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The systems listed below are currently available from Program Distribution in Palo Alto. Please submit requests to your local CONTROL DATA representative.

### CHIPPEWA OPERATING SYSTEM

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*The system library and source are distributed on one reel of tape. Please reference 64/6600 Systems Bulletin 2 for a description of the contents of the tape. 64/6600 Systems Bulletin 2 is part of the materials distributed with the above systems.

**Please specify when ordering that this product is to be used with Chippewa Operating System.
**SCOPE**

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The above systems were tested on a 6400 updated through Engineering Change Order (ECO) number 39.

*The system library and source are distributed on one reel of tape. Please reference 64/6600 Systems Bulletin 3 for a description of the contents of the tape. 64/6600 Systems Bulletin 3 is part of the materials distributed with the above systems.

**Please specify when ordering that this product is to be used with SCOPE.
SCOPE Version 2.0 along with ASCENT Version 2.0, FORTRAN Version 2.0 and COPYN Version 1.0 has now been released. The release consists of:


A master tape containing the following nine files recorded in binary mode:

File 1. The system file (binary)
File 2. System routines (COSY) (STL, DSD, MTR, CMR)
File 3. CM resident CP routines (COSY)
File 4. CM resident PP routines (COSY)
File 5. Disk resident PP routines (COSY)
File 6. Disk resident utility routines (COSY)
File 7. Disk resident FORTRAN object time routines (COSY)
File 8. ASCENT (COSY)
File 9. FORTRAN (COSY)

RELEASE DESCRIPTION

The System File

Each routine in the system appears on the system file as one or more binary logical records. These binary records are separated by zero length records into logical groups. RSL (and RPL) is no longer one logical record nor are the zero word terminators (3,7,9 card) used.

Group 1. System Routines (STL, DSD, MTR, CMR)
Group 2. Resident Subroutine Library (RSL)
Group 3. Resident Peripheral Library (RPL)
Group 4. Peripheral Library Directory Routines (PLD)
Group 5. Central Library Directory Routines (CLD)

