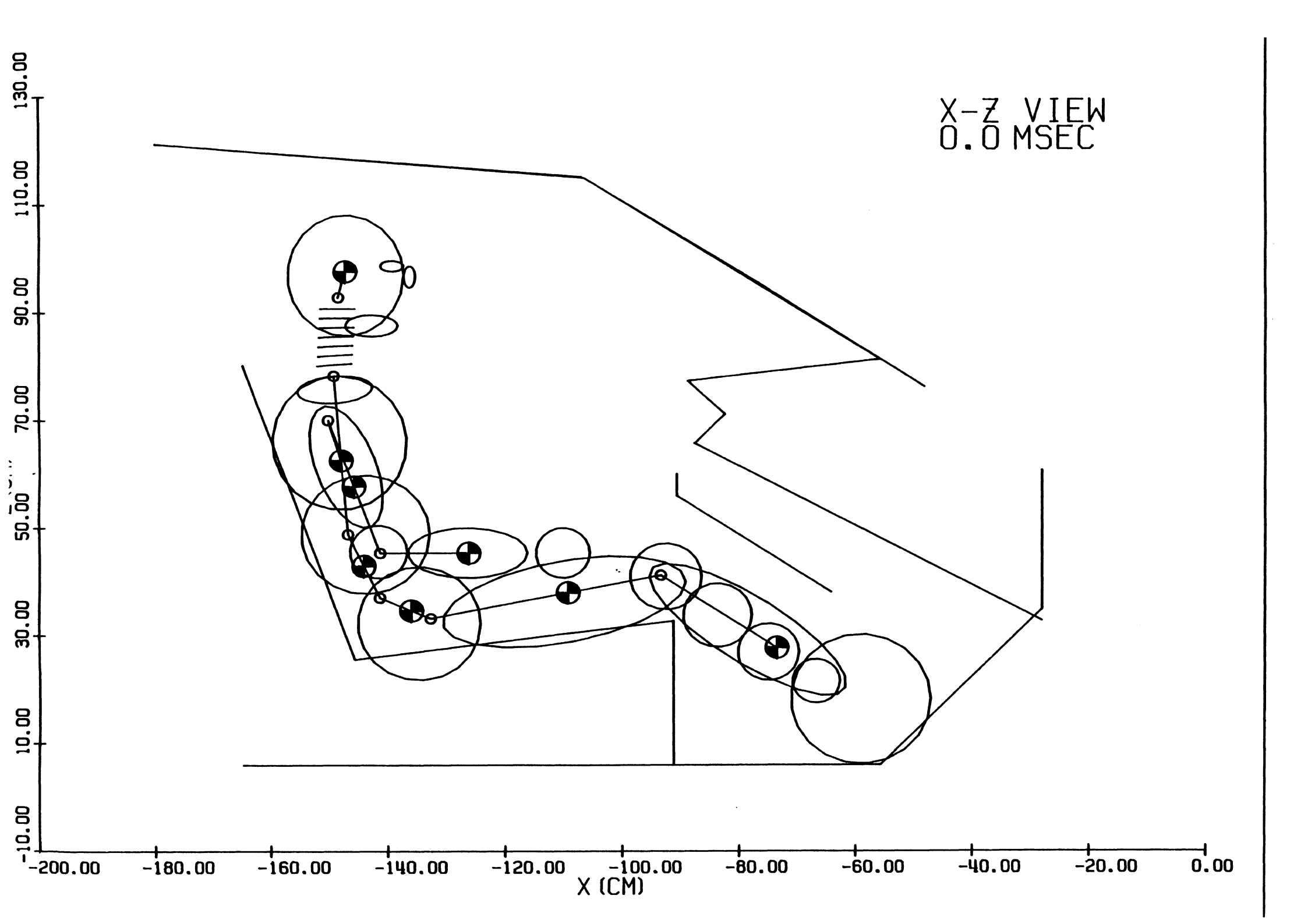
```
PLOT START TIME (MSEC)    0.0
PLOT END TIME (MSEC)     80.0000
PLOT INTERVAL (MSEC)     10.0000

PLOTTING PARAMETERS
PLOT #                      1         2         3


  ORGNRM:        0.0          0.0          0.0
  FORWRD:        1.0000       0.0          0.0
  GAUCHE:        0.0         -1.0000       0.0
     UP:         0.0          0.0         -1.0000
PLOT X ORIGIN (IN)          0.50      0.0       0.0
PLOT Z ORIGIN (IN)          0.50      0.0       0.0
PLOT X LENGTH (IN)         11.00      0.0       0.0
PLOT Z LENGTH (IN)          8.50      0.0       0.0

AXIS X ORIGIN (IN)          0.50      0.0       0.0
AXIS Z ORIGIN (IN)          0.75      0.0       0.0
AXIS X LENGTH (IN)         10.00      0.0       0.0
AXIS Z LENGTH (IN)          7.00      0.0       0.0

VIEWING SYSTEM PARAMETERS
POS'N ORIGIN X (IN)      -300.00      0.0       0.0
POS'N ORIGIN Z (IN)        -0.0       0.0       0.0
MAXIMUM X (IN)            200.00      0.0       0.0
MAXIMUM Z (IN)            140.00      0.0       0.0

ELLIPSE STEP FACTOR         5.00      0.0       0.0

VIEWING ROTATION MATRIX                  VIEW 1
                          1.0000000   0.0         0.0
                          0.0         1.0000000   0.0
                          0.0         0.0         1.0000000

END OF TIME PLOT NO.     9

END OF ALL PLOTS, TOTAL NUMBER =     9
```

```
2000      1 1 2 1-1  -1 1-1-1   1 1 1 1 1 0   0-1 1  -1 1-1   0 0 1
2001     1.       .1125    .1       .08      .1       .05      .15      .07      .045
2002     0.       80.      10.      .10      .15      6.
2003     1.       0.       0.
2004     0.       1.       0.
2005     0.       0.       1.
2006     .5       .5       11.      8.5
2007     .5       .5       10.      7.
2008     -300.    -100.    0.       -140.    5.       20.
2009        X-Z VIEW
```


X-Z VIEW
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Z (CM)
-300.00
-280.00
-260.00
-240.00
-220.00
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00
X (CM)

5.3 Unbelted Occupant Restrained by Simple Airbag. This data set is for PLOTCS plots for an MVMA 2-D run with the simple Airbag Submodel. Field 2 of Card 101 is set to -20. and the run duration is set to 0 to 80 msec. This also illustrates the use of the zero plot time increment to plot all data in the PLOTCS hold file.

```
2000      1 1 2 1-1   1 1 1 1   1 1 1 1 1 0   0-1 1  -1-1-1   0 0 1
2001     1.       .1125    .1       .08      .1       .05      .15      .07      .045
2002     0.       80.      0.       .10      .15      6.
2003     1.       0.       0.
2004     0.       1.       0.
2005     0.       0.       1.
2006     .5       .5       11.      8.5
2007     .5       .5       10.      7.
2008     -200.    0.0      10.      -130.    5.       20.
2009        X-Z VIEW
```

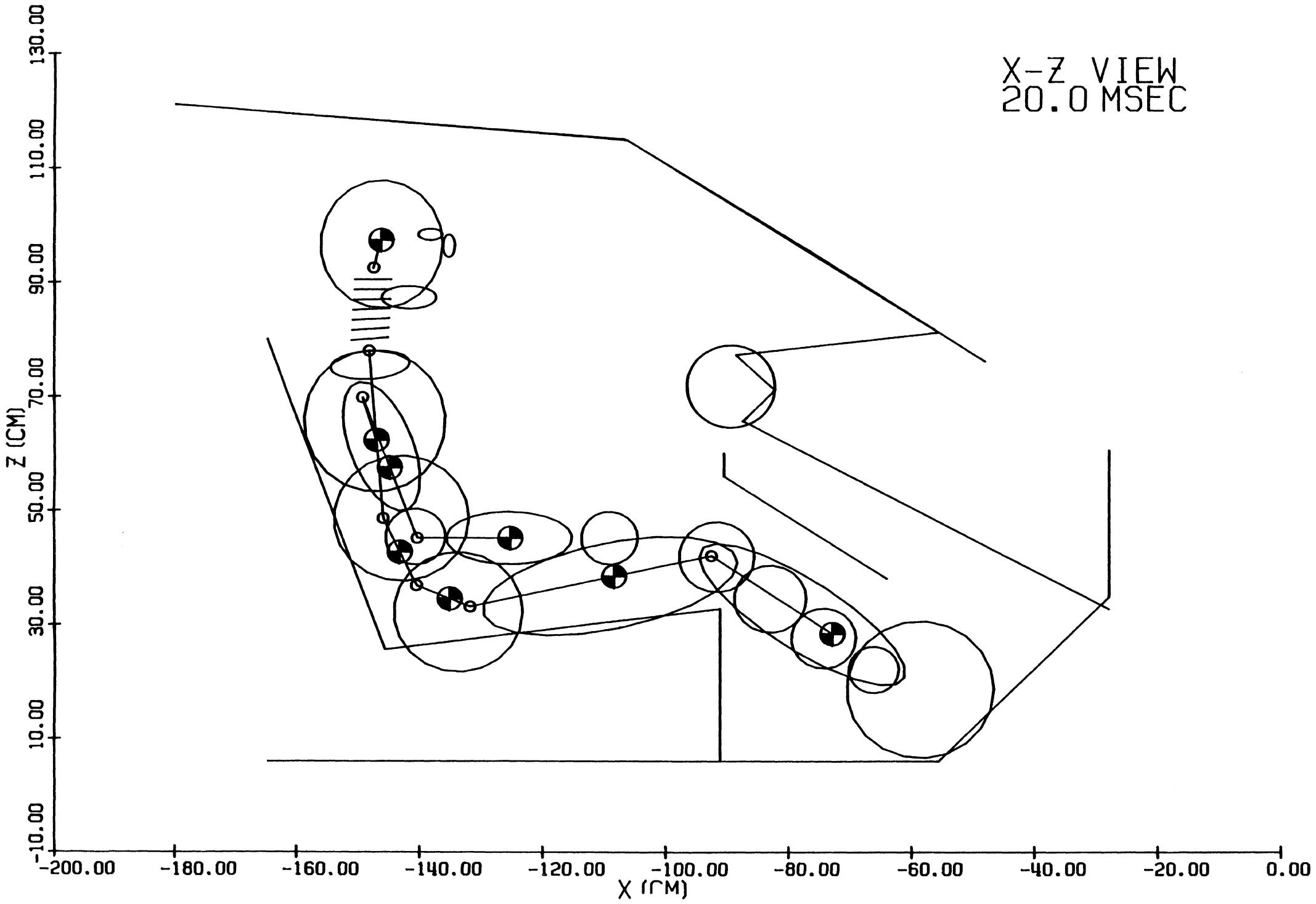

X-Z VIEW
0.0 MSEC
130.00
110.00
90.00
70.00
50.00
30.00
10.00
-10.00
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00
-80.00
-60.00
-40.00
-20.00
0.00
X (CM)

STICK FIGURE PRINTER PLOT FRAME FOR TIME= 0.0 MSEC.

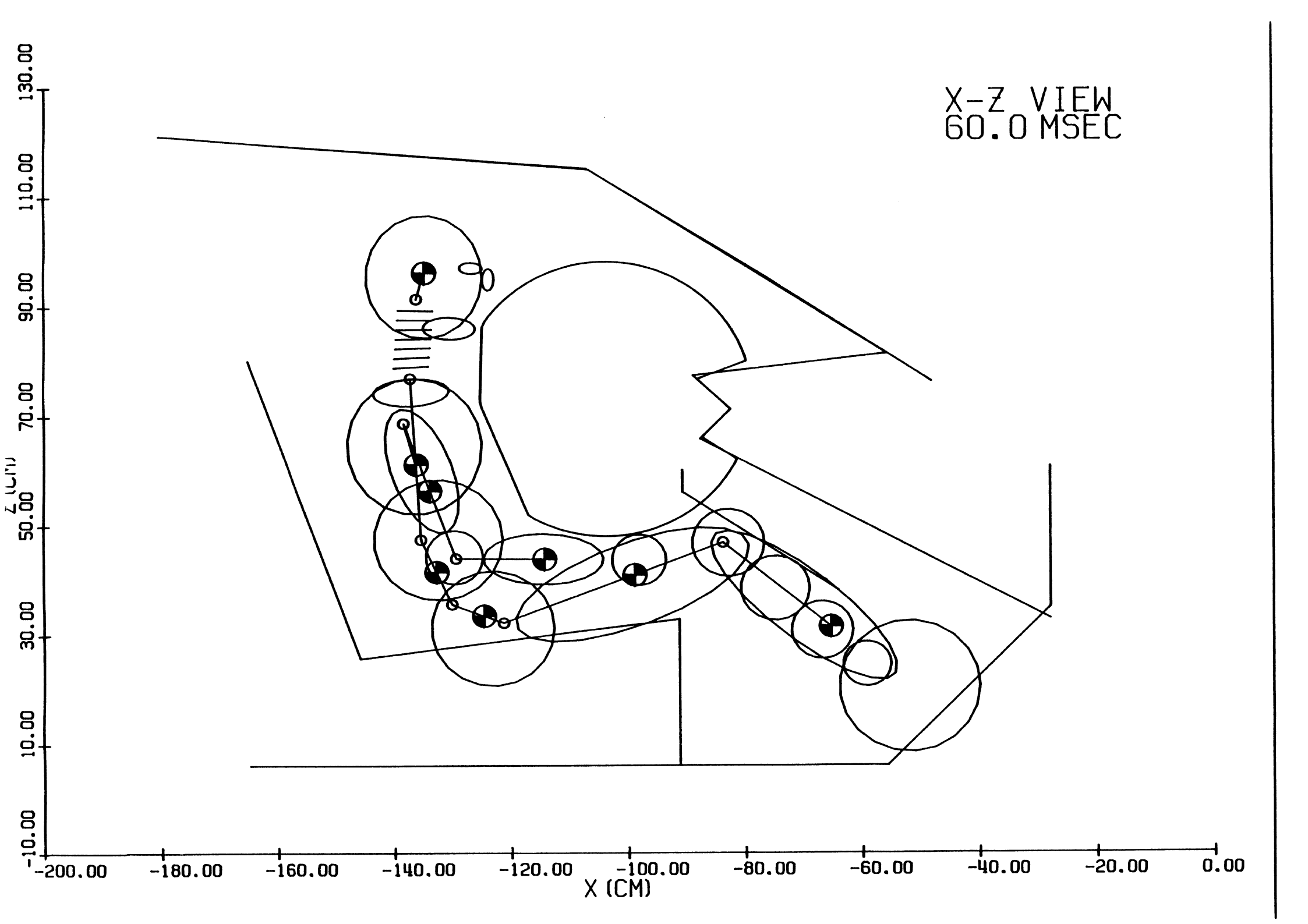
COORDINATE RANGES FOR PLOT ARE X=-181.39 (AT LEFT) TO -13.61 (AT RIGHT) AND Z= -6.00 (AT BOTTOM) TO-120.00 (AT TOP)
SCALE FACTOR IS (CM) = 6.910 (CM) . X AND Z POINT RESOLUTION ERRORS EQUAL RESPECTIVELY 0.645 AND 1.075 (CM) IN SCALE.

