N74-10176

NASA TECHNICAL MEMORANDUM

NASA TM X-2901

NASA TM X-2901

CASE FILE COPY

INTERCOMPUTER TRANSFER IN FULL PRECISION OF ARBITRARY DATA ON MAGNETIC TAPE EMPLOYING NASTRAN USER TAPE FORMAT

by James L. Rogers, Jr.

Langley Research Center
Hampton, Va. 23665

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • WASHINGTON, D. C. • NOVEMBER 1973

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA TM X-2901		
4. Title and Subtitle INTERCOMPUTER TRANSFER IN FULL PRECISION OF ARBITRARY DATA ON MAGNETIC TAPE EMPLOYING NASTRAN USER TAPE FORMAT		5. Report Date November 1973 6. Performing Organization Code
7. Author(s) James L. Rogers, Jr.		8. Performing Organization Report No. L-9052 10. Work Unit No. 501-22-01-01
9. Performing Organization Name and Address NASA Langley Research Center Hampton, Va. 23665		11. Contract or Grant No.
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, D.C. 20546		13. Type of Report and Period Covered Technical Memorandum 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

A description is presented of two new utility programs which implement the transfer, in full precision, of arbitrary data (matrices or tables) between any of the three NASTRAN operative computers without the handling of large card decks. These computers include the CDC 6000 series, the IBM 360-370 series, and the UNIVAC 1100 series. The data may be generated by NASTRAN or by another computer program if the NASTRAN user tape format is employed.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Intercomputer data transfer NASTRAN	Unclassified – Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified	46	Domestic, \$3.00 Foreign, \$5.50

*For sale by the National Technical Information Service, Springfield, Virginia 22151

CONTENTS

INTERCOMPUTER TRANSFER IN FULL PRECISION OF ARBITRARY DATA ON MAGNETIC TAPE EMPLOYING NASTRAN USER TAPE FORMAT

By James L. Rogers, Jr.
Langley Research Center

SUMMARY

A description is presented of two new utility programs which implement the transfer, in full precision, of arbitrary data (matrices or tables) between any of the three NASTRAN operative computers without the handling of large card decks. These computers include the CDC 6000 series, the IBM 360-370 series, and the UNIVAC 1100 series. The data may be generated by NASTRAN or by another computer program if the NASTRAN user tape format is employed.

INTRODUCTION

The NASTRAN computer program (refs. 1 and 2) is capable of execution on three different types of computers, namely, the CDC 6000 series, the IBM 360-370 series, and the UNIVAC 1100 series. A typical activity requiring transfer of data between dissimilar computers is the analysis of a large structure such as the Space Shuttle by substructuring. Models of portions of the vehicle which have been analyzed by subcontractors on their computers must be integrated into a model of the complete structure by the prime contractor on his computer. Presently the transfer of NASTRAN matrices or tables between two different types of computers is accomplished by punched cards or a magnetic tape containing card images. These methods of data transfer do not satisfy the requirements for intercomputer data transfer associated with a substructuring activity because (1) accuracy will be lost due to the precision limitations (10 significant digits) of the NASTRAN Direct Matrix Input (DMI) punched card and (2) large order matrices make card handling too cumbersome.

To provide a more satisfactory transfer of data, two new programs, RDUSER and WRTUSER, were created. These two programs, used in conjunction with NASTRAN modules OUTPUT2 (ref. 1, p. 5.3-20h) and INPUTT2 (ref. 1, p. 5.3-16h) available in level 15 and later versions of NASTRAN, allow data to be transferred between computers without loss of accuracy and without handling large decks of punched cards. The purpose of this paper is to describe both the utility programs RDUSER and WRTUSER and their applications by typical data transfer. Although data may come from any computer program using the NASTRAN user tape format, examples in this paper are confined to NASTRAN data since RDUSER and WRTUSER were written with the NASTRAN user in mind.

OVERVIEW OF PROGRAMS

Beginning with level 15 NASTRAN provided the capability of using FORTRAN WRITE statements to write intermediate data blocks (matrices or tables) on a magnetic tape. This was made possible by the NASTRAN module OUTPUT2 which has the following calling sequence:

OUTPUT2 DB1, DB2, DB3, DB4, DB5//V, N, P1/V, N, P2/V, N, P3 $

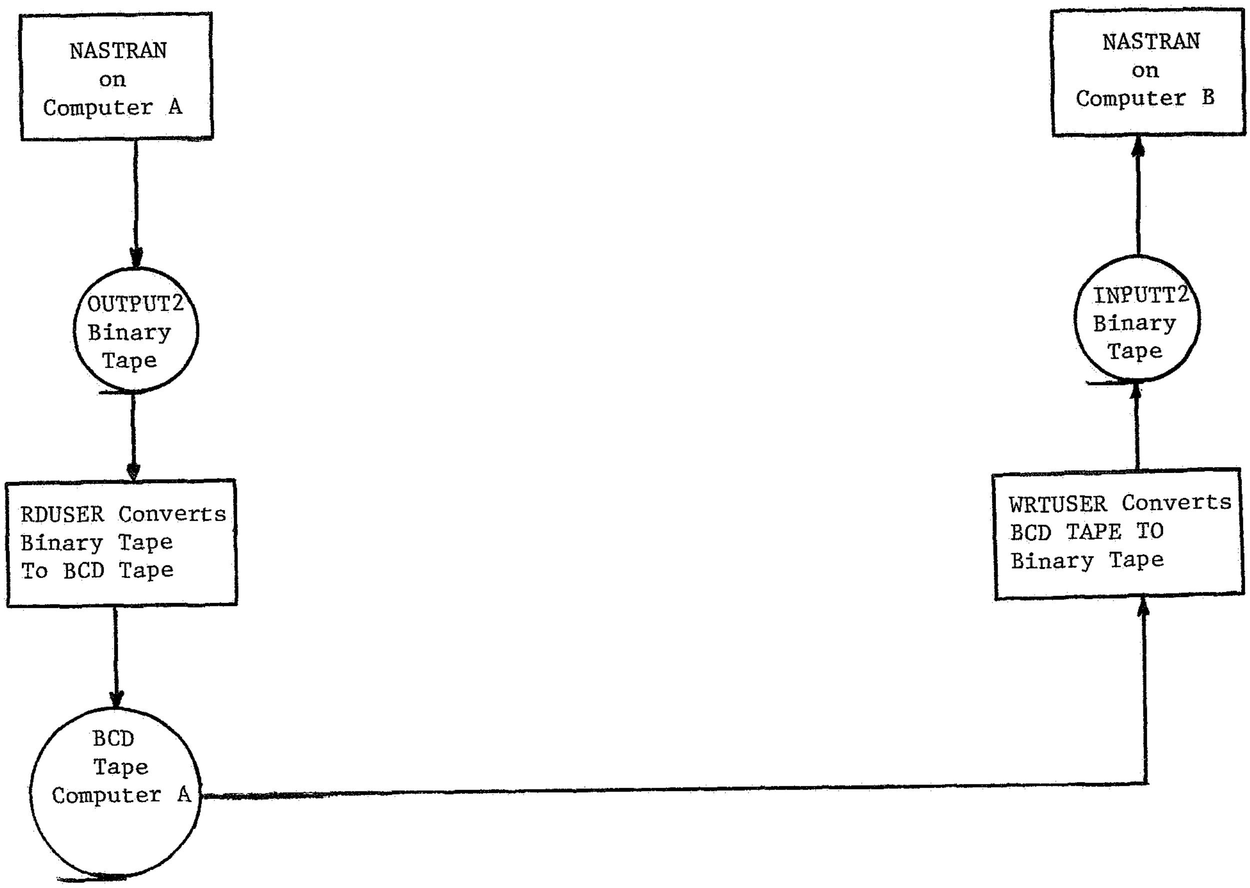
where the DBi are the data blocks to be written on tape, P1 is a parameter for positioning the tape, P2 is the FORTRAN unit number assigned to the tape, and P3 is the FORTRAN User Tape Label (default = XXXXXXXX).

The tape created by OUTPUT2 is a binary tape. Its format is shown in tables I, II, and III. Tapes created by a program other than NASTRAN are acceptable as long as the data are output in this format. In order to write the header information on the tape, the P1 parameter must be -1 (rewind before writing) the first time OUTPUT2 is called in NASTRAN; otherwise, P1 is zero. This binary tape must be converted to a BCD (binary coded decimal) tape before it can be used on a computer of a different type. The conversion is performed by the utility program RDUSER which accepts tables and single- or double-precision, real or complex matrices. No precision is lost in generating the BCD tape, and the problem of handling large numbers of punched cards is alleviated.

The tape containing the BCD data is transferred to another installation. Before these data can be used as input for NASTRAN at this installation, two tasks must be performed. The first task is to convert the source of the BCD tape, written by RDUSER, to another source form readable by the computer on which the data will be used. The second task is to convert the BCD tape into an acceptable binary form for the NASTRAN module INPUTT2. The program WRTUSER accomplishes both of these tasks. The calling sequence for the INPUTT2 module has the form

INPUTT2 DB1, DB2, DB3, DB4, DB5/V, N, P1/V, N, P2/V, N, P3 $

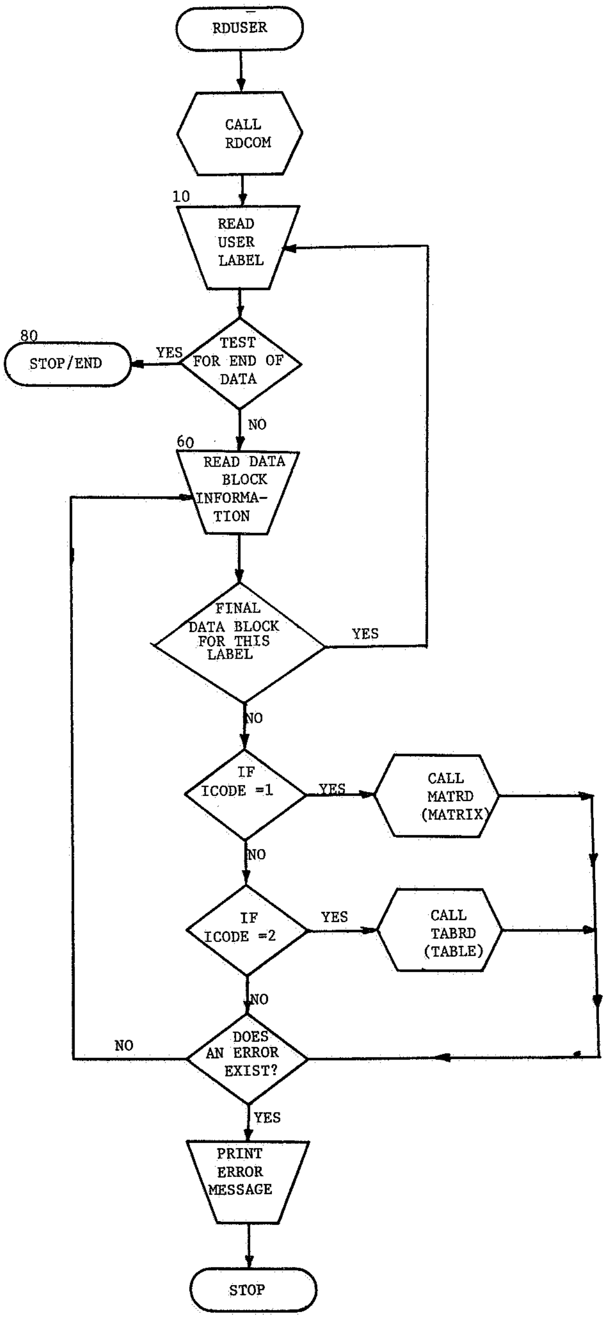
where the DBi are the data blocks to be recovered from the binary tape, P1 is a parameter for positioning the tape (P1 must be -1 for the first call to INPUTT2 and zero on all succeeding calls), P2 is the FORTRAN unit number assigned to the binary tape, and P3 is the FORTRAN User Tape Label (default = XXXXXXXX). A flow chart of the complete tape interface method is as follows:


NASTRAN
on
Computer A
OUTPUT2
Binary
Tape
RDUSER Converts
Binary Tape
To BCD Tape
BCD
Tape
Computer A
NASTRAN
on
Computer B
INPUTT2
Binary
Tape
WRTUSER Converts
BCD TAPE TO
Binary Tape