The ordering of routines within these groups is given in Figure 1.
The system file is represented as a binary card deck as follows:

```
STL
7-8-9 card
DSD
7-8-9 card
MTR
7-8-9 card
CMR
7-8-9 card
7-8-9 card
ACGOER
7-8-9 card
DBLE
7-8-9 card

system routines

TAN
7-8-9 card
XRCL
7-8-9 card
7-8-9 card
1AJ
7-8-9 card
1BJ
7-8-9 card

RSL

MSG
7-8-9 card
7-8-9 card

007
7-8-9 card
1CO
7-8-9 card

RPL

TIM
7-8-9 card
WBR
7-8-9 card
7-8-9 card

PLD

ASCENT
7-8-9 card
ASCENT1
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CLD

TANH
7-8-9 card
TIME
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END OF FILE
The Cosy Files

The content of each of the cosy files is as follows:

File 2. System Routines
1. STL
2. DSD
3. MTR
4. CMR

File 3. CM Resident CP Routines
1. ACGOER
2. DBLE
3. EXP
4. GETBA
5. IBAIEX
6. LOCF
7. SINCOS
8. SNGL
9. SQRT
10. SYSTEM
11. TAN
12. XRCL

File 4. CM Resident PP Routines
1. 1AJ
2. 1BJ
3. 1LJ
4. 1OT
5. 2BD
6. 2BP
7. 2CF
8. 2DF
9. 2DT
10. 2LP
11. 2RC
12. 2RD
13. 2TB
14. 2TJ
15. 2TR
16. 2TS
17. 2TW
18. 2WD
19. 7DP
20. 7TP
21. CHK
22. CIO
23. MSG

File 5. Disk Resident PP Routines
1. 007
2. 1CO
3. 1DF
4. 1DS
5. 1FM
6. 1LT
7. 1PL
8. 1PO
9. 1RF
10. 1RI
11. 1RO
12. 1TD
13. 2BT
14. 2EF
15. 2LA
16. 2LB
17. 2LE
18. 2PC
19. 2RT
20. 2WT
21. 3OT
22. 3SD
23. 4SD
24. DIS
25. DMP
26. HLP
27. LBC
28. LDR
29. LOC
30. LOD
31. PBC
32. PBS
33. RBR
34. RFL
35. SOS
36. TIM
37. WBR

File 6. Disk Resident Utility Routines
1. BKSP
2. CATALOG
3. COPY
4. COPYBF
5. CPYN
6. CPYSBF
7. LOADER
8. OVERLOD
9. REWIND
10. VERIFY

File 7. Disk Resident FORTRAN Object Time Routines
1. ALNLOG
2. ASINCOS
3. ATAN
4. ATAN2
5. BACKSP
6. BUFFEI
7. BUFFEO
8. CABS
9. CBAIEX
10. CCOS
11. CEXP
12. CLOG
13. CSIN
14. CSQRT
15. DABS
16. DATAN
17. DBADEX
18. DBAIEX
19. DEXP
20. DISPLA
21. DLNLOG
22. DMOD
23. DSIGN
24. DSINCOS
25. DSQRT
26. DUMP
27. DVCHEK
28. ENDFIL
29. IDINT
30. IFENDF
31. INPUTB
32. INPUTC
33. INPUTS
34. IOCHEC
35. IOCHEK
36. KODER
37. KRAKER
38. LENGTH
39. OUTPTB
40. OUTPTC
41. OUTPTS
42. OVERFL
43. OVERLAY
44. PAUSE
45. RANF
46. RBAIEX
47. RBAREX
48. REMARK
49. REWINM
50. SECOND
51. SEGMENT
52. SLITE
53. SLITE T
54. SSWITCH
55. START
56. TANH
57. TIME

File 8. ASCENT
1. ASCENT
2. ASCENT1

File 9. FORTRAN
1. RUN
2. RUN1
3. Q8DIAGP

(overlay 0,0)
(overlay 1,0)
(overlay 0,0)
(overlay 1,0)
(overlay 1,1)
The List Tape

The composite list tape contains the following routines and is written in packed display code:

- File 1 System routines (STL, DSD, MTR, CMR)
- File 2 CM resident CP routines
- File 3 CM resident PP routines
- File 4 Disk resident PP routines
- File 5 Disk resident utility routines
- File 6 Disk resident FORTRAN object time routines
- File 7 ASCENT
- File 8 FORTRAN

INSTALLATION INSTRUCTIONS

Modifying CMR

The only modifications which may be necessary to the system file are changes to the Equipment Status Table (EST). Memory size is automatically assigned by MTR at dead start time. The EST modifications may be made in a number of ways:

1. Changing EST (locations 2100-2200) from the console after dead start.
2. Use CMR from COSY file with appropriate modification cards.
A COSY deck of CMR has been included in this release (file 1 record 4). CMR is composed of sixteen elements in one ASPER program.

