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## THE VISIBILITY ANALYSIS PROGRAM USER'S GUIDE

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APRIL 1982

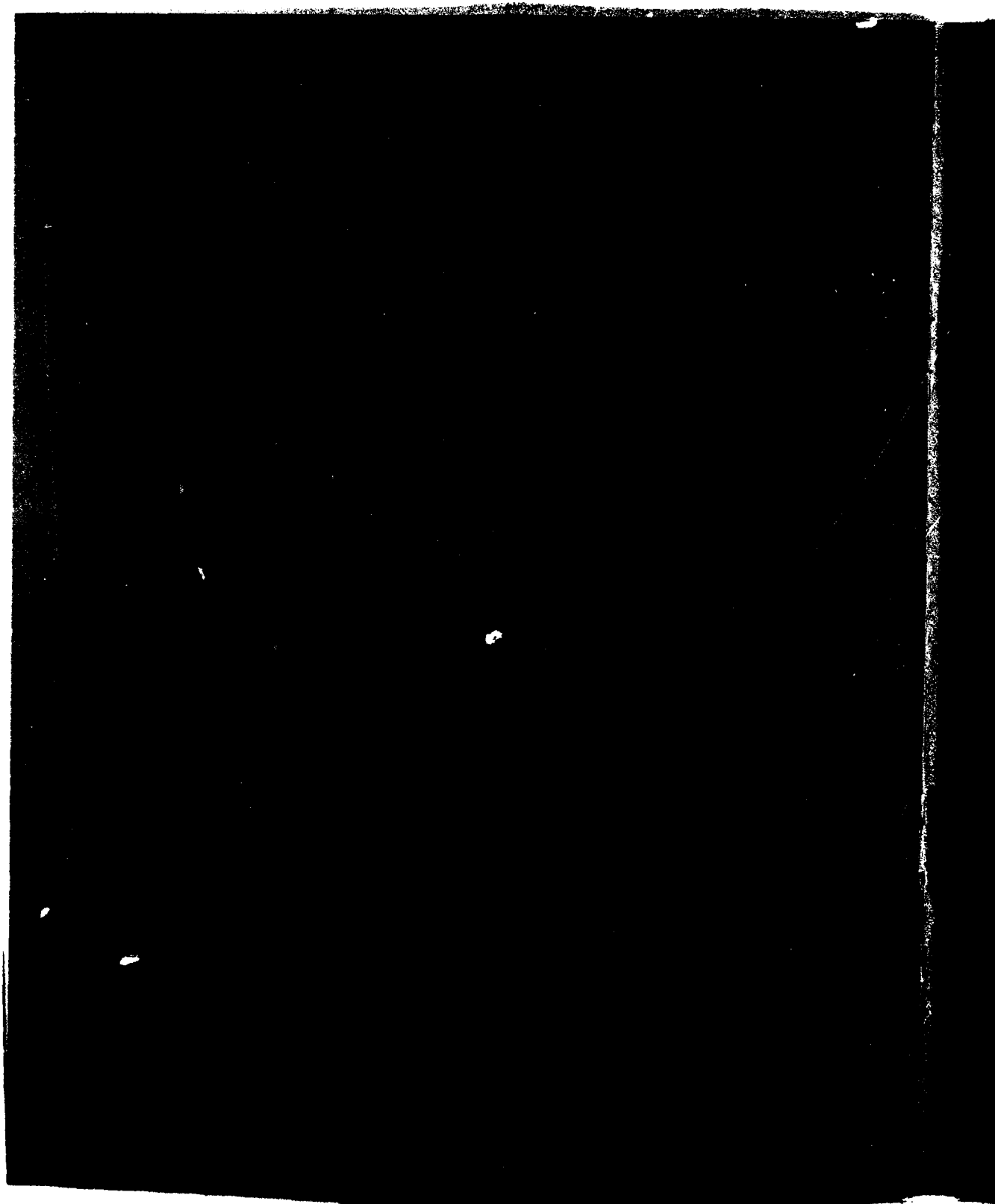
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FOR THE COMMANDER



CHARLES BATES, JR.

Chief

Human Engineering Division

Air Force Aerospace Medical Research Laboratory

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| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number)<br><br>This Visibility Analysis Program User's Guide describes a com-<br>puter program that generates a hard copy plot of the visual angles<br>to crew station components from the crewmember viewpoint. Using<br>this program crew station designers can evaluate crewmember/crew<br>station visual interaction. |                                     |                                                                                          |

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**Block 20 - Abstract (Continued)**

The Guide also describes a procedure to facilitate installation and use of the program at the user's facility. The procedure consists of three principle steps: installation of the program on user's computer system, digitization of crew stations, and program execution. A listing of the program is also included.

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## SUMMARY

Military Standard 850B titled "Aircrew Station Vision Requirements for Military Aircraft" establishes requirements for providing adequate vision from within the aircrew stations of military aircraft. The standard requires a "total vision envelope plot" as a means of demonstrating compliance. This plot is a map of visual angles of line-of-sight to obstructions to external vision, such as the aircraft structures, window frames, and accessory equipment (fixed and retractable) which obscure vision through the transparencies (windows). The standard describes a method for constructing total vision envelope plots from information found in crew station drawings. This method is quite time consuming and not versatile because plots are made from only one viewpoint, the hypothetical Design Eye Position, which is defined in MIL-STD-1333.

In developing the AFAMRL COMBIMAN (COMputerized BIomechanical MAN-model), we have created the capability to make total vision envelope plots with several enhancements not required by MIL-STD-850. Since the plots are drawn on a computer graphics device, the objects plotted need not be limited to those obstructing vision outside the aircraft, but may include the entire crew station with all the displays and controls. Because the model is general, the crew station or workplace is not limited to an aircraft cockpit, but can be any environment, such as an automobile, a computer terminal, etc. Furthermore, the model is not limited to the Design Eye Point. Plots can be quickly made from different eye positions, head orientations, or even plots from left and right eye positions.

This plotting program has such broad application that we have removed it from the COMBIMAN program so that it will be available to almost any computer user having a graphics plotter.

Dr. Joe McDaniel  
Workload and Ergonomics Branch  
Air Force Aerospace Medical  
Research Laboratory (AFAMRL)

## PREFACE

This work was performed under USAF Contract F33615-78-C-0507 entitled, *Biomechanics of Cockpit Evaluation*. The contract monitor and technical advisor for this contract is Dr. Joe McDaniel of the Workload and Ergonomics Branch of the Air Force Aerospace Medical Research Laboratory (AFAMRL), Wright-Patterson Air Force Base.

The purpose of this report is to provide a guide to use the VISIBILITY ANALYSIS program. The VISIBILITY ANALYSIS program was developed and revised over the years by the University of Dayton Research Institute as a part of the Computerized Biomechanical MAN-model (COMBIMAN) system of programs. The VISIBILITY ANALYSIS program is an independent program and runs separately from the COMBIMAN program.

Other methods of measuring cockpit visual angles include a Binocular Cockpit Visibility Camera developed between 1948 and 1951, primarily through the efforts of Mr. T. M. Edwards (1952). A comparison of 15 Air Force aircraft using this camera system was reported by Kennedy and McKechnie (1970).

The authors would like to acknowledge the contributions of Dr. Joe McDaniel, Dr. P. T. Bapu, Mr. Glen Potter and would like to thank Ms. Charlene Thompson for preparing the manuscript for publication.

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## SECTION 1

### INTRODUCTION

During the design and analysis phases of crew station development, it is essential to assess the accommodation of the crew station environment with respect to the human operator. The COMputerized BIomechanical MAN-model (COMBIMAN) system of programs has been developed to assist in the design and analysis phases of crew station development. One of the important capabilities of the COMBIMAN system of programs is to produce plots of an aircraft crew station from the crewmember's viewpoint. To enhance the capability of certain aircraft for nighttime operation, selective shieldings are installed on certain light sources. In order to evaluate these crew stations, it is necessary to map the visual angle of incidence from each crew member to each existing and proposed light source.

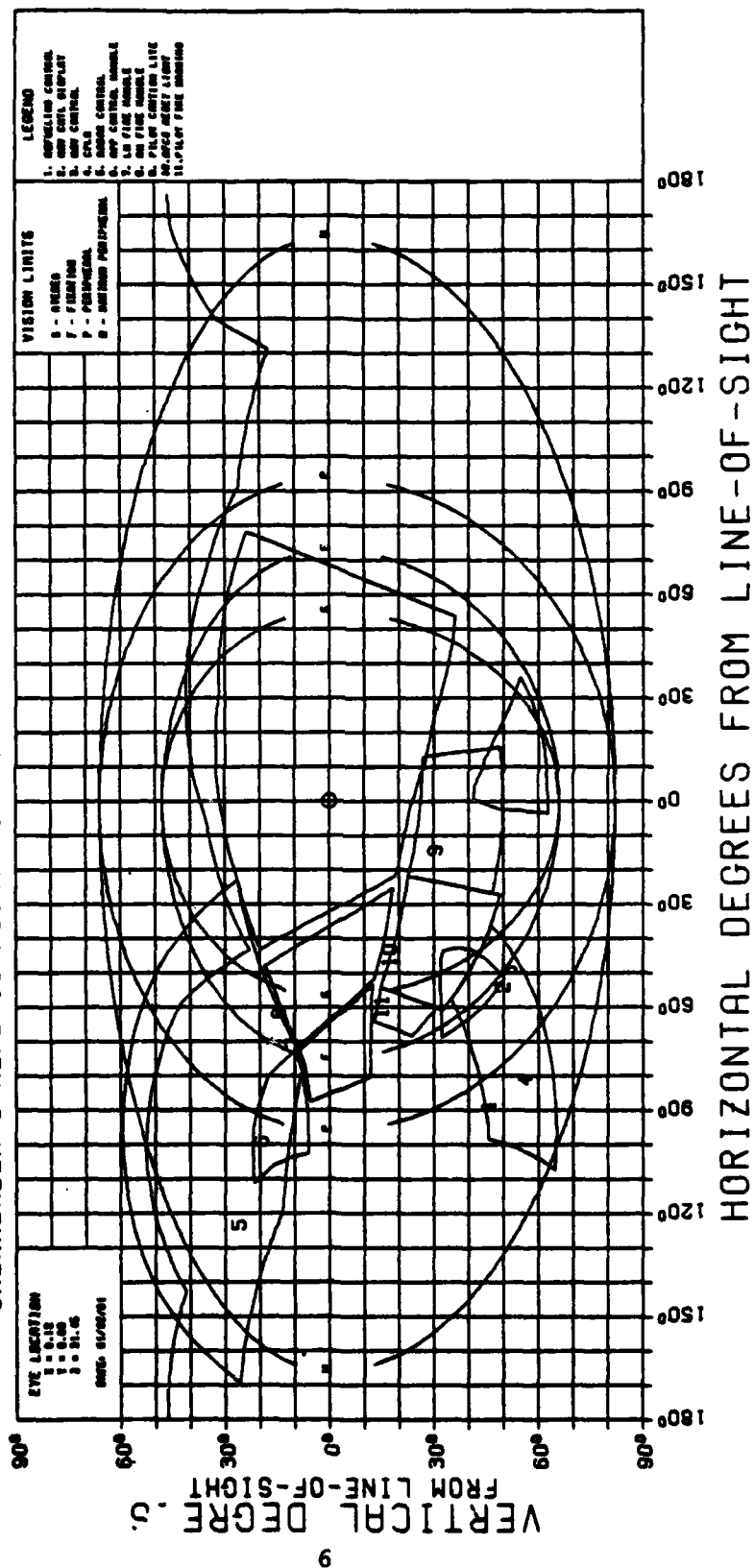
The VISIBILITY ANALYSIS program (VISANS) is developed to aid crew station designers to evaluate crewmembers/crew station visual interaction. The VISANS program was developed as a part of the COMBIMAN system of programs by the University of Dayton Research Institute under USAF Contract F33615-78-C-0507 entitled "Biomechanics of Cockpit Evaluation." The VISANS program is now an independent program and runs separately from the COMBIMAN program.

The VISANS program uses the three dimensional coordinates of the eye location of the crewmember and the three dimensional coordinates of the crew station (geometrically described as panels and contours) to generate a hard copy plot of the visual angles with respect to the crewmember's line-of-sight, together with legends identifying the instruments and/or light sources (see Figure 1). Four ellipses are superimposed on the plot to define the limits of various visual fields. The inner most field, denoted by the letter S, is the field of stereo vision, visible to both eyes simultaneously. The field denoted by the letter F

# VISIBILITY ANALYSIS

CREWSTATION: CH-53

CREWMEMBER'S HEAD IS POINTING 0° FROM FORWARD AND 0° FROM HORIZONTAL



is the field of fixation, that is, what the eyes can see directly without turning the head. The field denoted by the letter P is the field of peripheral vision with the eyes caged with respect to the head. The outermost field denoted by the letter M is the maximum peripheral vision limit for the extreme eye deviation. The user has the option to suppress these visual fields as explained in Section 4. In addition to generating a hard copy plot, the program calculates and prints the vision angles to each vertex of the panels and contours defining the crew station, together with the corresponding three dimensional coordinates of these vertices in the user's original coordinate system.

The panels and contours which geometrically describe the crew station may consist of 3 to 25 vertices each. These vertices must be input in consecutive order either clockwise or counterclockwise around the perimeter of each panel or contour. Miscellaneous equipment (instruments and/or light sources) consist of one vertex each, that is, a single point. Items identified with a single point location have their titles listed under the LEGEND heading as shown at the right side of the plot in Figure 1. These refer to the numbers on the plot itself. The center of the number is the exact location of the point on the plot. The coordinates of the vertices may be entered in any three dimensional system. However the user must specify the coordinates of a Seat Reference Point (SRP) with respect to the origin of the crew station coordinate system. The visibility analysis program (VISANS) converts all crew station data to a common right handed three dimensional coordinate system with the origin at the specified SRP. This conversion allows maximum flexibility for both military and nonmilitary applications.

The following procedure summary is included to facilitate installation and use of the program at the user's facility. The procedure consists of three principal steps as follows:

(1) Installation of the Program on User's Computer System.

Although the program is written in FORTRAN IV, the conventions for end-of-file (EOF) detection, plot initialization and termination,

as well as file handling procedures may differ from system to system and some minor modifications may be needed. In addition, the JCL and device references of Section 5 describe the procedures for a particular set of hardware and operating system (specifically a CDC 6600 computer, CDC tape drives, CALCOMP plotting hardware, and a NOS/BE operating system). It will be necessary to tailor the job control language to the user's system. A listing of the program is included in Appendix B.

(2) Digitization of Crew Stations. The workplace or crew station must be reduced to points, lines, and panels as described in Section 2 and Paragraph 4.2. These data may be stored on punched cards, magnetic tape, or disk, but must be coded for the user's specific application prior to using the program. The contents and complexity of these data depends on the user's application. In the examples in this report only the major console and window outlines are depicted along with a few control references; however, individual control panels, knobs, dials, etc., may be included if the user requires them.