DESCRIPTION OF RDUSER AND ITS SUBPROGRAMS

Program RDUSER

RDUSER is a FORTRAN main program that has as its primary function the calling of various subprograms for data manipulation. The flow chart and the program listing that follow show how RDUSER controls program operation.



```
C
C     THIS PROGRAM CONVERTS A BINARY UNFORMATTED TAPE OUTPUT FROM
C     NASTRAN MODULE OUTPUT2 INTO A BCD TAPE
C
      DIMENSION IRDIN(7)
      DATA IBLANK,ISTOP,IT/4H    ,4HSTOP,4H IT /
      WRITE (6,160)
C
C     COMENT READS USER INFORMATION ABOUT DATA BLOCKS ON TAPE
C
      CALL RDCOM
C
C     READ IN TAPE ID
C
   10 READ (5,90) NAM1,NAM2
      IF (NAM1.EQ.IBLANK.AND.NAM2.EQ.IBLANK) GO TO 80
      ISW=0
C
C     READ TAPE UNTIL MATCHING ID IS FOUND
C
   20 READ (9) ICNT
      IF (ISW.EQ.0.AND.ICNT.NE.3) GO TO 70
      ISW=1
      READ (9) (IRDIN(I),I=1,ICNT)
C
C     WRITE INFORMATION ON BCD TAPE
C
      IF (ICNT.EQ.3) WRITE (8,100) (IRDIN(I),I=1,ICNT)
C
C     WRITE INFORMATION ON BCD TAPE
C
      IF (ICNT.EQ.7) WRITE (8,110) (IRDIN(I),I=1,ICNT)
C
C     WRITE INFORMATION ON BCD TAPE
C
      IF (ICNT.EQ.2) WRITE (8,120) (IRDIN(I),I=1,ICNT)
C
C     CHECK FOR MATCH
C
      IF (NAM1.EQ.IRDIN(1).AND.NAM2.EQ.IRDIN(2)) GO TO 50
      GO TO 20
   50 READ (9) IDUM
      READ (9) IDUM
C
C     ID HAS BEEN FOUND ON TAPE
C     ICODE=1 WE ARE LOOKING FOR A MATRIX
C     ICODE=2 WE ARE LOOKING FOR A TABLE
C     IOPT=0 DO NOT PRINT DATA BLOCK ELEMENTS
C     IOPT=1 PRINT DATA BLOCK ELEMENTS
C
   60 READ (5,90) NAM1,NAM2,ICODE,IOPT
      IF (NAM1.EQ.IBLANK.AND.NAM2.EQ.IBLANK) GO TO 10
      IF (ICODE.EQ.1) CALL MATRD (NAM1,NAM2,IERR,IOPT)
      IF (ICODE.EQ.2) CALL TABRD (NAM1,NAM2,IERR,IOPT)
      IF (IERR.EQ.0) GO TO 60
C
C     MATRIX OR TABLE NAME NOT FOUND ON TAPE
C
      WRITE (6,130) NAM1,NAM2
      GO TO 80
```

```
C                                                                      RDU 570
C     TAPE ID WAS NOT FOUND ON TAPE                                    RDU 580
C                                                                      RDU 590
   70 WRITE (6,140) NAM1,NAM2                                          RDU 600
      STOP                                                             RDU 601
C                                                                      RDU 607
C     WRITE EOF ON TAPE                                                RDU 608
C                                                                      RDU 609
   80 ICNT=0                                                           RDU 610
      WRITE (8,150) ICNT                                               RDU 620
      WRITE (8,170) ISTOP,IT                                           RDU 621
      WRITE (6,160)                                                    RDU 630
      STOP                                                             RDU 640
C                                                                      RDU 650
   90 FORMAT (2A4,2I2)                                                 RDU 660
  100 FORMAT (50X,3I10)                                                RDU 670
  110 FORMAT (10X,7(A4,6X))                                            RDU 680
  120 FORMAT (60X,2(A4,6X))                                            RDU 690
  130 FORMAT (10H THE NAME ,2A4 ,23H WAS NOT FOUND ON TAPE /)          RDU 700
  140 FORMAT (7H LABEL ,2A4 ,23H WAS NOT FOUND ON TAPE /)              RDU 710
  150 FORMAT (70X,I10)                                                 RDU 720
  160 FORMAT (1H1)                                                     RDU 730
  170 FORMAT (72X,2A4)                                                 RDU 731
      END                                                              RDU 740-
```

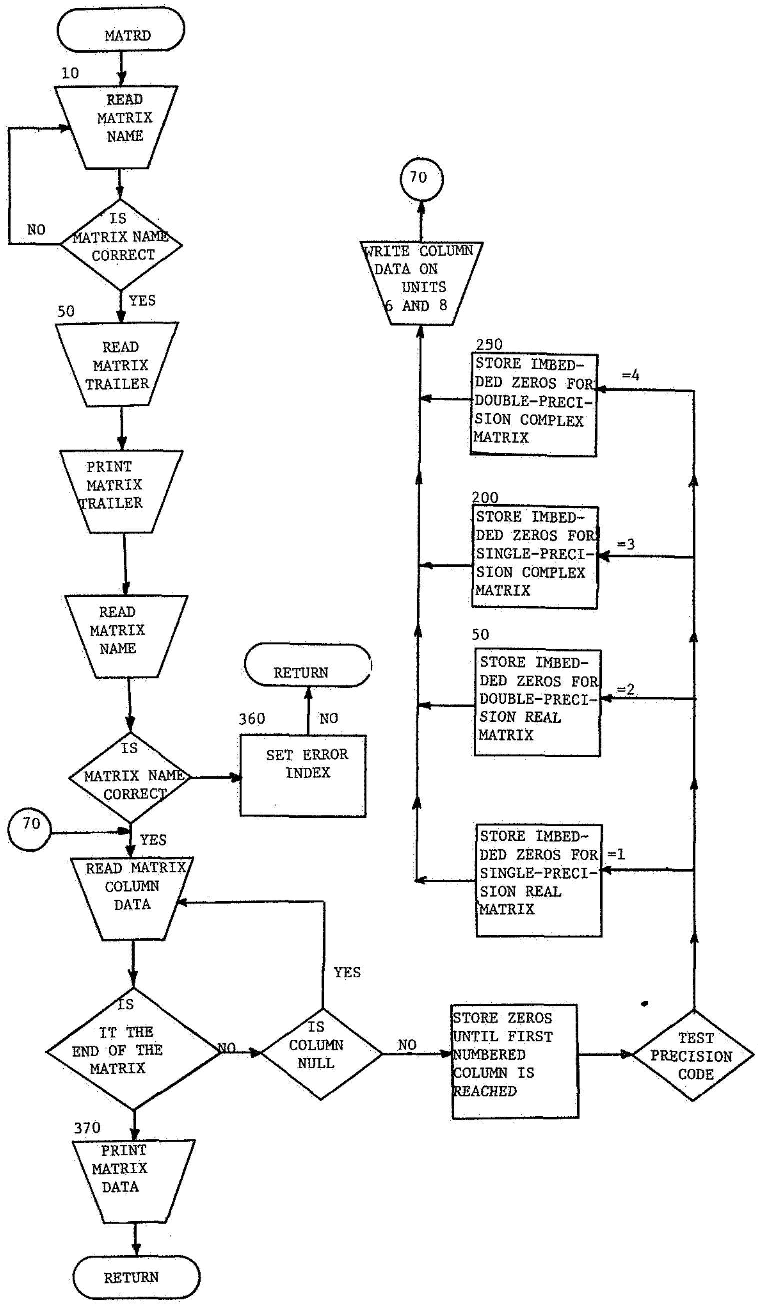
Subprogram RDCOM

RDCOM is a FORTRAN subprogram. The primary job of RDCOM is to read comments by the user about the data on the tape. These comments are punched on cards for input into RDUSER. The cards are read with a free field format and thus may contain any information describing the data blocks. The comments are written on unit 8. The RDCOM subprogram listing follows.

```
      SUBROUTINE RDCOM
C
C     THIS SUBROUTINE READS COMMENTS FROM CARDS AND WRITES THEM ON TAPE
C
      DIMENSION ICOM(20)
      DATA IQUIT/4H END/
   10 READ (5,20) (ICOM(I),I=1,20)
      PRINT 20, (ICOM(I),I=1,20)
      WRITE (8,20) (ICOM(I),I=1,20)
      IF (ICOM(20).NE.IQUIT) GO TO 10
      RETURN
C
   20 FORMAT (20A4)
      END
```