<table>
<thead>
<tr>
<th></th>
<th>Location (octal)</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>POINTERS</td>
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<tr>
<td>2.</td>
<td>DATE LINE</td>
</tr>
<tr>
<td>3.</td>
<td>START</td>
</tr>
<tr>
<td>4.</td>
<td>PPCOM</td>
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<td>5.</td>
<td>CPAREA</td>
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<td>6.</td>
<td>CPRES</td>
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<td>7.</td>
<td>EST</td>
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<tr>
<td>8.</td>
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<tr>
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<td>TRT2</td>
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<td>13.</td>
<td>TRT3</td>
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<tr>
<td>14.</td>
<td>TRT4</td>
</tr>
<tr>
<td>15.</td>
<td>FNT/FST</td>
</tr>
<tr>
<td>16.</td>
<td>DFB</td>
</tr>
</tbody>
</table>

aaaa may vary from 2600 to 3200 depending on the number of disks in the system. Each disk requires a 100₈ word TRT (TRT0, TRT1, TRT2, TRT3, TRT4). When the system contains fewer than 5 disks, the origin of FNT/FST may be moved back into the space reserved for the unused TRT tables. CMR is provided in ASPER source language. This is necessary in order that the binary text be free of loader tables.

**Equipment Status Table (EST)**

The format of EST for 6000 equipment is as follows:

<table>
<thead>
<tr>
<th>z</th>
<th>00cc</th>
<th>e0uu</th>
<th>o</th>
<th>h</th>
<th>x000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>48</td>
<td>36</td>
<td>24</td>
<td>23</td>
<td>12</td>
</tr>
</tbody>
</table>
z=2000  Signifies an empty EST entry. The remaining bytes are zero.

=0000  Signifies the entry defines a piece of equipment in the system. The remaining bytes are significant.

c  Channel on which the equipment is attached.

e  6000 synchronizer number.

uu  Unit number

O  On/off bit; 0 indicates off, 1 indicates on. This bit can be changed with the ONnn/OFFnn statements from the console.

h  Equipment type in display code:
   DA  Channel 0 disk unit
   DB  Channel 1 disk unit
   DC  Channel 2 disk unit
   DD  Channel 3 disk unit
   DE  Channel 4 disk unit
   CR  Card reader
   CP  Card punch
   DS  Display console
   LP  Line printer
   MT  607 magnetic tape
   WT  626 magnetic tape

x  Zero indicates 6000 equipment.

The format of EST for 3000 equipment is as follows:

<table>
<thead>
<tr>
<th>Z</th>
<th>BB AA</th>
<th>DD CC</th>
<th>O HH</th>
<th>SEUU</th>
</tr>
</thead>
</table>

where

- \( Z = 2000 \)  Signifies an empty EST entry. The remaining bytes are zero. (12 bits)
- \( =0000 \)  Signifies the entry defines a piece of equipment.
- AA, BB, CC, DD are channels connected. (6 bits each)
- O is the on/off bit. (1 bit)
- HH is the equipment type (11 bits) in display code as listed above.
- S is the 6681 number. (3 bits)
- E is the equipment number. (3 bits)
- UU is the unit number. (6 bits).
CMR -- CENTRAL MEMORY RESIDENT

*** ALL CENTRAL MEMORY TABLES ARE POSITIONED
AND POINTERS ARE SET ACCORDING TO
THE STARTING ADDRESSES SET BELOW ***

CMAREA EQU 2000B , CONTROL POINT AREAS
CMRES EQU 2000B , CP RESIDENTS
EST EQU 2100B , EQUIPMENT STATUS TABLE