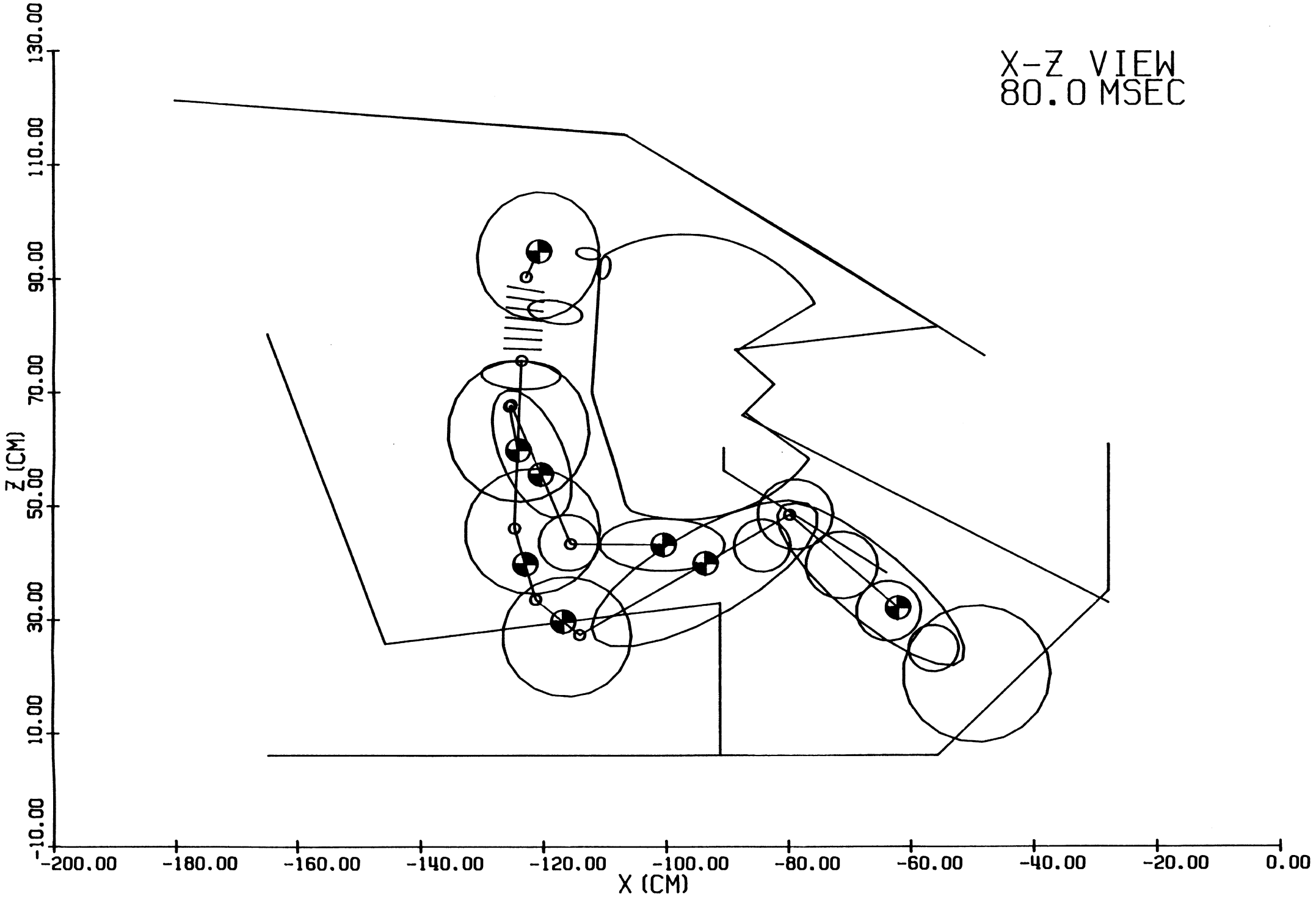
```
BEGIN 2-D OCCUPANT KINEMATICS POST PROCESSOR
BELTS WILL BE DRAWN, IF PRESENT.
PANELS WILL BE DRAWN, IF PRESENT.
JOINTS AND CENTERLINES WILL BE DRAWN, IF PRESENT.
ELLIPSOIDS WILL BE DRAWN, IF PRESENT.
AIRBAG OUTLINES WILL BE DRAWN, IF PRESENT.
```

```
  PLOT START TIME (MSEC)    0.0
  PLOT END TIME (MSEC)     80.0000
  PLOT INTERVAL (MSEC)      0.0

  PLOTTING PARAMETERS
  PLOT #                     1        2        3


    ORGNRM:        0.0          0.0          0.0
    FORWRD:        1.0000       0.0          0.0
    GAUCHE:        0.0         -1.0000       0.0
        UP:        0.0          0.0         -1.0000
  PLOT X ORIGIN (IN)          0.50     0.0      0.0
  PLOT Z ORIGIN (IN)          0.50     0.0      0.0
  PLOT X LENGTH (IN)         11.00     0.0      0.0
  PLOT Z LENGTH (IN)          8.50     0.0      0.0

  AXIS X ORIGIN (IN)          0.50     0.0      0.0
  AXIS Z ORIGIN (IN)          0.75     0.0      0.0
  AXIS X LENGTH (IN)         10.00     0.0      0.0
  AXIS Z LENGTH (IN)          7.00     0.0      0.0

  VIEWING SYSTEM PARAMETERS
  POS'N ORIGIN X, (IN)     -200.00     0.0      0.0
  POS'N ORIGIN Z (IN)       -10.00     0.0      0.0
  MAXIMUM X (IN)            200.00     0.0      0.0
  MAXIMUM Z (IN)            140.00     0.0      0.0

  ELLIPSE STEP FACTOR         5.00     0.0      0.0

VIEWING ROTATION MATRIX                VIEW 1
                          1.0000000  0.0          0.0
                          0.0        1.0000000    0.0
                          0.0        0.0          1.0000000

END OF TIME PLOT NO.     1

END OF TIME PLOT NO.     2

END OF TIME PLOT NO.     3

END OF TIME PLOT NO.     4

END OF TIME PLOT NO.     5

END OF TIME PLOT NO.     6

MISSING TIME STEP INFORMATION ON PLOTCS HOLD FILE.

END OF ALL PLOTS, TOTAL NUMBER =     6
```


X-Z VIEW
20.0 MSEC
Z (CM)
130.00
110.00
90.00
70.00
50.00
30.00
10.00
-10.00
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00
-80.00
-60.00
-40.00
-20.00
0.00
X (CM)

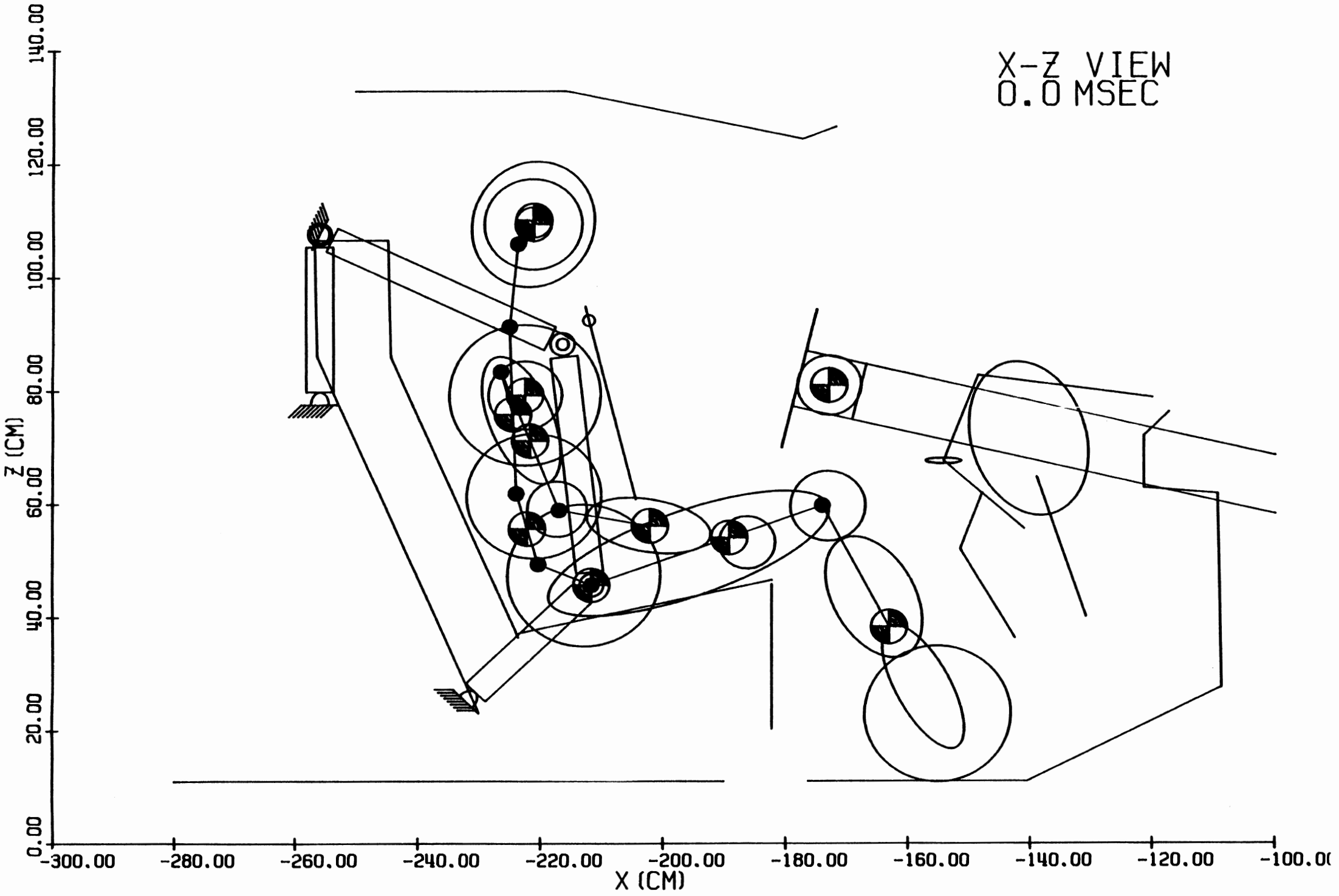
Z (CM)
-10.00
10.00
30.00
50.00
70.00
90.00
110.00
130.00
X (CM)
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00
-80.00
-60.00
-40.00
-20.00
0.00
X-Z VIEW
40.0 MSEC


X-Z VIEW
60.0 MSEC
130.00
110.00
90.00
70.00
50.00
30.00
10.00
-10.00
Z (CM)
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00
-80.00
-60.00
-40.00
-20.00
0.00
X (CM)


X-Z VIEW
80.0 MSEC
130.00
110.00
90.00
70.00
50.00
30.00
10.00
-10.00
Z (CM)
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00
-80.00
-60.00
-40.00
-20.00
0.00
X (CM)

5.4 Occupant Restrained by Shoulder Belt System With Belt Extension Through Fixed Ring. In this MVMA 2-D run, Field 2 of Card 101 was set to -1. and the run time duration was set to 0 to 2 msec. This PLOTCS run illustrates the user's control over the size of symbols, the alternate filled-circle representation for joints, and an alternate representation of belts.