(3) Program Execution. Each program run requires crew station data, an eye location, and eye orientation information. These requirements are described in detail in Paragraph 4.2. Note that it is possible to obtain many plots in a single run, each depicting a different crew station and/or eye orientation, by judicious arrangement of the input data.

## SECTION 2

### AN ILLUSTRATION

In order to use the Visibility Analysis Program (VISANS) the user must be able to geometrically describe the crew station to be analyzed. The example used to illustrate this procedure is based on the crew station in Figure 2 consisting of a six drawer desk. In modeling the desk, only the desk's top, front side, and leg well are defined. The other sides are not needed because they do not cause any physical or visual interference to a person sitting at a desk.

First, we arbitrarily choose an origin and define a coordinate system. In this example we chose the mid-point of the front edge of the top of the desk to be the origin and defined the coordinate system as follows:

+X Forward  
+Y Left  
+Z Up .

Using the dimensions of the desk, and the origin of the coordinate system, the three dimensional coordinates are obtained for the various vertices of the panels and for the location of any controls or other miscellaneous equipment as needed. Next the user must supply the program with the three dimensional coordinates of the Seat Reference Point (SRP) with respect to the origin of the crew station's coordinate system. The three dimensional coordinates of SRP with respect to the origin of the desk are defined as follows:

X-Coordinate = -15.0  
Y-Coordinate = 0.0  
Z-Coordinate = -11.0 .

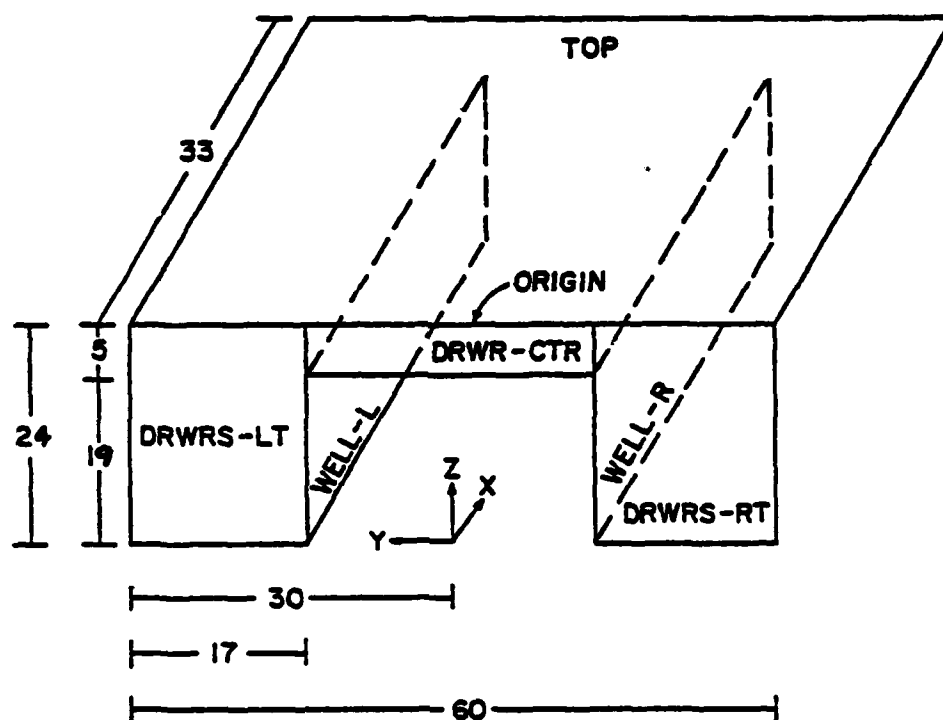


Figure 2. Sample Crew Station - DESK.

As shown in Figure 2, the "DESK" consists of a total of six panels. Each panel has four vertices, and is rectangular in shape. The coordinates of the vertices are shown in Figures 3a and 3b.

Figure 4a shows a visibility plot of the "DESK" shown in Figure 2. The eye location ( $X=6.12$ ,  $Y=0.0$ , and  $Z=31.46$ ) shown in this figure was arbitrarily selected, the user may enter any desired values as described in Paragraph 4.1. The user may modify or change the visual field overlays by changing the equations defining these overlays in subroutine VISPLT (see Appendix B). For this example, the crewmember (the person sitting at the desk) is looking  $0^\circ$  from forward and  $0^\circ$  from horizontal. The information provided by the visibility plot is explained in Paragraph 3.1.

Figure 4b shows the program input used to generate the visibility plot. This is explained in Section 4.



# ITOP

| POINT | X    | Y     | Z   |
|-------|------|-------|-----|
| 1     | 0.0  | 30.0  | 0.0 |
| 2     | 33.0 | 30.0  | 0.0 |
| 3     | 33.0 | -30.0 | 0.0 |
| 4     | 0.0  | -30.0 | 0.0 |



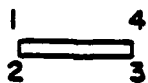
# 2DRWRS - LT

| POINT | X   | Y    | Z     |
|-------|-----|------|-------|
| 1     | 0.0 | 30.0 | 0.0   |
| 2     | 0.0 | 13.0 | 0.0   |
| 3     | 0.0 | 13.0 | -24.0 |
| 4     | 0.0 | 30.0 | -24.0 |



# 3DRWRS - RT

| POINT | X   | Y     | Z     |
|-------|-----|-------|-------|
| 1     | 0.0 | -30.0 | 0.0   |
| 2     | 0.0 | -13.0 | 0.0   |
| 3     | 0.0 | -13.0 | -24.0 |
| 4     | 0.0 | -30.0 | -24.0 |



# 4DRWRS - CT

| POINT | X   | Y     | Z    |
|-------|-----|-------|------|
| 1     | 0.0 | 13.0  | 0.0  |
| 2     | 0.0 | 13.0  | -5.0 |
| 3     | 0.0 | -13.0 | -5.0 |
| 4     | 0.0 | -13.0 | 0.0  |

Figure 3a. X, Y, and Z Coordinates of Panels of DESK.

|   |   |
|---|---|
| 1 | 4 |
| 2 | 3 |

# 5WELL-LT

| <u>POINT</u> | <u>X</u> | <u>Y</u> | <u>Z</u> |
|--------------|----------|----------|----------|
| 1            | 0.0      | 13.0     | -5.0     |
| 2            | 0.0      | 13.0     | -24.0    |
| 3            | 33.0     | 13.0     | -24.0    |
| 4            | 33.0     | 13.0     | -5.0     |

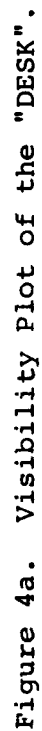
|   |   |
|---|---|
| 1 | 4 |
| 2 | 3 |

# 6WELL-RT

| <u>POINT</u> | <u>X</u> | <u>Y</u> | <u>Z</u> |
|--------------|----------|----------|----------|
| 1            | 0.0      | -13.0    | -5.0     |
| 2            | 0.0      | -13.0    | -24.0    |
| 3            | 33.0     | -13.0    | -24.0    |
| 4            | 33.0     | -13.0    | -5.0     |

Figure 3b. X, Y, and Z Coordinates of Panels of DESK.

CREWSTATION: DESK  
CREWMEMBER'S HEAD IS POINTING 0° FROM FORWARD AND 0° FROM HORIZONTAL





### SECTION 3

#### THE VISIBILITY ANALYSIS (VISANS) PROGRAM\* OUTPUT

This program provides visibility data to evaluate crewmember/crew station or other crew station interactions. It allows the user to label the instruments and/or light sources (miscellaneous equipments) of a crew station and it also includes an optional overlay defining the limits of various visual fields.

##### 3.1 THE VISIBILITY ANALYSIS OUTPUT

The program provides both printed and graphical output (hard copy plot). The graphical output is shown in Figure 4c. The plot provides the user with the following information:

- (1) The eye location of the crewmember with respect to the seat reference point (SRP) of the crew station (see Paragraph 4.2).
- (2) The name of the crew station.
- (3) Definition of the vision limits.
- (4) The vision limits themselves.
- (5) A rectilinear plot of the crew station and miscellaneous equipments.
- (6) A LEGEND defining the miscellaneous equipment.
- (7) The orientation of the head, in degrees.\*

The printed output for this program contains:

- (1) An output from subroutine VISVDM containing the crew station data (Figure 5 is an example of subroutine VISVDM output - see Paragraph 4.2 for details), and
- (2) An output from the main routine for each plot consisting of the Namelist CNTRL's variable values, the eye location, head orientation, and, for each vertex, its three dimensional coordinates (in the original crew station coordinate system) along with the vision angles at which that vertex can be found.

\*Note that for line-of-sight angles, positive horizontal is left of forward and positive vertical is above the horizontal.

# VISIBILITY ANALYSIS

CREWSTATION: DESK

CREWMEMBER'S HEAD IS POINTING 10° LEFT OF FORWARD AND 30° BELOW HORIZONTAL

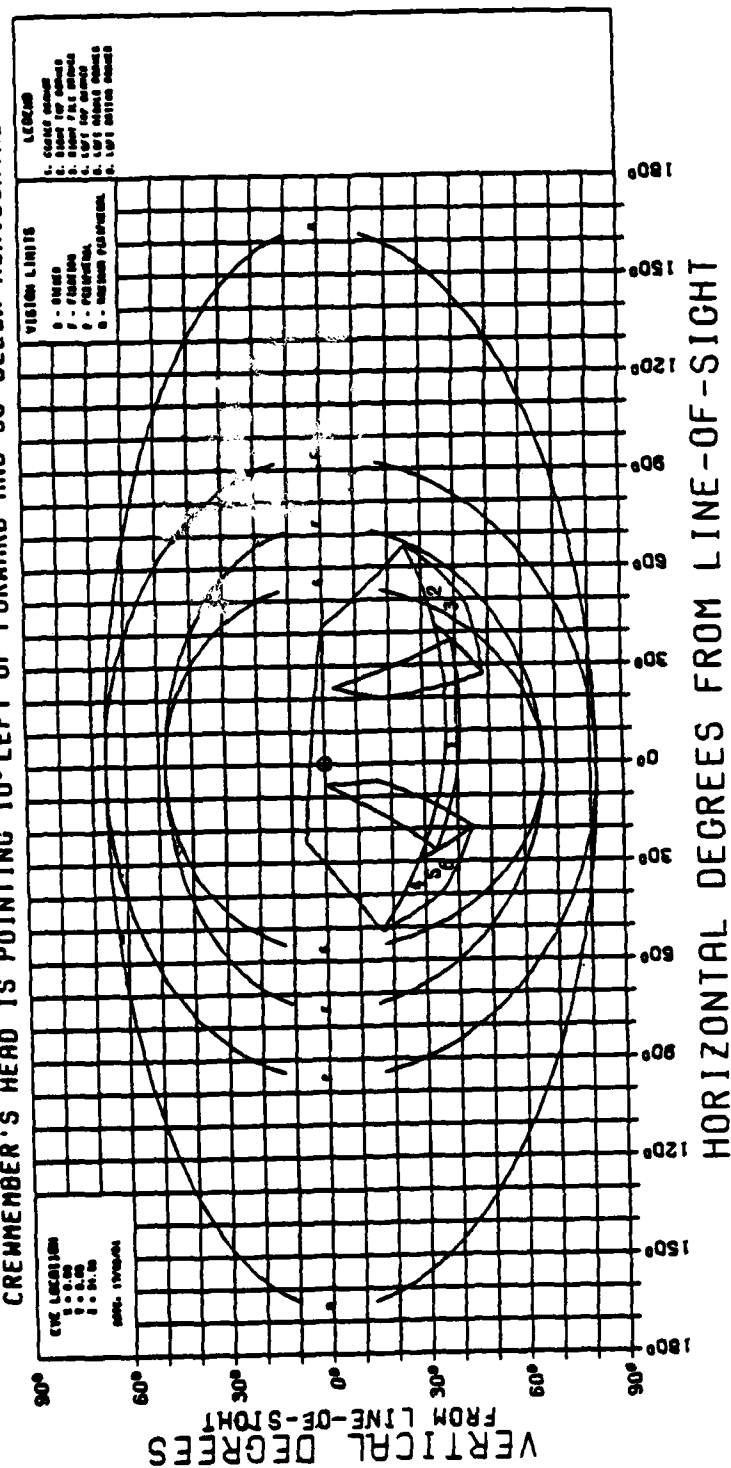


Figure 4c. The Graphical Output of the Desk. (The person sitting at the desk is look 30° down and 10° to the left.)

```

VIS5001 GADD CM 53 121113.00 24.00148.70 A R U
VIS5191 MEMBER, CM-13 (01/02/01), HAS 12 BOUNDARIES AND 11 MISCELLANEOUS EQUIPMENTS
VIS5201 COORDINATES ARE TRANSLATED TO ( 143.00, 24.00, 140.70).
VIS5211 COORDINATES GIVEN AS A, R AND U ARE NOW F, L, AND U.
1.) RSIDE
4 VERTICES --INPUT COORDINATES--
( 116.25 13.21 146.73) TO ( 27.55 10.75 6.03) --ABSOLUTE COORDINATES--
( 116.25 30.00 146.73) TO ( 27.55 -6.00 6.03)
( 111.47 30.00 158.55) TO ( 32.33 -6.00 17.05)
( 110.01 13.21 160.14) TO ( 32.99 10.75 19.44)
2.) CENTER
4 VERTICES --INPUT COORDINATES--
( 116.01 13.21 145.07) TO ( 26.99 10.75 4.37)
( 110.01 13.21 160.14) TO ( 32.99 10.75 19.44)
( 110.01 -13.21 160.14) TO ( 32.99 37.25 19.44)
( 116.01 -13.21 145.07) TO ( 26.99 37.25 4.37)
3.) LSIDE
4 VERTICES --INPUT COORDINATES--
( 116.25 -13.21 146.73) TO ( 27.55 37.25 6.03)
( 110.01 -13.21 160.14) TO ( 32.99 37.25 19.44)
( 111.47 -30.00 158.55) TO ( 32.33 54.00 17.05)
( 116.25 -30.00 146.73) TO ( 27.55 54.00 6.03)
4.) OVERHEAD
4 VERTICES --INPUT COORDINATES--
( 126.92 19.44 178.00) TO ( 16.00 4.56 37.30)
( 162.00 19.44 184.00) TO ( -10.20 4.56 43.30)
( 162.00 -19.44 184.00) TO ( -10.20 43.44 43.30)
( 126.92 -19.44 178.00) TO ( 16.00 43.44 37.30)
5.) LURCONSL
4 VERTICES --INPUT COORDINATES--
( 142.30 8.75 138.22) TO ( 1.42 15.25 -2.48)
( 116.01 8.75 145.07) TO ( 26.99 15.25 4.37)
( 116.01 -8.75 145.07) TO ( 26.99 32.75 4.37)
( 142.30 -8.75 138.22) TO ( 1.42 32.75 -2.48)
50.) WINDOW-UPPER RIGHT
10 VERTICES --INPUT COORDINATES--
( 126.00 13.00 179.00) TO ( 17.00 11.00 30.30)
( 131.00 13.00 184.00) TO ( 12.00 11.00 43.30)
( 140.00 13.00 187.00) TO ( 3.00 11.00 46.30)
( 152.00 13.00 188.00) TO ( -8.20 11.00 47.30)
( 152.00 27.00 187.00) TO ( -8.20 -3.00 46.30)
( 152.00 36.10 184.00) TO ( -8.20 -12.10 43.30)
( 136.00 30.00 179.00) TO ( -8.20 -16.30 38.30)
( 134.00 33.00 179.00) TO ( 9.00 -14.00 30.30)
( 126.00 23.00 179.00) TO ( 9.00 -9.00 38.30)
( 126.00 -13.00 179.00) TO ( 19.00 1.00 38.30) --ABSOLUTE COORDINATES--
57.) WINDOW-UPPER LEFT
10 VERTICES --INPUT COORDINATES--
( 126.00 -13.00 179.00) TO ( 17.00 37.00 38.30)
( 131.00 13.00 184.00) TO ( 12.00 37.00 43.30)
( 140.00 -13.00 187.00) TO ( 3.00 37.00 46.30)
( 152.00 -13.00 188.00) TO ( -8.20 37.00 47.30)
( 152.00 -27.00 187.00) TO ( -8.20 51.00 46.30)
( 152.00 36.10 184.00) TO ( 8.20 60.10 43.30)
( 152.00 -40.30 179.00) TO ( -8.20 64.30 38.30)
( 136.00 -30.00 179.00) TO ( 5.00 62.00 38.30)