Subprogram MATRD

MATRD is a FORTRAN subprogram. Its parameters are the matrix name (NAM1, NAM2), an error flag (IERR), and a print option (IOPT) for the user to print or not to print the elements of a column. The primary job of MATRD is to read the matrix data from unit 9, unpack the columns, and write them on unit 8 in a suitable format. If the matrix name cannot be found on unit 9, IERR will be set to one (1) and the program will stop upon returning to RDUSER. A MATRD flow chart and the subprogram listing follow.



```
      SUBROUTINE MATRD (NAM1,NAM2,IERR,IOPT)                            MAT  10
C                                                                       MAT  11
C     THIS SUBROUTINE READS MATRIX DATA BLOCKS                          MAT  12
C                                                                       MAT  13
C                                                                       MAT  14
C     DIMENSION STATEMENTS MUST BE CHANGED IN ACCORDANCE WITH           MAT  15
C     THE SIZE OF THE MATRICES BEING READ                               MAT  16
C                                                                       MAT  17
      DOUBLE PRECISION DVAL(100)                                        MAT  20
      DIMENSION WRDIN(100), IRDIN(100), VAL(100)                        MAT  30
      EQUIVALENCE (WRDIN(1),IRDIN(1))                                   MAT  40
      LOGICAL INTGER                                                    MAT  50
      DATA ALPI,SQ1,SQ2,REC1,REC2,SYM1,SYM2,RE,COM1,COM2/1HI,4H SQU,4HARMAT  60
     1E ,4HRECT,4HNGLE,4HSYME,4HTRIC,4HREAL,4HCOMP,4HLEX /              MAT  70
      DATA BLANK/4H    /                                                MAT  80
      DATA SING1,SING2,DOUB1,DOUB2/4H SIN,4HGLE ,4H DOU,4HBLE /         MAT  90
C                                                                       MAT 100
C     *****************************************************************MAT 110
C                    FORMAT FOR A MATRIX DATA BLOCK                     MAT 120
C                                                                       MAT 130
C     RECORD NO. *  WORD NO.   *    DESCRIPTION     *      TYPE         MAT 140
C       1       *     1-2     * MATRIX LABEL       *  ALPHA-NUMERIC  * MAT 150
C       2       *      1      *     EOR    (-1)    *      INTEGER    * MAT 160
C       3       *      1      *NO. WORDS NEXT REC. *      INTEGER    * MAT 170
C       4       *      1      *(TRAILER) GINO NAME *      INTEGER    * MAT 180
C       4       *      2      * NO. OF COLUMNS     *      INTEGER    * MAT 190
C       4       *      3      * NO. OF ROWS        *      INTEGER    * MAT 200
C       4       *      4      * FORM OF MATRIX     *      INTEGER    * MAT 210
C       4       *      5      * TYPE OF MATRIX     *      INTEGER    * MAT 220
C       4       *      6      *NO. NONZERO TERMS   *      INTEGER    * MAT 230
C       4       *      7      * PER CENT FULLNESS  *      INTEGER    * MAT 240
C       5       *      1      *     EOR    (-2)    *      INTEGER    * MAT 250
C       6       *      1      *NO. WORDS NEXT REC. *      INTEGER    * MAT 260
C       7       *     1-2     *  MATRIX LABEL      *  ALPHA-NUMERIC  * MAT 270
C       8       *      1      *     EOR    (-3)    *      INTEGER    * MAT 280
C       9       *      1      *NO. WORDS NEXT REC. *      INTEGER    * MAT 290
C      10       *      1      *FIRST NON-ZERO COL. *      INTEGER    * MAT 300
C      10       *      2      *  PRECISION         *      INTEGER    * MAT 310
C      10       *      3      *     NOT USED       *      INTEGER    * MAT 320
C      10       *      4      *     NOT USED       *      INTEGER    * MAT 330
C      10       *      5      *     NOT USED       *      INTEGER    * MAT 340
C      10       * 6-NO. WORDS-1* ELEMENTS OF ROW   *       REAL      * MAT 350
C      10       * 6-NO.WORDS-1*POINTERS ARE IMBEDDED*     INTEGER    * MAT 360
C      10       *   NO. WORDS  *  END OF COLUMN    *                 * MAT 370


C     RECORDS 8,9, AND 10 ARE REPEATED FOR EACH COLUMN OF THE MATRIX    MAT 380
C     WITH THE RECORD CORRESPONDING TO RECORD 8 DECREASING BY ONE       MAT 390
C     EACH TIME. THIS IS STOPPED WHEN A ZERO (0) IS ENCOUNTERED IN      MAT 400
C     THE RECORD CONTAINING THE NUMBER OF WORDS IN THE NEXT RECORD.     MAT 410
C                                                                       MAT 420
C     *****************************************************************MAT 430
C                                                                       MAT 440
      ICODE=1                                                           MAT 450
      WRITE (6,380)                                                     MAT 460
      IERR=0                                                            MAT 470
C                                                                       MAT 480
C     READ TAPE                                                         MAT 490
C                                                                       MAT 500
   10 READ (9) ICNT                                                     MAT 510
      IF (ICNT.EQ.0) GO TO 360                                          MAT 511
      READ (9) (IRDIN(I),I=1,ICNT)                                      MAT 530
```

```
C
C     CHECK FOR CORRECT MATRIX LABEL
C
C     WRITE INFORMATION ON BCD TAPE
      IF (NAM1.EQ.IRDIN(1).AND.NAM2.EQ.IRDIN(2)) GO TO 50
   40 READ (9) JCNT
      READ (9) ICNT
      IF (ICNT.EQ.0) GO TO 10
      READ (9) (IRDIN(I),I=1,ICNT)
      GO TO 40
   50 IF (ICNT.EQ.2) WRITE (8,390) (IRDIN(I),I=1,ICNT),ICODE
      READ (9) JCNT
      READ (9) ICNT
C
C     READ INFORMATION FROM TRAILER
C
      READ (9) (IRDIN(I),I=1,ICNT)
C
C     WRITE INFORMATION ON BCD TAPE
C
      WRITE (8,400) (IRDIN(I),I=1,ICNT)
      ICOL=IRDIN(2)
      IROW=IRDIN(3)
      IFORM=IRDIN(4)
      ITYPE=IRDIN(5)
      NUMNZ=IRDIN(6)
      FULL=FLOAT(IRDIN(7))/100.
      ICROW=2*IROW
C
C     PRINT INFORMATION FROM TRAILER
C
      WRITE (6,410) NAM1,NAM2,(IRDIN(IJ),IJ=1,ICNT)
      IF (IFORM.EQ.1) FORM1=SQ1
      IF (IFORM.EQ.1) FORM2=SQ2
      IF (IFORM.EQ.2) FORM1=REC1
      IF (IFORM.EQ.2) FORM2=REC2
      IF (IFORM.EQ.6) FORM1=SYM1
      IF (IFORM.EQ.6) FORM2=SYM2
      IF (ITYPE.EQ.1.OR.ITYPE.EQ.2) TYPE1=RE
      IF (ITYPE.EQ.1.OR.ITYPE.EQ.2) TYPE2=BLANK
      IF (ITYPE.EQ.3.OR.ITYPE.EQ.4) TYPE1=COM1
      IF (ITYPE.EQ.3.OR.ITYPE.EQ.4) TYPE2=COM2
C
C     PRINT MATRIX HEADER
C
      WRITE (6,420) NAM1,NAM2,TYPE1,TYPE2,ICOL,IROW,FORM1,FORM2
C
C     READ TAPE
C
   60 READ (9) JCNT
      READ (9) ICNT
      READ (9) (IRDIN(I),I=1,ICNT)
C
C     CHECK FOR CORRECT MATRIX LABEL
C
      IF (NAM1.EQ.IRDIN(1).AND.IRDIN(2).EQ.NAM2) GO TO 65
      GO TO 360
   65 WRITE (8,460) ICNT
      WRITE (8,550) (IRDIN(I),I=1,ICNT)
C
C     READ TAPE
C
```

```
   70 READ (9) JCNT
      NULCOL=-JCNT-2
      READ (9) ICNT
C
C     TEST FOR ZERO TO END THE READING OF THE MATRIX
C
      IF (ICNT.EQ.0) GO TO 370
C
C     TEST FOR NULL COLUMN
C
      IF (ICNT.NE.1) GO TO 80
      READ (9) INUMB
      WRITE (8,460) ICNT
      WRITE (8,460) INUMB
      IF (IOPT.EQ.1) PRINT 430, NULCOL
      GO TO 70
C
C     READ RECORDS OF INFORMATION
C
   80 READ (9) (IRDIN(I),I=1,5),(WRDIN(I),I=6,ICNT)
      NZROW=IRDIN(1)
      IPREC=IRDIN(2)
      K=0
      IK=-3
C
C     STORE ZEROS IN APPROPIATE LOCATIONS
C
      IF (NZROW.EQ.1) GO TO 100
C
C     STORE ZEROS IN THE BEGINNING OF THE COLUMN
C
      NZROW=NZROW-1
      K=-1
      DO 90 I=1,NZROW
      IK=IK+4
      K=K+2
      IF (IPREC.EQ.1) VAL(I)=0.
      IF (IPREC.EQ.2) DVAL(I)=0.0D0
      IF (IPREC.EQ.3) VAL(K)=0.
      IF (IPREC.EQ.3) VAL(K+1)=0.
      IF (IPREC.EQ.4) DVAL(K)=0.0D0
      IF (IPREC.EQ.4) DVAL(K+1)=0.0D0
C
C     STORE DATA FOR BCD TAPE
C
      IF (IPREC.EQ.2) VAL(K)=0.
      IF (IPREC.EQ.2) VAL(K+1)=0.
      IF (IPREC.EQ.4) VAL(IK)=0.
      IF (IPREC.EQ.4) VAL(IK+1)=0.
      IF (IPREC.EQ.4) VAL(IK+2)=0.
      IF (IPREC.EQ.4) VAL(IK+3)=0.
   90 CONTINUE
      IF (IPREC.EQ.2) K=K+1
      NZROW=NZROW+1
  100 I=NZROW-1
      IF (IPREC.EQ.3.OR.IPREC.EQ.4) I=2*(NZROW-1)-1
      IF (IPREC.EQ.2) GO TO 150
      IF (IPREC.EQ.3) GO TO 200
      IF (IPREC.EQ.4) GO TO 250
C
C     STORE SINGLE PRECISION MATRIX ELEMENTS
C
```

```
      IWRD=5
      J=NZROW+ICNT-7
  110 I=I+1
      IWRD=IWRD+1
C
C     CHECK POINTER FOR IMBEDDED ZEROS
C
      IF (INTGER(WRDIN(IWRD))) GO TO 120
      GO TO 140
  120 JJ=IRDIN(IWRD)-1
      I=I-1
  130 I=I+1
C
C     STORE IMBEDDED ZEROS
C
      VAL(I)=0.
      IF (I.NE.JJ) GO TO 130
      I=I+1
      IWRD=IWRD+1
  140 VAL(I)=WRDIN(IWRD)
      KCNT=IWRD+NZROW-6
      IF (KCNT.LT.J) GO TO 110
      GO TO 300
C
C     STORE DOUBLE PRECISION MATRIX ELEMENTS
C
  150 IWRD=4
      IK=K-1
      J=NZROW+ICNT-6
  160 I=I+1
      IWRD=IWRD+2
C
C     CHECK IMBEDDED ZEROS
C
      IF (INTGER(WRDIN(IWRD))) GO TO 170
      GO TO 190
  170 JJ=IRDIN(IWRD)-1
      I=I-1
  180 I=I+1
C
C     STORE IMBEDDED ZEROS
C
      DVAL(I)=0.0D0
C
C     STORE DATA FOR BCD TAPE
C
      IK=IK+2
      VAL(IK)=0.
      VAL(IK+1)=0.
      IF (I.NE.JJ) GO TO 180
      I=I+1
      IWRD=IWRD+1
  190 DVAL(I)=DBLE(WRDIN(IWRD))
C
C     STORE DATA FOR BCD TAPE
C
      IK=IK+2
      VAL(IK)=WRDIN(IWRD)
      VAL(IK+1)=WRDIN(IWRD+1)
      KCNT=IWRD+NZROW-4
      IF (KCNT.LT.J) GO TO 160
      GO TO 300
```

```
C                                                                       MAT2340
C     STORE COMPLEX MATRIX ELEMENTS                                     MAT2350
C                                                                       MAT2360
  200 IWRD=4                                                            MAT2370
      J=NZROW+ICNT-6                                                    MAT2380
  210 I=I+2                                                             MAT2390
      IWRD=IWRD+2                                                       MAT2400
C                                                                       MAT2410
C     CHECK IMBEDDED ZEROS                                              MAT2420
C                                                                       MAT2430
      IF (INTGER(WRDIN(IWRD))) GO TO 220                                MAT2440
      GO TO 240                                                         MAT2441
  220 IF (IRDIN(IWRD).EQ.0) GO TO 240                                   MAT2450
      JJ=2*(IRDIN(IWRD)-1)-1                                            MAT2460
      I=I-2                                                             MAT2470
C                                                                       MAT2480
C     STORE IMBEDDED ZEROS                                              MAT2490
C                                                                       MAT2500
  230 I=I+2                                                             MAT2510
      VAL(I)=0.                                                         MAT2520
      VAL(I+1)=0.                                                       MAT2530
      IF (I.NE.JJ) GO TO 230                                            MAT2540
      I=I+2                                                             MAT2550
      IWRD=IWRD+1                                                       MAT2560
  240 VAL(I)=WRDIN(IWRD)                                                MAT2570
      VAL(I+1)=WRDIN(IWRD+1)                                            MAT2580
      KCNT=IWRD+NZROW-4                                                 MAT2590
      IF (KCNT.LT.J) GO TO 210                                          MAT2600
      GO TO 300                                                         MAT2610
C                                                                       MAT2620
C     STORE COMPLEX DOUBLE PRECISION MATRIX ELEMENTS                    MAT2630
C                                                                       MAT2640
  250 IWRD=2                                                            MAT2650
      J=NZROW+ICNT-4                                                    MAT2660
  260 I=I+2                                                             MAT2670
      IWRD=IWRD+4                                                       MAT2680
C                                                                       MAT2690
C     CHECK POINTER FOR IMBEDDED ZEROS                                  MAT2700
C                                                                       MAT2710
      IF (INTGER(WRDIN(IWRD))) GO TO 270                                MAT2720
      GO TO 290                                                         MAT2721
  270 IF (IRDIN(IWRD).EQ.0) GO TO 290                                   MAT2730
      JJ=2*(IRDIN(IWRD)-1)-1                                            MAT2740
      I=I-2                                                             MAT2750
C                                                                       MAT2760
C     STORE IMBEDDED ZEROS                                              MAT2770
C                                                                       MAT2780
  280 I=I+2                                                             MAT2790
      DVAL(I)=0.0D0                                                     MAT2800
      DVAL(I+1)=0.0D0                                                   MAT2810
C                                                                       MAT2820
C     STORE DATA FOR BCD TAPE                                           MAT2830
C                                                                       MAT2840
      IK=IK+4                                                           MAT2850
      VAL(IK)=0.                                                        MAT2860
      VAL(IK+1)=0.                                                      MAT2870
      VAL(IK+2)=0.                                                      MAT2880
      VAL(IK+3)=0.                                                      MAT2890
      IF (I.NE.JJ) GO TO 280                                            MAT2900
      I=I+2                                                             MAT2910
      IWRD=IWRD+1                                                       MAT2920
  290 DVAL(I)=DBLE(WRDIN(IWRD))                                         MAT2930
```