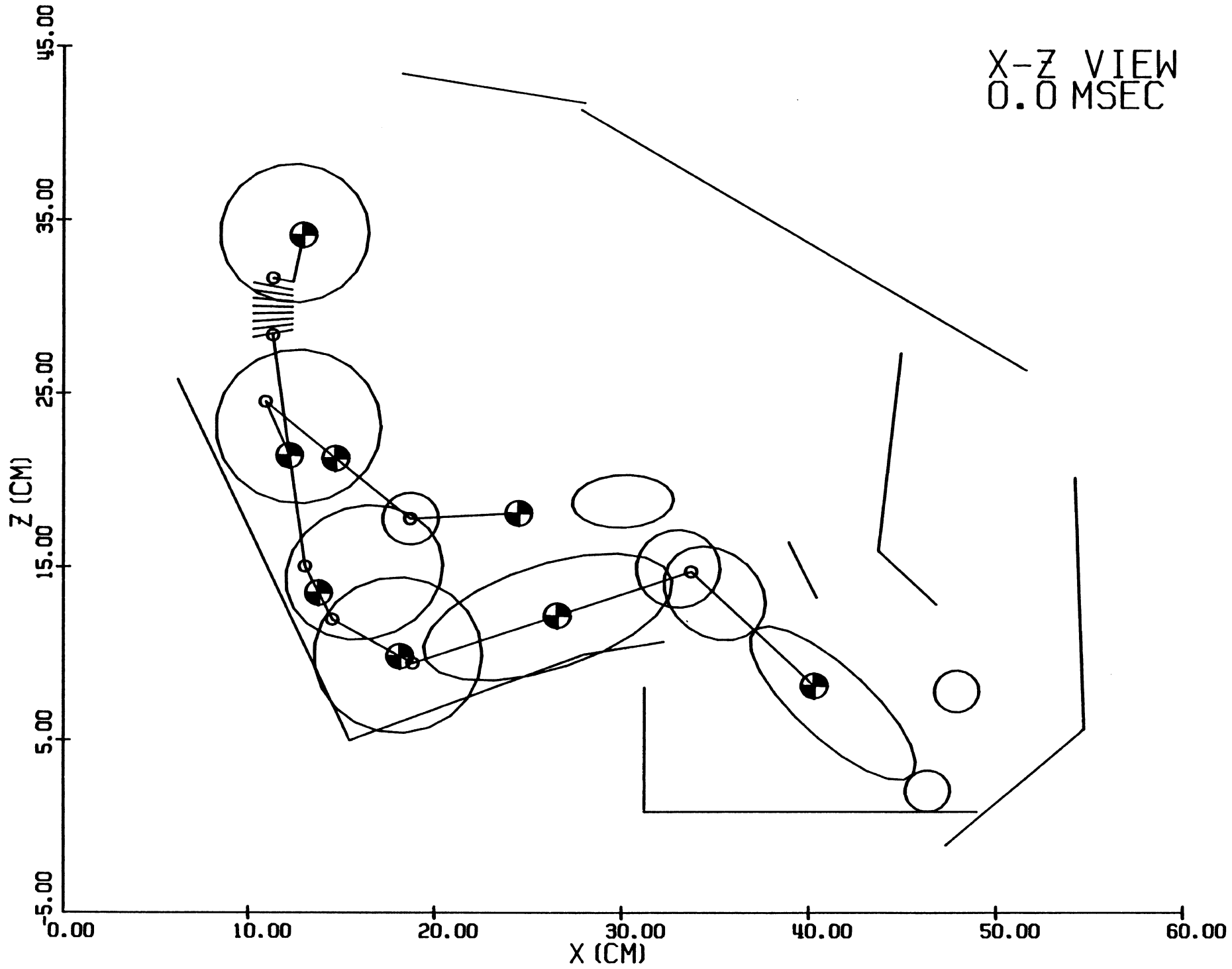
```
2000      1 1 1-1 1    1 1 1 1    1-1 1 1 1 0    0-1 1  -1-1-1    0 0 1
2001     1.        .1125    .1        .08       .1        .05       .15       .07       .06
2002     0.        2.       2.        .15       .15       6.
2003     1.        0.       0.
2004     0.        1.       0.
2005     0.        0.       1.
2006     .5        .5       11.       8.5
2007     .5        .5       10.       7.
2008     -300.     -100.    0.        -140.     1.25      20.
2009        X-Z VIEW
```


X-Z VIEW
0.0 MSEC
Z (CM)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
-300.00
-280.00
-260.00
-240.00
-220.00
-200.00
-180.00
-160.00
-140.00
-120.00
-100.00
X (CM)

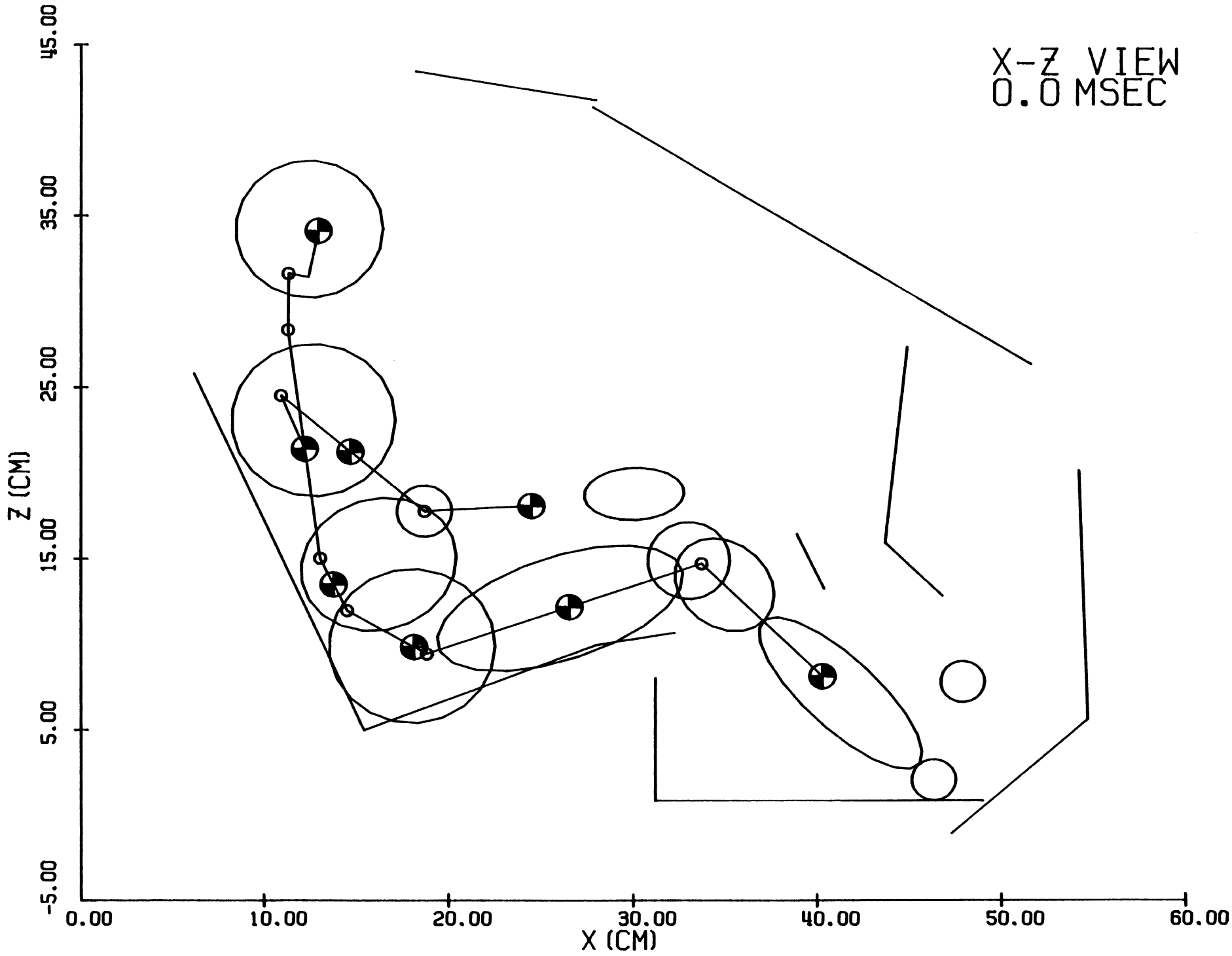
5.5 MVMA 2-D Tutorial Example Data Set No. 1 (1977) in English Units. The data set used for this run is the ENGLISH data set which is included on release tapes of the MVMA 2-D model. Ten different PLOTCS data sets are presented here, together with corresponding plots, to illustrate use of the first five PLOTCS control switches and their results. [Note: It will be seen that while the ENGLISH data set and the data used for PLOTCS are in English units, plot axes are labeled "CM". Provision has not been made in PLOTCS for "INCH" labeling because it is thought that all current (and anticipated) use of MVMA 2-D is in metric system units.]

Listing of DATRO1.P at 21:27:03 on JAN 15, 1989 for CCid=SXA3 on UM

```
2000      1 1 2 1 1   1 1 1 1   1 1 1 1 1 0   0-1 1  -1-1-1   0 0 1
2001     1.       .1125    .1       .08      .1       .05      .15      .07      .045
2002     0.       20.      20.      .10      .15      6.
2003     1.       0.       0.
2004     0.       1.       0.
2005     0.       0.       1.
2006     .5       .5       11.      8.5
2007     .5       .5       10.      7.
2008     0.       60.      +5.      -45.     5.       10.
2009        X-Z VIEW
```


X-Z VIEW
0.0 MSEC
45.00
35.00
25.00
15.00
5.00
-5.00
Z (CM)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
X (CM)

```
2000      1 1 2-1 1   1 1 1 1   1 1 1 1 1 0   0-1 1  -1-1-1   0 0 1
2001     1.       .1125    .1       .08      .1       .05      .15      .07      .045
2002     0.       20.      20.      .10      .15      6.
2003     1.       0.       0.
2004     0.       1.       0.
2005     0.       0.       1.
2006     .5       .5       11.      8.5
2007     .5       .5       10.      7.
2008     0.       60.      +5.      -45.     5.       10.
2009        X-Z VIEW
```

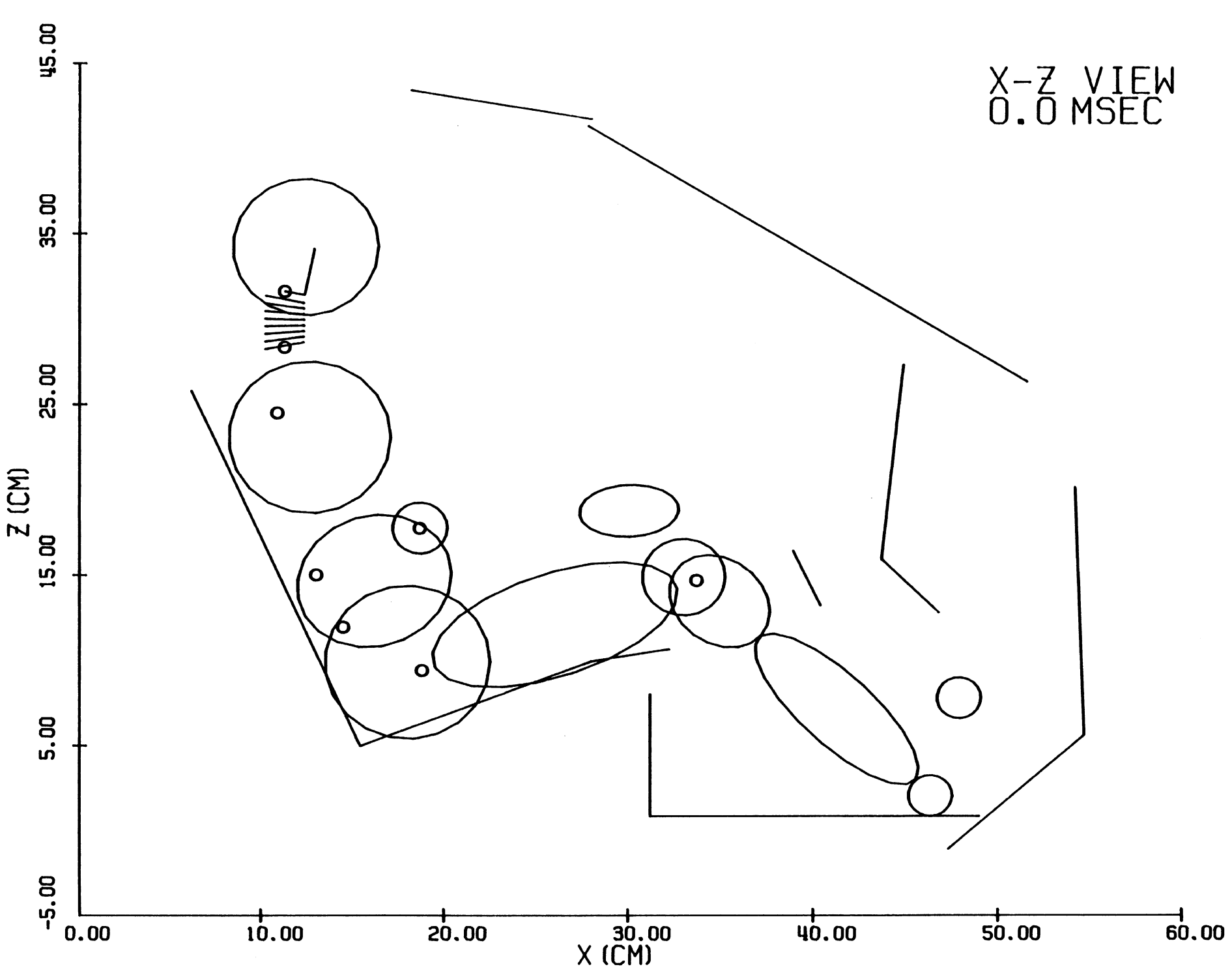

X-Z VIEW
0.0 MSEC
45.00
35.00
25.00
15.00
5.00
-5.00
Z (CM)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
X (CM)

```
BEGIN 2-D OCCUPANT KINEMATICS POST PROCESSOR
BELTS WILL BE DRAWN, IF PRESENT.
PANELS WILL BE DRAWN, IF PRESENT.
JOINTS AND CENTERLINES WILL BE DRAWN, IF PRESENT.
ELLIPSOIDS WILL BE DRAWN, IF PRESENT.
AIRBAG OUTLINES WILL BE DRAWN, IF PRESENT.
```

```
  PLOT START TIME (MSEC)    0.0
  PLOT END TIME (MSEC)     20.0000
  PLOT INTERVAL (MSEC)     20.0000

  PLOTTING PARAMETERS
  PLOT #                     1         2         3


    ORGNRM:        0.0          0.0          0.0
    FORWRD:        1.0000       0.0          0.0
    GAUCHE:        0.0         -1.0000       0.0
       UP:         0.0          0.0         -1.0000
  PLOT X ORIGIN (IN)          0.50      0.0       0.0
  PLOT Z ORIGIN (IN)          0.50      0.0       0.0
  PLOT X LENGTH (IN)         11.00      0.0       0.0
  PLOT Z LENGTH (IN)          8.50      0.0       0.0

  AXIS X ORIGIN (IN)          1.30      0.0       0.0
  AXIS Z ORIGIN (IN)          0.75      0.0       0.0
  AXIS X LENGTH (IN)          8.40      0.0       0.0
  AXIS Z LENGTH (IN)          7.00      0.0       0.0

  VIEWING SYSTEM PARAMETERS
  POS'N ORIGIN X (IN)         0.0       0.0       0.0
  POS'N ORIGIN Z (IN)        -5.00      0.0       0.0
  MAXIMUM X (IN)             60.00      0.0       0.0
  MAXIMUM Z (IN)             50.00      0.0       0.0

  ELLIPSE STEP FACTOR         5.00      0.0       0.0

VIEWING ROTATION MATRIX                  VIEW 1
                          1.0000000  0.0          0.0
                          0.0        1.0000000    0.0
                          0.0        0.0          1.0000000

END OF TIME PLOT NO.     1

END OF TIME PLOT NO.     2

END OF ALL PLOTS, TOTAL NUMBER =     2
```