```

Figure 5. Subroutine VISVDM Printed Output.



```

11 ) REFUELLING CONTROL      ( 105.10 -30.50 110.70) TO ( 36.70 62.50 -30.00)
( 103.30 35.00 106.30) TO ( 40.50 59.00 -34.40)
( 101.80 -20.30 102.90) TO ( 42.00 52.30 -37.80)
( 101.50 -21.00 102.10) TO ( 42.30 49.00 -30.60)
( 93.20 -21.00 100.60) TO ( 50.00 45.00 -32.10)
( 88.60 -21.00 115.30) TO ( 55.20 45.00 -25.40)
( 86.50 -23.40 122.00) TO ( 57.30 47.40 18.70)
1 VERTICES --INPUT COORDINATES--
( 137.50 -6.00 139.50) TO ( 6.30 30.00 -1.20)
1 VERTICES --INPUT COORDINATES--
( 124.50 5.00 143.00) TO ( 19.30 19.00 2.30)
1 VERTICES --INPUT COORDINATES--
( 124.00 7.50 143.25) TO ( 19.00 16.50 2.55)
1 VERTICES --INPUT COORDINATES--
( 135.00 4.00 140.00) TO ( 8.00 20.00 -.70)
1 VERTICES --INPUT COORDINATES--
( 150.00 6.00 162.00) TO ( 6.20 18.00 41.30)
1 VERTICES --INPUT COORDINATES--
( 142.00 0.00 160.00) TO ( 1.00 24.00 39.30)
1 VERTICES --INPUT COORDINATES--
( 128.00 -5.00 177.00) TO ( 15.00 29.00 36.30)
1 VERTICES --INPUT COORDINATES--
( 128.00 5.00 177.00) TO ( 15.00 19.00 36.30)
1 VERTICES --INPUT COORDINATES--
( 116.00 18.00 150.00) TO ( 27.00 6.00 17.30)
1 VERTICES --INPUT COORDINATES--
( 116.00 0.00 161.00) TO ( 27.00 24.00 20.30)
1 VERTICES --INPUT COORDINATES--
( 116.00 -10.00 150.00) TO ( 27.00 42.00 17.30)
WTS9361 CH-53 WITH 12 BOUNDARIES AND 11 MISCELLANEOUS EQUIPMENTS HAS BEEN ADDED.

```

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Figure 5. Subroutine VISVDM Printed Output.

Figure 6 is a sample of the main routine output and contains the following:

- (1) The program name.
- (2) The page number.
- (3) The visibility member name and the date created.
- (4) The eye location.
- (5) The head orientation.
- (6) Each visibility contour, panel, and/or point source name.
- (7) Cross reference output showing the vision angles for each vertex of the visibility member.

VISANS -- VISIBILITY ANALYSIS PROGRAM

VISIBILITY MEMBER NAME CH-53 (01702/81)  
EYE LOCATION IN SRP SYSTEM ( 6.12, 0.00, 31.45)  
LINE-OF-SIGHT IN DEGREES ( 0, 0)

VISIBILITY PLOT DATA FOR: KSIDE

| LINE OF SIGHT ANGLES |       | ORIGINAL COORDINATES |        |
|----------------------|-------|----------------------|--------|
| HORIZ.               | VERT. | A                    | U      |
| 27                   | -47   | 116.250              | 13.250 |
| -16                  | -49   | 116.250              | 30.000 |
| -13                  | -27   | 111.470              | 30.000 |
| 22                   | -23   | 110.810              | 13.250 |

VISIBILITY PLOT DATA FOR: CENTER

| LINE-OF-SIGHT ANGLES |       | ORIGINAL COORDINATES |         |
|----------------------|-------|----------------------|---------|
| HORIZ.               | VERT. | A                    | U       |
| 27                   | -49   | 116.810              | 13.250  |
| 22                   | -23   | 110.810              | 13.250  |
| 54                   | -15   | 110.810              | -13.250 |
| 61                   | -32   | 116.810              | -13.250 |

VISIBILITY PLOT DATA FOR: LSIDE

| LINE OF SIGHT ANGLES |       | ORIGINAL COORDINATES |         |
|----------------------|-------|----------------------|---------|
| HORIZ.               | VERT. | A                    | U       |
| 60                   | -31   | 116.250              | -13.250 |
| 54                   | -15   | 110.810              | -13.250 |
| 64                   | -13   | 111.470              | -30.000 |
| 68                   | -24   | 116.250              | -30.000 |

VISIBILITY PLOT DATA FOR: OVERHEAD

| LINE-OF-SIGHT ANGLES |       | ORIGINAL COORDINATES |         |
|----------------------|-------|----------------------|---------|
| HORIZ.               | VERT. | A                    | U       |
| 23                   | 27    | 126.920              | 19.440  |
| 169                  | 26    | 162.000              | 19.440  |
| 119                  | 13    | 162.000              | -19.440 |
| 74                   | 7     | 126.920              | -19.440 |

Figure 6. Sample of Main Routine Printed Output. For line-of-sight angles, positive horizontal is left of forward, positive vertical is above the horizontal.

## SECTION 4

### INPUT TO VISANS PROGRAM

The input for program VISANS is of three types:

- (1) input/output control,
- (2) crew station data, and
- (2) eye/head positional data.

The data stream is entered in the following form:

- the namelist CNTRL,
- crew station data,
- coordinates of the eye position, and
- coordinates of the point at which the head is pointing or the vertical and horizontal angular offsets of the head with respect to straightforward.

As many sets of input as desired may be entered ending with:

- the namelist CNTRL with IEND=1.

The general deck layout is shown in Figure 7. The following three paragraphs describe the format and content of the data input.

#### 4.1 THE NAMELIST CNTRL

Input/output control for VISANS is accomplished using the namelist CNTRL. The namelist CNTRL and its default values are:

- NEW - if NEW is set equal to 1, VISVDM is called to read crew station data from Unit 3\* in card image format as described in Paragraph 4.2 (default:0). If NEW=0, VISVDM is bypassed and the data is read from Unit 9.\*\* (This is the case after the first plot when more than one plot of the same crew station are requested).

\*Unit 3 is defined by the user and contains the input data.

\*\*Unit 9 is where the reformatted data is written for use by program.

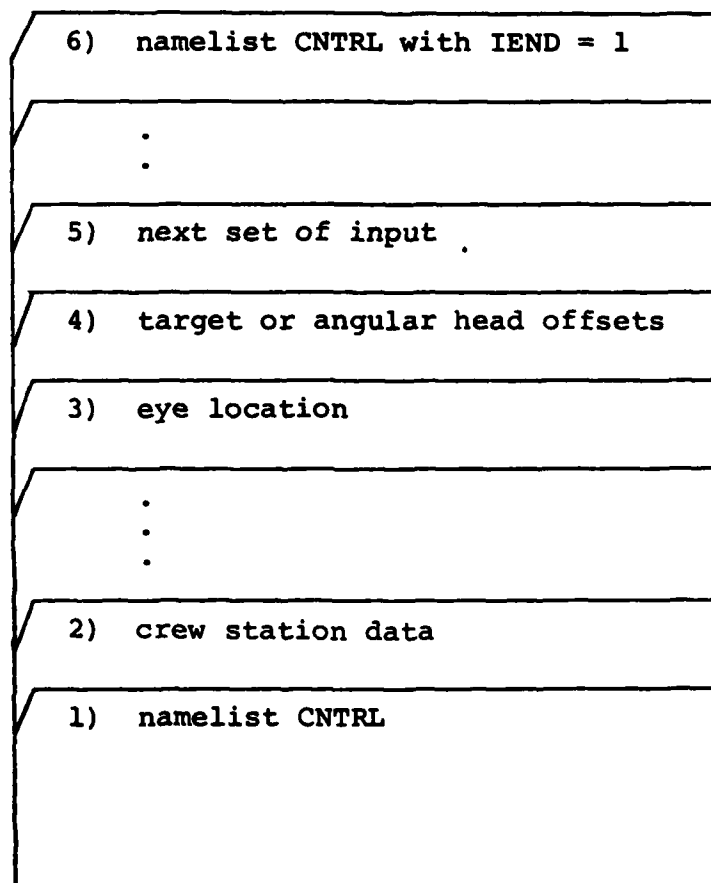


Figure 7. General Input Deck Layout.

- EYELOC - if EYELOC is set equal to 1, the eye location is read from Unit 3\*, otherwise the EYELOC used on the previous plot is used. If this is the first plot and EYELOC=0, the Design Eye Position (described in MIL-STD-1333) for a 13° seat back angle (6.07, 0.0, 31.5) is used (default:0).
- TARG - if TARG is set equal to zero, horizontal and vertical angle offsets for the line-of-sight are read from UNIT 3. If TARG=1, the program looks for the three dimensional coordinates of the point at which the eye is looking. (The coordinates are read from Unit 3.\*) (default:0).
- ILIM - if ILIM is set equal to 1, the vision limits are superimposed on the visibility plot. If ILIM=0, no vision limits are plotted. (default:1).
- IEND - IEND set equal to 1 denotes the end of the input data. If IEND=0, the program looks for more data on Unit 3. (default:0).

The format of the namelist CNTRL is as follows (see Figure 8a):

- column 1        a blank
- column 2        a dollar sign(\$)\*\*
- column 3-7     the word CNTRL
- column 8        a blank.

After column 8 the user may code none, all or any combinations of the control variables in the form NEW=1, EYELOC=1, ..., the last one followed by a \$ sign. Note that, although embedded blanks are acceptable, on some machines they will be considered as zeros when they occur between a variable value and the following comma. Thus, a namelist string of the form NEW=1, EYELOC=1, IEND=1\$ might be interpreted as NEW=1, EYELOC=10, and IEND=1.

---

\*Unit 3 is defined by the user and contains the input data.

\*\*Note that the format of the Namelist convention is highly machine dependent.



Figure 8b is the namelist CNTRL input that contributed to Figure 2 as follows:

- NEW=1 caused VISVDM to be called to read the CH-53 data from Unit 3.
- EYELØC=1 therefore, eye location was read as X=6.12, Y=0.0, Z=31.45.
- TARG=0 therefore, the vertical and horizontal angle offsets were read as VANG=0° and HANG=0°, i.e. head is pointing straightforward.
- ILIM=1 therefore, the vision limits are overlayed onto the visibility plot.
- IEND=0 indicating that this is not the end of the input data.

#### 4.2 ENTERING CREW STATION DATA

Crew station data are entered with coordinates in a user defined coordinate system (see Section 2). Data may be entered as boundary definitions (panels or visibility contours) consisting of three to twenty-five vertices, or single point miscellaneous equipment to be labeled and identified on the plot legend. A combined total of 100 boundary definitions and miscellaneous equipment is allowed with no more than 40 miscellaneous equipment. The data flow is shown in Figure 9.

(1) The \$ADD card containing

|               |                                                                      |
|---------------|----------------------------------------------------------------------|
| columns 1-4   | \$ADD                                                                |
| column 5      | blank                                                                |
| columns 6-13  | crew station member name                                             |
| columns 14-16 | the number of visibility boundary definitions for this member (NBND) |
| columns 17-18 | the number of miscellaneous equipment for this member (NEQPTS)       |
| columns 19-24 | the neutral seat reference point (NSRP)                              |
|               | X-coordinate (ACXYZ(1))*                                             |
| columns 25-30 | the NSRP Y-coordinate (ACXYZ(2))*                                    |
| columns 31-36 | the NSRP Z-coordinate (ACXYZ(3))*                                    |
| column 37     | blank                                                                |

\*Note that the coordinates of the NSRP are in the user's defined coordinate system.



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|        |    |                                                                                                                     |
|--------|----|---------------------------------------------------------------------------------------------------------------------|
| column | 38 | the direction of the positive x-axis of the input coordinate system (IX), with respect to the operator, as follows: |
|        |    | F for Forward                                                                                                       |
|        |    | A for Aft                                                                                                           |
|        |    | L for Left                                                                                                          |
|        |    | R for Right                                                                                                         |
|        |    | U for Up                                                                                                            |
|        |    | D for Down                                                                                                          |
| column | 39 | blank                                                                                                               |
| column | 40 | the direction of the positive y-axis defined as above (IY)                                                          |
| column | 41 | blank                                                                                                               |
| column | 42 | the direction of the positive z-axis defined as above (IZ)                                                          |

(2) The NBNDS boundary definitions as follows:

|                |       |                                                |
|----------------|-------|------------------------------------------------|
| Card 1 columns | 1-3   | sequence number for this boundary (BNØ)        |
| columns        | 4-27  | the boundary name (BNAME)                      |
| columns        | 28-29 | blank                                          |
| columns        | 30-32 | the number of vertices for this boundary (BNV) |

This is followed by BNV cards with the coordinates for each vertex as follows:

|         |       |                                                  |
|---------|-------|--------------------------------------------------|
| columns | 1-6   | the X-coordinate in the input coordinate system* |
| columns | 7-12  | the Y-coordinate for this vertex                 |
| columns | 13-18 | the Z-coordinate for this vertex                 |

(3) The NEQPTS miscellaneous equipment definitions as follows:

|                |       |                                                                |
|----------------|-------|----------------------------------------------------------------|
| Card 1 columns | 1-3   | a sequence number (BNØ)                                        |
| columns        | 4-27  | the name for this point to be placed in the legend (BNAME)     |
| column         | 32    | a 1                                                            |
| Card 2 columns | 1-6   | the X-coordinate for this point in the input coordinate system |
| columns        | 7-12  | the Y-coordinate for this point                                |
| columns        | 13-18 | the Z-coordinate for this point                                |

\*Note that if a decimal point is not included for any coordinate, one is assumed to be between the second last and third to the last columns of each field (F6.2).