CLD EQU 2400B , CENTRAL LIBRARY DIRECTARY
PLD EQU 2400B , PERIPHERAL LIBRARY DIRECTARY
TMT2 EQU 2300B , TRACK RESERVATION TABLE -- DISK 0
FNT EQU 3000B , FILE NAME + STATUS TABLE
DFB EQU 4000B , DAYFILE BUFFER
RSL EQU 5000B , RESIDENT CP SUBROUTINE LIBRARY
RFL EQU 7000B , RESIDENT PERIPHERAL LIBRARY

DFBIN EQU DFB+3 , INPUT POINTER FOR DFB
TMT1 EQU TMT+100B , TRACK RESERVATION TABLE -- DISK 1
TMT2 EQU TMT1+100B , TRACK RESERVATION TABLE -- DISK 2
TMT3 EQU TMT2+100B , TRACK RESERVATION TABLE -- DISK 3
TMT4 EQU TMT3+100B , TRACK RESERVATION TABLE -- DISK 4
LTRK EQU 7777B , LAST TRACK NO. (DISK POSITION)

SLOZ EQU 0100B , SECTOR LIMIT FOR OUTER ZONE HALF-TRACKS
SLIZ EQU 0062B , SECTOR LIMIT FOR INNER ZONE HALF-TRACKS

POINTER TO CM TABLES

CON 0315B, 2200B, 0, 0, 5000B SYSTEM LABEL -- CMR.

CON RFL, 0, 0, 0, 0 , RFL POINTER,

CON PLD, TMT2, 0, 0, 0 , PLD POINTER,

CON DFR, DFBIN, DFB, RSL, 0 , DFB POINTER,

CON FNT, DFB, 0, 0, 0 , FNT POINTER,
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<th>PAGE NO.</th>
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EXCHANGE JUMP PACKAGE

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RA=CONTROL POINT

BSSZ 7U
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EXCHANGE JUMP PACKAGE

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RA=CONTROL POINT

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EXCHANGE JUMP PACKAGE

BSSZ 560

BSSZ 560

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BSSZ 560
ASCENT - VERSION 2.0

RA=CONTROL POINT

CON 1400H,0,0,0 00081

SSSZ 7H
CON 0,0,0,1400H,0 00082

EXCHANGE JUMP PACKAGE

SSSZ 595
EQU 20228 00083

START OF STORAGE MOVE PROGRAM

SSSZ 5
CON 408,0,0,0,0 00084

SET EXIT MODE

SSSZ 7D
CON 0,0,0,1400H,0 00085

EXCHANGE JUMP PACKAGE

ENTRY CON 04128,0,618,7008B,1 00086

* STORAGE MOVE PROGRAM *

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**ASCENT • VERSION 2.0**

**EST • EQUIPMENT STATUS TABLE**

**FORMAT FOR 3000-SERIES CONTROLLERS**

1ST BYTE = CONTROL PT, ADDRESS (TO WHICH EQUIP IS ASSIGNED)

2ND BYTE = A + B CHANNELS CONNECTED INTO CONTROLLER

3RD BYTE = C + D CHANNELS CONNECTED INTO CONTROLLER

4TH BYTE = EQUIP, TYPE (2 LETTERS IN DISPLAY CODE)

5TH BYTE, LEFTMOST BIT = INTERLOCK (0 = ON, 1 = OFF)

5TH BYTE = 9801 NO., 3000 EQUIP, NO. + UNIT NO.

**FORMAT FOR 6000 SYNCHRONIZERS**

1ST BYTE = CONTROL POINT ADDRESS, OR 2000 IF EMPTY ENTRY

2ND BYTE = CHANNEL NO.

3RD BYTE = SYNCHRONIZER + UNIT NO.

4TH BYTE = INTERLOCK + EQUIP, TYPE IN DISPLAY CODE

5TH BYTE = NOT USED

**IN EQU 0, EQUIPMENT IS IN THIS CONFIGURATION**

**OUT EQU 2000B, EMPTY EST ENTRY = NO EQUIP, ATTACHED**

**DA EQU 0, DISK 0 (DA) CHANNEL = 0**

**SYNC EQU 1000B, DISK SYNCRONIZER = 1, UNIT NO. = 0**

**CM1C EQU 120, CARD READER 1 ON CHAN 12**

**CM4E EQU 400B, CARD READER 1 = EQUIP, 4**

**CP1C EQU 13B, CARD PUNCH ON CHAN, 13**

**CP1 C EQU 700B, CARD PUNCH = EQUIP, 7**

**D1C EQU 11B, DISPLAY SCOPE 1 ON CHAN, 10**

**D4N EQU 700B, DISPLAY SCOPE SYNCRONIZER = 7**

**LP1C EQU 11B, LINE PRINTER 1 ON CHAN, 11**

**LP1C EQU 600B, LINE PRINTER 1 = EQUIP, 6**

**LP2C EQU 11B, LINE PRINTER 2 ON CHAN, 11**

**LP2C EQU 700B, LINE PRINTER 2 = EQUIP, 7**

**MT1C EQU 120, MAG, TAPE CONTROLLER ON CHANNEL 12**

**MT1C EQU 500B, MT1 = EQUIP, 5, UNIT 0**

**MT2C EQU 51B, MT2 = EQUIP, 5, UNIT 1**

**MT3C EQU 52B, MT3 = EQUIP, 5, UNIT 2**

**MT4C EQU 53B, MT4 = EQUIP, 5, UNIT 3**

**DA EQU 0401B, DISK 0 ON CHAN 0, 0**

**CM EQU 02B, DISK 0 ON CHAN 0, 0**

**CP EQU 0400B, UNIT 0**

**DS EQU 0423H, UNIT 0**

**LP EQU 1402H, UNIT 0**

**MT EQU 1224B, UNIT 0**

**CON IN, DACH, SYNC, DA, 0**
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**ASCENT - VERSION 2.0**