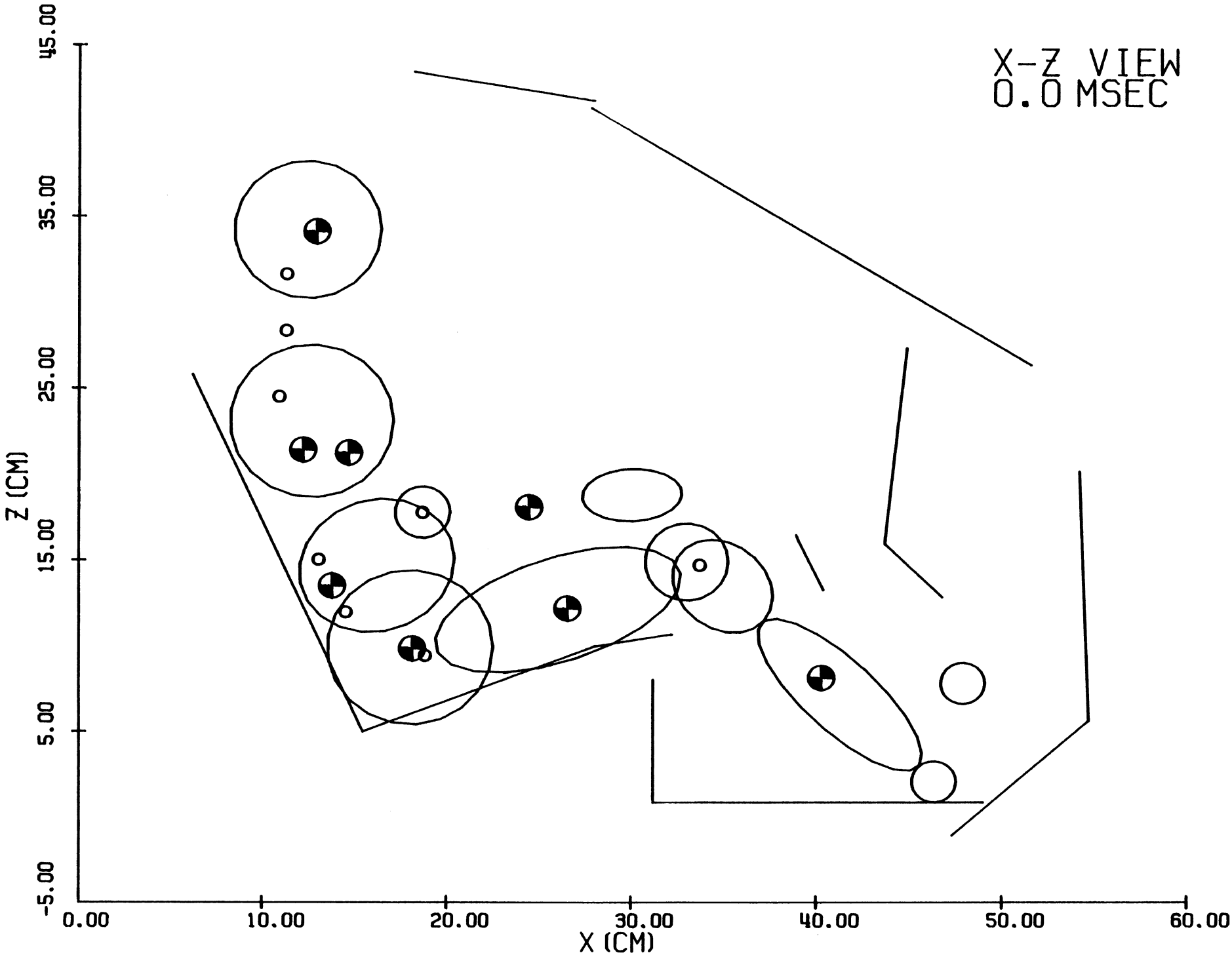
Listing of DATRO3.P at 21:32:42 on JAN 15, 1989 for CCid=SXA3 on UM

```
2000    -1-1 2 1 1   1 1 1 1   1 1 1 1 1 0   0-1 1  -1-1-1   0 0 1
2001    1.       .1125   .1      .08      .1      .05      .15      .07      .045
2002    0.       20.     20.      .10      .15     6.
2003    1.       0.      0.
2004    0.       1.      0.
2005    0.       0.      1.
2006    .5       .5      11.     8.5
2007    .5       .5      10.     7.
2008    0.       60.     +5.     -45.     5.      10.
2009        X-Z VIEW
```

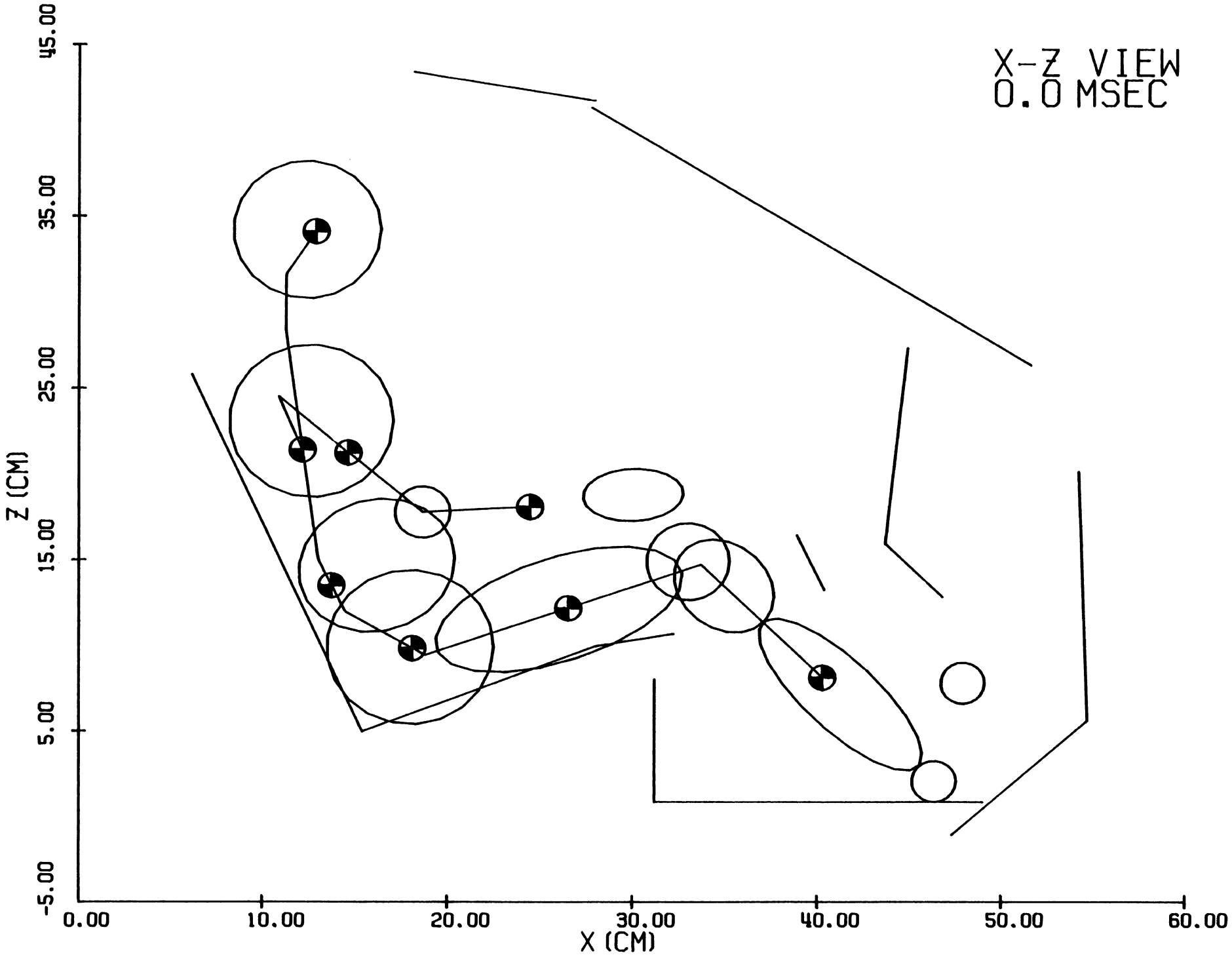

X-Z VIEW
0.0 MSEC
45.00
35.00
25.00
15.00
5.00
-5.00
Z (CM)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
X (CM)

Listing of DATRO4.P at 21:35:17 on JAN 15, 1989 for CCid=SXA3 on UM

```
2000      1-1 2-1-1   1 1 1 1   1 1 1 1 1 0   0-1 1  -1-1-1   0 0 1
2001     1.       .1125    .1       .08      .1       .05      .15      .07      .045
2002     0.       20.      20.      .10      .15      6.
2003     1.       0.       0.
2004     0.       1.       0.
2005     0.       0.       1.
2006     .5       .5       11.      8.5
2007     .5       .5       10.      7.
2008     0.       60.      +5.      -45.     5.       10.
2009        X-Z VIEW
```

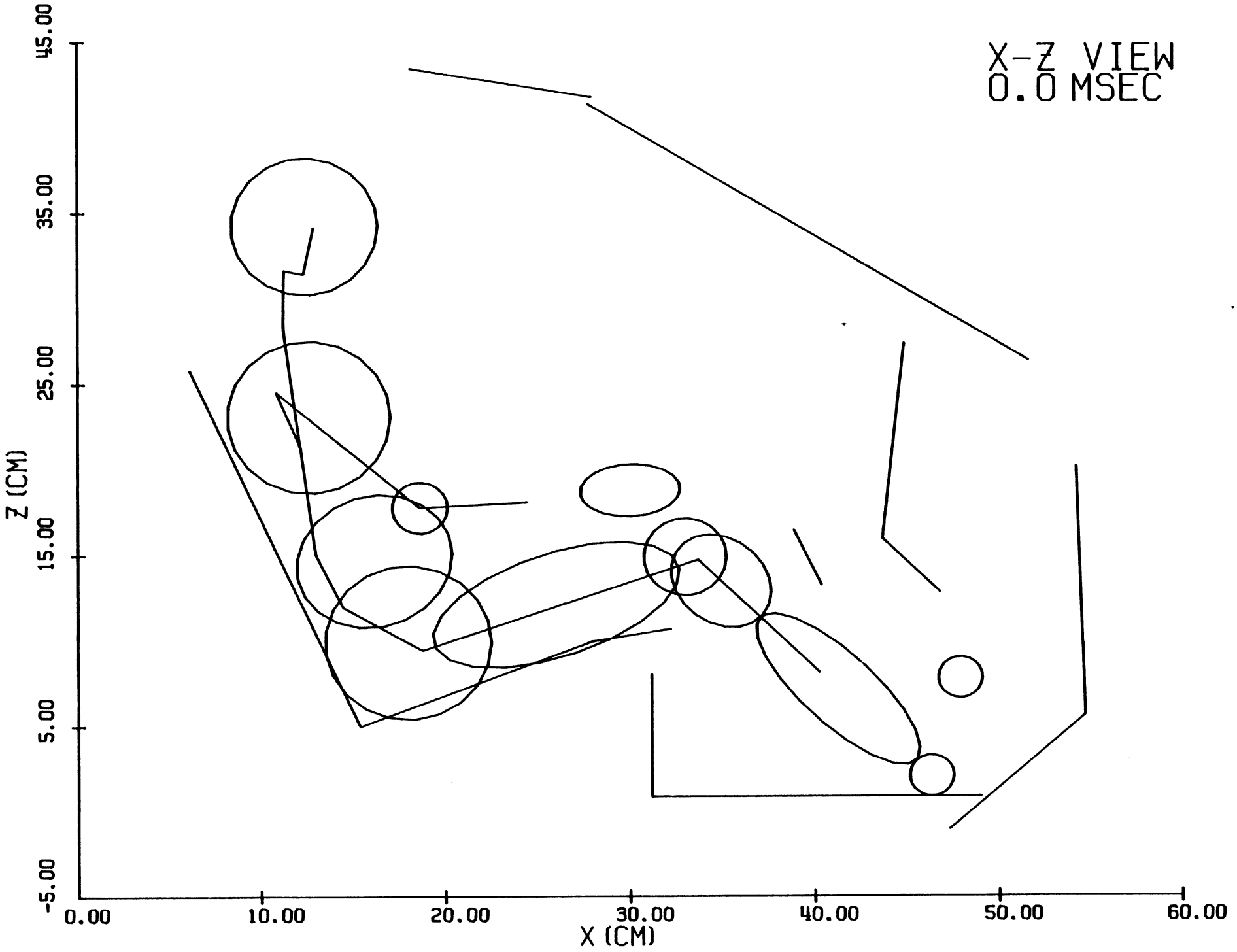

X-Z VIEW
0.0 MSEC
45.00
35.00
25.00
15.00
5.00
-5.00
Z (CM)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
X (CM)

```
2000      1 1-1-1-1   1 1 1 1   1 1 1 1 1 0   0-1 1  -1-1-1   0 0 1
2001     1.       .1125    .1       .08      .1       .05      .15      .07      .045
2002     0.       20.      20.      .10      .15      6.
2003     1.       0.       0.
2004     0.       1.       0.
2005     0.       0.       1.
2006     .5       .5       11.      8.5
2007     .5       .5       10.      7.
2008     0.       60.      +5.      -45.     5.       10.
2009        X-Z VIEW
```