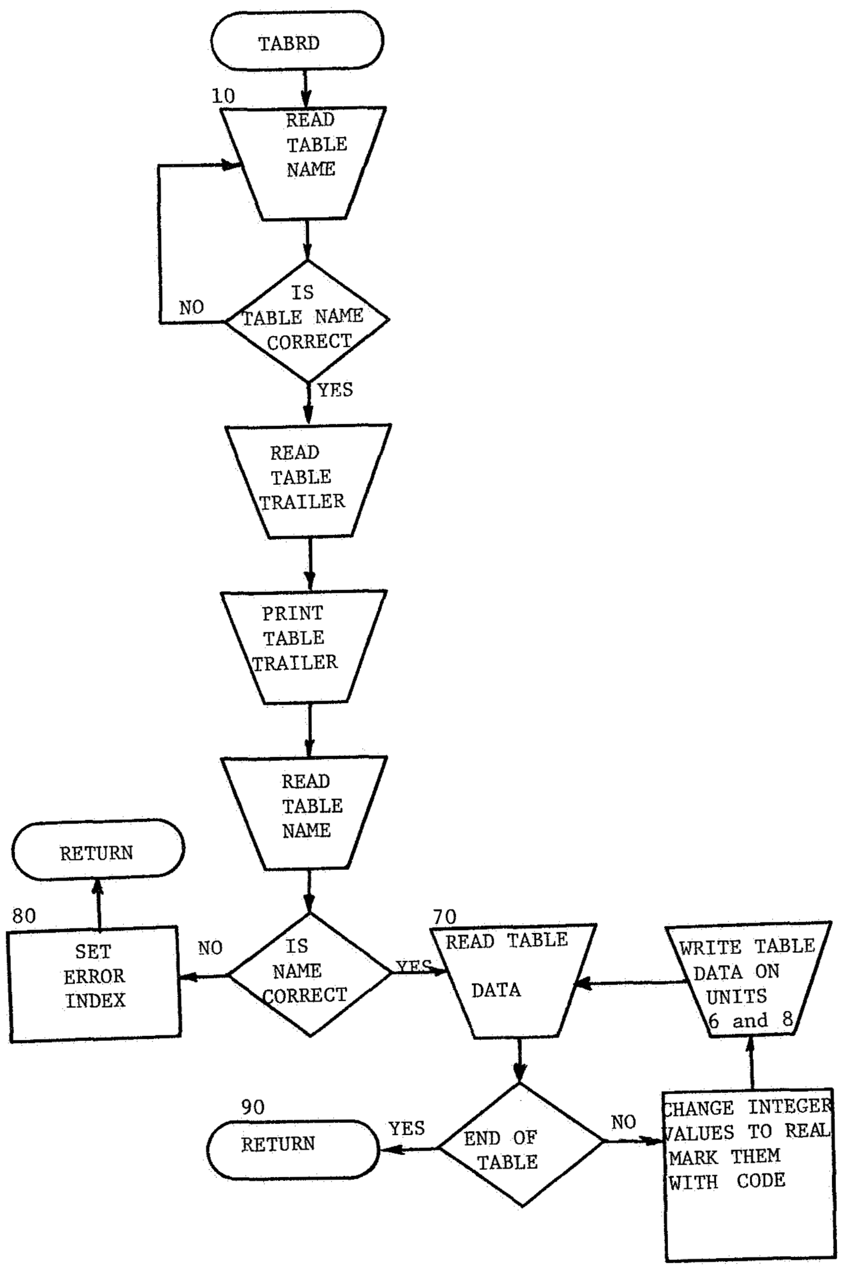
```
      DVAL(I+1)=DBLE(WRDIN(IWRD+2))
C
C     STORE DATA FOR BCD TAPE
C
      IK=IK+4
      VAL(IK)=WRDIN(IWRD)
      VAL(IK+1)=WRDIN(IWRD+1)
      VAL(IK+2)=WRDIN(IWRD+2)
      VAL(IK+3)=WRDIN(IWRD+3)
      KCNT=IWRD+NZROW
      IF (KCNT.LT.J) GO TO 260
  300 IF ((IPREC.EQ.1.OR.IPREC.EQ.2).AND.IROW.EQ.I) GO TO 320
      IF (IPREC.EQ.1.OR.IPREC.EQ.2) K=(I+1)/2
      IF ((IPREC.EQ.3.OR.IPREC.EQ.4).AND.IROW.EQ.K) GO TO 320
      IF (IPREC.EQ.3.OR.IPREC.EQ.4) K=I
C
C     STORE ZEROS AT THE END OF THE COLUMN
C
      J=I+1
      DO 310 I=J,IROW
      IF (IPREC.EQ.2) IK=IK+2
      IF (IPREC.EQ.4) IK=IK+4
      K=K+2
      IF (IPREC.EQ.1) VAL(I)=0.
      IF (IPREC.EQ.2) DVAL(I)=0.0D0
      IF (IPREC.EQ.3) VAL(K)=0.
      IF (IPREC.EQ.3) VAL(K+1)=0.
      IF (IPREC.EQ.4) DVAL(K)=0.0D0
      IF (IPREC.EQ.4) DVAL(K+1)=0.0D0
C
C     STORE DATA FOR BCD TAPE
C
      IF (IPREC.EQ.2) VAL(IK)=0.
      IF (IPREC.EQ.2) VAL(IK+1)=0.
      IF (IPREC.EQ.4) VAL(IK)=0.
      IF (IPREC.EQ.4) VAL(IK+1)=0.
      IF (IPREC.EQ.4) VAL(IK+2)=0.
      IF (IPREC.EQ.4) VAL(IK+3)=0.
  310 CONTINUE
  320 IF (IOPT.EQ.1) PRINT 440, NULCOL
      IF (IPREC.EQ.2) GO TO 330
      IF (IPREC.EQ.3) GO TO 340
      IF (IPREC.EQ.4) GO TO 350
C
C     PRINT SINGLE PRECISION NUMBERS
C
      IF (IOPT.EQ.1) WRITE (6,450) (VAL(I),I=1,IROW)
C
C     WRITE INFORMATION ON BCD TAPE
C
      WRITE (8,460) IROW
C
C     WRITE INFORMATION ON BCD TAPE
C
      WRITE (8,470) (IRDIN(I),I=1,5)
C
C     WRITE INFORMATION ON BCD TAPE
C
      WRITE (8,480) (VAL(I),I=1,IROW)
      GO TO 70
C
C     PRINT DOUBLE PRECISION NUMBERS
C
```

```
 330  IF (IOPT.EQ.1) WRITE (6,490) (DVAL(I),I=1,IROW)                MAT3570
      IROW1=IROW*2                                                    MAT3580
C                                                                     MAT3590
C     WRITE INFORMATION ON BCD TAPE                                   MAT3600
C                                                                     MAT3610
      WRITE (8,460) IROW1                                             MAT3620
C                                                                     MAT3630
C     WRITE INFORMATION ON BCD TAPE                                   MAT3640
C                                                                     MAT3650
      WRITE (8,470) (IRDIN(I),I=1,5)                                  MAT3660
C                                                                     MAT3670
C     WRITE INFORMATION ON BCD TAPE                                   MAT3680
C                                                                     MAT3690
      WRITE (8,480) (VAL(I),I=1,IROW1)                                MAT3700
      GO TO 70                                                        MAT3710
C                                                                     MAT3720
C     PRINT COMPLEX SINGLE PRECISION NUMBERS                          MAT3730
C                                                                     MAT3740
 340  IF (IOPT.EQ.1) WRITE (6,500) (VAL(I),VAL(I+1),ALPI,I=1,ICROW,2)  MAT3750
C                                                                     MAT3760
C     WRITE INFORMATION ON BCD TAPE                                   MAT3770
C                                                                     MAT3780
      WRITE (8,460) ICROW                                             MAT3790
C                                                                     MAT3800
C     WRITE INFORMATION ON BCD TAPE                                   MAT3810
C                                                                     MAT3820
      WRITE (8,470) (IRDIN(I),I=1,5)                                  MAT3830
C                                                                     MAT3840
C     WRITE INFORMATION ON BCD TAPE                                   MAT3850
C                                                                     MAT3860
      WRITE (8,480) (VAL(I),I=1,ICROW)                                MAT3870
      GO TO 70                                                        MAT3880
C                                                                     MAT3890
C     PRINT COMPLEX DOUBLE PRECISION NUMBERS                          MAT3900
C                                                                     MAT3910
 350  IF (IOPT.EQ.1) WRITE (6,510) (DVAL(I),DVAL(I+1),ALPI,I=1,ICROW,2) MAT3920
      ICROW1=ICROW*2                                                  MAT3930
C                                                                     MAT3940
C     WRITE INFORMATION ON BCD TAPE                                   MAT3950
C                                                                     MAT3960
      WRITE (8,460) ICROW1                                            MAT3970
C                                                                     MAT3980
C     WRITE INFORMATION ON BCD TAPE                                   MAT3990
C                                                                     MAT4000
      WRITE (8,470) (IRDIN(I),I=1,5)                                  MAT4010
C                                                                     MAT4020
C     WRITE INFORMATION ON BCD TAPE                                   MAT4030
C                                                                     MAT4040
      WRITE (8,480) (VAL(I),I=1,ICROW1)                               MAT4050
      GO TO 70                                                        MAT4060
C                                                                     MAT4061
C     RETURN WITH ERROR MESSAGE                                       MAT4062
C                                                                     MAT4063
 360  IERR=1                                                          MAT4070
      RETURN                                                          MAT4080
C                                                                     MAT4090
C     PRINT MATRIX INFORMATION                                        MAT4100
C                                                                     MAT4110
```

```
 370  WRITE (6,520) NUMNZ                                                   MAT4120
      WRITE (6,530) FULL                                                    MAT4130
      IF (IPREC.EQ.1.OR.IPREC.EQ.3) WRITE (6,540) SINGI,SING2               MAT4140
      IF (IPREC.EQ.2.OR.IPREC.EQ.4) WRITE (6,540) DOUBI,DOUB2               MAT4150
C                                                                           MAT4160
C     WRITE INFORMATION ON BCD TAPE                                         MAT4170
      WRITE (8,460) ICNT                                                    MAT4180
      RETURN                                                                MAT4190
C                                                                           MAT4200
 380  FORMAT (1H1)                                                          MAT4210
 390  FORMAT (50X,2(A4,6X),I10)                                             MAT4220
 400  FORMAT (10X,7I10)                                                     MAT4230
 410  FORMAT (//28H THE TRAILER FOR THE MATRIX ,2A4,4H IS ,7I7)             MAT4240
 420  FORMAT (//8H MATRIX ,2A4,6H IS A ,2A4,I4,10H COLUMN X ,I4,5H ROW ,MAT4250
     12A4,8H MATRIX /)                                                      MAT4260
 430  FORMAT (/8H COLUMN ,I6,8H IS NULL/)                                   MAT4270
 440  FORMAT (/8H COLUMN ,I6)                                               MAT4280
 450  FORMAT (6E20.12,1X/)                                                  MAT4290
 460  FORMAT (70X,I10)                                                      MAT4300
 470  FORMAT (30X,5I10)                                                     MAT4310
 480  FORMAT (4E20.12)                                                      MAT4320
 490  FORMAT (4D30.22,1X/)                                                  MAT4330
 500  FORMAT (3(E20.12,E20.12,A1),1X/)                                      MAT4340
 510  FORMAT (2(D30.22,D30.22,A1),1X/)                                      MAT4350
 520  FORMAT (/54H THE NUMBER OF NON-ZERO WORDS IN THE LONGEST RECORD       MAT4360
     1,I6)                                                                  MAT4370
 530  FORMAT (/31H THE DENSITY OF THIS MATRIX IS ,F8.2,9H PERCENT /)        MAT4380
 540  FORMAT (/15H THIS MATRIX IS,2A4,9HPRECISION)                          MAT4390
 550  FORMAT (2(A4,6X),(6I10))                                              MAT4391
      END                                                                   MAT4400-
```