Figure 10 shows input for the Air Force's PAVLØ aircraft which contributed to the plot in Figure 1. Figure 11 shows the printed output generated by VISVDM. The first line shows the \$ADD card as read by the program.

```
$ADD CH-53 121143.8 524143.80 24.00140.70 A R U
```

The second output line gives the member name, creation date, number of boundaries, and number of miscellaneous equipment, as read from the \$ADD card.

```
MEMBER,CH-53 PAVLO (01/02/81), HAS 12 BOUNDARIES AND 11 MISCELLANEOUS EQUIPMENT
```

The third line shows the X, Y, and Z coordinate offsets used to translate the new station to the programs coordinate system with the origin at the NSRP.

```
COORDINATES ARE TRANSLATED TO (143.80, 24.00, 140.70).
```

The next line describes the direction changes in the coordinate system as follows:

```
COORDINATES GIVEN AS A, R AND U ARE NOW F, L, AND U.
```

| <u>Input</u>                         | <u>Absolute</u>       |
|--------------------------------------|-----------------------|
| + x - <u>A</u> ft (Fuselage Station) | + x - <u>F</u> orward |
| + y - <u>R</u> ight (Butt Line)      | + y - <u>L</u> eft    |
| + z - <u>U</u> p (Waterline)         | + z - <u>U</u> p      |

The remaining VISVDM printed output includes, for each boundary and miscellaneous equipment, the sequence number, the number of vertices, and the coordinates of each vertex both before and after translation. The last line starting with VIS534I is a message which indicates that VISVDM has successfully completed processing the visibility member.

|                      |                            |  |          |
|----------------------|----------------------------|--|----------|
| SCNTRL NEW=1 3       |                            |  |          |
| LA00 CH-53           | 12111 3.8 24.0 140.7 A R U |  | 01/02/81 |
| 1KSIDE               | 1 4                        |  |          |
| 116.25 13.25146.73   |                            |  |          |
| 116.25 30.00146.73   |                            |  |          |
| 111.47 30.00158.55   |                            |  |          |
| 110.81 13.25160.14   |                            |  |          |
| 2CENTER              | 1 4                        |  |          |
| 116.81 13.25145.07   |                            |  |          |
| 110.81 13.25160.14   |                            |  |          |
| 110.81-13.25160.14   |                            |  |          |
| 116.81-13.25145.07   |                            |  |          |
| 3LSIDE               | 1 4                        |  |          |
| 116.25-13.25146.73   |                            |  |          |
| 110.81-13.25160.14   |                            |  |          |
| 111.47-30.00158.55   |                            |  |          |
| 116.25-30.00146.73   |                            |  |          |
| 4OVERHEAD            | 1 4                        |  |          |
| 126.92 19.4+178.00   |                            |  |          |
| 152.00 19.4+184.00   |                            |  |          |
| 162.00-19.4+184.00   |                            |  |          |
| 125.92-19.4+178.00   |                            |  |          |
| 5LWRCONSL            | 1 4                        |  |          |
| 1-2.38 8.75138.22    |                            |  |          |
| 116.81 8.75145.07    |                            |  |          |
| 116.81 -8.75145.07   |                            |  |          |
| 1-2.38 -8.75138.22   |                            |  |          |
| 11REFUELING CONTROL  | 8 1                        |  |          |
| 137.50 -6.00139.50   |                            |  |          |
| 16NAV CNTL DISPLAY   | 8 1                        |  |          |
| 124.50 5.00143.00    |                            |  |          |
| 17NAV CONTROL        | 8 1                        |  |          |
| 124.00 7.50143.25    |                            |  |          |
| 28CPLR               | 8 1                        |  |          |
| 135.00 4.00140.00    |                            |  |          |
| 21RADAR CONTROL      | 8 1                        |  |          |
| 150.00 6.00182.00    |                            |  |          |
| 22APP CONTROL HANDLE | 8 1                        |  |          |
| 142.00 0.0 180.00    |                            |  |          |
| 23LM FIRE HANDLE     | 8 1                        |  |          |
| 128.00 -5.00177.00   |                            |  |          |
| 24RH FIRE HANDLE     | 8 1                        |  |          |
| 128.00 5.00177.00    |                            |  |          |
| 29PILOT CAUTION LITE | 8 1                        |  |          |
| 116.00 18.00158.00   |                            |  |          |
| 30AFCS RESET LIGHT   | 8 1                        |  |          |
| 116.00 0.0 161.00    |                            |  |          |
| 31PILOT FIRE WARNING | 8 1                        |  |          |
| 116.00-18.00158.00   |                            |  |          |
| 6.12                 | 31 45                      |  |          |
| SCNTRL IENO=1 3      |                            |  |          |

Boundary  
Data

Miscellaneous  
Equipments

Figure 10. CH-53 Aircraft Input.

```

VIS5001 SADD CH 53      12111+3.00 24.00140.70 A R U
VIS5191 MEMBER, CH-53   (01/02/81), HAS 12 BOUNDARIES AND 11 MISCELLANEOUS EQUIPMENTS
VIS5201 COORDINATES ARE TRANSLATED TO ( 143.00, 24.00, 140.70).
VIS5211 COORDINATES GIVEN AS A, R AND U ARE NOW F, L, AND U.
1.) RSIDE
  4 VERTICES --INPUT COORDINATES--
    ( 116.25 13.25 146.73) TO ( 27.55 10.75 6.03)
    ( 116.25 30.00 146.73) TO ( 27.55 -6.00 6.03)
    ( 111.47 30.00 150.55) TO ( 32.33 -6.00 17.05)
    ( 118.01 13.25 160.14) TO ( 32.99 10.75 19.44)
  4 VERTICES --INPUT COORDINATES--
    ( 116.01 13.25 145.07) TO ( 26.99 10.75 4.37)
    ( 118.01 13.25 160.14) TO ( 32.99 10.75 19.44)
    ( 118.01 -13.25 160.14) TO ( 32.99 37.25 19.44)
    ( 116.01 -13.25 145.07) TO ( 26.99 37.25 4.37)
  4 VERTICES --INPUT COORDINATES--
    ( 116.25 -13.25 146.73) TO ( 27.55 37.25 6.03)
    ( 118.01 -13.25 160.14) TO ( 32.99 37.25 19.44)
    ( 111.47 -30.00 150.55) TO ( 32.33 54.00 17.05)
    ( 116.25 -30.00 146.73) TO ( 27.55 54.00 6.03)
  4 VERTICES --INPUT COORDINATES--
    ( 126.92 19.44 170.00) TO ( 16.00 4.56 37.30)
    ( 162.00 19.44 164.00) TO ( -10.20 4.56 43.30)
    ( 162.00 -19.44 164.00) TO ( -18.20 43.44 43.30)
    ( 126.92 -19.44 170.00) TO ( 16.00 43.44 37.30)
  4 VERTICES --INPUT COORDINATES--
    ( 142.30 8.75 130.22) TO ( 1.42 15.25 -2.40)
    ( 116.01 8.75 145.07) TO ( 26.99 15.25 4.37)
    ( 116.01 -8.75 145.07) TO ( 26.99 32.75 4.37)
    ( 142.30 -8.75 130.22) TO ( 1.42 32.75 -2.40)
  10 VERTICES --INPUT COORDINATES--
    ( 126.00 13.00 179.00) TO ( 17.00 11.00 30.30)
    ( 131.00 13.00 164.00) TO ( 12.00 11.00 43.30)
    ( 140.00 13.00 167.00) TO ( 3.00 11.00 46.30)
    ( 152.00 13.00 180.00) TO ( -0.20 11.00 47.30)
    ( 152.00 27.00 187.00) TO ( -0.20 -3.00 46.30)
    ( 152.00 36.10 184.00) TO ( -0.20 -12.10 43.30)
    ( 142.00 40.30 179.00) TO ( -0.20 -16.30 30.30)
    ( 136.00 30.00 179.00) TO ( 5.00 -14.00 30.30)
    ( 134.00 33.00 179.00) TO ( 9.00 -9.00 30.30)
    ( 120.00 23.00 179.00) TO ( 15.00 1.00 30.30)
  10 VERTICES --INPUT COORDINATES--
    ( 126.00 -13.00 179.00) TO ( 17.00 37.00 30.30)
    ( 131.00 13.00 164.00) TO ( 12.00 37.00 43.30)
    ( 140.00 -13.00 167.00) TO ( 3.00 37.00 46.30)
    ( 152.00 -13.00 180.00) TO ( -0.20 37.00 47.30)
    ( 152.00 -27.00 187.00) TO ( -0.20 51.00 46.30)
    ( 152.00 36.10 184.00) TO ( 0.20 60.10 43.30)
    ( 152.00 -40.30 179.00) TO ( -0.20 64.30 30.30)
    ( 136.00 -30.00 179.00) TO ( 5.00 62.00 30.30)
  57.) WINDOW-UPPER LEFT
  58.) WINDOW-UPPER RIGHT
  59.) WINDOW-LOWER LEFT
  60.) WINDOW-LOWER RIGHT
  61.) WINDOW-UPPER LEFT
  62.) WINDOW-UPPER RIGHT
  63.) WINDOW-LOWER LEFT
  64.) WINDOW-LOWER RIGHT
  65.) WINDOW-UPPER LEFT
  66.) WINDOW-UPPER RIGHT
  67.) WINDOW-LOWER LEFT
  68.) WINDOW-LOWER RIGHT
  69.) WINDOW-UPPER LEFT
  70.) WINDOW-UPPER RIGHT
  71.) WINDOW-LOWER LEFT
  72.) WINDOW-LOWER RIGHT
  73.) WINDOW-UPPER LEFT
  74.) WINDOW-UPPER RIGHT
  75.) WINDOW-LOWER LEFT
  76.) WINDOW-LOWER RIGHT
  77.) WINDOW-UPPER LEFT
  78.) WINDOW-UPPER RIGHT
  79.) WINDOW-LOWER LEFT
  80.) WINDOW-LOWER RIGHT
  81.) WINDOW-UPPER LEFT
  82.) WINDOW-UPPER RIGHT
  83.) WINDOW-LOWER LEFT
  84.) WINDOW-LOWER RIGHT
  85.) WINDOW-UPPER LEFT
  86.) WINDOW-UPPER RIGHT
  87.) WINDOW-LOWER LEFT
  88.) WINDOW-LOWER RIGHT
  89.) WINDOW-UPPER LEFT
  90.) WINDOW-UPPER RIGHT
  91.) WINDOW-LOWER LEFT
  92.) WINDOW-LOWER RIGHT
  93.) WINDOW-UPPER LEFT
  94.) WINDOW-UPPER RIGHT
  95.) WINDOW-LOWER LEFT
  96.) WINDOW-LOWER RIGHT
  97.) WINDOW-UPPER LEFT
  98.) WINDOW-UPPER RIGHT
  99.) WINDOW-LOWER LEFT
  100.) WINDOW-LOWER RIGHT

```

Figure 11. Subroutine VISVDM Output.



```

11 ) REFUELING CONTROL      ( 105.10 -38.50 110.70) TO ( 38.70 62.50 -30.00)
( 103.30 35.00 106.30) TO ( 40.50 59.00 -34.40)
( 101.80 -26.30 102.90) TO ( 42.00 52.30 -37.80)
( 101.50 -21.80 102.10) TO ( 42.30 45.60 -38.60)
( 93.20 -21.80 100.60) TO ( 50.60 45.60 -32.10)
( 86.60 -21.80 115.30) TO ( 55.20 45.60 -25.40)
( 86.50 -23.40 122.00) TO ( 57.30 47.40 18.70)
1 VERTICES --INPUT COORDINATES-- --ABSOLUTE COORDINATES--
( 137.50 -6.00 139.50) TO ( 6.30 30.00 -1.20)
1 VERTICES --INPUT COORDINATES-- --ABSOLUTE COORDINATES--
( 124.50 5.00 143.00) TO ( 19.30 19.00 2.30)
1 VERTICES --INPUT COORDINATES-- --ABSOLUTE COORDINATES--
( 124.00 7.50 143.25) TO ( 19.80 16.50 2.55)
1 VERTICES --INPUT COORDINATES-- --ABSOLUTE COORDINATES--
( 135.00 4.00 140.00) TO ( 8.00 20.00 -.70)
1 VERTICES --INPUT COORDINATES-- --ABSOLUTE COORDINATES--
( 150.00 6.00 162.00) TO ( 6.20 18.00 41.30)
1 VERTICES --INPUT COORDINATES-- --ABSOLUTE COORDINATES--
( 142.00 8.00 160.00) TO ( 1.00 24.00 39.30)
1 VERTICES --INPUT COORDINATES-- --ABSOLUTE COORDINATES--
( 128.00 -5.00 177.00) TO ( 15.00 29.00 36.30)
1 VERTICES --INPUT COORDINATES-- --ABSOLUTE COORDINATES--
( 128.00 5.00 177.00) TO ( 15.00 19.00 36.30)
1 VERTICES --INPUT COORDINATES-- --ABSOLUTE COORDINATES--
( 116.00 18.00 158.00) TO ( 27.00 6.00 17.30)
1 VERTICES --INPUT COORDINATES-- --ABSOLUTE COORDINATES--
( 116.00 6.00 161.00) TO ( 27.00 26.00 20.30)
1 VERTICES --INPUT COORDINATES-- --ABSOLUTE COORDINATES--
( 116.00 -18.00 158.00) TO ( 27.00 42.00 17.30)
VIS34I CH-53 WITH 12 BOUNDARIES AND 11 MISCELLANEOUS EQUIPMENTS HAS BEEN ADDED.

```

Figure 11. Subroutine VISVDM Output.

The remaining VISVDM printed output includes, for each boundary and miscellaneous equipment, the sequence number, the number of vertices, and the coordinates of each vertex both before and after translation. The last line starting with VIS534I is a message which indicates that VISVDM has successfully completed processing the visibility member.

#### 4.3 EYE POSITIONAL DATA

The eye positional data consist of an (X, Y, Z) coordinate triplet that describes the eye location with respect to the origin of the visibility member data, and the line-of-sight information in the form of a target point for the head (X, Y, Z) or the vertical and horizontal angular offsets for the head (HANG, VANG)\*.

The eye location is entered in the following format (see Figure 12a):

- columns 1-10 the X-coordinate of the eye,
- columns 11-20 the Y-coordinate of the eye,
- columns 21-30 the Z-coordinate of the eye.

This should be entered in the SRP system (i.e. (0,0,0)=seat reference point, and axes FLU). Note that if a decimal point is not punched in the field, it is assumed to be between the second and third to the last columns in each field. Thus, the input card of Figure 12b gives the eye location X=6.12, Y=0.00, Z=31.45 for the plot of Figure 4.