X-Z VIEW
0.0 MSEC
45.00
35.00
25.00
15.00
5.00
-5.00
Z (CM)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
X (CM)

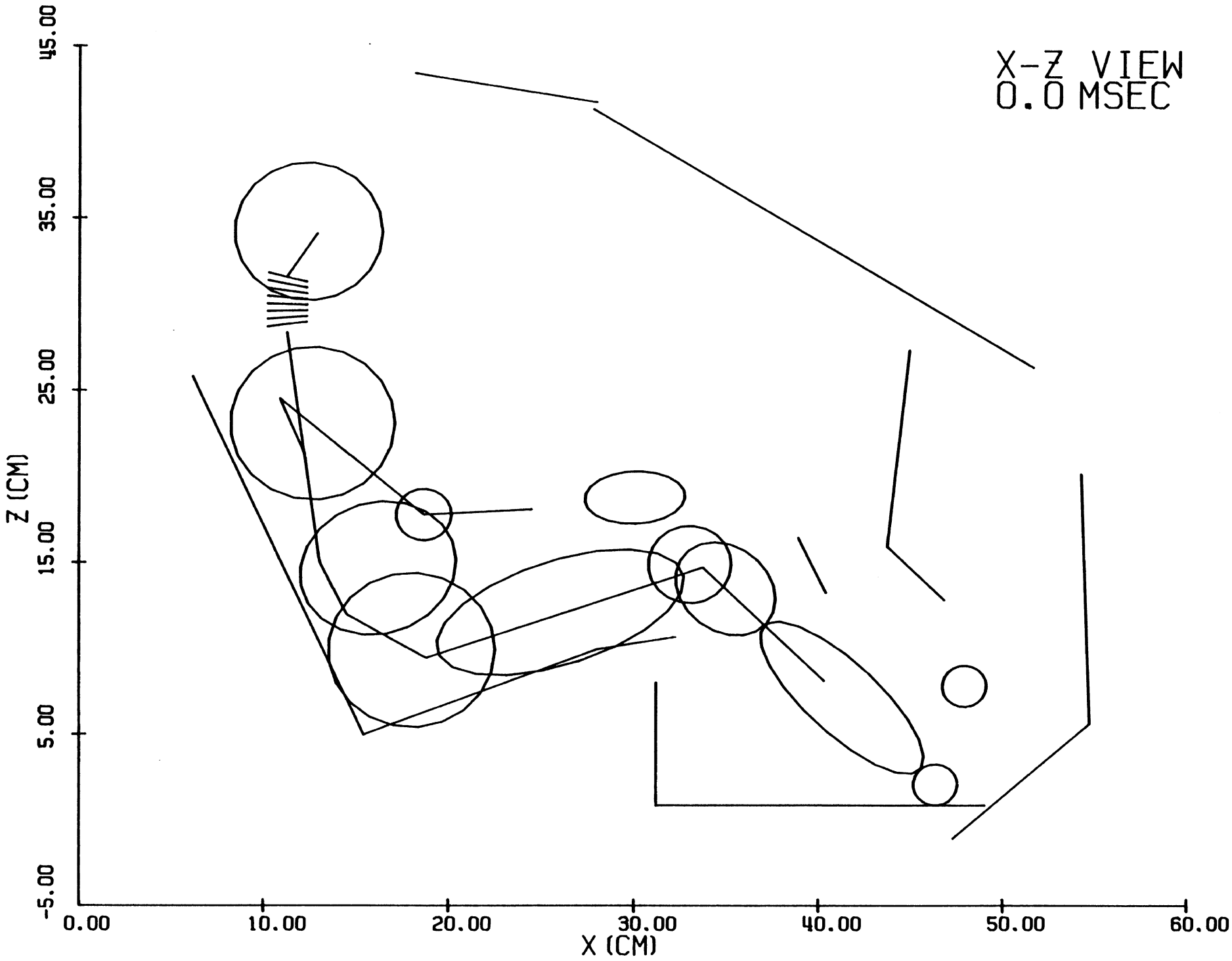
Listing of DATRO6.P at 21:44:15 on JAN 15, 1989 for CCid=SXA3 on UM

```
2000    -1 1-1-1 1   1 1 1 1   1 1 1 1 1 0   0-1 1  -1-1-1   0 0 1
2001    1.       .1125   .1      .08      .1      .05      .15      .07      .045
2002    0.       20.     20.     .10      .15     6.
2003    1.       0.      0.
2004    0.       1.      0.
2005    0.       0.      1.
2006    .5       .5      11.     8.5
2007    .5       .5      10.     7.
2008    0.       60.     +5.     -45.     5.      10.
2009        X-Z VIEW
```


X-Z VIEW
0.0 MSEC
45.00
35.00
25.00
15.00
5.00
-5.00
Z (CM)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
X (CM)

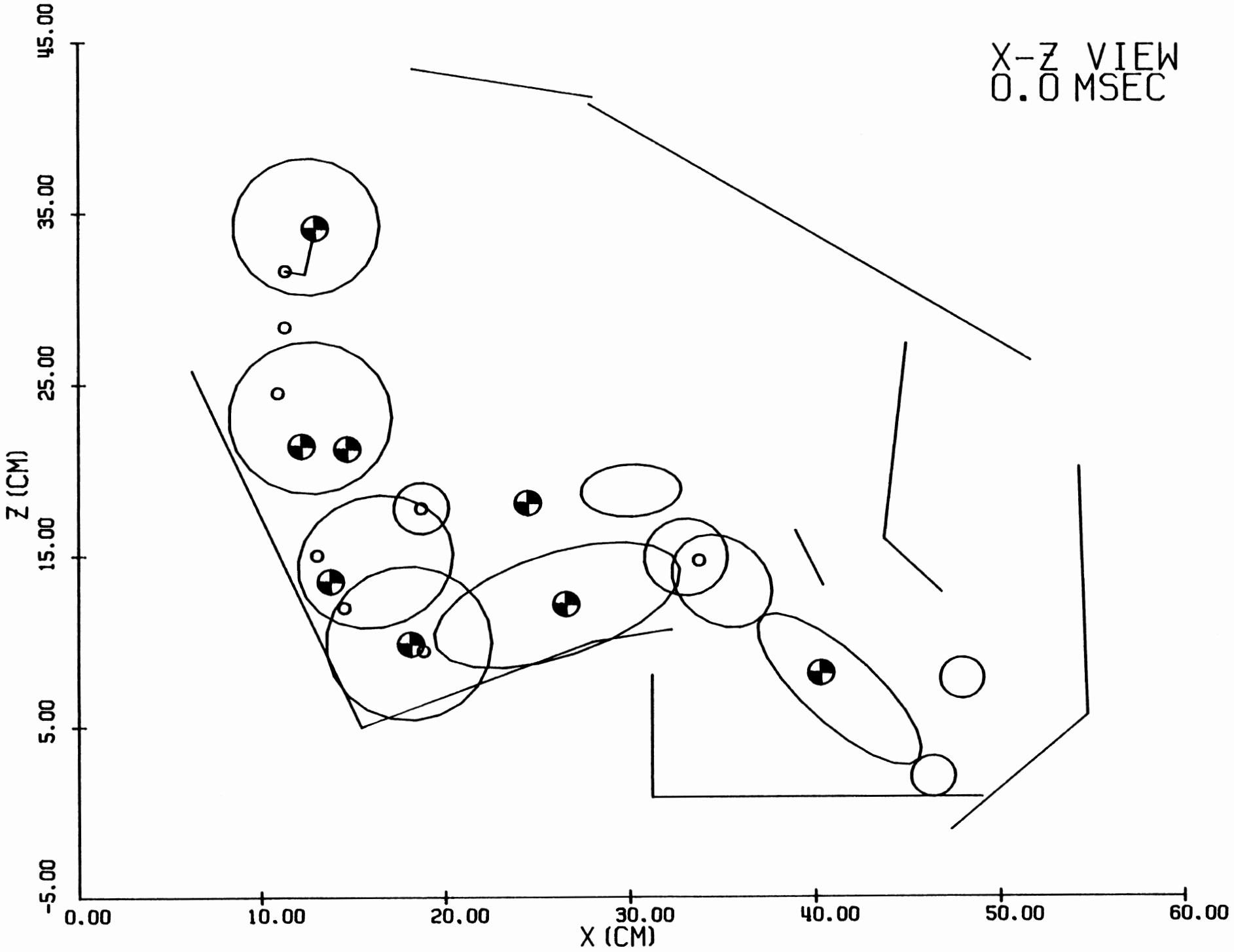
Listing of DATRO7.P at 21:46:09 on JAN 15, 1989 for CCid=SXA3 on UM

```
2000    -1 1-1 1-1   1 1 1 1   1 1 1 1 1 0   0-1 1  -1-1-1   0 0 1
2001    1.       .1125    .1       .08      .1       .05      .15      .07      .015
2002    0.       20.      20.      .10      .15      6.
2003    1.       0.       0.
2004    0.       1.       0.
2005    0.       0.       1.
2006    .5       .5       11.      8.5
2007    .5       .5       10.      7.
2008    0.       60.      +5.      -45.     5.       10.
2009        X-Z VIEW
```


X-Z VIEW
0.0 MSEC
45.00
35.00
25.00
15.00
5.00
-5.00
Z (CM)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
X (CM)

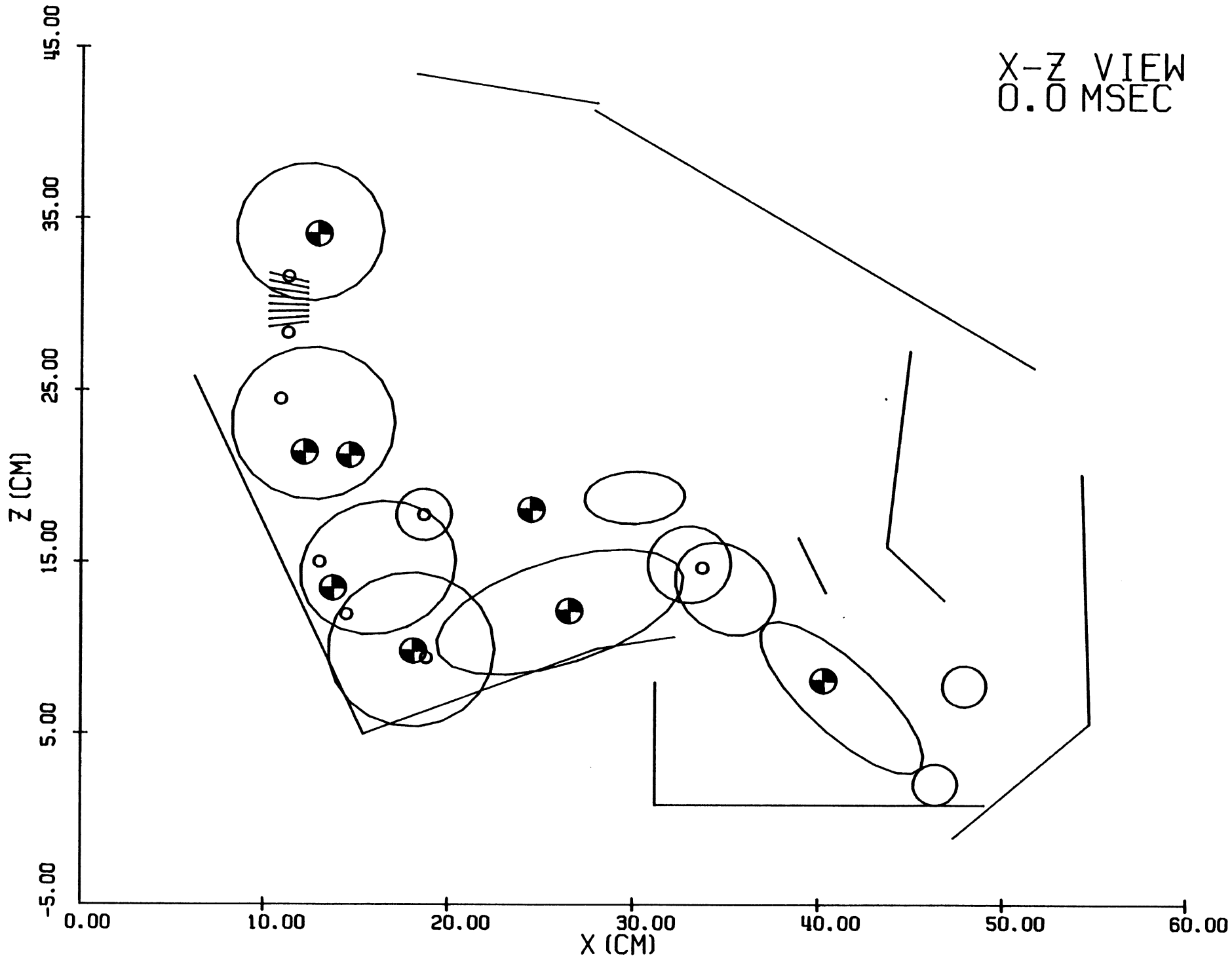
Listing of DATR08.P at 21:48:17 on JAN 15, 1989 for CCid=SXA3 on UM

```
2000      1-1 2-1 1   1 1 1 1   1 1 1 1 1 0   0-1 1  -1-1-1   0 0 1
2001     1.       .1125    .1       .08      .1       .05      .15      .07      .045
2002     0.       20.      20.      .10      .15      6.
2003     1.       0.       0.
2004     0.       1.       0.
2005     0.       0.       1.
2006     .5       .5       11.      8.5
2007     .5       .5       10.      7.
2008     0.       60.      +5.      -45.     5.       10.
2009        X-Z VIEW
```