Subprogram TABRD

TABRD is a FORTRAN subprogram. Its parameters are the table name (NAM1, NAM2), an error flag (IERR), and a print option (IOPT) for the user to print or not to print the elements of the table. The primary tasks of TABRD are to read the table data from unit 9 and write it on unit 8 in a suitable format. TABRD converts integers into real numbers to facilitate the transfer. Integers are marked with a code so that they are easily recognized by the WRTUSER program. A TABRD flow chart and the subprogram listing follow.



```
      SUBROUTINE TABRD (NAM1,NAM2,IERR,IOPT)                            TAB  10
C                                                                       TAB  11
C     THIS SUBROUTINE READS TABLE DATA BLOCKS                           TAB  12
C                                                                       TAB  13
C                                                                       TAB  14
C     DIMENSION STATEMENTS MUST BE CHANGED IN ACCORDANCE WITH           TAB  15
C     THE SIZE OF THE TABLES BEING READ                                 TAB  16
C                                                                       TAB  17
      DIMENSION IRDIN(100),WRDIN(100),VAL(100)                          TAB  20
      EQUIVALENCE(IRDIN(1),WRDIN(1))                                    TAB  21
      LOGICAL INTGER                                                    TAB  22
C                                                                       TAB  30
C     *****************************************************************TAB  40
C                        FORMAT FOR A TABLE DATA BLOCK                  TAB  50
C                                                                       TAB  60
C     RECORD NO.  *  WORD NO.    *    DESCRIPTION     *      TYPE       TAB  70
C      1        *     1-2       * TABLE LABEL        *   ALPHA-NUMERIC  * TAB  80
C      2        *      1        *     EOR     (-1)   *       INTEGER    * TAB  90
C      3        *      1        *NO. WORDS NEXT REC. *       INTEGER    * TAB 100
C      4        *      1        * TRAILER GINO NAME  *       INTEGER    * TAB 110
C      4        *     2-N       * MISC. INFORMATION  *       INTEGER    * TAB 120
C      5        *      1        *     EOR     (-2)   *       INTEGER    * TAB 130
C      6        *      1        *NO. WORDS NEXT REC. *       INTEGER    * TAB 140
C      7        *     1-2       * TABLE LABEL        *       INTEGER    * TAB 150
C      8        *      1        *     EOR     (-3)   *       INTEGER    * TAB 160
C      9        *      1        *NO. WORDS NEXT REC. *       INTEGER    * TAB 170
C     10        *     ALL       *ELEMENTS OF FIRST   *       INTEGER,REAL* TAB 180
C     10        *     ALL       *  RECORD OF TABLE   *       INTEGER,REAL* TAB 190
C     RECORDS 8,9, AND 10 ARE REPEATED FOR EACH RECORD OF THE TABLE.    TAB 200
C     WITH THE RECORD CORRESPONDING TO RECORD 8 DECREASING BY ONE EACH  TAB 210
C     TIME. THIS IS STOPPED WHEN A ZERO (0) IS ENCOUNTERED IN THE RECORDTAB 220
C     CONTAINING THE NUMBER OF WORDS IN THE NEXT RECORD.                TAB 230
C                                                                       TAB 240
C     *****************************************************************TAB 250
C                                                                       TAB 260
      ICODE=2                                                           TAB 270
      WRITE (6,100)                                                     TAB 280
      IERR=0                                                            TAB 290
C                                                                       TAB 300
C     READ TAPE                                                         TAB 310
C                                                                       TAB 320
   10 READ (9) ICNT                                                     TAB 330
      IF (ICNT.EQ.0) GO TO 80                                           TAB 331
      READ (9) (IRDIN(I),I=1,ICNT)                                      TAB 340
C                                                                       TAB 370
C     CHECK FOR CORRECT TABLE LABEL                                     TAB 380
C                                                                       TAB 390
      IF (NAM1.EQ.IRDIN(1).AND.NAM2.EQ.IRDIN(2)) GO TO 50               TAB 400
   40 READ (9) JCNT                                                     TAB 410
      READ (9) ICNT                                                     TAB 420
      IF (ICNT.EQ.0) GO TO 10                                           TAB 430
      READ (9) (IRDIN(I),I=1,ICNT)                                      TAB 440
      GO TO 40                                                          TAB 450
C                                                                       TAB 460
C     WRITE INFORMATION ON BCD TAPE                                     TAB 470
C                                                                       TAB 480
   50 IF (ICNT.EQ.2) WRITE (8,110) (IRDIN(I),I=1,ICNT),ICODE            TAB 490
      READ (9) JCNT                                                     TAB 500
      READ (9) ICNT                                                     TAB 510
C                                                                       TAB 520
C     READ TRAILER                                                      TAB 530
C                                                                       TAB 540
```

```
      READ (9) (IRDIN(I),I=1,ICNT)                                      TAB 550
C                                                                       TAB 560
C     WRITE INFORMATION ON BCD TAPE                                     TAB 570
C                                                                       TAB 580
      WRITE (8,120) (IRDIN(I),I=1,ICNT)                                 TAB 590
C                                                                       TAB 600
C     PRINT TRAILER                                                     TAB 610
C                                                                       TAB 620
      WRITE (6,130) NAM1,NAM2,(IRDIN(I),I=1,ICNT)                       TAB 630
C                                                                       TAB 640
C     READ TAPE                                                         TAB 650
C                                                                       TAB 660
      READ (9) JCNT                                                     TAB 670
      READ (9) ICNT                                                     TAB 680
      READ (9) (IRDIN(I),I=1,ICNT)                                      TAB 690
C                                                                       TAB 700
C     CHECK FOR CORRECT TABLE LABEL                                     TAB 710
C                                                                       TAB 720
      IF (NAM1.EQ.IRDIN(1).AND.NAM2.EQ.IRDIN(2)) GO TO 60               TAB 730
      GO TO 80                                                          TAB 740
   60 NCNT=0                                                            TAB 750
      WRITE (8,140) ICNT                                                TAB 751
      WRITE (8,180) (IRDIN(I),I=1,ICNT)                                 TAB 752
C                                                                       TAB 760
C     READ TAPE                                                         TAB 770
C                                                                       TAB 780
   70 READ (9) JCNT                                                     TAB 790
      READ (9) ICNT                                                     TAB 800
C                                                                       TAB 850
C     TEST FOR ZERO (0) TO END THE READING OF THE TABLE                 TAB 860
C                                                                       TAB 870
      IF (ICNT.EQ.0) GO TO 90                                           TAB 880
      NCNT=NCNT+1                                                       TAB 890
C                                                                       TAB 900
C     READ THE VALUES OF THE TABLE                                      TAB 910
C                                                                       TAB 920
      READ (9) (WRDIN(I),I=1,ICNT)                                      TAB 921
C                                                                       TAB 922
C     TEST ELEMENTS TO BE REAL OR INTEGER                               TAB 923
C                                                                       TAB 924
      KCNT=0                                                            TAB 925
      DO 75 I=1,ICNT                                                    TAB 926
      IF(INTGER(WRDIN(I)).AND.WRDIN(I).NE.0.0) GO TO 71                 TAB 927
      GO TO 72                                                          TAB 928
   71 KCNT=KCNT+1                                                       TAB 929
      VAL(KCNT)=-9999.99                                                TAB 930
C                                                                       TAB 931
C     TEMPORARILY CHANGE INTEGER TO REAL , STORE CODE TO SHOW CHANGE    TAB 932
C                                                                       TAB 933
      KCNT=KCNT+1                                                       TAB 934
      VAL(KCNT)=FLOAT(IRDIN(I))                                         TAB 935
      GO TO 75                                                          TAB 936
   72 KCNT=KCNT+1                                                       TAB 937
      VAL(KCNT)=WRDIN(I)                                                TAB 938
   75 CONTINUE                                                          TAB 939
C                                                                       TAB 940
C     WRITE INFORMATION ON BCD TAPE                                     TAB 950
C                                                                       TAB 960
      WRITE (8,140) KCNT                                                TAB 961
      WRITE (8,150)(VAL(I),I=1,KCNT)                                    TAB 970
C                                                                       TAB 980
C     PRINT THE VALUES OF THE TABLE                                     TAB 990
C                                                                       TAB1000
```

```
      IF (IOPT.EQ.1) WRITE (6,160) NCNT,(IRDIN(I),I=1,ICNT)             TAB1010
      IF (IOPT.EQ.1) WRITE (6,170) NCNT,(WRDIN(I),I=1,ICNT)             TAB1020
      GO TO 70                                                          TAB1030
   80 IERR=1                                                            TAB1040
C                                                                       TAB1041
C     WRITE INFORMATION ON BCD TAPE                                     TAB1042
C                                                                       TAB1043
   90 WRITE (8,140) ICNT                                                TAB1044
      RETURN                                                            TAB1050
C                                                                       TAB1060
  100 FORMAT (1H1)                                                      TAB1070
  110 FORMAT (50X,2(A4,6X),I10)                                         TAB1080
  120 FORMAT (10X,7I10)                                                 TAB1090
  130 FORMAT (//27H THE TRAILER FOR THE TABLE ,2A4,4H IS /(13I10))      TAB1100
  140 FORMAT (70X,I10)                                                  TAB1110
  150 FORMAT (4E20.12)                                                  TAB1120
  160 FORMAT (/34H THE INTEGER VALUES OF RECORD NO. ,I6,4H ARE/,(13I10))TAB1130
  170 FORMAT (/31H THE REAL VALUES OF RECORD NO. ,I6,4H ARE/,(6E20.12)) TAB1131
  180 FORMAT (2(A4,6X),(6I10))                                          TAB1132
      END                                                               TAB1140-
```

Subprogram INTGER

INTGER is a logical function subprogram. It is written in FORTRAN or assembly language, depending upon the computer on which it is being used. It is a computer-dependent routine. INTGER has one parameter (WORD) which contains a number either real or integer. INTGER tests each of the exponent bits for a zero and returns a .TRUE. if each bit is a zero (indicating this number is an integer); otherwise it returns a .FALSE. (indicating this number is real). INTGER is called by both MATRD and TABRD. The INTGER subprogram listings for each of the three NASTRAN operative computers follow.

```
          IDENT    INTGER                                                  INT    1
*                                                                          INT    2
*                                                                          INT    3
*         LOGICAL FUNCTION INTGER (WORD)                                   INT    4
*                                                                          INT    5
*         RETURNS TRUE IF UPPER 12 BITS ARE ZERO                           INT    6
*         FOR USE ON THE CDC 6000 SERIES COMPUTER                          INT    7
*                                                                          INT    8
          ENTRY    INTGER                                                  INT    9
          VFD      42/0LINTGER,18/2                                        INT   10
 INTGER   BSS      1                   E/E LINE                            INT   11
          SA1      B1                                                      INT   12
          MX2      12                                                      INT   13
          BX3      X2*X1                                                   INT   14
          MX6      60                                                      INT   15
          ZR       X3,INTGER                                               INT   16
          SX6      B0                                                      INT   17
          EQ       INTGER                                                  INT   18
          END                                                              INT   19
```

```
      LOGICAL FUNCTION INTGER(WORD)                                     INT  10
C                                                                       INT  20
C     THIS SUBROUTINE TESTS THE UPPER EIGHT BITS OF A WORD FOR ZEROS    INT  30
C     IF ALL EIGHT BITS ARE ZERO INTGER RETURNS TRUE OTHERWISE FALSE    INT  40
C     FOR USE ON THE IBM 360-370 COMPUTER                               IBM  41
C                                                                       INT  50
      LOGICAL*1 TEST                                                    INT  60
      EQUIVALENCE(TEST,ACHK)                                            INT  70
      ACHK=WORD                                                         INT  80
      IF(TEST) 10,20,10                                                 INT  90
   10 INTGER=.FALSE.                                                    INT 100
      RETURN                                                            INT 110
   20 INTGER=.TRUE.                                                     INT 120
      RETURN                                                            INT 130
      END                                                               INT 140
```

```
      LOGICAL FUNCTION INTGER(WORD)                                     INT  10
C                                                                       INT  20
C     THIS SUBROUTINE TESTS THE UPPER NINE BITS OF A WORD FOR ZEROS     INT  30
C     INTGER RETURNS TRUE IF THE WORD IS AN INTEGER OTHERWISE IT RETURNSINT  40
C     FALSE                                                             INT  50
C     FOR USE ON THE UNIVAC 1100 SERIES COMPUTER                        INT  51
C                                                                       INT  60
      ITEST=FLD(0,9,WORD)                                               INT  70
      IF(ITEST)10,20,10                                                 INT  80
   10 INTGER=.FALSE.                                                    INT  90
      RETURN                                                            INT 100
   20 INTGER=.TRUE.                                                     INT 110
      RETURN                                                            INT 120
      END                                                               INT 130
```

RDUSER USAGE

Control-Card Operation for RDUSER

RDUSER is executed on different computers by a different set of control cards. The following three sets are acceptable for the indicated computer:

(1) CDC 6000 series (Control Data 6000 series computer systems)

```
JOB,...
REQUEST,TAPE9,HY.  number,ROL  (Binary input tape)
REWIND(TAPE9)
REQUEST,TAPE8,HY,X.  number,RIL, initials, identification  (BCD output tape)
   X (external) is optional depending on where the tape is being sent.
RUN(S)
LGO.
DROPFIL(TAPE8)
DROPFIL(TAPE9)
7/8/9  (END-OF-RECORD)
   PROGRAM RDUSER(INPUT,OUTPUT,TAPE5=INPUT,
   TAPE6=OUTPUT,TAPE8,TAPE9)
.
.  {source deck}
.
7/8/9
.
.  {card input}
.
6/7/8/9  (END-OF-FILE)
```

(2) IBM 360-370 series

```
//JOB,...
//A EXEC FORTRAN H
//TIME = number
//SYSIN DD *
.
.  {source deck}
.
//B EXEC LINKGO
```

```
//GO.FT05F001 DD *
.
.  {card input}
.
//GO.FT08F001 DD UNIT=7TRACK,VOL=SER=number,
//     LABEL=(,NL),DISP=NEW,DSN=name,
//     DCB=(RECFM=F,LRECL=136,BLKSIZE=136,TRTCH=ET   (BCD output tape)
//GO.FT09F001 DD UNIT=2400-3,VOL=SER=number,
//     LABEL=(,NL),DISP=OLD,DSN=name,
//     DCB=(RECFM=VBS,LRECL=84,BLKSIZE=944)  (Binary input tape)
/*
```

(3) UNIVAC 1100 series

```
@ RUN,//...
@ ASG,T      9,T,SAVE05          {Binary input tape}
@ REWIND     9
@ ASG,T      8,T,SAVE05          {BCD output tape}
@ REWIND     8
@ FOR,IS     RDUSER,RDUSER
.
.  {source deck}
.
@ MAP,I      relocatable element, absolute element
@ XQT        absolute element
.
.  {data deck}
.
```

Error Messages Output by RDUSER

Messages from RDUSER indicating an error are defined in the following list:

LABEL (name) WAS NOT FOUND ON TAPE
User tape label is missing on the input tape (unit 9).