To enter target data (point at which the head is pointing), enter an (X, Y, Z) coordinate triplet as follows (see Figure 13a):

- columns 1-10 X-coordinate of head target (F10.2)
- columns 11-20 Y-coordinate of head target (F10.2)
- columns 21-30 Z-coordinate of head target (F10.2).

This should be entered in the user's coordinate system. Figure 13b shows input for the point X=16.12, Y=0.0, and Z=21.45. The user may use any desired values). Horizontal and vertical offsets to line-of-sight are entered as follows

\*Note that the head position is specified by entering either target data or angular offsets, but not both.





(see Figure 14a):

- columns 1-7 the vertical angle (HANG) offset
- columns 8-14 the horizontal angle (VANG) offset.

Figure 14b shows the sample input for  $HANG=0.0^\circ$  and  $VANG=-45.0^\circ$ . Note that as with the other eye positional input, when no decimal point is entered, the assumed point is between the second and third to the last card columns in each field.

The user can specify the head position by entering either target data or angular offsets, but not both. Which one the user enters depends on the value of TARG in the CNTRL namelist (see Paragraph 4.1).



## SECTION 5

### JOB CONTROL

VISANS originated as a function of the COMputerized BIO-mechanical MAN-model interactive graphics program. The current version of VISANS creates offline plots on a CALCOMP 1036 three-pen plotter using a CDC CYBER computer at Wright-Patterson Air Force Base, Ohio. The job control cards used for these runs are shown in the deck setup of Figure 15. Plot information is transferred to TAPE7 under system control. This plot tape produces three-color plots on a CALCOMP 1036 drum plotter utilizing a CALCOMP Model 925 controller with a universal tape drive.

If online plots are desired, a dummy subroutine, NEWPEN(I) must be added to the Program Source as shown in Figure 16. The deck setup for online plot runs is shown in Figure 17.

The Visibility Analysis program (VISANS) is written in FORTRAN IV using a CALCOMP based plotting package. It uses the following units for I/O:

- Unit 3 - user input, card image format (see Section 4)
- Unit 6 - printed output
- Unit 7 - Gould plotter output
- Unit 9 - Scratch file used by the program.

```

VIS,T25,IØ50,CM105000.  ID#
FTN.
ATTACH,CCPLØT,CCPLØT1036,ID=LIBRARY,SN=ASD.
LABEL,TAPE7,W,D=PE,VSN=Tape#,RING.
LDSET,LIB=CCPLØT.
LGØ.
7/8/9 (EØF)
.
.      Source Deck
.
7/8/9 (EØF)
.
.      Input Data
.
6/7/8/9 (EØJ)

```

Figure 15. Deck Layout for Offline Plot Runs.

```
SUBROUTINE NEWPEN(I)  
RETURN  
END
```

Figure 16. Dummy Subroutine NEWPEN.

VIS,T25,IØ50,CM105000. ID#  
 FTN.  
 ATTACH,CCPLØT,CCPLØT56X,ID=LIBRARY,SN=ASD.  
 LIBRARY,CCPLØT.  
 LGØ.  
 RØUTE,PLØT,TID=Terminal ID,DC=PT,ST=System designation.  
 7/8/9 (EØF)  
 .  
 . Source Deck  
 .  
 7/8/9 (EØF)  
 .  
 . Input Data  
 .  
 6/7/8/9 (EØJ)

Figure 17. Deck Layout for Online Plot Run.

APPENDIX A  
COMPUTATION OF THE VISION ANGLES

As mentioned in Section 1, crew stations are defined geometrically as panels and contours. These panels and contours are represented by closed polygons, and are input to the program in a user defined coordinate system.

Before calculating the vision angles the user defined coordinate system is transformed through the following steps:

- (1) Convert to the three dimensional coordinate system with

+x = forward  
+y = left  
+z = up

and seat reference point = (0,0,0).

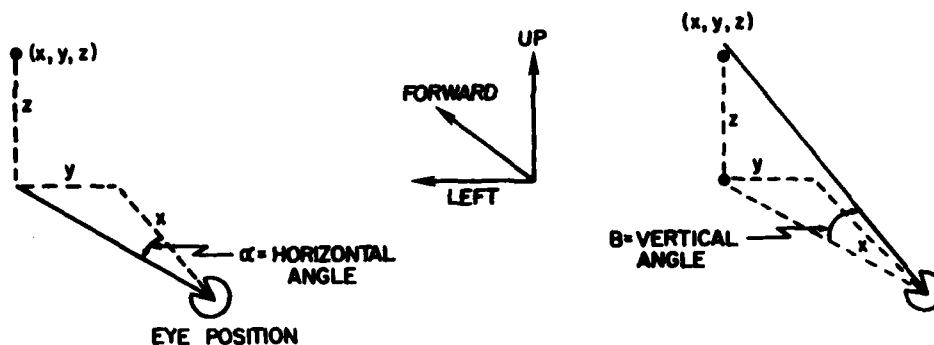
- (2) Translate the origin to the eye location of the crew-member.
- (3) Then, if the crewmembers head is pointed HANG degrees left of forward and VANG degrees above horizontal
  - a) rotate HANG degrees left about the z-axis and
  - b) rotate VANG degrees up about the y-axis.

Angles are calculated in this resulting coordinate system as follows:

If the coordinates of the point are (x, y, z), then

horizontal angle  $\alpha = \tan^{-1}(y/x)$

vertical angle  $\beta = \sin^{-1}(z/\sqrt{x^2+y^2+z^2})$



For the program's visibility plot, these angles are sampled at one inch intervals along the polygon perimeters. To save plotting time and storage, each polygon side is tested to see if it is perpendicular to the x-y plane; and if true, the segment is not sampled (because it will show up as a straight line on the plot). For the printed output the angles are calculated only at the polygon vertices.

APPENDIX B  
VISIBILITY ANALYSIS PROGRAM LISTINGS

```

1  PROGRAM VISANS (INPUT,OUTPUT,TAPES=INPUT,TAPES=OUTPUT,TAPE7,TAPE9) 000100
C  ***** 000110
C  CBHVIS -- GENERATES VISIBILITY PLOTS USING THREE DIMENSIONAL 000120
C  EYE POSITION, AND CREWSTATION COORDINATES 000130
C  ***** 000140
5  C  ***** 000150
C  THE INPUT STREAM IS AS FOLLOWS: 000160
C  1. THE NAMELIST CNTRL 000170
C  2. IF MEN=1; CREWSTATION DATA(SEE SECTION 3 OF USER'S GUIDE) 000180
C  3. IF EYELOC.NE.0; THE EYE POSITION (5X,3F10.2) 000190
C  4. IF TARG=1; THREE DIMENSIONAL COORDINATES OF A POINT AT 000200
C  5. IF TARG=0; WHICH THE EYE IS LOOKING. (3F10.2) 000210
C  6. IF TARG=0; THE VERTICAL AND HORIZONTAL LINE OF SIGHT 000220
C  7. ANGLES(IN THAT ORDER) FOR THE EYES(2F7.2) 000230
C  8. AS MANY MORE COPIES OF #S 1-4 AS NEEDED 000240
C  9. THE NAMELIST CNTRL WITH IEND=1 000250
C  ***** 000260
C  ***** 000270
C  ***** 000280
20 C  THE NAMELIST CNTRL'S VARIABLES: 000290
C  MEN.....IF MEN=1 READ IN VISIBILITY DATA FROM UNIT 3 000300
C  THE DATA IS REFORMATTED AND WRITTEN TO UNIT 9 000310
C  FOR USE BY THE PROGRAM. 000320
C  IF MEN=0 THE PROGRAM ASSUMES DATA IS ALREADY PRESENT ON 000330
C  UNIT 9 IN THE PROPER FORMAT AND BYPASSES THE 000340
C  CALL TO VISVDM. THIS IS THE CASE AFTER THE 000350
C  FIRST PLOT WHEN MORE THAN ONE PLOT IS BEING MADE. 000360
C  OF A PARTICULAR CREWSTATION. (DEFAULT=0) 000370
C  TARG.....IF TARG=1 ENTER AN (X,Y,Z) COORDINATE TRIPLET OF THE 000380
C  POINT AT WHICH THE EYE IS LOOKING. 000390
C  IF TARG=0 ENTER THE VERTICAL AND HORIZONTAL OFFSETS FOR 000400
C  THE LINE OF SIGHT OF THE EYE, IN DEGREES, 000410
C  WITH RESPECT TO STRAIGHT AHEAD. (DEFAULT=0) 000420
C  IEND IEND=1 SIGNALS THE END OF THE DATA. (DEFAULT=0) 000430
C  EYELOC..EYELOC=0 USE THE X, Y, AND Z COORDINATES OF THE EYE 000440
C  FROM THE PREVIOUS PLOT, IF THIS IS NOT THE FIRST PLOT, 000450
C  OR (0.0, 0.0, 0.0) IF IT IS THE FIRST PLOT 000460
C  EYELOC=1 READ THE EYE COORDINATES FOR THIS PLOT. 000470
C  (DEF: EYELOC=1) 000480
C  ILM.....IF ILM=0 NO VISUAL FIELD LIMITS ARE PLOTTED 000490
C  IF ILM=1 VISUAL FIELD LIMITS ARE PLOTTED (DEF:ILM=1) 000500
C  ***** 000510
C  ***** 000520
C  ***** 000530
45 COMMON /VISARC/ IPG,ILN,DATE(2) 000540
COMMON /VSPT/ ILM,HANG,VANG,XLEYE,YLEYE,ZLEYE, 000550
# IYAVE(2),NEQPTS 000560
COMMON /AXES/ IX1,IX2,IY1,IY2,IZ1,IZ2,SEAT(1) 000570
DIMENSION LNAME(60,6) 000580
REAL ACXYZ(3,20),FCYZ(3,20),ALPH(3000),BETA(3000) 000590
REAL MHX,MHY,MHZ,FCYZ(3,20),A(3) 000600
INTEGER VERA(20),HEPA(20) 000610
INTEGER NA4E(6),BNO 000620
INTEGER TARG,EYELOC 000630
NAMELIST/CNTRL/ NLW,EYELOC,TARG,ILIM,IEND 000640
RADANG=57.29577951 000650
XLEYE=6.07 000660

```



```

115 C *****
116 C * ENTER LINE OF SIGHT ANGLES *
117 C * + VANG UP *
118 C * + VANG TO LEFT *
119 C *****
120 READ(3,1005)HANG,VANG
121 17 CONTINUE
122 C *****
123 C * READ IN CANOPY COORD IN SRP SYSTEM *
124 IF(EOF(9).GT.0) GO TO 995
125 NNN=NBND5+NEQPTS
126 CALL VISDPG(0)
127 IF(HANG.LT.0.) IMA=HANG+.5
128 IMA=VANG+.5
129 IF(VANG.LT.0.) IVA=VANG+.5
130 WRITE(6,2005) IMA,DATE,XLEVE,YLEVE,ZLEVE,IMA,IVA
131 CALL VISDPG(5)
132 KBN=3
133 DO 430 IJ=1,NNN
134 READ(9,1004) SNC,NAME,NOVC,((CACXYZ(L,J),L=1,3),J=1,NOVC)
135 IF(EOF(9).GT.0) GO TO 996
136 IF(IJ.LE.NBND5) GO TO 50
137 DO 40 II=1,6
138 40 LNAME(IJ-NBND5,II)=NAME(II)
139 50 CONTINUE
140 C *****
141 C * TRANSLATE COORD. FROM SRP SYSTEM TO LEVE SYSTEM *
142 C *****
143 DO 100 I=1,NOVC
144 LXYZ(1,I)=ACXYZ(1,I)-XLEVE
145 EXYZ(2,I)=ACXYZ(2,I)-YLEVE
146 EXYZ(3,I)=ACXYZ(3,I)-ZLEVE
147 100 CONTINUE
148 C *****
149 C * ROTATE AXES *
150 C *****
151 CALL ROTATE(CXYZ,NOVC,HANG,VANG)
152 C *****
153 C * LOOP THRU XYZ ARRAY AND LOCATE POINTS OF INTERSECTION *
154 C *****
155 NPNTS=0
156 DO 300 I=1,NOVC
157 IVA=-I+1
158 IF(IEQ.NOVC) IVA=1
159 DELX=EXYZ(1,IVAR)-EXYZ(1,I)
160 DELY=EXYZ(2,IVAR)-EXYZ(2,I)
161 DELZ=EXYZ(3,IVAR)-EXYZ(3,I)
162 VMAG=SQRT(DELX**2+DELY**2+DELZ**2)
163 LIM=IFX(VMAG)+1
164 C *****
165 C * VERTICAL LINE TEST *
166 C *****
167 IF(VMAG.GT.1.4NU.(VMAG-ABS(DELZ)).L.F.2.) LIM=2
168 IF(VMAG.EQ.0.) VMAG=1.
169 DO 250 ICHT=1,LIM

```

```

175 D1NCR=(ICNT-1)/VMAG
    IF(ICNT EQ LIM) D1NCR=1.0
    X3=XYZ(1,I)+D1NCR*DELX
    Y3=-(XYZ(2,I)+D1NCR*DELY)
    Z3=XYZ(3,I)+D1NCR*DELZ
    TEMP=0.
    RTMP=X3**2+Y3**2
    IF(RTMP.GT..00001) TEMP=(ATAN2(Y3,X3))*RADANG
    ALPHA=TEMP*180.
    NPNTS=NPNTS+1
    ALPH(NPNTS)=ALPHA
    DEN=SQRT(X3**2+Y3**2+Z3**2)
    C FLAG POINTS THAT LAND ON EYE
    185 IF(TEMP.GT.0.) GO TO 244
        ALPHA=1.E9
        BETAT=1.E9
        ALPH(NPNTS)=ALPHA
        BETA(NPNTS)=BETAT
        GO TO 246
    C VERTICAL ANGLE CALCULATED USING ARCSIN
    190 244 CONTINUE
        BETA=(ASIN(Z3/DEN))*RADANG*90.
        BETA(NPNTS)=BETAT
        GO TO 246
    C
    195 246 CONTINUE
        IF(ICNT.GT.1) GO TO 250
        HERA(I)=(180.-ALPHA)*SIGN(.5,180.-ALPHA)
        VERA(I)=(BETAT-90.)*SIGN(.5,BETAT-90.)
        200 250 CONTINUE
        300 CONTINUE
        C *****
        C IF(IJ.EQ.1) CALL VISPLT
        C *
        C * PLOT POINTS ALONG CONTOUR
        C *****
        205 CALL NEMPEN(1)
            IPEN=3
            DO 300 I=1,NPNTS
                XT=ALPH(I)*.04
                YT=BETA(I)*.04
                IF(I.EQ.1) GO TO 373
                ALPH=ABS(ALPH(I)-ALPH(I-1))
                ALPHI=(ALPH(I)+ALPH(I-1))/2
                BBETAI=(BETA(I)+BETA(I-1))/2
                IF(ALPHI.GE.35) IPEN=3
                IF(ALPHI.LT.1. .OR. AA*PHI.GT. 359. .OR.
                    * JBETA1.LT.1. .OR. BBETA1.GT. 179.) IPEN=3
                313 IF(IJ GT NBND) RBN=RBN+1
                IF(XD.LT.0..OR.XD.GT.14.3.DP.YD.LT.0..OR.YD.GT.17.125) GO TO 379
                IF(XD.LT.2.0.DP.XD.GT.12.3) AND(YD.GT.5.925) GO TO 379
                IF(IJ.LE.NBND) GO TO 375
                CALL NUMBER(XD,YD,.150,RBN,0.0,-1)
                GO TO 380
                315 CALL PLCT(XD,YD,IPEN)
                    IPEN=2
                    GO TO 380
                373 IPEN=3
                380 CONTINUE
            C *****