X-Z VIEW
0.0 MSEC
45.00
35.00
25.00
15.00
5.00
-5.00
Z (CM)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
X (CM)

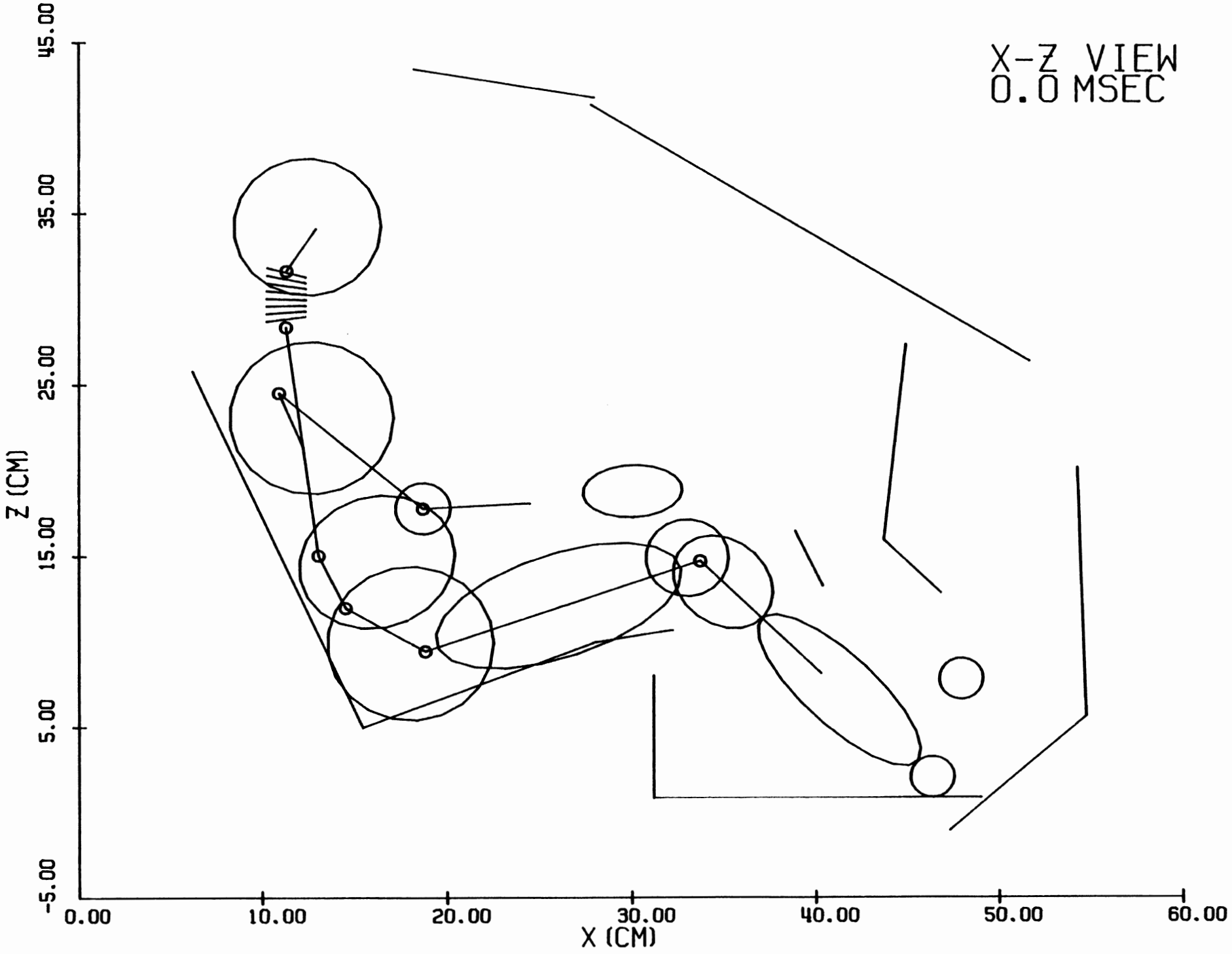
Listing of DATRO9.P at 21:50:08 on JAN 15, 1989 for CCid=SXA3 on UM

```
2000      1-1 2 1-1   1 1 1 1   1 1 1 1 1 0   0-1 1  -1-1-1   0 0 1
2001     1.       .1125   .1       .08      .1       .05      .15      .07      .045
2002     0.       20.     20.      .10      .15      6.
2003     1.       0.      0.
2004     0.       1.      0.
2005     0.       0.      1.
2006     .5       .5      11.      8.5
2007     .5       .5      10.      7.
2008     0.       60.     +5.      -45.     5.       10.
2009        X-Z VIEW
```


X-Z VIEW
0.0 MSEC
45.00
35.00
25.00
15.00
5.00
-5.00
Z (CM)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
X (CM)

Listing of DATR10.P at 21:51:56 on JAN 15, 1989 for CCid=SXA3 on UM

```
2000    -1 1 2 1-1   1 1 1 1   1 1 1 1 1 0   0-1 1  -1-1-1   0 0 1
2001    1.      .1125    .1      .08     .1      .05     .15     .07     .045
2002    0.      20.      20.     .10     .15     6.
2003    1.      0.       0.
2004    0.      1.       0.
2005    0.      0.       1.
2006    .5      .5       11.     8.5
2007    .5      .5       10.     7.
2008    0.      60.      45.     -45.    5.      10.
2009        X-Z VIEW
```


X-Z VIEW
0.0 MSEC
45.00
35.00
25.00
15.00
5.00
-5.00
Z (CM)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
X (CM)

6.0 References

1. Bowman, B. M., and Bennett, R. O., MVMA Two-Dimensional Crash Victim Simulation, Version 6. UMTRI-88-23,1,2,3. 3 vol., 980 p. University of Michigan Transportation Research Institute, June 1988.

2. Fleck, J. T., Butler, F. E., and Vogel, S. L., An Improved Three-Dimensional Computer Simulation of Vehicle Crash Victims. Report No. DOT HS-801 507,508,509,510. Calspan Corporation, April 1975.

Appendix A. PLOTCS HOLD FILE RECORD LAYOUTS

Three-dimensional data is stored in the PLOTCS Hold File in appropriate character representation (ASCII/EBCDIC/ etc) using the formats described in this Appendix. This hold file contains a complete description of the three-dimensional configuration at a number of specified discrete time points within the time interval of interest.

This hold file is organized into two parts: the specification of those quantities which do not change as a function of time (this part occurs first), and the specification at each recorded time for those quantities which do change as a function of time. This Appendix is organized in the same manner.

The specification of all these quantities is organized in terms of a number of coordinate systems called "general segment systems." The conventions for presenting these coordinate systems to the PLOTCS program are presented in Table A-1.

Table A-1. Coordinate System Ordering Required

1 to NSEG		User-specified Systems
NSEG + 1 to NVEH		Vehicle Systems (of which the last is the principal vehicle)
NVEH + 1 to NVEH + NBAG		Airbag Systems
NGRD = NVEH + NBAG + 1		Inertial System

Note: Each of the variable names used in Table A-1 and A-2 are defined in Table A-4.

PLOTCS recognizes ellipsoids used to represent several different physical elements in the three-dimensional configuration. Table A-2 presents the ordering conventions for groups of the various kinds of ellipsoids.

Table A-2. Ellipsoid Ordering Required

1	to	IPANPT	Fixed axis length ellipsoids controlled by inputted switch "IELL".
IPANPT + 1	to	IELBAG	Fixed axis length ellipsoids controlled by inputted switch "IABP".
IELBAG + 1	to	NELP	Ellipsoids with axis length as a function of time and controlled by inputted switch "IBAG".

where IELBAG = IPANPT + NOABPN and/or = NELP - NBAG

Table A-4 makes use of several record numbering conventions. Certain variable names occur in record number expressions. The meanings of these variable names are presented in Table A-3. This Appendix organizes the layout specifications in terms of groups of records called "sections". Each section is replicated as necessary for the complete description of the three-dimensional configuration and is limited as stated within the section.

Table A-3. Variable Names Used in Record Number Expressions

Symbol	Description
k	Record number of the last record of the last replication of the last section previous to the current section.
m	Current count index for the current section whose limits are defined at the beginning and end of the description of the current section.
J	Number of replications for the current section.

Note: Each of these variables take on appropriate values for each different section. Square brackets in an expression indicate integer arithmetic is used.

Table A-4. Layout of PLOTCS Hold File (1 of 19)

PART 1: TIME INVARIANT RECORD LAYOUTS (1 of 12)

RECORD 1 -- Controls and Counts (1 of 2)

Columns	Item and Description
01-08	Record File Identifier: "1PLOTCS "
09-14	NOABPN: Number of airbag panel ellipsoids
15-20	IPANPT: Base index of airbag panel ellipsoids among all ellipsoids
21-26	NSEG: Total no. of user-specified coordinate systems (min 0; max 98)
27-32	NJNT: Total no. of joints (connections between segments by relating a fixed point w.r.t. one system to a fixed point w.r.t. the other system) (min 0; max 97)
33-38	NBLT: Total no. of belts (min 0; max 18)
39-44	NRING: Total no. of rings (min 0; max 2)
45-50	NBAG: Total no. of ellisoidal airbag outlines (variable-sized ellipsoids) (min 0; max 98)

Table A-4. Layout of PLOTCS Hold File (2 of 19)

PART 1: TIME INVARIANT RECORD LAYOUTS (2 of 12)

RECORD 1 -- Controls and Counts (2 of 2)

Columns	Item and Description	
52-56	NPL:	Total no. of parallelogram-shaped planar surfaces (min 0; max 100)
57-62	NELP:	Total no. of ellipsoids (min 0; max 100) (includes regular ellipsoids, additional ellipsoids, airbag panel ellipsoids, and ellipsoidal airbag outlines)
63-68	NGRD, or MAXSEG:	Number of general segment coordinate systems and also the number of the model run inertial coordinate system. (min 2; max 100)
69-74	NVEH:	Number of the principal vehicle coordinate system. (min 1; max 99)
75-80	MODSGP:	Number of groups of special points to be connected with lines (0-50, see note in Special Points Section of Part 2).

RECORD 2 -- Title Record 1

Columns	Description
01-08	Record Identifier: " TITLE "
09-80	HTITLE(1-18), Model Run Title

Table A-4. Layout of PLOTCS Hold File (3 of 19)

PART 1: TIME INVARIANT RECORD LAYOUTS (3 of 12)

RECORD 3 -- Title Record 2

Columns	Description
01-12	Record Identifier: " SUBTITLE "
13-80	STITLE(1-17), Model Run Subtitle, Part 1

RECORD 4 -- Title Record 3

Columns	Description
01-08	Blanks
05-80	STITLE(18-35), Model Run Subtitle, Part 2

RECORD 5 -- Title Record 4

Columns	Description
01-16	Record Identifier: " DATE,TIME, JOB "
17-28	DATE(1-3), Model Run Date
29-40	Blanks
41-48	TIMDAY(1-2), Model Run Time of Day
49-60	Blanks
61-68	NAMJOB(1-2), Model Run Job Name or Account
61-80	Blanks

Table A-4. Layout of PLOTCS Hold File (4 of 19)

PART 1: TIME INVARIANT RECORD LAYOUTS (4 of 12)

BELT SECTION OF RECORDS (1 of 2):
(The following section of three records occurs exactly J = NBLT times; it is absent if J = 0.)

RECORD 3*m+3 -- Belt Title Typical Record

Columns	Description
01-06	Record Identifier, " BELT "
07-11	Belt Number (m)
12-12	Blank
13-32	BLTTTL(1-5,m), Belt Title
33-40	KBLT(1,m), Belt Drawing Control Switch: 0 draw 2 lines: AA to TA and AB to TB. 1 draw 1 line: AA to TA. 2 draw 2 lines: AA to AB and TA to TB. 3 draw 2 lines: TA to TB and TB to AA. 4 draw 1 line: TA to TB. 5 draw 1 line: AA to AB. 6 draw 1 line: TA to AA.
41-48	KBLT(2,m), Point AA attachment system number.
49-56	KBLT(3,m), Point AB attachment system number.
57-64	KBLT(4,m), Point TA attachment system number.
65-72	KBLT(5,m), Point TB attachment system number.
73-80	KBLT(6,m), Symbol control switch: A:B A is KBLT(1,m) setting; B is KBLT(6,m) setting. 0:0 AA & AB are anchors; TA & TB are attach. 1:0 AA is anchor and TA is attach; 1:1 AA is anchor and TA is none. 2:0 AA is anchor, AB & TB are attach, TA is none. 3:0 AA is anchor, TA is attach, TB is none. 4:0 TA is none and TB is attach; 4:1 TA is attach and TB is none. 5:0 AA is anchor and AB is attach; 5:1 AA & AB are attach; 5:2 AA is attach and AB is anchor; 5:3 AA & AB are none; 5:4 AA is anchor and AB is none. 6:0 AA is attach and TA is none.

Table A-4. Layout of PLOTCS Hold File (5 of 19)

PART 1: TIME INVARIANT RECORD LAYOUTS (5 of 12)

BELT SECTION OF RECORDS (2 of 2):

RECORD 3*m+4 -- Belt Endpoint AA Relative Position

Columns	Description	
01-12	Blanks	
13-29	BBELT(1,m)	(X,Y,Z) of Endpoint AA which is fixed w.r.t. system no. KBLT(2,m)
30-46	BBELT(2,m)	
47-63	BBELT(3,m)	

RECORD 3*m+5 -- Belt Endpoint AB Relative Position

Columns	Description	
01-12	Blanks	
13-29	BBELT(4,m)	(X, Y, Z) of Endpoint AB which is fixed w.r.t. system no. KBLT(3,m)
30-46	BBELT(5,m)	
47-63	BBELT(6,m)	

for m = 1, NBLT

Table A-4. Layout of PLOTCS Hold File (6 of 19)

PART 1: TIME INVARIANT RECORD LAYOUTS (6 of 12)

PARALLELOGRAM SECTION OF RECORDS:
(This section of one record occurs exactly
J = [NPL + 2] / 3 times.)