THE NAME (name) WAS NOT FOUND ON TAPE
The matrix or table named is missing on the input tape (unit 9).

Restrictions in RDUSER

The dimensions for DVAL, VAL, IRDIN, and VAL in the two subroutines MATRD and TABRD must be large enough to accommodate a single column of the largest matrix and table being transferred.

The tape must be created on a 7-track tape drive when the receiving installation has a CDC or a UNIVAC computer.

Card Input for RDUSER

The input for RDUSER is as follows:

The first N cards are read with a free field format (20A4). These cards are used to describe the data blocks being passed between computers. The Nth card must have a blank in column 77 and END in columns 78 to 80 to stop the reading of the comments (see sample input in the next section). The next card is read with the format (2A4) and will have the FORTRAN User Tape Label (left justified). The remaining cards will be read with the format (2A4,2I2). Columns 1 to 8 will have the data block name (left justified). Column 10 will have a code for determining whether a data block is a matrix (1) or a table (2). Column 12 will contain a code determining the option of printing (1) or not printing (0) the elements of the data block.

Sample Input for RDUSER

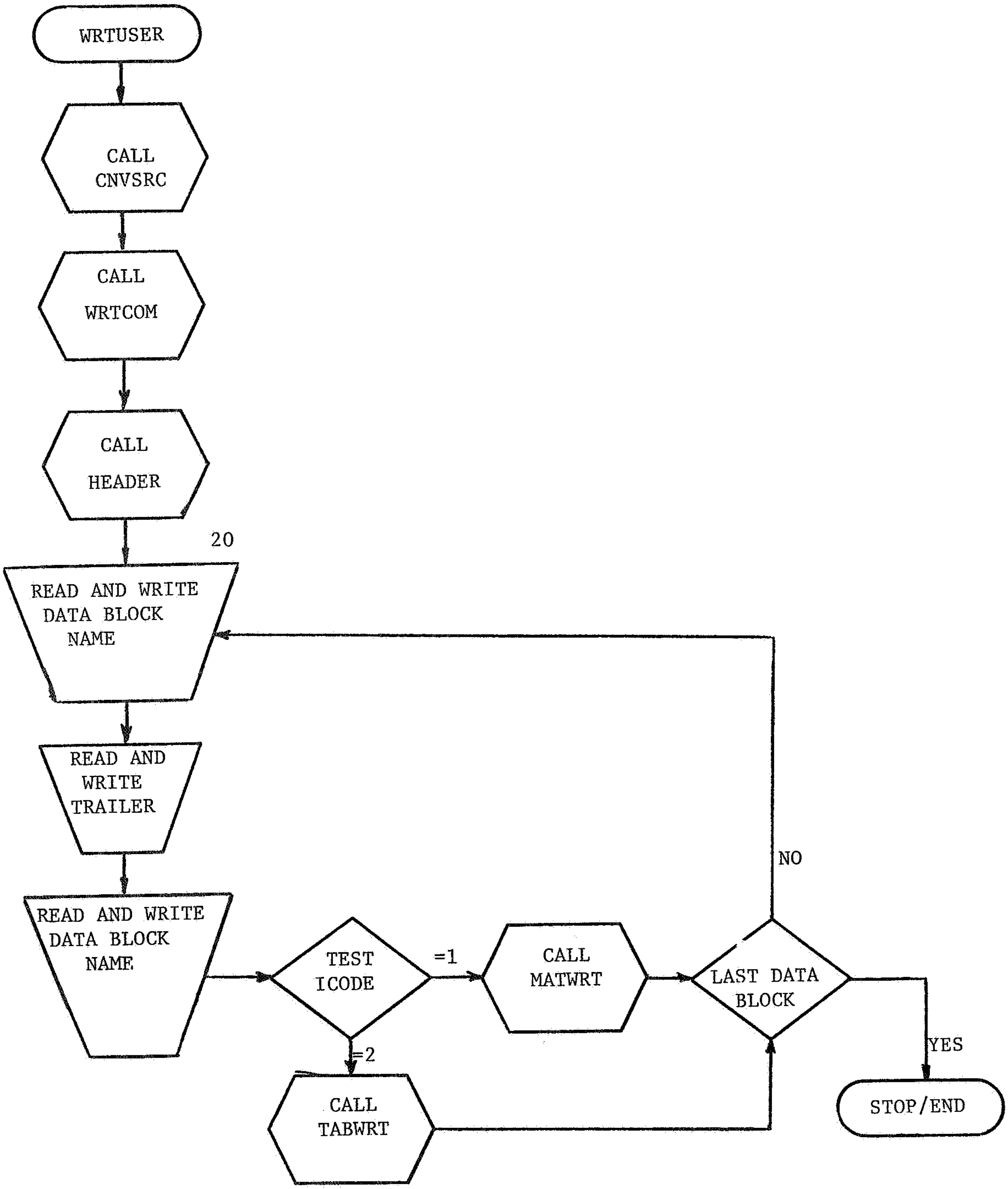
A sample input for RDUSER is as follows:

```
THE MATRICES ARE TO TEST SINGLE , DOUBLE PRECISION , COMPLEX AND REAL
              MATRICES , TO TEST THE ORDER OF OUTPUT2 , THE
              ORDER OF HEADERS AND FINALLY
                    NULL COLUMNS                                   END
XXXXXXXX
ZCOL5     1 1
ZCOL6     1 0
ZCOL8     1 0
ZCOL1     1 0
ZCOL2     1 1
ZCOL3     1 1
B         1 0
X         1 1
EQEXIN    2 1
GPDT      2 0
```

DESCRIPTION OF WRTUSER AND ITS SUBPROGRAMS

Program WRTUSER

WRTUSER is a FORTRAN main program that has as its primary function the calling of various subprograms for data manipulation. The flow chart and program listing that follow show how WRTUSER controls program operation.



```
C
C     THIS PROGRAM CONVERTS A BCD TAPE INTO A BINARY UNFORMATTED TAPE
C     FOR USE AS INPUT INTO NASTRAN MODULE INPUTT2
C
      DIMENSION NAME(2), ITRAIL(7), IRDIN(100)
C
C     CNVSRC CONVERTS THE SOURCE FROM ONE COMPUTER INTO A SOURCE FORM
C     READABLE BY A DIFFERENT COMPUTER
C
      CALL CNVSRC
C
C     READ IN COUNTER FOR NUMBER OF DATA BLOCKS FOR THIS LABEL
C     MACH=1 IMPLIES MACHINE FOR OUTPUT TAPE IS CDC
C     MACH=2 IMPLIES MACHINE FOR OUTPUT TAPE IS IBM
C     MACH=3 IMPLIES MACHINE FOR OUTPUT TAPE IS UNIVAC
C
      READ (5,40) NAM1,NAM2,ITOT,MACH
C
C     CALL SUBROUTINES FOR COMMENT AND HEADER INFORMATION
C
      PRINT 50
      CALL WRTCOM
      PRINT 50
      CALL HEADER
      I=0
   20 ICNT=2
      WRITE (8) ICNT
      READ (9,60) NAME,ICODE
C
C     WRITE THE DATA BLOCK NAME
C
      WRITE (8) NAME
      ICNT=-1
      WRITE (8) ICNT
      ICNT=7
      WRITE (8) ICNT
      READ (9,70) ITRAIL
C
C     WRITE THE TRAILER
C
      WRITE (8) ITRAIL
      ICNT=-2
      WRITE (8) ICNT
      READ (9,90) ICNT
      WRITE (8) ICNT
C
C     READ AND WRITE THE DATA BLOCK NAME
C
      READ (9,100) (IRDIN(L),L=1,ICNT)
      WRITE (8) (IRDIN(L),L=1,ICNT)
C
C     CALL A SUBROUTINE TO WRITE THE MATRICES
C
      IF (ICODE.EQ.1) CALL MATWRT(MACH)
C
C     CALL A SUBROUTINE TO WRITE THE TABLES
C
      IF (ICODE.EQ.2) CALL TABWRT
      I=I+1
C
C     CHECK FOR THE END OF THE DATA BLOCKS FOR THAT HEADING
C
```

```
      PRINT 80, NAME                                                    WRT 530
      IF (I.LT.ITOT) GO TO 20                                           WRT 540
      END FILE 8                                                        WRT 560
      STOP                                                              WRT 570
C                                                                       WRT 580
   40 FORMAT (2A4,2I5)                                                  WRT 590
   50 FORMAT (1H1)                                                      WRT 600
   60 FORMAT (50X,2(A4,6X),I10)                                         WRT 610
   70 FORMAT (10X,7I10)                                                 WRT 620
   80 FORMAT (1H0,12H DATA BLOCK ,2A4,25H HAS BEEN WRITTEN ON TAPE)     WRT 630
   90 FORMAT (70X,I10)                                                  TAB 631
  100 FORMAT (2(A4,6X),(6I10))                                          TAB 632
      END                                                               WRT 640-
```

Subprogram CNVSRC

CNVSRC is a FORTRAN subprogram. The primary job of CNVSRC is to convert the source of one computer into a source form readable by a computer of a different type. The CNVSRC subprogram listing follows.

```
      SUBROUTINE CNVSRC
C
C     THIS PROGRAM CONVERTS THE SOURCE FROM ONE COMPUTER (MACH1) TO THE
C     SOURCE FOR ANOTHER COMPUTER (MACH2)
C
      DIMENSION IDATA(20)
      DATA ISTOP,IT/4HSTOP,4H IT /
      K=0
C
C     READ IN COMPUTER TYPES
C
      READ (5,30) MACH1,MACH2
      PRINT 40,MACH1,MACH2
C
C     READ IN DATA
C
   10 READ (3,50) IDATA
      IF (IDATA(19).EQ.ISTOP.AND.IDATA(20).EQ.IT) GO TO 20
      K=K+1
      WRITE (9,50) IDATA
      GO TO 10
   20 PRINT 60,K
      REWIND 9
      RETURN
C
   30 FORMAT (A4,2X,A4)
   40 FORMAT( 1H1,34H START CONVERTING SOURCE FROM THE ,A4,17H COMPUTER
     1TO THE ,A4,9H COMPUTER /)
   50 FORMAT (20A4)
   60 FORMAT (//24H STOP SOURCE CONVERSION ,/1X,I5,29H RECORDS HAVE BEEN
     1 CONVERTED )
      END
```

Subprogram WRTCOM

WRTCOM is a FORTRAN subprogram that reads the comments generated by RDUSER on unit 9 and prints them out. The WRTCOM subprogram listing follows.

```
      SUBROUTINE WRTCOM
C
C     THIS SUBROUTINE READS AND PRINTS COMMENTS
C
      DIMENSION ICOM(20)
      DATA IQUIT/4H END/
   10 READ (9,20) (ICOM(I),I=1,20)
      PRINT 20, (ICOM(I),I=1,20)
      IF (ICOM(20).NE.IQUIT) GO TO 10
      RETURN
C
   20 FORMAT (20A4)
      END
```