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WSSZ 2540
CON 0401B,3106B,1114B,0500B,0020B DAYFILE

WSSZ 1915
UPC * 00.00.00, DEAD-STAR INITIAL DAYFILE ENTRY
00,00,59, ACMR000, READ,
00,00,59, ACMR000, PP 000 SEC,
00,00,59, ACMR000, ACMR,10,1000,70000,
00,01,13, ACMR000, REQUEST COSTAPE,
00,01,13, ACMR000, (52 ASSIGNED)
00,01,13, ACMR000, COPYN(DISC,COSTAPE)
00,01,23, ACMR000, ASCENT(LIST,C1,DISC)
00,01,27, ACMR000, 500 ERRORS IN CMR
00,01,28, ACMR000, CP 000,238 SEC,
00,01,28, ACMR000, PP 013,198 SEC,

SCOPE OPERATING SYSTEM = VERSION 2.0, JULY 1966
Dead Start Panel Settings

The dead start panel is set as follows:

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where e=controller number, u=unit number, and xx=channel number on which the system tape is mounted. (For 3000 systems, xx may only be channels 12 or 13.)

Word 14 has been changed from that in Version 1.1 to make the panel the same as for the engineer’s tape.

Preparing The System File From COSY Files

ASCENT Version 2.0 produces a new COSY format. It accepts as input either the old format or the new. The new format allows for COSY output on files other than P80C. The COSY decks in this release are in the new format and must be assembled with Version 2.0. The ASCENT control card and identification of COSY alter cards have also been changed to allow for more flexible file manipulation.

All binary and COSY decks produced by ASCENT and RUN contain an identification header before the binary text. The purpose of this header is to provide a uniform means for identifying the program. The ID header has the following format:

word 1-- 7700 0016 0000 0000 0000B
word 2-- seven or less character name in display code, left justified.
word 3 through 15-- reserved for future use.
COPYN, a new routine provided to aid in library preparation, uses the name in word 2 to identify the logical record. The ID header is stripped off at dead start time by STL. However, STL itself must not contain the header. It must either be stripped off by COPYN or it must be removed physically from a card deck (first card). For decks produced by ASCENT the name is the name found in the operand field of an ASCENT or ASPER pseudo operation. For a FORTRAN program the name is the program name.

FORTRAN and ASCENT are on the library in overlay format. Therefore, whenever changes are made to the programs a new absolute overlay must be generated. This requires assembling the overlay to be corrected, inserting the appropriate overlay card in front of the binary output and then having the loader generate the absolute overlays.

It is possible to create a complete binary system tape without producing binary decks. The following listing shows the control cards along with the associated ASCENT and COPYN directives that are necessary to create such a tape.