```

```

230 C *
C ***** PRINT TABULAR DATA *****
      DO 420 I=1,NOVC
        XYZ(I,I)=ACXYZ(IX,I)*IX+XC
        XYZ(I,I)=ACXYZ(IY,I)*IY+YC
        XYZ(I,I)=ACXYZ(IZ,I)*IZ+ZC
240 420 CONTINUE
      IP= NOVC+7
      CALL VISDPG(IP)
      IF(ILN.NE.0) GO TO 402
      CALL VISDPG(5)
      WRITE(6,2005) INAME,DATE,XLEYE,YLEYE,ZLEYE,IHA,IVA
      02 WRITE(6,2006) NAME,IX,IY,IZ
      DO 450 I=1,NOVC
        WRITE(6,2006) HERA(I),VERA(I),(8XYZ(J,I),J=1,3)
245 450 CONTINUE
      460 CONTINUE
      REWIND 9
      CALL PLOT(14,4,0,0,-3)
      IF(NEQPTS.NE.0) CALL LSLGND(NEQPTS,LNAME)
      TSP=3.
      IF(NEQPTS.EQ.0) ISP=1.
      CALL PLOT(TSP,9,0,3)
      CALL PLOT(TSP,-1.6,-2)
      GO TO 10
C
255 465 CONTINUE
      WRITE (6,2012)
      GO TO 997
      995 WRITE (6,2010)
      GO TO 997
      996 WRITE (6,2011)
      997 CALL PLOTE(AAA)
      STOP
C ***** FORMATS *****
C *
C *****
265 1001 FORMAT(///,10X,44H INVALID DATA . TARGET LOCATION EQUIVALENT ,
      # 16H TO EYE LOCATION )
270 1002 FORMAT(3F10.2)
275 1003 FORMAT(5X,2A4,1X,12,3F6.2,3(1X,A1),3(1X,A2))
      1004 FORMAT(13,6A4,13/,4(3F6.2))
      1005 FORMAT(2F7.2)
      2005 FORMAT(/,38X,23HVISIBILITY PLOT DATA FOR: ,A4,
      # 29HVEY LOCATION IN SRP SYSTEM ( ,2(F6.2,1H),F6.2,1H),
      # //39X,24HLINE-OF-SIGHT IN DEGREES,6X,1H( ,14,2H ,14,1H))
280 2006 FORMAT(13X,15,3X,15,11X,3F10.3)
      2008 FORMAT(14H-38X,26HVISIBILITY PLOT DATA FOR: ,A4,
      # //13X,20HLINE-OF-SIGHT ANGLES,13X,20HORIGINAL COORDINATES ,
      # //13X,14HMOKIZ. VERT.,16X,A2,8X,A2,6X,A2//)
285 2010 FORMAT(53H VIS0504 NO VISIBILITY PLOT DATA AVAILABLE ON UNIT 9. )
      2011 FORMAT(131H VIS0514 END OF DATA ON UNIT 9. )
      2012 FORMAT(44H VIS0521 VISIBILITY PLOT GENERATED SUCCESSFULLY. )
      END

```

## SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS OFF LINE REFERENCES  
10273 VISANS 1

VARIABLES SN TYPE RELOCATION

|              |         |        |         |         |         |         |       |       |
|--------------|---------|--------|---------|---------|---------|---------|-------|-------|
| 26370 A      | REAL    | ARRAY  | 102     | 103     | 104     | 3*106   | 3*110 | 2*111 |
| 11553 AAA    | REAL    |        | 51      | 100     | 101     | 102     | 103   | 104   |
| 11554 AALPH  | REAL    |        | 261     | 211     |         |         |       |       |
| 11555 AALPH1 | REAL    |        | 214     | 212     |         |         |       |       |
| 12324 ACXYZ  | REAL    | ARRAY  | 2*215   | 147     | 148     | 232     | 233   | 234   |
| 12111 ALPH   | REAL    | ARRAY  | 136     | 2*211   | 2*212   | DEFINED | 182   | 188   |
| 11540 ALPHA  | REAL    |        | 182     | 2*197   | DEFINED | 180     | 186   |       |
| 11550 BETA1  | REAL    |        | 2*215   | 213     |         |         |       |       |
| 20404 BETA   | REAL    | ARRAY  | 50      | 2*213   | DEFINED | 189     | 194   |       |
| 11542 BETAT  | REAL    |        | 189     | 2*198   | DEFINED | 187     | 193   |       |
| 11573 BNO    | INTEGER |        | 53      | 136     |         |         |       |       |
| 25274 SXYZ   | REAL    | ARRAY  | REFS    | DEFINED | 232     | 233     | 234   |       |
| 2 DATE       | REAL    | ARRAY  | 45      | 240     |         |         |       |       |
| 11525 DELX   | REAL    |        | 164     | DEFINED | 161     |         |       |       |
| 11526 DELY   | REAL    |        | 164     | DEFINED | 162     |         |       |       |
| 11527 DELZ   | REAL    |        | 164     | DEFINED | 163     |         |       |       |
| 11541 DEN    | REAL    |        | 185     | DEFINED | 183     |         |       |       |
| 11533 DIMGR  | REAL    |        | 174     | DEFINED | 175     | 172     | 173   |       |
| 12-20 SXYZ   | REAL    | APRAY  | 50      | 2*151   | 2*162   | 2*163   | 174   | 175   |
| 11-75 EYELOC | INTEGER |        | 54      | 147     | 148     | 69      |       |       |
| 1 HANG       | REAL    | VSPT   | REFS    | 89      | DEFINED | 73      | 112   |       |
| 2-17 MEPA    | INTEGER |        | 120     | 2*129   | 153     |         |       |       |
| 11522 I      | INTEGER | ARRAY  | 52      | DEFINED | 197     | 160     | 161   | 162   |
|              | INTEGER |        | 2*146   | 2*148   | 159     | 198     | 208   | 209   |
|              |         |        | 174     | 176     | 197     | 2*234   | 3*243 |       |
| 11532 ICNT   | INTEGER |        | 2*211   | 2*213   | 2*232   | 2*233   |       |       |
| 11511 IFND   | INTEGER |        | 145     | 207     | 231     | 262     |       |       |
| 11512 IHA    | INTEGER |        | 172     | 196     | DEFINED | 171     |       |       |
| 11521 II     | INTEGER |        | 55      | DEFINED | 72      | 129     |       |       |
| 11515 IJ     | INTEGER |        | 132     | DEFINED | 128     |         |       |       |
|              | INTEGER |        | 2*140   | 139     |         | 220     |       |       |
|              |         |        | 138     | 201     | 217     |         |       |       |
| 0 ILI4       | INTEGER |        | DEFINED | 71      |         |         |       |       |
| 1 ILN        | INTEGER | VSPT   | REFS    | 55      | DEFINED |         |       |       |
| 2 INAME      | INTEGER | VISADC | 46      | 238     |         |         |       |       |
| 11551 IP     | INTEGER | AKPAY  | REFS    | 132     | DEFINED | 124     |       |       |
| 11543 IPEN   | INTEGER |        | 237     | 240     |         |         |       |       |
| 0 IPG        | INTEGER |        | 223     | 236     | 214     | 215     | 224   | 226   |
| 11513 IVA    | INTEGER | VISADC | 45      | 206     |         |         |       |       |
| 11524 IVAR   | INTEGER |        | 132     | DEFINED | 130     | 131     | 160   |       |
| 11506 IX     | INTEGER |        | 161     | 163     | DEFINED | 159     |       |       |
| 0 IX1        | INTEGER |        | 241     | 124     |         |         |       |       |
| 1 IX2        | INTEGER | AXES   | 48      | 99      |         |         |       |       |
| 2 IY1        | INTEGER | AXES   | 2*1     | 232     |         |         |       |       |
| 3 IY2        | INTEGER | AXES   | 48      | 100     |         |         |       |       |

RELOCATION

VARIABLES SN TYPE

11510 IZ INTEGER

11511 IZ1 INTEGER

11512 IZ2 INTEGER

11513 J INTEGER

11514 L INTEGER

11515 L1M INTEGER

11516 LNA4E INTEGER

11517 MHX REAL

11518 MHY REAL

11519 MHZ REAL

11520 NAME INTEGER

11521 NAME INTEGER

11522 NAME INTEGER

11523 NAME INTEGER

11524 NAME INTEGER

11525 NAME INTEGER

11526 NAME INTEGER

11527 NAME INTEGER

11528 NAME INTEGER

11529 NAME INTEGER

11530 NAME INTEGER

11531 NAME INTEGER

11532 NAME INTEGER

11533 NAME INTEGER

11534 NAME INTEGER

11535 NAME INTEGER

11536 NAME INTEGER

11537 NAME INTEGER

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11560 NAME INTEGER

11561 NAME INTEGER

11562 NAME INTEGER

11563 NAME INTEGER

11564 NAME INTEGER

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STATEMENT LABELS  
11416 2012 FMT  
DEF LINE REFERENCES  
281 256

| LOOPS | LABEL | INDEX | FROM TO | LENGTH | PROPERTIES | EXT REFS | EXITS | NOT INNER |
|-------|-------|-------|---------|--------|------------|----------|-------|-----------|
| 10-34 | 400   | IJ    | 135 245 | 345B   |            |          |       |           |
| 10450 | 40    | IJ    | 139 140 | 38     | INSTACK    |          |       |           |
| 10470 | 100   | I     | 145 149 | 68     | INSTACK    |          |       |           |
| 10503 | 300   | I     | 158 200 | 127B   |            |          |       |           |
| 10537 | 250   | ICNT  | 171 199 | 118    |            |          |       |           |
| 10641 | 360   | I     | 207 227 | 61B    |            |          |       |           |
| 10736 | 420   | I     | 231 235 | 11B    | OPT        |          |       |           |
| 10763 | 450   | I     | 242 244 | 14B    |            |          |       |           |

COMMON BLOCKS LFNTH

| VISAOC | VSPT | AXES | MEMBERS | BIAS NAME (LENGTH) | 1 ILN | 1 HANG | 4 YLEVE | 8 NEOPTS | 1 IX2 | 4 IZ1 | 2 DATE | 2 VANG | 5 ZLEVE | 2 IY1 | 5 IZ2 |
|--------|------|------|---------|--------------------|-------|--------|---------|----------|-------|-------|--------|--------|---------|-------|-------|
|        |      |      | 0 IPS   | (1)                | (1)   | (1)    | (1)     | (1)      | (1)   | (1)   | (2)    | (1)    | (1)     | (1)   | (1)   |
|        |      |      | 0 ILIM  | (1)                | (1)   | (1)    | (1)     | (1)      | (1)   | (1)   | (1)    | (1)    | (1)     | (1)   | (1)   |
|        |      |      | 3 XLEVE | (1)                | (1)   | (1)    | (1)     | (1)      | (1)   | (1)   | (1)    | (1)    | (1)     | (1)   | (1)   |
|        |      |      | 6 INAME | (2)                | (2)   | (2)    | (2)     | (2)      | (2)   | (2)   | (2)    | (2)    | (2)     | (2)   | (2)   |
|        |      |      | 0 IX1   | (1)                | (1)   | (1)    | (1)     | (1)      | (1)   | (1)   | (1)    | (1)    | (1)     | (1)   | (1)   |
|        |      |      | 3 IY2   | (1)                | (1)   | (1)    | (1)     | (1)      | (1)   | (1)   | (1)    | (1)    | (1)     | (1)   | (1)   |
|        |      |      | 6 SEAT  | (3)                | (3)   | (3)    | (3)     | (3)      | (3)   | (3)   | (3)    | (3)    | (3)     | (3)   | (3)   |

STATISTICS

| PROGRAM LENGTH           | 165378 | 7531 |
|--------------------------|--------|------|
| BUFFER LENGTH            | 76728  | 4026 |
| CM LABELED COMMON LENGTH | 268    | 22   |
| 320008 CM USED           |        |      |

```

1      SUBROUTINE VISPLT
COMMON /VISAD/ IPIG,ILN,DATE(2)
COMMON /VISPT/ ILIH,HANG,VANG,XLEYE,YLEYE,ZLEYE,
      0 INAL(2),NEOPTS
5      DIMENSION AB(3,4)
      INTEGER ABC(4)
      DIMENSION INT(3),IHL(3),IVT(3),IVL(3)
      DATA INT/9,RIGHT OF ,5MFOM ,ARLEFT OF ,IHL/9,5,8/
      DATA IVT/6,MBELOW ,SHFROM ,6HABOVE ,IVL/6,5,6/
      DATA AB/165,66,-82,95,66,-82,74,48,-56,56,48 , 06./
      DATA ABC/1HM,1HP,1HF,1HS/

C      CALL PLOT(1,0,-3)
C *****
C *      PLOT HEADINGS
C *****
      AL=17.
      IF(NEOPTS.EQ.0) AL=AL-2.
      CALL SYMBOL(1,2,8,-3,16HVERTICAL DEGREES,90.,16)
      CALL SYMBOL(5,3,3,2,18HFROM LINE-OF-SIGHT,90.,18)
      TSP=(AL-9.5)/2.+6
      CALL SYMBOL(TSP,3,8,-5,19HVISIBILITY ANALYSIS ,0.,19)
      TSP=(AL-4.2)/2.+6
      CALL SYMBOL(TSP,9,4,-2,13HCREWSTATION; ,0.,13)
      CALL SYMBOL(999,999,-2,1NAME(1),0.,4)
      CALL SYMBOL(999,999,-2,1NAME(2),0.,4)
      TSP=(AL-11.1)/2.+6
      CALL SYMBOL(TSP,-4,-3,37HHORIZONTAL DEGREES FROM LINE-OF-SIGHT,
      0.,37)
C *****
C *      OUTLINE AREA OF PLOT
C *****
      CALL PLOT(1,2,1,5,3)
      CALL PLOT(1,2,6,8,2)
      CALL PLOT(15,6,8,2)
      CALL PLOT(15,6,1,5,2)
      CALL PLOT(1,1,1,6,2)
C *****
C *      DRAW HORIZONTAL GRID
C *****
      CALL NEMPEN(2)
      XC=15.6
      XD=1.1
      YC=1.6
      DO 320 I=1,17,2
      YC=YC+.4
      CALL PLOT(XD,YC,3)
      CALL PLOT(XC,YC,2)
      IF(I.EQ.17) GO TO 320
      IF(I.EQ.1) XC=13.6
      IF(I.EQ.15) XD=3.2
      YC=YC+.4
      CALL PLOT(XC,YC,3)
      CALL PLOT(XD,YC,2)
320 CONTINUE
C *****
C *      JAW VERTICAL GRID
C *****