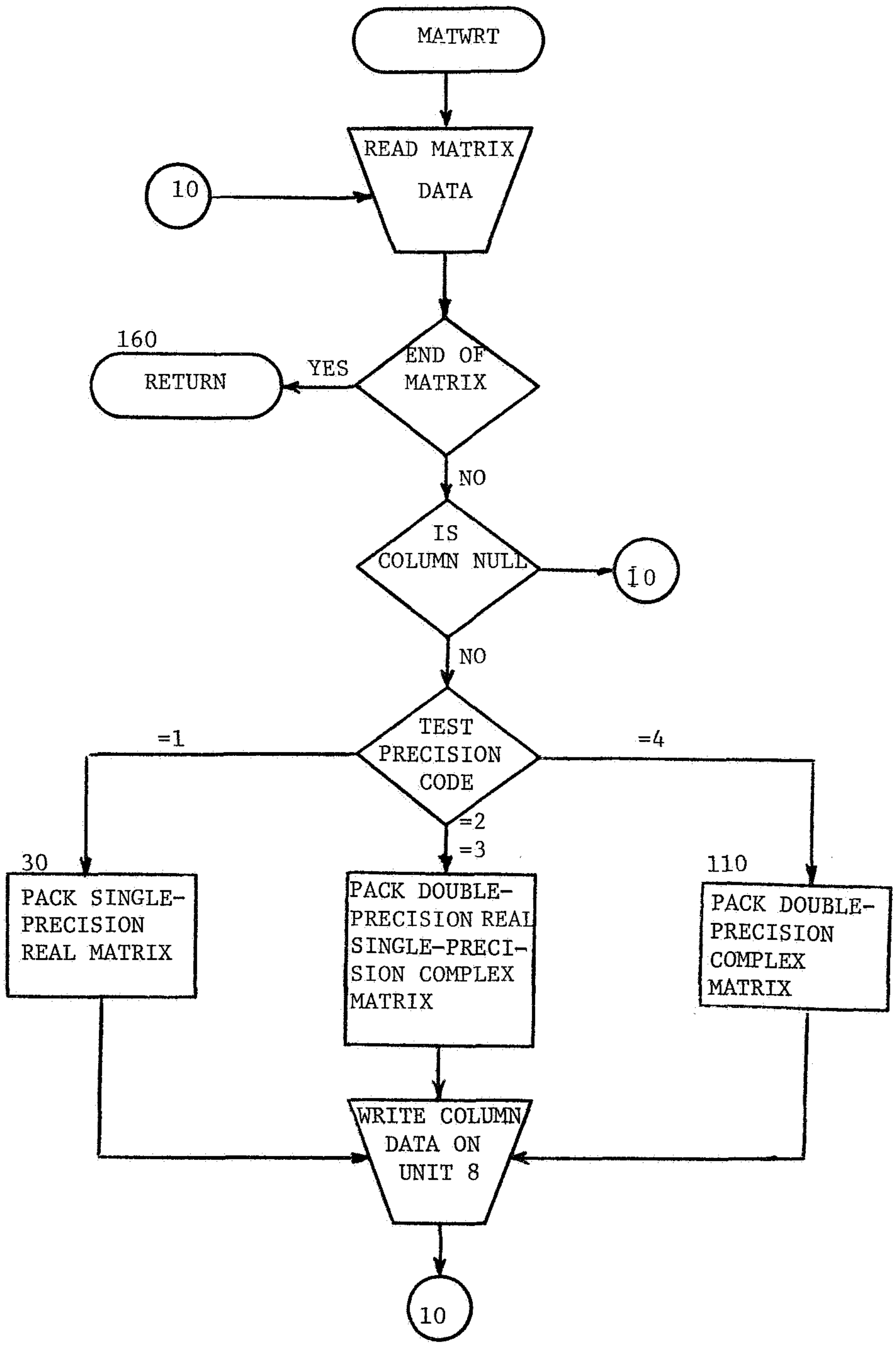
Subprogram HEADER

HEADER is a FORTRAN subprogram. Its purpose is to write the header information on unit 8 in binary form. The header information includes the data, header, and user tape label. The HEADER subprogram listing follows.

```
      SUBROUTINE HEADER
C
C     SUBROUTINE FOR WRITING HEADER INFORMATION
C
      DIMENSION IDATE(3), HEAD(7), NAME(2)
      ICNT=3
      WRITE (8) ICNT
      READ (9,10) IDATE
C
C     WRITE THE DATE
C
      WRITE (8) IDATE
      ICNT=7
      WRITE (8) ICNT
      READ (9,20) HEAD
C
C     WRITE THE HEADER
C
      WRITE (8) HEAD
      ICNT=2
      WRITE (8) ICNT
      READ (9,30) NAME
C
C     WRITE THE LABEL
C
      WRITE (8) NAME
      ICNT=-1
      WRITE (8) ICNT
      ICNT=0
      WRITE (8) ICNT
      RETURN
C
   10 FORMAT (50X,3I10)
   20 FORMAT (10X,7(A4,6X))
   30 FORMAT (60X,2(A4,6X))
      END
```

Subprogram MATWRT

MATWRT is a FORTRAN subprogram. Its parameter is the computer (MACH) on which the tape output on unit 8 from WRTUSER will be used. The primary task for MATWRT is to pack a matrix a column at a time and write it in binary form on unit 8. A MATWRT flow chart and a subprogram listing follow.



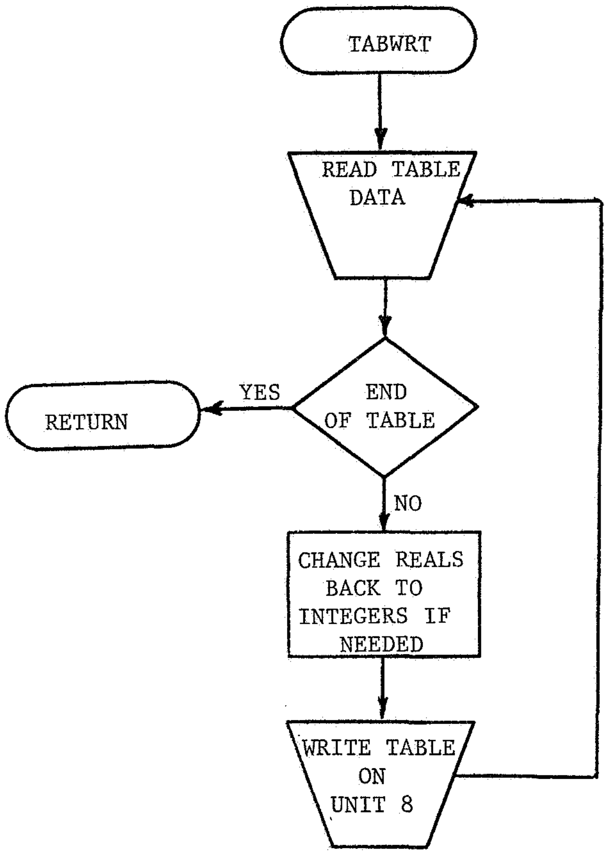
```
      SUBROUTINE MATWRT(MACH)
C
C     SUBROUTINE FOR WRITING MATRICES
C
C
C     DIMENSION STATEMENT MUST BE ADJUSTED ACCORDING TO SIZE OF MATRIX
C
      DIMENSION IRDIN(5), WRDIN(100), IVAL(200), VAL(200)
      EQUIVALENCE (IVAL(1),VAL(1))
      IF (MACH.EQ.1) ISTORE=131071
      IF (MACH.EQ.2) ISTORE=16777215
      IF (MACH.EQ.3) ISTORE=29843125
      JCNT=-2
   10 JCNT=JCNT-1
      WRITE (8) JCNT
      READ (9,170) ICNT
C
C     CHECK FOR END OF DATA BLOCK
C
      IF (ICNT.EQ.0) GO TO 160
      IF (ICNT.NE.1) GO TO 20
      READ (9,170) INUMB
      WRITE (8) ICNT
      WRITE (8) ISTORE
      GO TO 10
   20 READ (9,180) (IRDIN(I),I=1,5)
      NZCOL=IRDIN(1)
      IPREC=IRDIN(2)
      READ (9,190) (WRDIN(I),I=1,ICNT)
      KCNT=0
      ISW=0
C
C     IPREC=1 IMPLIES SINGLE PRECISION REAL MATRIX
C     IPREC=2 IMPLIES DOUBLE PRECISION REAL MATRIX
C     IPREC=3 IMPLIES SINGLE PRECISION COMPLEX MATRIX
C     IPREC=4 IMPLIES DOUBLE PRECISION COMPLEX
C
      GO TO (30,70,70,110), IPREC
C
C     WRITE SINGLE PRECISION REAL MATRICES
C
   30 DO 60 I=NZCOL,ICNT
C
C     CHECK FOR IMBEDDED ZEROS
C
      IF (WRDIN(I).EQ.0.) GO TO 50
      IF (ISW.EQ.0) GO TO 40
      KCNT=KCNT+1
C
C     STORE POINTER TO NEXT NON-ZERO ELEMENT
C
      IVAL(KCNT)=I
   40 KCNT=KCNT+1
      ISW=0
C
C     STORE NON-ZERO ELEMENTS
C
      VAL(KCNT)=WRDIN(I)
      GO TO 60
```

```
   50 ISW=1
   60 CONTINUE
      LCNT=KCNT+6
      WRITE (8) LCNT
C
C     WRITE COLUMN OF MATRIX ON TAPE
C
      WRITE (8) (IRDIN(I),I=1,5),(VAL(I),I=1,KCNT),ISTORE
      GO TO 10
C
C     WRITE DOUBLE PRECISION REAL MATRICES
C     WRITE SINGLE PRECISION COMPLEX MATRICES
C
   70 IZCOL=(2*NZCOL)-1
      DO 100 I=IZCOL,ICNT,2
C
C     CHECK FOR IMBEDDED ZEROS
C
      IF (WRDIN(I).EQ.0..AND.WRDIN(I+1).EQ.0.) GO TO 90
      IF (ISW.EQ.0) GO TO 80
      KCNT=KCNT+1
C
C     STORE POINTER TO NEXT NON-ZERO ELEMENT
C
      IVAL(KCNT)=(I+1)/2
   80 KCNT=KCNT+1
C
C     STORE NON-ZERO ELEMENTS
C
      VAL(KCNT)=WRDIN(I)
      KCNT=KCNT+1
      VAL(KCNT)=WRDIN(I+1)
      ISW=0
      GO TO 100
   90 ISW=1
  100 CONTINUE
      LCNT=KCNT+6
      WRITE (8) LCNT
C
C     WRITE COLUMN OF MATRIX ON TAPE
C
      WRITE (8) (IRDIN(I),I=1,5),(VAL(I),I=1,KCNT),ISTORE
      GO TO 10
C
C     WRITE DOUBLE PRECISION COMPLEX MATRICES
C
  110 IZCOL=(4*NZCOL)-3
      DO 150 I=IZCOL,ICNT,4
C
C     CHECK FOR IMBEDDED ZEROS
C
      IF (WRDIN(I).EQ.0..AND.WRDIN(I+1).EQ.0..AND.WRDIN(I+2).EQ.0..AND.W
     1RDIN(I+3).EQ.0.) GO TO 140
      IF (ISW.EQ.0) GO TO 120
      KCNT=KCNT+1
C
C     STORE POINTER TO NEXT NON-ZERO ELEMENT
C
      IVAL(KCNT)=(I+3)/4
  120 ISW=0
      DO 130 J=1,4
      KCNT=KCNT+1
```

```
C
C     STORE NON-ZERO ELEMENTS
C
      VAL(KCNT)=WRDIN(I+J-1)
  130 CONTINUE
      GO TO 150
  140 ISW=1
  150 CONTINUE
      LCNT=KCNT+6
      WRITE (8) LCNT
C
C     WRITE COLUMN OF MATRIX ON TAPE
C
      WRITE (8) (IRDIN(I),I=1,5),(VAL(I),I=1,KCNT),ISTORE
      GO TO 10
  160 WRITE (8) ICNT
      RETURN
C
  170 FORMAT (70X,I10)
  180 FORMAT (30X,5I10)
  190 FORMAT (4E20.12)
      END
```