```
LBUILD,10,4000,55000.
REQUEST COSY.
REQUEST LIBRARY.
REWIND (COSY)
COPYBF (COSY,XX)
ASCENT (PO,F1,Cl,COSY)
ASCENT (LGO,F2,Cl,COSY)
ASCENT (PO,F3,Cl,COSY)
ASCENT (PO,F4,Cl,COSY)
ASCENT (LGO,F5,Cl,COSY)
ASCENT (LGO,F6,Cl,COSY)
ASCENT (LGO,F7,Cl,COSY)
ASCENT (LGO,F8,Cl,COSY)
COPYN (F9,F7)
COPYN (F10,F8)
LOAD (F9)
NOGO.
LOAD(F10)
NOGO.
COPYN (1,LIBRARY,F1)
COPYN (L,LIBRARY,F1)
CATALOG (LIBRARY)
UNLOAD (LIBRARY)
7-8-9 card
    IDENT
7-8-9 card
    IDENT
7-8-9 card
    IDENT
7-8-9 card
    IDENT
7-8-9 card
    IDENT
7-8-9 card
    IDENT
```

LIBRARY TAPE
NEW LIBRARY TAPE
SKIP OVER BINARY LIBRARY
ASSEMBLE 8 COSY FILES

INSERT OVERLAY DIRECTIVES
GENERATE ABSOLUTE OVERLAYS

STRIP ID FROM STL
GENERATE NEW LIBRARY TAPE
CATALOG NEW TAPE

END OF CONTROL CARDS
ASCENT DIRECTIVES TO
ASSEMBLE 8 FILES

COSY MODS TO ROUTINES MAY
BE INCLUDED HERE.

29
IDENT
IDENT
IDENT
REWIND (F7)
1,,INPUT
1,,F7
1,,INPUT
1,,F7
\$EOF (F9)
REWIND (F8)
1,,INPUT
1,,F8
1,,INPUT
1,,F8
\$EOF (F10)
REWIND (F12,0,0)
REWIND (F12,1,0)
REWIND (F12,1,1)
REWIND (LIBRARY)
REWIND (F1)
REWIND (F2)
REWIND (F3)
REWIND (F4)
REWIND (F5)
REWIND (F6)
REWIND (F11)
REWIND (F12)
STL,,F1
$EOF (F1)
SKIPF(LIBRARY,-1)
1,,INPUT
1,,F2
SKIPF(LIBRARY,-1)
1,,INPUT
1,,F3
SKIPF(LIBRARY,-1)
COPYN DIRECTIVES TO INSERT OVERLAY CARDS
END COPYN DIRECTIVES
INPUT TO COPYN ASCENT OVERLAY CARDS
COPYN DIRECTIVES TO INSERT OVERLAY CARDS
END COPYN DIRECTIVES
INPUT TO COPYN FORTRAN OVERLAY CARDS
COPYN DIRECTIVES
END COPYN DIRECTIVES
COPY FILE THRU END OF FILE SKIP BACK OVER FILE MARK COPY ZERO LENGTH RECORD
The following example illustrates how to assemble a program (1BJ), with modification, from the master file and generate a modified library.