```







| VARIABLES | SN | TYPE    | RELOCATION |
|-----------|----|---------|------------|
| 1360 J    |    | INTEGER |            |
| 1350 K    |    | INTEGER |            |
| 1355 L    |    | INTEGER |            |
| 10 NEQPTS |    | INTEGER | VSPT       |
| 1361 SQ1  |    | REAL    |            |
| 1333 TSP  |    | REAL    |            |
| 1350 VA   |    | REAL    |            |
| 2 VANG    |    | REAL    | VSPT       |
| 1341 X    |    | REAL    |            |
| 1334 XC   |    | REAL    |            |
| 1335 XD   |    | REAL    |            |
| 3 XLEYE   |    | REAL    | VSPT       |
| 1347 XP   |    | REAL    |            |
| 1357 X1   |    | REAL    |            |
| 1362 X11  |    | REAL    |            |
| 1336 YC   |    | REAL    |            |
| 4 YLEYE   |    | REAL    |            |
| 1343 YP   |    | REAL    | VSPT       |
| 1353 Y1   |    | REAL    |            |
| 1363 Y11  |    | REAL    |            |
| 1364 Y2   |    | REAL    |            |
| 1365 Y21  |    | REAL    |            |
| 5 ZLEYE   |    | REAL    |            |

| EXTERNALS | TYPE | ARGS    | REFERENCES |
|-----------|------|---------|------------|
| NEWPEN    | 1    | 4,1     | 75         |
| NUMBER    | 6    | 85      | 89         |
| PLOT      | 3    | 13      | 33         |
|           |      | 51      | 64         |
|           |      | 186     |            |
| SORT.     | 1    | LIBRARY | 172        |
| SYMBOL    | 6    | 19      | 20         |
|           |      | 80      | 81         |
|           |      | 92      | 93         |
|           |      | 151     | 152        |

| INLINE FUNCTIONS | TYPE | ARGS   | DEF LINE | REFERENCES |
|------------------|------|--------|----------|------------|
| IABS             | 1    | INTRIN | 101      | 114        |
| IFIX             | 1    | INTRIN | 168      |            |

| STATEMENT LABELS | DEF LINE | REFERENCES |
|------------------|----------|------------|
| 111 320          | 55       | 49         |
| 0 331            | 125      | 121        |
| 303 332          | 129      | 122        |
| 305 333          | 131      | 123        |
| 306 335          | 132      | 126        |
| 0 336            | 134      | 133        |
| 313 337          | 137      | 133        |

| DEF LINE | REFERENCES |
|----------|------------|
| 117      | 171        |
| 171      | 174        |
| 174      | 171        |
| 171      | 171        |
| 3        | 176        |
| 176      | 176        |
| 22       | 176        |
| 24       | 176        |
| 27       | 176        |
| 135      | 176        |
| 132      | 176        |
| 80       | 176        |
| 81       | 176        |
| 82       | 176        |
| 64       | 176        |
| 65       | 176        |
| 117      | 176        |
| 118      | 176        |
| 62       | 176        |
| 59       | 176        |
| 54       | 176        |
| 43       | 176        |
| 51       | 176        |
| 114      | 176        |
| 170      | 176        |
| 106      | 176        |
| 53       | 176        |
| 115      | 176        |
| 63       | 176        |
| 54       | 176        |
| 116      | 176        |
| 101      | 176        |
| 160      | 176        |
| 175      | 176        |
| 176      | 176        |
| 179      | 176        |
| 183      | 176        |
| 186      | 176        |
| 184      | 176        |
| 89       | 176        |
| 159      | 176        |
| 89       | 176        |
| 34       | 176        |
| 62       | 176        |
| 22       | 176        |
| 62       | 176        |
| 104      | 176        |
| 161      | 176        |
| 114      | 176        |

| DEF LINE | REFERENCES |
|----------|------------|
| 149      | 149        |
| 47       | 149        |
| 177      | 149        |
| 48       | 149        |
| 178      | 149        |
| 105      | 149        |
| 26       | 149        |
| 86       | 149        |
| 146      | 149        |
| 70       | 149        |
| 25       | 149        |
| 84       | 149        |
| 144      | 149        |
| 110      | 149        |
| 118      | 149        |
| 179      | 149        |
| 161      | 149        |
| 114      | 149        |

| DEF LINE | REFERENCES |
|----------|------------|
| 145      | 145        |
| 37       | 145        |
| 157      | 145        |
| 28       | 145        |
| 88       | 145        |
| 167      | 145        |
| 70       | 145        |
| 90       | 145        |
| 148      | 145        |
| 79       | 145        |
| 91       | 145        |
| 150      | 145        |

STATEMENT LABELS

| DEF LINE | REFERENCES |
|----------|------------|
| 315 318  | 132        |
| 316 339  | 136        |
| 143 340  | 61         |
| 0 345    | 99         |
| 0 350    | 108        |
| 243 353  | 109        |
| 0 360    | 120        |
| 451 362  | 111        |
| 0 363    | 182        |
| 467 364  | 174        |
| 0 365    | 169        |
|          | 187        |
|          | 181        |
|          | 190        |
|          | 166        |

INACTIVE

171

| LOOPS LABEL | INDEX | FROM-TO | LENGTH | PROPERTIES |
|-------------|-------|---------|--------|------------|
| 64 320      | I     | 45 55   | 308    | EXT REFS   |
| 117 340     | I     | 61 71   | 278    | EXT REFS   |
| 215 350     | I     | 99 108  | 268    | EXT REFS   |
| 247 360     | I     | 111 120 | 278    | EXT REFS   |
| 402 365     | I     | 166 190 | 778    | EXT REFS   |
| 407 363     | K     | 169 189 | 678    | EXT REFS   |
| -12 363     | J     | 171 189 | 628    | EXT REFS   |

EXITS

NOT INNER  
NOT INNER

COMMON BLOCKS

1 ILW (1)  
1 HANG (1)  
4 YLEYE (1)  
8 NEQPTS (1)

2 DATE (2)  
2 VANG (1)  
5 ZLEYE (1)

STATISTICS

|                          |       |     |
|--------------------------|-------|-----|
| PROGRAM LENGTH           | 15248 | 852 |
| CM LABELED COMMON LENGTH | 158   | 13  |
| 320008 CM USED           |       |     |

```

1      SUBROUTINE VISVDM
C *****
C * CBMVDM - VISIBILITY DATABASE MAINTENANCE *
C *
C *****
C      COMMON /VISADC/ IPG,ILN,DATE(12)
C      COMMON /AXES/ IX1,IX2,IY1,IY2,IZ1,IZ2,ACXYZ(3)
C      INTEGER IYIP(6),BNV,NAME(12),ITYPE(6)
C      INTEGER BNO(100),BNAME(6,100)
C      REAL BX(25),BY(25),EZ(25),BXYZ(3,25,100)
C      DATA IADD/4*HADD/
C      DATA IYIP/INF,1HA,1HL,1HR,1HU,1HD/
C      DATA IYTYPE /1,-1,2,-2,3,-3/,BLANK/4H
C      DATA BXYZ/7100*0./
C      IPG=0
C      JCHK=0
C *****
C * COMMAND PROCESSOR *
C *****
C      10 READ(3,1000) IOPR,NAME,NBND,NEQPTS,ACXYZ,IX,IY,IZ,DATE
C      CALL VISDPG(0)
C      IF(IOPR.EQ.IADD) GO TO 20
C      ** ERROR ** 1ST CARD IS NOT AN 'ADD' CARD
C      WRITE(6,1001) IOPR,NAME,NBND,NEQPTS,ACXYZ,IX,IY,IZ
C      WRITE(6,2000) IOPR
C      GO TO 710
C *****
C * ADD CREW STATION DATA MEMBER *
C *****
C      20 CONTINUE
C      CALL VISDPG(1)
C      PRINT THE 1ST INPUT CARD AS READ IN
C      WRITE(5,1001) IOPR,NAME,NBND,NEQPTS,ACXYZ,IX,IY,IZ
C      IF(NAME(1).NE.BLANK.OR.NAME(2).NE.BLANK) GO TO 22
C      CALL VISDPG(1)
C      WRITE(5,2005) IOPR
C      GO TO 10
C      22 NBN=NBNDS+NEQPTS
C      IF(NBN.GE.1.AND.NBN.LE.100.AND.NEQPTS.LE.0) GO TO 25
C      ** ERROR ** TOTAL NUMBER OF BOUNDARIES AND MISC EQUIP TOO LARGE
C      CALL VISDPG(1)
C      WRITE(6,2007) NAME
C      GO TO 10
C      25 DO 30 I=1,N
C      IF(IX.EQ.IYIP(I)) GO TO 40
C      30 CONTINUE
C      ** ERROR ** ILLEGAL X-AXIS QUALIFIER
C      CALL VISDPG(1)
C      WRITE(6,2008) IX,NAME
C      GO TO 10
C      40 IX1=IABS(ITYPE(I))
C      IX2=ISIGN(1,ITYPE(I))
C      DO 50 I=1,6
C      IF(IY.EQ.IYIP(I)) GO TO 60
C      50 CONTINUE
C      ** ERROR ** ILLEGAL Y-AXIS QUALIFIER
C      CALL VISDPG(1)

```

```

        WRITE(6,2009) IY,NAME
        GO TO 10
60      IY1=IABS(IYTYPE(I))
        IY2=ISIGN(1,IYTYPE(I))
        DO 70 I=1,6
        IF(IY2.EQ.IYTYPE(I)) GO TO 80
        70 CONTINUE
        C ** ERROR ** ILLEGAL Z-AXIS QUALIFIER
        CALL VISDPG(1)
        WRITE(6,2010) IZ,NAME
        GO TO 10
        80 IZ1=IABS(IYTYPE(I))
        IZ2=ISIGN(1,IYTYPE(I))
        IF(IZ1.NE.IY1.AND.IZ1.NE.IZ1.AND.IY1.NE.IZ1) GO TO 95
        C ** ERROR ** COLINEAR AXES
        CALL VISDPG(1)
        WRITE(6,2011) NAME
        GO TO 10
        95 CONTINUE
        CALL VISDPG(4)
        WRITE(6,2019) NAME,DATE,NBNDOS,NEQPTS,ACXYZ,IX,IY,IZ
        WRITE(6,2012) NAME,NBNDOS,NEQPTS,ACXYZ,IX,IY,IZ
        C PROCESSOR BOUNDARY DEFINED
        DO 110 I=1,NNN
        RFAD(3,1002) BNO(I),(BNAME(J,I),J=1,6),BNV,
        * (BX(J),BY(J),BZ(J),J=1,6)
        K=I-1
        DO 93 J=1,K
        IF(I.NE.1.AND.BNO(J).EQ.BNO(I)) GO TO 94
        93 CONTINUE
        94 CALL VISDPG(1)
        WRITE(6,2025) (BNAME(L,I),L=1,6),(BNAME(L,J),L=1,6)
        JCHK=JCHK+1
        99 DO 100 J=1,6
        IXYZ(IX1,J,I)=(BX(J)-ACXYZ(1))*IX2
        IXYZ(IY1,J,I)=(BY(J)-ACXYZ(2))*IY2
        IXYZ(IZ1,J,I)=(BZ(J)-ACXYZ(3))*IZ2
        CALL VISDPG(1)
        WRITE(6,1003) BNO(I),(BNAME(J,I),J=1,6),BNV
        DO 107 J=1,6
        CALL VISDPG(1)
        107 WRITE(6,1004) (BX(J),BY(J),BZ(J),(BXYZ(K,J,I),K=1,3))
        IF(JCHK.EQ.0) WRITE(6,2013) BNO(I),(BNAME(J,I),J=1,6),BNV,
        * ((3XYZ(K,J,I),K=1,3),J=1,6)
        110 CONTINUE
        IF(JCHK.NE.0) GO TO 170
        C PROCESSING COMPLETED SUCCESSFULLY
        WRITE(6,2026) NAME,NBNDOS,NEQPTS
        REMIND 9
        RETURN
        C
        C ERROR ENCOUNTERED DURING PROCFSSING
        170 WRITE(6,2029) NAME,JCHK
        GO TO 710
        C
        C

```

FTN 4.8+528

SUBROUTINE VISVDM 74/74 OF 1=1

```

111 C FEND
112 C
113 7 10 W:IT:(6,2039)
114 STOP
115 C
116 C *****
117 C * FORMATS
118 C *
119 C *****
120 1000 FORMAT(A4,1X,2A4,I3,I2,3F6.2,J(1X,A1),8X,2A4 )
121 1001 FORMAT(9H VTS509A ,A1,1X,2A4,I3,I2,3F6.2,J(1X,A1),3(1X,A2))
122 1002 FORMAT(I3,bA4,2X,I3/I3(F6.2))
123 1003 FORMAT(I15,3H,) ,A4,2X,I2,I2,19H VERTICES --INPUT C,
124 # 2COORDINATES - ABSOLUTE COORDINATES--
125 1004 FORMAT(50X,1H(,3F7.2,6H) TO (,3F7.2,1H))
126 C
127 2000 FORMAT(9H VTS501A ,A1,19H- UNKNOWN OPERATION.)
128 2005 FORMAT(24H VTS509A NO NAME GIVEN, ,A4,10H, IGNORED.)
129 2007 FORMAT(56H VTS507A NUMBER OF BOUNDARIES OR EQUIPMENTS INVALID FOR
130 # 7H MEMBER ,2A4,1H.)
131 2008 FORMAT(9H VTS508A ,A1,26H FOR X INVALID, MEMBEF IS ,2A4,1H.)
132 2009 FORMAT(9H VTS509A ,A1,26H FOR Y INVALID, MEMBEF IS ,2A4,1H.)
133 2010 FORMAT(9H VTS510A ,A1,26H FOR Z INVALID, MEMBEF IS ,2A4,1H.)
134 2011 FORMAT(49H VTS511A X,Y, X&Z OR Y&Z ARE COLINEAR FOR MEMBER ,2A4)
135 2012 FORMAT(5X,2A4,1X,I2,I2,3F6.2,J(1X,A1))
136 2013 FORMAT(I3,6A4,I3,/,6(3F6.2))
137 2019 FORMAT(17H VTS519I MEMBER, ,2A4,2H (,2A4,1H),5H, HAS,I&H,
138 # 15H BOUNDARIES AND,I3,24H MISCELLANEOUS EQUIPMENTS /
139 # 30H VTS520I COORDINATES ARE TRANSLATED TO,
140 # 8HVEN AS ,A1,2H, ,A1,5H AND ,A1,21H ARE NOW F, L, AND U.)
141 2025 FORMAT(9H VTS531A ,6A4,20H HAS SAME NUMBER AS ,6A4,1H.)
142 2023 FORMAT(9H VTS534I ,2A4,5H WITH,I5,15H BOUNDARIES AND,I3,
143 # 40H MISCELLANEOUS EQUIPMENTS HAS BEEN ADDED. )
144 2029 FORMAT(9H VTS535A ,2A4,17H NOT ADDED DUE TO,I5,10H ERROR(S).)
145 2059 FORMAT(21H VTS522I PROGRAM END.)
146 END
147