Subprogram TABWRT

TABWRT is a FORTRAN subprogram that reads a table from unit 9, converts real numbers to integers if needed, and writes the table on unit 8 in binary form. A TABWRT flow chart and a subprogram listing follow.



```
      SUBROUTINE TABWRT                                                 TAB  10
C                                                                       TAB  20
C     SUBROUTINE FOR WRITING TABLES                                     TAB  30
C                                                                       TAB  40
C                                                                       TAB  41
C     DIMENSION STATEMENT MUST BE ADJUSTED ACCORDING TO SIZE OF TABLE   TAB  42
C                                                                       TAB  43
      DIMENSION IVAL(100),VAL(100),WRDIN(100)                           TAB  50
      EQUIVALENCE (IVAL(1),VAL(1))                                      TAB  51
      JCNT=-3                                                           TAB  60
   10 WRITE (8) JCNT                                                    TAB  70
      READ (9,30) ICNT                                                  TAB  80
C                                                                       TAB 100
C     CHECK FOR END OF DATA BLOCK                                       TAB 110
C                                                                       TAB 120
      IF (ICNT.EQ.0) GO TO 20                                           TAB 130
      READ (9,40) (WRDIN(I),I=1,ICNT)                                   TAB 140
C                                                                       TAB 141
C     CHANGE REALS BACK INTO INTEGERS IF NEEDED                         TAB 142
C                                                                       TAB 143
      KCNT=0                                                            TAB 144
      I=0                                                               TAB 145
   11 I=I+1                                                             TAB 146
      IF(I.GT.ICNT) GO TO 13                                            TAB 147
      IF(WRDIN(I).EQ.-9999.99) GO TO 12                                 TAB 148
      KCNT=KCNT+1                                                       TAB 149
      VAL(KCNT)=WRDIN(I)                                                TAB 150
      GO TO 11                                                          TAB 151
   12 I=I+1                                                             TAB 152
      KCNT=KCNT+1                                                       TAB 153
      IVAL(KCNT)=IFIX(WRDIN(I))                                         TAB 154
      GO TO 11                                                          TAB 155
C                                                                       TAB 150
C     WRITE THE TABLE                                                   TAB 160
C                                                                       TAB 170
   13 WRITE (8) KCNT                                                    TAB 179
      WRITE (8) (VAL(I),I=1,KCNT)                                       TAB 180
      JCNT=JCNT-1                                                       TAB 190
      GO TO 10                                                          TAB 200
   20 WRITE (8) ICNT                                                    TAB 210
      RETURN                                                            TAB 211
C                                                                       TAB 220
   30 FORMAT (70X,I10)                                                  TAB 230
   40 FORMAT(4E20.12)                                                   TAB 240
      END                                                               TAB 250-
```

WRTUSER USAGE

Control-Card Operation for WRTUSER

WRTUSER is executed on different computers by a different set of control cards. The following three sets are acceptable for the indicated computer:

(1) CDC 6000 series

```
JOB,...
REQUEST TAPE3,HY,X.  number,ROL  (BCD input tape)
   X (external) is optional depending on where the tape was generated
REWIND(TAPE3)
REQUEST(TAPE8),HY.  number,RIL, initials, identification  (Binary output tape)
REWIND(TAPE8)
RUN(S)
LGO.
DROPFIL(TAPE3)
DROPFIL(TAPE8)
EXIT.
DROPFIL(TAPE3)
DROPFIL(TAPE8)
```

$^{7}8_{9}$ (END-OF-RECORD)

```
PROGRAM WRTUSER(INPUT,OUTPUT,TAPE5=INPUT,TAPE8,TAPE9,TAPE3)
.
.  {source deck}
.
```

$^{7}8_{9}$ (END-OF-RECORD)

```
.
.  {card input}
.
```

$^{6}7_{8_{9}}$ (END-OF-FILE)

(2) IBM 360-370 series

```
//JOB,...
//A EXEC FORTRANH
//TIME=number
//SYSIN DD *
```

```
.
.  {source deck}
.

//B EXEC LINKGO
//GO.FT05F001 DD *

.
.  {card input}
.

//GO.FT03F001 DD UNIT=7TRACK,VOL=SER=number,LABEL=(,NL),
//    DISP=OLD,DSN=name,DCB=(RECFM=F,LRECL=136,BLKSIZE=136,TRTCH=ET)
      (BCD input tape)
//GO.FT08F001 DD UNIT=2400-3,VOL=SER=number,LABEL=(,NL),
//    DISP=NEW,DSN=name,DCB=(RECFM=VBS,LRECL=84,BLKSIZE=844)
      (Binary output tape)
//GO.FT09F001 DD UNIT=2314,DISP=NEW,SPACE=(TRK,(10,1)),
//    DCB=(RECFM=FB,LRECL=80,BLKSIZE=960)
/*
```

(3) UNIVAC 1100 series

```
@ RUN, //
@ ASG,T        3,T,SAVE05              (BCD input tape)
@ REWIND       3
@ ASG,T        8,T,SAVE05              (Binary output tape)
@ REWIND       8
@ ASG,T        9,T                     (scratch space)
@ FOR,IS       WRTUSER,WRTUSER

.
.  {source deck}
.

@ MAP,I        relocatable element, absolute element
@ XQT          absolute element

.
.  {data deck}
.
```

Error Messages Output by WRTUSER

There are no error messages in the WRTUSER program.

Restrictions in WRTUSER

The dimensions for IVAL, VAL, and WRDIN in the two subroutines TABWRT and MATWRT must be large enough to accommodate a single column of the largest matrix and table being transferred.

Card Input for WRTUSER

The input for WRTUSER is as follows:

The first card, a comment card, is read with the format (A4,2X,A4) where columns 1 to 4 have the type of computer (left justified) on which the tape was created and columns 7 to 10 contain the type of computer (left justified) on which the tape is being converted. The second card is read with the format (2A4,2I5). Columns 1 to 8 have the FORTRAN User Tape Label (left justified). Columns 9 to 13 have the number of data blocks to be converted. Column 18 has a code to show that the tape is being converted for use on a CDC (1), IBM (2), or UNIVAC (3) computer.

Sample Input for WRTUSER

The following is a sample input for WRTUSER:

```
IBM   CDC
XXXXXXXX    10    1
```

VERIFICATION OF PROGRAMS

RDUSER and WRTUSER were executed for four[1] of the nine possibilities shown in figure 1 and found to possess the desired qualities lacking in DMI punched cards. Card handling for the input to NASTRAN was cut to the minimum. Square, rectangular, and symmetric matrices containing single-precision real, single-precision complex, double-precision real, and double-precision complex elements were used in the test runs. In each case the answers listed on one computer agreed with the answers listed on dissimilar and similar computers, which indicated that no precision was lost in the transfer.

---

[1]UNIVAC paths were not tested due to errors in the INPUTT2 and OUTPUT2 NASTRAN modules on the UNIVAC computer.

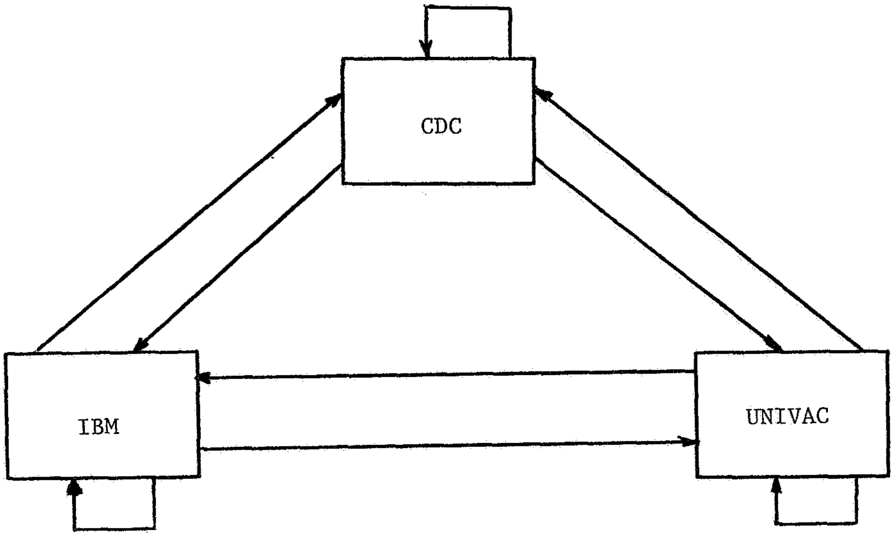


Figure 1.- Paths of data between computers.

CONCLUDING REMARKS

The transfer of data between dissimilar computers by using the two new NASTRAN utility programs RDUSER and WRTUSER has been done successfully for the IBM and CDC computers. The transfer of data to and from the UNIVAC computer has not been completely tested due to errors in the NASTRAN modules OUTPUT2 and INPUTT2. Square, rectangular, and symmetric matrices containing single-precision real, single-precision complex, double-precision real, and double-precision complex elements were used in the test runs. In each case the answers listed on one computer agreed with the answers listed on a similar or dissimilar computer, which indicated that no precision was lost in the transfer.

Langley Research Center,
National Aeronautics and Space Administration,
Hampton, Va., September 24, 1973.

REFERENCES

1. McCormick, Caleb W., ed.: The NASTRAN User's Manual (Level 15). NASA SP-222(01), 1972.

2. Anon.: The NASTRAN Programmer's Manual. NASA SP-223(01), 1972.

TABLE I.- FORMAT OF HEADER FOR THE NASTRAN USER TAPE

Record	Word	Type (a)	Description
1	1	I	Number of words in next record (3)
2	1 to 3	I	Date
3	1	I	Number of words in next record (7)
4	1 to 7	A	Header
5	1	I	Number of words in next record (2)
6	1 to 2	A	User tape label
7	1	I	End of record (-1)
8	1	I	End of file (0)
9	1	I	Number of words in next record (2)

[a]A = Alphanumeric
I = Integer

TABLE II.- FORMAT OF MATRIX FOR THE NASTRAN USER TAPE

Record	Word	Type (a)	Description
1	1 to 2	A	Matrix label
2	1	I	End of record (-1)
3	1	I	Number of words in next record (7)
4			Trailer
	1	I	Gina name
	2	I	Number of columns
	3	I	Number of rows
	4	I	Form of matrix
	5	I	Type of matrix
	6	I	Number of nonzero terms in the longest record
	7	I	Percent fullness of matrix
5	1	I	End of record (-2)
6	1	I	Number of words in next record (2)
7	1 to 2	A	Matrix label
8	1	I	End of record (-3)
9	1	I	Number of words in next record
10			Column of matrix
	1	I	First nonzero row
	2	I	Precision of matrix
	3 to 5	I	Not used
	6 through no. words -1	R,I	Elements of column. Integer pointers to nonzero elements are imbedded in this record
	No. words	I	End of column
11	1	I	End of record
12 to N			Records 9, 10, and 11 are repeated until a zero (0) is found for the record containing the number of words in the next record
N + 1	1	I	Either a zero (0) for an end of file or a two (2) showing the number of words in the next record

[a]A = Alphanumeric
I = Integer
R = Real

TABLE III.- FORMAT OF TABLE FOR THE NASTRAN USER TAPE

Record	Word	Type (a)	Description
1	1 to 2	A	Table label
2	1	I	End of record (-1)
3	1	I	Number of words in next record (7)
4			Trailer
	1	I	Gino name
	2 to N	I	Miscellaneous information
5	1	I	End of record (-2)
6	1	I	Number of words in next record (2)
7	1 to 2	A	Table label
8	1	I	End of record (-3)
9	1	I	Number of words in next record
10	All	I	Element of first record of table
11	1	I	End of record
12 to N			Records 9, 10, and 11 are repeated until a zero (0) is found for the number of words in the next record
N + 1	1	I	Either a zero (0) for an end of file or a two (2) showing the number of words in the next record

[a]A = Alphanumeric
I = Integer

NASA-Langley, 1973 —— 8 L-9052

"The aeronautical and space activities of the United States shall be conducted so as to contribute . . . to the expansion of human knowledge of phenomena in the atmosphere and space. The Administration shall provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."

—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

NASA SCIENTIFIC AND TECHNICAL PUBLICATIONS

TECHNICAL REPORTS: Scientific and technical information considered important, complete, and a lasting contribution to existing knowledge.

TECHNICAL NOTES: Information less broad in scope but nevertheless of importance as a contribution to existing knowledge.

TECHNICAL MEMORANDUMS: Information receiving limited distribution because of preliminary data, security classification, or other reasons. Also includes conference proceedings with either limited or unlimited distribution.

CONTRACTOR REPORTS: Scientific and technical information generated under a NASA contract or grant and considered an important contribution to existing knowledge.

TECHNICAL TRANSLATIONS: Information published in a foreign language considered to merit NASA distribution in English.

SPECIAL PUBLICATIONS: Information derived from or of value to NASA activities. Publications include final reports of major projects, monographs, data compilations, handbooks, sourcebooks, and special bibliographies.

TECHNOLOGY UTILIZATION PUBLICATIONS: Information on technology used by NASA that may be of particular interest in commercial and other non-aerospace applications. Publications include Tech Briefs, Technology Utilization Reports and Technology Surveys.

Details on the availability of these publications may be obtained from:

SCIENTIFIC AND TECHNICAL INFORMATION OFFICE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Washington, D.C. 20546