RECORD k+m -- Parallelogram Plane Title Typical Record

Columns	Description	
01 to 07	Record Identifier: " PLANES"	
08 to 11	Number of first plane for record (b=3*m-2)	
12 to 12	Blank	
13 to 32	PLTTL(1-5,b),	Title for bth parallelogram planar surface
33 to 35	Number of second plane for record (b+1)	
36 to 36	Blank	
37 to 56	PLTTL(1-5,b+1),	Title for (b+1)st parallelogram planar surface
57 to 59	Number of third plane for record (b+2)	
60 to 60	Blank	
61 to 80	PLTTL(1-5,b+2),	Title for (b+2)nd parallelogram planar surface

where m = 1, J

Table A-4. Layout of PLOTCS Hold File (7 of 19)

PART 1: TIME INVARIANT RECORD LAYOUTS (7 of 12)

BAG SECTION OF RECORDS:
(This section is exactly similar to the parallelogram section above.)

(This section of one record occurs exactly J = [NBAG + 2] / 3 times.)

RECORD k+m -- Airbag Plane Title Typical Record

Columns	Description
01 to 07	Record Identifier:" AIRBAG"
08 to 11	Number of first airbag for record (b=3*m-2)
12 to 12	Blank
13 to 32	BAGTTL(1-5,b), Title for bth airbag
33 to 35	Number of second airbag for record (b+1)
36 to 36	Blank
37 to 56	BAGTTL(1-5,b+1), Title for (b+1)st airbag
57 to 59	Number of third airbag for record (b+2)
60 to 60	Blank
61 to 80	BAGTTL(1-5,b+2), Title for (b+2)nd airbag

where m = 1 to J

Table A-4. Layout of PLOTCS Hold File (8 of 19)

PART 1: TIME INVARIANT RECORD LAYOUTS (8 of 12)

GENERAL SEGMENT COORDINATE SYSTEM SECTION OF RECORDS:
(This section of one record occurs exactly
J = [NGRD+1] / 2 times.)

RECORD k+m -- Coordinate System Designation Typical Record

Columns	Description
01 to 05	Record Identifier: " GSEG"
06 to 09	Number of first segment system for record (b=2*m-1)
10 to 10	Blank
11 to 11	CGS(b), 1 character plot symbol for system
12 to 13	Blanks
14 to 17	SEG(b), 4 character abbreviation for segment system
18 to 20	Blanks
21 to 40	SEGTTL(1-5,b), 20 character title for segment system
41 to 46	Blanks
47 to 49	Number of second segment system for record (b+1)
50 to 50	Blank
51 to 51	CGS(b+1), 1 character plot symbol for system
52 to 53	Blanks
54 to 57	SEG(b+1), 4 character abbrev. for segment system
58 to 60	Blanks
61 to 80	SEGTTL(1-5,b+1), 20 character title for segment system

where m = 1, J

Table A-4. Layout of PLOTCS Hold File (9 of 19)

PART 1: TIME INVARIANT RECORD LAYOUTS (9 of 12)

ELLIPSOIDAL SECTION OF RECORDS (1 of 2):
(This section of four records occurs exactly J=NELP times.)

RECORD k+4*m-3 -- Ellipsoid Orientation Matrix (First Row)

Columns	Description
01 to 04	Record Identifier, " ELL"
05 to 08	Ellipsoid Number
09 to 09	Blanks
10 to 29	ELLNAM(1-5,m), Ellipsoid Name
30 to 46	DELP(1,1,m) | Orientation Direction
47 to 63	DELP(1,2,m) | Cosine Matrix, First Row
64 to 80	DELP(1,3,m) | w.r.t. Inertial System

RECORD k+4*m-2 -- Ellipsoid Orientation Matrix (Second Row)

Columns	Description
01 to 04	Blanks
05 to 08	IELSEG(m), Coordinate System Number to which Ellipsoid is attached
13 to 29	BD(1,m), Semiaxis Length Along Ellipsoid x-Axis
30 to 46	DELP(2,1,m) | Orientation Direction
47 to 63	DELP(2,2,m) | Cosine Matrix, Second Row
64 to 80	DELP(2,3,m) | w.r.t. Inertial System

Table A-4. Layout of PLOTCS Hold File (10 of 19)

PART 1: TIME INVARIANT RECORD LAYOUTS (10 of 12)

ELLIPSOIDAL SECTION OF RECORDS (2 of 2):

RECORD k+4*m-1 -- Ellipsoid Orientation Matrix (Third Row)

Columns	Description	
01 to 12	Blanks	
13 to 29	BD(2,m), Semiaxis Length Along Ellipsoid y-Axis	
30 to 46	DELP(3,1,m)	Orientation Direction Cosine Matrix, Third Row w.r.t. Inertial System
47 to 63	DELP(3,2,m)	
64 to 80	DELP(3,3,m)	

RECORD k+4*m -- Ellipsoid Attachment Position

Columns	Description	
01 to 12	Blanks	
13 to 29	BD(3,m), Semiaxis length along ellipsoid z-axis	
30 to 46	SOFT(1,m)	(X, Y, Z) of Ellipsoid Center w.r.t. Coordinate system IELSEG(m)
47 to 63	SOFT(2,m)	
64 to 80	SOFT(3,m)	

for m = 1 to NELP

Table A-4. Layout of PLOTCS Hold File (11 of 19)

PART 1: TIME INVARIANT RECORD LAYOUTS (11 of 12)

JOINT SECTION OF RECORDS (1 of 2):
(This section of two records occurs exactly NJNT times.)

RECORD k+2*m-1 -- Joint Identification and Connected Segments

Columns	Description
01 to 07	Record Identifier, " JOINTS"
08 to 12	Joint Number
13 to 13	Blank
14 to 17	JOINT(m), Joint Name (4 characters)
18 to 18	Blank
19 to 19	JS(m), Joint Plot Symbol (1 character)
20 to 24	JTOFRO(1,m), Segment Number to which Joint connects (n1)
25 to 29	JTOFRO(2,m), Segment Number from which Joint connects (n2)
30 to 46	POSJNT(1,1,m) |
47 to 63	POSJNT(2,1,m) | (X, Y, Z) of joint point specified w.r.t. coordinate system n1
64 to 80	POSJNT(3,1,m) |

Note: INECK is specified to be the Joint Number from columns 08 through 12 for the neck joint.

Table A-4. Layout of PLOTCS Hold File (12 of 19)

PART 1: TIME INVARIANT RECORD LAYOUTS (12 of 12)

JOINT SECTION OF RECORDS (2 of 2):

RECORD k+2*m -- Joint Position

Columns	Description	
01 to 29	Blanks	
30 to 46	POSJNT(1,2,m)	(X, Y, Z) of joint point specified w.r.t. coordinate system n2
47 to 63	POSJNT(2,2,m)	
64 to 80	POSJNT(3,2,m)	

for m = 1 to NJNT

Note: If either/both system's joint point is not coincident with that system's origin and/or the two system's joint points are not coincident, then a line is drawn between them. Each joint will produce 0, 1, 2, or 3 lines.

Table A-4. Layout of PLOTCS Hold File (13 of 19)

PART 2: TIME VARIANT RECORD LAYOUTS FOR TYPICAL TIME (1 of 7)

Note: (All the applicable records occurring in Part 1 are written in the hold file followed by all the applicable records occurring in this part for each time point that is to be recorded in ascending order of time.)

RECORD k+1 -- Specification of Time for This Set of Time Variant Record

Columns	Description
01 to 10	Record Identifier, "0FOR TIME="
11 to 27	Model simulated time at which the following values were effective.

COORDINATE SYSTEM SECTION OF RECORDS:
(This section of four records occurs exactly J=NGRD times. k for this section of records is the same as it was for the first (previous) record for this set of time variant records.)

RECORD k+4*m-2 -- Coordinate System Origin Position

Columns	Description	
01 to 05	Record Identifier, " SEG "	
06 to 10	Coordinate System Number	
11 to 27	SEGLP(1,m)	(X, Y, Z) of coordinate system origin w.r.t. Inertial System
28 to 44	SEGLP(2,m)	
45 to 61	SEGLP(3,m)	

Table A-4. Layout of PLOTCS Hold File (14 of 19)

PART 2: TIME VARIANT RECORD LAYOUTS FOR TYPICAL TIME (2 of 7)

(One set of these cards is needed for each recorded time.)

RECORD k+4*m-1 -- Coordinate System Orientation Matrix Row 1

Columns	Description	
01 to 10	Blanks	
11 to 27	D(1,1,m)	Coordinate System Direction Cosine Orientation Matrix, Row 1 w.r.t. Inertial System
28 to 44	D(1,2,m)	
45 to 61	D(1,3,m)	

RECORD k+4*m -- Coordinate System Orientation Matrix Row 2

Columns	Description	
01 to 10	Blanks	
11 to 27	D(2,1,m)	Coordinate System Direction Cosine Orientation Matrix, Row 2 w.r.t. Inertial System
28 to 44	D(2,2,m)	
45 to 61	D(2,3,m)	

RECORD k+4*m+1 -- Coordinate System Orientation Matrix Row 3

Columns	Description	
01 to 10	Blanks	
11 to 27	D(3,1,m)	Coordinate System Direction Cosine Orientation Matrix, Row 3 w.r.t. Inertial System
28 to 44	D(3,2,m)	
45 to 61	D(3,3,m)	

Table A-4. Layout of PLOTCS Hold File (15 of 19)

PART 2: TIME VARIANT RECORD LAYOUTS FOR TYPICAL TIME (3 of 7)

(One set of these cards is needed for each recorded time.)

PLANAR PARALLELOGRAM SECTION OF RECORDS (1 of 2):
(This section of three records occurs exactly J=NPL times.)

RECORD k+3m-2 -- Corner Point X-Coordinates

Columns	Description
01 to 03	Record Identifier, " PL"
04 to 08	Parallelogram Number (m)
09 to 12	Blanks
13 to 29	PPLTS(1,1,m), Corner Point 1 X-coordinate (w.r.t. inertial system)
30 to 46	PPLTS(2,1,m), Corner Point 2 (Clockwise Adjacent to Corner 1) X-coordinate (w.r.t. inertial system)
47 to 63	PPLTS(3,1,m), Corner Point 3 (Clockwise Adjacent to Corner 2) X-coordinate (w.r.t. inertial system)
64 to 80	PPLTS(4,1,m), Corner Point 4 (Clockwise Adjacent to Corner 3) X-coordinate (w.r.t. inertial system)

RECORD k+3m-1 -- Corner Point Y-Coordinates

Columns	Description
01 to 12	Blanks
13 to 29	PPLTS(1,2,m), Corner Point 1 Y-coordinate
30 to 46	PPLTS(2,2,m), Corner Point 2 Y-coordinate
47 to 63	PPLTS(3,2,m), Corner Point 3 Y-coordinate
64 to 80	PPLTS(4,2,m), Corner Point 4 Y-coordinate

Table A-4. Layout of PLOTCS Hold File (16 of 19)

PART 2: TIME VARIANT RECORD LAYOUTS FOR TYPICAL TIME (4 of 7)

PLANAR PARALLELOGRAM SECTION OF RECORDS (2 of 2):

RECORD k+3m -- Corner Point Z-Coordinates

Columns	Description
01 to 12	Blanks
13 to 29	PPLTS(1,3,m), Corner Point 1 Z-coordinate
30 to 46	PPLTS(2,3,m), Corner Point 2 Z-coordinate
47 to 63	PPLTS(3,3,m), Corner Point 3 Z-coordinate
64 to 80	PPLTS(4,3,m), Corner Point 4 Z-coordinate

for m = 1, to NPL

RING SECTION OF RECORDS:
(This section of one record occurs exactly J=NRING times.)

RECORD k+m -- Ring Position

Columns	Description
01 to 06	Record Identifier, " RING "
07 to 12	Ring number (m)
13 to 20	Blanks
21 to 40	XRING(m) | (X, Y, Z) of Ring m w.r.t. Vehicle System
41 to 60	YRING(m) |
61 to 80	ZRING(m) |

for m = 1 to NRING

Table A-4. Layout of PLOTCS Hold File (17 of 19)

PART 2: TIME VARIANT RECORD LAYOUTS FOR TYPICAL TIME (5 of 7)

(One set of these cards is needed for each recorded time.)

BELT SECTION OF RECORDS:
(This section of two records occurs exactly J=NBLT times.)

RECORD k+2*m-1 -- Time Variant Belt Endpoint TA Position

Columns	Description	
01 to 04	Record Identifier, " BLT"	
05 to 09	Belt Number (m)	
10 to 20	Blanks	
21 to 40	TTPTS(1,m)	(X, Y, Z) of Endpoint TA
41 to 60	TTPTS(2,m)	fixed w.r.t. KBLT(4,m) system
61 to 80	TTPTS(3,m)	

RECORD k+2*m -- Time Variant Belt Endpoint B Position

Columns	Description	
01 to 20	Blanks	
21 to 40	TTPTS(4,m)	(X, Y, Z) of Endpoint TB
41 to 60	TTPTS(5,m)	fixed w.r.t. KBLT(5,m) system
61 to 80	TTPTS(6,m)	

Table A-4. Layout of PLOTCS Hold File (18 of 19)

PART 2: TIME VARIANT RECORD LAYOUTS FOR TYPICAL TIME (6 of 7)

(One set of these cards is needed for each recorded time.)

AIRBAG SECTION OF RECORDS:
(This section occurs only if NBAG > 0 and consists of exactly J=NBAG records.)