```

SYMBOLIC REFERENCE MAP (R=3)

| ENTRY POINTS | DEF LINE | REFERENCES | SM TYPE | RELOCATION | AXES | REFS    | 7       | 24      | 33  | 78      | 79      | 93    | 94 |
|--------------|----------|------------|---------|------------|------|---------|---------|---------|-----|---------|---------|-------|----|
| 1 VISVDM     | 1        | 108        |         |            |      |         |         |         |     |         |         |       |    |
| VARIABLES    |          |            |         |            |      |         |         |         |     |         |         |       |    |
| 6 ACXYZ      |          |            |         |            |      |         |         |         |     |         |         |       |    |
| 345 BLANK    | FEAL     |            |         |            |      | 95      | DEFINED | 20      |     |         |         |       |    |
| 1177 BNAYE   | FEAL     |            |         |            |      | REFS    | 2*30    | DEFINED | 13  |         |         |       |    |
| 1033 ANO     | INTEGEF  | ARRAY      |         |            |      | REFS    | 9       | 2*90    | 97  | 101     | DEFINED | 82    |    |
| 1000 BNV     | INTEGEF  | ARRAY      |         |            |      | REFS    | 9       | 2*86    | 97  | 101     | DEFINED | 82    |    |
|              | INTEGEK  |            |         |            |      | REFS    | 8       | 82      | 92  | 97      | 99      | 2*101 |    |
|              |          |            |         |            |      | DEFINED | 82      |         |     |         |         |       |    |
| 2327 AX      | FEAL     | ARRAY      |         |            |      | REFS    | 10      | 93      | 100 | DEFINED | 82      |       |    |
| 2.42 9XY2    | FEAL     | ARRAY      |         |            |      | REFS    | 10      | 100     | 101 | DEFINED | 14      | 93    | 94 |
|              |          |            |         |            |      | 95      |         |         |     |         |         |       |    |

| VA-variables     | SN | TYPE    | RELOCATION | REFS       | 10    | 94      | 100     | DEFINED | 82      | 61   | 63  | 94 | 62 |
|------------------|----|---------|------------|------------|-------|---------|---------|---------|---------|------|-----|----|----|
| 2360 BY          |    | REAL    | ARRAY      | REFS       | 10    | 94      | 100     | DEFINED | 82      |      |     |    |    |
| 2411 BZ          |    | REAL    | ARRAY      | REFS       | 10    | 94      | 100     | DEFINED | 82      |      |     |    |    |
| 2 DATE           |    | REAL    | ARRAY      | REFS       | 6     | 78      | DEFINED | 20      |         |      |     |    |    |
| 1011 I           |    | INTEGER |            | REFS       | 45    | 51      | 52      | 54      | 60      | 61   | 63  |    |    |
|                  |    |         |            | REFS       | 70    | 2*82    | 84      | 2*86    | 90      | 93   | 94  |    |    |
|                  |    |         |            | REFS       | 2*97  | 100     | 3*101   | DEFINED | 44      | 53   |     |    |    |
|                  |    |         |            | REFS       | 81    |         |         |         |         |      |     |    |    |
| 3-- IADJ         |    | INTEGER |            | REFS       | 22    | UFFINED | 11      |         |         |      |     |    |    |
| 1 ILN            |    | INTEGER |            | REFS       | 6     |         |         |         |         |      |     |    |    |
| 1002 IOP1        |    | INTEGER | VISADC     | REFS       | 22    | 24      | 25      | 33      | 36      |      |     |    |    |
|                  |    |         |            | REFS       | 20    |         |         |         |         |      |     |    |    |
| 0 IPG            |    | INTEGER |            | REFS       | 6     | DEFINED | 15      | 63      | DEFINED | 12   |     |    |    |
| 1010 ITP         |    | INTEGER |            | REFS       | 8     | 45      | 54      | 60      | 61      | 69   |     |    |    |
| 1025 ITYPE       |    | INTEGER | ARRAY      | REFS       | 8     | 51      | 52      | 60      |         | 70   |     |    |    |
|                  |    |         | ARRAY      | REFS       | 13    |         |         |         |         |      |     |    |    |
|                  |    |         |            | REFS       | 24    | 33      | 45      | 49      | 78      | 79   |     |    |    |
| 100 IX           |    | INTEGER |            | REFS       | 20    |         |         |         |         |      |     |    |    |
|                  |    |         |            | REFS       | 24    |         |         |         |         |      |     |    |    |
| 0 IX1            |    | INTEGER | AXES       | REFS       | 7     | 2*71    | 93      | DEFINED | 51      |      |     |    |    |
| 1 IX2            |    | INTEGER | AXES       | REFS       | 7     | 93      | DEFINED | 52      |         |      |     |    |    |
| 1006 IY          |    | INTEGER |            | REFS       | 24    | 33      | 54      | 50      | 70      | 79   |     |    |    |
|                  |    |         |            | REFS       | 20    |         |         |         |         |      |     |    |    |
| 2 IY1            |    | INTEGER | AXES       | REFS       | 7     | 2*71    | 94      | DEFINED | 60      |      |     |    |    |
| 3 IY2            |    | INTEGER | AXES       | REFS       | 7     | 94      | DEFINED | 61      |         |      |     |    |    |
| 1007 IZ          |    | INTEGER |            | REFS       | 24    | 33      | 63      | 67      | 78      | 79   |     |    |    |
|                  |    |         |            | REFS       | 20    |         |         |         |         |      |     |    |    |
| 4 IZ1            |    | INTEGER | AXES       | REFS       | 7     | 2*71    | 95      | DEFINED | 69      |      |     |    |    |
| 5 IZ2            |    | INTEGER | AXES       | REFS       | 7     | 95      | DEFINED | 70      |         |      |     |    |    |
| 1012 J           |    | INTEGER |            | REFS       | 4*82  | 86      | 90      | 2*93    | 2*94    | 2*95 | 97  |    |    |
|                  |    |         |            | REFS       | 2*101 | DEFINED | 2*82    | 85      | 92      | 97   | 98  |    |    |
|                  |    |         |            | REFS       | 2*101 |         |         |         |         |      |     |    |    |
| 1001 JCHK        |    | INTEGER |            | REFS       | 91    | 101     | 104     | 111     | DEFINED | 16   | 91  |    |    |
| 1013 K           |    | INTEGER |            | REFS       | 85    | 100     | 101     | DEFINED | 84      | 100  | 101 |    |    |
| 1014 L           |    | INTEGER |            | REFS       | 2*90  | DEFINED | 2*90    |         |         |      |     |    |    |
| 1023 NAME        |    | INTEGER | ARRAY      | REFS       | 8     | 24      | 33      | 2*34    | 42      | 49   | 58  |    |    |
|                  |    |         |            | REFS       | 74    | 78      | 79      | 106     | 111     |      |     |    |    |
|                  |    |         |            | REFS       | 67    |         |         |         |         |      |     |    |    |
| 1003 NBNDS       |    | INTEGER |            | REFS       | 20    | 33      | 38      | 78      | 79      | 106  |     |    |    |
|                  |    |         |            | REFS       | 24    |         |         |         |         |      |     |    |    |
| 1004 NEQPTS      |    | INTEGER |            | REFS       | 20    | 33      | 38      | 39      | 70      | 79   | 106 |    |    |
|                  |    |         |            | REFS       | 24    |         |         |         |         |      |     |    |    |
| 1010 NNM         |    | INTEGER |            | REFS       | 20    |         |         |         |         |      |     |    |    |
|                  |    |         |            | REFS       | 2*39  | 81      | DEFINED | 38      |         |      |     |    |    |
| FILE NAMES       |    | MODE    |            |            |       |         |         |         |         |      |     |    |    |
| TAPE3            |    | FMT     | READS      | 20         | 82    |         |         |         |         |      |     |    |    |
| TAPE6            |    | FMT     | WRITES     | 24         | 25    | 33      | 36      | 42      | 49      | 58   | 67  |    |    |
|                  |    |         | 74         | 78         | 90    | 97      | 100     | 106     | 111     | 117  |     |    |    |
| TAPE9            |    | FMT     | WRITES     | 79         | 101   | MOTION  | 107     |         |         |      |     |    |    |
| EXTERNALS        |    | TYPE    | REFERENCES |            |       |         |         |         |         |      |     |    |    |
| VISOPG           |    | 1       | REFERENCES | 31         | 35    | 41      | 48      | 57      | 66      | 73   | 77  |    |    |
|                  |    |         | 21         | 85         | 99    |         |         |         |         |      |     |    |    |
| INLINE FUNCTIONS |    | TYPE    | DEF LINE   | REFERENCES |       |         |         |         |         |      |     |    |    |
| IAB5             |    | INTEGER | 1 INTRIN   | 60         | 69    |         |         |         |         |      |     |    |    |
| ISIGN            |    | INTEGER | 2 INTRIN   | 61         | 70    |         |         |         |         |      |     |    |    |

STATEMENT LABELS

DEF LINE REFERENCES

75

50

59

68

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17 20

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50 30

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62 40

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108 60

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116 80

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201 94

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89

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89

89

89

134 95

76

76

76

76

76

76

76

76

76

76

216 99

92

92

92

92

92

92

92

92

92

92

0 100

100

100

100

100

100

100

100

100

100

100

0 107

103

103

103

103

103

103

103

103

103

103

325 170

111

111

111

111

111

111

111

111

111

111

330 710

117

117

117

117

117

117

117

117

117

117

566 1001

124

124

124

124

124

124

124

124

124

124

574 1002

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125

125

125

125

125

125

125

125

125

600 1003

126

126

126

126

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126

126

126

126

126

612 1004

128

128

128

128

128

128

128

128

128

128

617 2009

130

130

130

130

130

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130

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130

624 2005

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632 2007

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643 2008

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652 2003

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661 2010

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678 2011

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677 2012

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703 2013

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707 2013

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741 2025

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PAGE 6

08/05/81 15.45.00

FTN 4.8+128

74/74 OPT=1

SUBROUTINE VISDOM

STATISTICS  
PROGRAM LENGTH 21156B 8814  
CM LABELED COMMON LENGTH 158 13  
32000B CM USED



PAGE 2

06/05/81 15.45.00

FTN 4.8+528

74/74 OPT=1

SUBROUTINE VISDPG

STATISTICS

|                          |     |    |
|--------------------------|-----|----|
| PROGRAM LENGTH           | 338 | 27 |
| CM LABELED COMMON LENGTH | 48  | 4  |
| 32000 CM USED            |     |    |



PAGE 2

08/15/81 15.45.00

FTN 4.84528

74/74 OPT=1

SUBROUTINE LSLGND

STATISTICS  
PROGRAM LENGTH 1578 111

52008 CM USED

```

1 SUBROUTINE VISTPG
C *****
C * VISTPG PRINTS A TITLE PAGE
C *****
5 WRITE(6,1000)
WRITE(6,1001)
WRITE(6,1002)
RETURN
C
10 1000 FORMAT (1HS)
1001 FORMAT(23H1 A COMPUTER PROGRAM OF/
132H THE UNITED STATES AIR FORCE/
242H AEROSPACE MEDICAL RESEARCH LABORATORY/
342H WRIGHT-PATTERSON AIR FORCE BASE, OHIO/
415H ...../
556H THE ELECTRICAL & COMPUTER ENGINEERING DIVISION/
649H UNIVERSITY OF DAYTON RESEARCH INSTITUTE/
723H DAYTON , OHIO)
1002 FORMAT ( 15(//),
1 50X,14H-- VISANS -- ,//,40X,30HOREMEMBER VISIBILITY ANALYSIS,
2 6H PROGRAM )
C
20 END

```

SYMBOLIC REFERENCE MAP (R=3)

| ENTRY POINTS | DEF LINE | REFERENCES |
|--------------|----------|------------|
| 1 VISTPG     | 1        | 6          |

| FILE NAMES | MODE | WRITS | 5 | 6 | 7 |
|------------|------|-------|---|---|---|
| TAPE6      | FMT  |       |   |   |   |

| STATEMENT LABELS | DEF LINE | REFERENCES |
|------------------|----------|------------|
| 22 1000 FMT      | 10       | F          |
| 24 1001 FMT      | 11       | 6          |
| 65 1002 FMT      | 19       | 7          |

| STATISTICS | PROGRAM LENGTH | 768 | 62 |
|------------|----------------|-----|----|
|            | 320009 CM USED |     |    |



SUBROUTINE COTATE 74/74 OPT=1

VARIABLES SN TYPE  
64 VCOS REAL  
65 VSIN REAL

RELOCATION

REFS  
REFS

22  
23

30  
30

28  
28

EXTERNALS TYPE  
COS REAL  
SIN REAL

ARGS REFERENCES  
1 LIBRARY 11  
1 LIBRARY 12

22  
23

STATEMENT LABELS  
0 100  
0 200

DEF LINE REFERENCES  
20 16  
31 27

LOOPS LABEL INDEX  
23 100 I  
4 200 I

FROM-TO LENGTH PROPERTIES  
16 20 68 INSTACK  
27 31 68 INSTACK

STATISTICS  
PROGRAM LENGTH  
320008 CH USED

1628 .114

CSU NOS/3E L530C L530C-CM83 R N 09.21

15.44.28.PMG326K FROM /92

15.44.28.IP 0000012. WORDS - FILE INPUT , DC 04

15.44.28.PMG, I10, I01. L710431 POTTER

15.44.30.ATTACH, FILE, VISPROG, NR=1.

15.44.30.AT CY= 052 SN=AMRL

15.45.00.FTN, I=FILE, R=3.

15.45.58 3.801 CP SECONDS COMPILATION TIME

15.45.58.OP 0001260 WORDS - FILE OUTPUT , DC 40

15.45.58.MS 1.592 WORDS ( 32832 MAX USED)

15.45.58.CPA 3.862 SEC 1.933 ADJ.

15.45.58.I0 13.798 SEC. 7.810 ADJ.

15.45.58.CH 332.336 KMS. 2.703 ADJ.

15.45.58.CRUS 12.447

15.45.58.COST .56

15.45.58.PP 16.060 SEC. DATE 06/05/61

15.45.58.EJ FND OF JOB, 92 L710461.

PMG928K //// END OF LIST ////

#### REFERENCES

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