RECORD k+m -- Time Variant Airbag Outline Ellipsoid Semiaxes

Columns	Description
01 to 04	Record Identifier, " BAG"
05 to 09	Airbag Number (m)
10 to 20	Blanks
21 to 40	BD(1,m), Airbag Outline Semiaxis in Airbag X-direction
41 to 60	BD(2,m), Airbag Outline Semiaxis in Airbag Y-direction
61 to 80	BD(3,m), Airbag Outline Semiaxis in Airbag Z-direction

for m = 1 to NBAG

Table A-4. Layout of PLOTCS Hold File (19 of 19)

PART 2: TIME VARIANT RECORD LAYOUTS FOR TYPICAL TIME (7 of 7)

(One set of these cards is needed for each recorded time.)

SPECIAL POINTS SECTION OF RECORDS:
(This section occurs only if MODSPG > 0 and consists of one card with MODSPG fields followed by one record for each special point specified on the first card.)

RECORD k+1 -- Group Layout Card for Special Points

Columns	Description
01 to 08	Record Identifier, "0GROUPS ".
6j+3 to 6j+8	NSPTGP(j), Number of points in group j (>=0).

for j = 1, MODSPG

RECORD k+m+1 -- Time Variant Special Points to Connect in Groups
(There are exactly MODSPP of these cards where MODSPP is the sum of NSPTGP(j),j=1,MODSPG.)

Columns	Description
01 to 08	Record Identifier, " SPC PTS".
09 to 12	j, Group number (1 to MODSPG).
13 to 16	Point number (1 to NSPTGP(j)).
17 to 20	General segment attachment number (1 to NGRD).
21 to 40	X-coordinate of current special point.
41 to 60	Y-coordinate of current special point.
61 to 80	Z-coordinate of current special point.

for m = 1, MODSPP

Note: Groups of special points can be specified here and also in the control card input. The total of all groups from both sources (INPSGP+MODSGP) cannot exceed 50, and the total of all points in all these groups (INPSPP+MODSPP) cannot exceed 400.

Appendix B. Dependence of PLOTCS on the Standard CALCOMP Plot System Subroutines

This Appendix deals with the use of hardware/system-dependent plot routines within the PLOTCS program. The usage of such routines is organized in two levels. The first level is identified as the PLOTCS Plot Interface. Routines at this level call routines at the second level, namely, the Standard CALCOMP Plot System Subroutines (which on MTS at the University of Michigan are also an interface to the local plotting system). The purpose of this appendix is to describe both the routines of the PLOTCS Plot Interface and those of the Standard CALCOMP Plot System Subroutines which are used by the PLOTCS Plot Interface.

Installation of PLOTCS on a system which makes use of a non-CALCOMP plotting package will generally be accomplished by changing the routines of the PLOTCS Plot Interface to call the routines of the local plotting system. The information in this Appendix should expedite these necessary changes in the PLOTCS Plot Interface.

The PLOTCS Plot Interface consists of eight subroutines, each with one or two plotting functions. Three of these routines are accomplished in terms of other routines of the PLOTCS Plot Interface. They are included here in case it is easier for the installer to call some of his own more advanced routines directly. Tables B-1 through B-8 describe each of the eight subroutines and detail their use within PLOTCS. Tables B-9 through B-12 present descriptions of the four Standard CALCOMP Subroutines needed by the PLOTCS Plot Interface as found in MTS Volume 11 for the Michigan Terminal System.

Table B-1. Subroutine VPLOT

Purpose: This subroutine performs appropriate coordinate conversions, restricts drawing to the user-specified plot area, and calls lower level plotting functions. The two plotting functions used in PLOTCS are moving the plotting pen to a particular location with the plotting pen up or with the plotting pen down.

Fortran call: VPLOT(JR, X, Y, Z, IFUN, ISYS)

Arguments:

JR — Calling Purpose Indicator for use in producing auxiliary or debugging printout when that is required.

X, Y, Z — Location to which to move the plotting pen.
If ISYS = 0, this is the three-dimensional location in the PLOTCS Plot Space system.
If ISYS = 1, this is the two-dimensional location on the plotting paper; Y is ignored.

IFUN — Plotting Function Indicator
If IFUN = 0, do no plotting function and return after any needed coordinate conversion.
If IFUN = 2, draw with pen down within the plotting area only.
If IFUN = 3, move with pen up within the plotting area only.

ISYS — Location Dependence Indicator (see above).

Discussion:

VPLOT always remembers its last call and computes the appropriate edge point for any destination outside the plot area. If any function lies entirely outside the plot area, it is ignored except for its effects on the next function. The use of VPLOT for conversion purposes has almost entirely been replaced by calls to a newer routine, CONVRT. This routine is completely parallel to ZDBPLT as far as plot function is concerned. The difference is that this routine accommodates to the plot area while ZDBPLT is absolute.

Table B-2 Subroutine ZDBAXS

Purpose: To draw a single axis with numbering and a title.

Fortran call: ZDBAXS(X, Z, C, N, AXL, ANG, V1ST, VDEL, SCALE)

Arguments:

X, Z	Location of origin of the axis on the plot. (inches)
C	A character array containing the axis title.
N	Magnitude is the number of characters in the axis title. Sign is positive if all labeling is placed on the counterclockwise side of the axis. Sign is negative if all labeling is placed on the clockwise side of the axis.
AXL	Length of the axis. (inches)
ANG	Counterclockwise angle of the axis from the horizontal at its origin. (degrees)
V1ST	Value to be plotted at the axis origin.
VDEL	Increment in value at each tick mark.
SCALE	Scale factor for value per plot inch.

Discussion:

This subroutine is written in terms of ZDBNUM, ZDBPLT, and ZDBSYM.

Table B-3 Subroutine ZDBBEG

Purpose: Initializes the plot.

Fortran call: ZDBBEG(JJROUT)

Arguments:

JJROUT	Calling Purpose Indicator for use in producing auxiliary or debugging printout when that is required.

Discussion:

This subroutine makes use of subroutine PLOTS.

Table B-4 Subroutine ZDBCRV

Purpose: Draws a curve with a broken line specified by pairs of data values in two arrays. Curve is restricted to the plot area.

Fortran call: ZDBCRV(X, Z, NUM)

Arguments:

X, Z	Two arrays containing the locations of endpoints of the broken line on the plot.
NUM	Number of endpoints to be plotted.

Discussion:

This subroutine uses VPLOT to carry out its function.

Table B-5 Subroutine ZDBEND

Purpose: Terminates a plot or all plotting and prints an advisory message in the printed output.

Fortran call: ZDBEND(I, NUM)

Arguments:

I	Function indicator. If I = 0, end current plot. If I = 1, end all plotting.
NUM	Number of current plot or all plots to be included in advisory message.

Discussion:

This subroutine uses ZDBPLT. In other systems, this subroutine will likely call two different subroutine and not subroutine ZDBPLT.

Table B-6 Subroutine ZDBNUM

Purpose: Draws a number.

Fortran call: ZDBNUM(JJROUT, X, Z, H, V, A, N)

Arguments:

JJROUT	Calling Purpose Indicator for use in producing auxiliary or debugging printout when that is required.
X, Z	Location of lower left corner of leading digit of number on plot area. (inches)
H	Height of each digit for plotting. (inches)
V	Value to be plotted.
A	Orientation angle from horizontal. (degrees)
N	Indicator for number of digits to the right of the decimal point.

Discussion:

This subroutine calls subroutine NUMBER to do its task. The option for N which is presented above is the only one used by PLOTCS. Other options are presented in Table B-9.

Table B-7 Subroutine ZDBPLT

Purpose: Move plotting pen either up or down.

Fortran call: ZDBPLT(JJROUT, X, Z, N)

Arguments:

JJROUT	Calling Purpose Indicator for use in producing auxiliary or debugging printout when that is required.
X, Z	Location in plot area to which the pen is to be moved. (inches)
N	Function indicator. N = 2 if to move with plotting pen down. N = 3 if to move with plotting pen up.

Discussion:

This subroutine makes use of subroutine PLOT. It actually has all the functions of PLOT, but PLOTCS uses only the two above and plot termination. The other functions are not detailed here but can be found in Table B-10.

Table B-8 Subroutine ZDBSYM

Purpose: Draws a character string.

Fortran call: ZDBSYM(JJROUT, X, Z, H, C, A, N)

Arguments:

JJROUT	Calling Purpose Indicator for use in producing auxiliary or debugging printout when that is required.
X, Z	Location in plot area at which the lower left corner of the first character is to be drawn. (inches)
V	Character variable containing characters to be plotted.
A	Orientation angle for characters plotted from horizontal. (degrees)
N	Number of characters to be plotted.

Discussion:

This subroutine uses subroutine SYMBOL. There are options to this subroutine which are not used by PLOTCS and are not explained here. In PLOTCS its only function is to plot a character string. See Table B-12 for other functions if they are of interest.

Table B-9. NUMBER Subroutine Description

NUMBER

Subroutine Description

Purpose: NUMBER draws a number.

Calling Sequence:

CALL NUMBER(x,y,height,fnum,angle,lfrac)

Parameters:

x,y	are the floating-point (REAL*4) coordinates of the lower-left corner of the first character of the number.
height	is the floating-point (REAL*4) height of the characters to be drawn.
fnum	is the floating-point (REAL*4) number to be drawn.
angle	is the floating-point (REAL*4) angle in degrees at which the characters are drawn.
lfrac	lfrac is a fullword integer (INTEGER*4). If lfrac is positive, it is the number of digits to the right of the decimal point. The maximum value is nine. If lfrac is zero, the number is drawn without a fraction, but with a decimal point. If lfrac is -1, the decimal point is not drawn. If lfrac is less than -1, the lfrac-1 low-order digits are truncated.

Table B-10. PLOT Subroutine Description

PLOT

Subroutine Description

Purpose: PLOT moves the pen from its current position to the point (X,Y). PLOT may also be used to move the origin or terminate the plot file.

Calling Sequence:

CALL PLOT(x,y,ic)

Parameters:

x,y are the floating-point (REAL*4) coordinate values of the new pen position. x and y may be either absolute or relative, depending on the value of IC.

ic is a fullword integer (INTEGER*4) specifying the function to be performed by PLOT. The values for ic are:

- 2 Draw (with the pen down) to the absolute coordinate (x,y).
- 3 Move (with the pen up) to the absolute coordinate (x,y).
- 12 Draw (with the pen down) to the relative coordinate (x,y).
- 13 Move (with the pen up) to the relative coordinate (x,y).
- 999 The pen is moved to the end of the plotting region and the plot is terminated.

If the value of ic is negative, the function specified by the absolute value of ic is performed. In addition, the new pen position becomes the origin of the absolute coordinate system.

Table B-11. PLOTS Subroutine Description

MTS 11: Plot Description System

August 1978

PLOTS

Subroutine Description

Purpose: PLOTS initializes the plot.

Calling Sequence:

```
CALL PLOTS
```

Description: The PLOTS subroutine should be called before any other plotting subroutines are called. It should be called only once.

All arguments are ignored. Some installations may require arguments to the PLOTS subroutine. The arguments required vary depending on the installation.

Table B-12. SYMBOL Subroutine Description (1 of 2)

MTS 11: Plot Description System

August 1978

SYMBOL

Subroutine Description

Purpose: SYMBOL draws symbols.

Calling Sequence:

CALL SYMBOL(x,y,height,char,angle,nc)

Parameters:

x,y	are floating-point (REAL*4) coordinates. If nc is positive, x and y are the coordinates of the lower-left corner of the first character drawn. If nc is negative, x and y are the coordinates of the center of the symbol.
height	is the floating-point (REAL*4) height of the characters to be drawn.
char	If nc is positive, char is the character string to draw. If nc is negative, char is an integer number specifying the single symbol to draw.
angle	is the floating-point (REAL*4) angle in degrees at which the characters are drawn.
nc	is a fullword integer (INTEGER*4). If nc is positive, it is the number of characters in char. The valid negative values for nc are -1 Move with the pen up to the center of the symbol. -2 Move with the pen down to the center of the symbol.

Description: Four special control characters exist in the character set. These are backspace (hexadecimal 11), carriage return (hexadecimal 15), superscript (hexadecimal 2E), and subscript (hexadecimal 2F). Backspace backspaces over the previous character. Carriage return returns to the beginning of the line and spaces down by 1.5*height. If a superscript code is encountered in normal text, succeeding characters are raised 0.7*height and are drawn with a size of 0.5*height. A subscript code reverts to normal placement and size. Subscript positioning is similar to superscript positioning.

The following page defines the character set produced by SYMBOL.

Table B-12. SYMBOL Subroutine Description (2 of 2)

SYMBOL SET (HEX CODE : SYMBOL OR CONTROL)

00	□	10	|	20	}	30	∑	40		50	&	60	-	70	0
01	○	11	"BS"	21	{	31	+	41	A	51	J	61	/	71	1
02	△	12	∧	22	μ	32	≤	42	B	52	K	62	S	72	2
03	+	13	≡	23	π	33	≥	43	C	53	L	63	T	73	3
04	×	14	→	24	Φ	34	Δ	44	D	54	M	64	U	74	4
05	◇	15	"CR"	25	⊖	35	⊏	45	E	55	N	65	V	75	5
06	⏀	16	≠	26	⊬	36	⊐	46	F	56	O	66	W	76	6
07	⧖	17	±	27	×	37	\	47	G	57	P	67	X	77	7
08	Z	18	_	28	ω	38	⊤	48	H	58	Q	68	Y	78	8
09	Y	19	=	29	λ	39	⌠	49	I	59	R	69	Z	79	9
0A	⧓	1A		2A	∝	3A	‡	4A	¢	5A	!	6A	∞	7A	:
0B	✳	1B	∫	2B	δ	3B	⁑	4B	.	5B	$	6B	,	7B	#
0C	⧖	1C	⊃	2C	∈	3C	←	4C	<	5C	*	6C	%	7C	@
0D	|	1D	∨	2D	η	3D	×	4D	(	5D	)	6D	—	7D	'
0E	★	1E	~	2E	"UC"	3E	↑	4E	+	5E	;	6E	>	7E	=
0F	_	1F	≈	2F	"LC"	3F	↓	4F	|	5F	¬	6F	?	7F	"