```
JOB,10,400,60000.
REQUEST MASTER.
COPYN (.NEWCOSY,MASTER) FETCH 1BJ
ASCENT (L,PO,XX,CI,NEWCOSY) ASSEMBLE 1BJ
REQUEST OLDLIB.
REWIND (OLDLIB)
REQUEST NEWLIB.
REWIND (NEWLIB)
COPYN (.NEWLIB, OLDLIB,XX) MERGE OLDLIB AND 1BJ ONTO NEWLIB
CATALOG (NEWLIB)
UNLOAD (NEWLIB)
7-8-9 card
REWIND (MASTER)
SKIPF (MASTER,3)
1BJ ,MASTER
REWIND (NEWCOSY)
7-8-9 card
COSY mods
' COSY
7-8-9 card
1,1AJ, OLDLIB
1BJ ,XX
2,*,OLDLIB
```

COPYN DIRECTIVES
1BJ IN 4th FILE
1BJ COSY TO NEWCOSY
END COPYN DIRECTIVES
MODIFICATIONS TO 1JB
COSY (column 11) TERM, MODS
COPY ROUTINES UP TO 1BJ
COPY NEW 1BJ
SKIP OLD 1BJ,COPY REST
REWRITE (OLDLIB)
REWRITE (NEWLIB)
7-8-9 card
6-7-8-9 card

This example illustrates how to modify ASCENT1, generate new overlays for ASCENT, and prepare a new library.

JOB, 10,200,60000.
REQUEST NEWLIB.
REWRITE (NEWLIB)
REQUEST OLDLIB.
REWRITE (OLDLIB)
REQUEST MASTER.
REWRITE (MASTER)
COPYBF (MASTER,YY,7)
ASCENT(LP,XX,CI,MASTER)
COPYN (.L1,XX)
LOAD (L1)
NOCO.
COPYN (.NEWLIB,OLDLIB,L2)
CATALOG (NEWLIB)
UNLOAD (NEWLIB)
7-8-9 card
    IDENT ASCENT1
    (COSY Mods)
    COSY
    FINIS
7-8-9 card
REWRITE (XX)
1.,INPUT
1.,XX
1.,INPUT
1.,XX
7-8-9 card
OVERLAY (L2,0,0)
7-8-9 card
OVERLAY (L2,1,0)
7-8-9 card
1,ASCENT,OLDLIB
SKR PR (NEWLIB, -1)
REWRITE (L2)
1,2,L2
2.*,OLDLIB
REWRITE (OLDLIB)
REWRITE (NEWLIB)
7-8-9 card
6-7-8-9 card

SKP 7 FILES.
ASSEMBLE ASCENT, ASCEI1
INSERT OVERLAY CARDS
GENERATE OVERLAYS
MERGE OLDLIB AND ASCENT

Mods to ASCEI1

COPYN DIRECTIVES
OVERLAYS TO L1

END COPYN DIRECTIVES
INPUT TO COPYN.

COPYN DIRECTIVES
COPY UP TO ASCEI1

COPY A.SCEI1, ASCENT1
COPY REST OF FILE

32
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NUMBER OF LINES WITH DIAGNOSTICS --- 0
CURE MAP 00.01.48. NORMAL CONTROL 000100 000133 000000 0000

---TIME---LOAD MODE --L1--L2---TYPE------------------USER--------CALL--------------FWA LOAD--LMA LOAD--BLNK COMM--LENGTH--

FWA LOADER 125123  FWA TABLES 125111
=PROGRAM==ADDRESS=
=DECK1= 000100
=ENTRY==ADDRESS=
START 000105
====UNSATISFIED EXTERNALS====

SCOPE WORKS OK.

REFERENCES

REFERENCES
00.01.42, JOB1001, READ.
00.01.44, JOB1001, PP 002 SEC.
00.01.44, JOB1001, JOB1, 17, 100, 130000.
00.01.45, JOB1001, ASCENT(LIST, PW, LGU, FILE1)
00.01.47, JOB1001, FILE1.
00.01.48, JOB1001, CP 000.440 SEC.
00.01.48, JOB1001, PP 002.422 SEC.
SCOPE OPERATING SYSTEM - VERSION 2.0, JULY 1966
ASCENT • VERSION 2.0

ENTRY TEST

MACRO REVEAL, CC, NN, FF, II, OO, LL

SX6 FF
SA6 FINST
SX6 II
SA6 IN
SX6 OO
SA6 OUT
SX6 LL
SA6 LIMIT
SA5 CC
SX6 NN
BX6 X5*X6
SA6 CBP
SX5 031117B
LX5 42
SX6 CBP
BX6 X5*X6
SA6 1
SA1 1
NZ X1,*
SA1 CBP
LX1 59
NG X1,++3
SX6 2203148
LX6 42
SA6 1
JP **-4

+ENDM

000000 000000000000000000000000 CBP
000001 000000000000000000000000 HSS 1
000002 000000000000000000000000 IN
000003 000000000000000000000000 HSS 1
000004 000000000000000000000000 LIMIT
000005 111202524000000000000000 INPUT VFD D30/INPUT
000006 172524202524000000000000 OUTPUT VFD D30/OUTPUT

MACRO WRITE, FIRSTWA, LASTWA
HEVAL OUTPUT, 248, FIRSTWA, LASTWA, FIRSTWA, LASTWA

ENDM

. FINAL IS A MACRO WHICH TERMINATES A PROGRAM

MACRO FINAL
SA1 EXIT
SX6 X1
SA6 1
PS
ENDM

000007 051604000000000000000000 EXIT VFD D18/END

TEST WRITE MESS1, MESS2
ASCENT = VERSION 2.0

000010 7160000112 R TEST SX6 MESS1
000011 7160000120 R SX6 FIRST
000012 7160000112 R SX6 MESS2
000013 7160000121 R SA6 IN
000014 5160000000 R SX6 MESS1
000015 5160000000 R SX6 OUT
000016 7150031117 R SX6 MESS2+1
000017 7160000000 R SA6 LIMIT
000018 20552 R SA5 OUTPUT
000019 12656 R SX6 248
000020 5160000000 R SX6 X5*6
000021 5110000000 R SA6 CDR
000022 5110000000 R SX5 31117B
000023 20173 R LX5 528
000024 20652 R SX6 CHP
000025 5160000001 R SX6 X5*6
000026 020000021 R SA6 1
000027 5160000001 R SA1 1
000028 5160000000 R NZ X1.*
000029 0311000021 R SA1 CHP
00002a 20173 R SX1 738
00002b 7160220314 R NG X1.*3
00002c 20652 R SX6 2203148
00002d 5160000001 R LX6 528
00002e 020000021 R SA6 1
00002f 46000 R JP **4
000030 5110000000 R NO
000031 10610 R FINAL
000032 20173 R SA1 EXIT
000033 020000021 R SX6 X1
000034 5160000001 R SA6 1
000035 0000000000 R PS
000036 34012303051624550116 MESS1 WOK
000037 0455141701040527523 UPC 501ASCENT AND LOADER SEEM TO WORK
000038 050515524175271722 CON 0
000039 13555555555555555555 CON 0
00003a 55555555555555555555 END TEST
00003b 00000000000000000000

NUMBER OF LINES WITH DIAGNOSTICS --- 0
CORE MAP 00.02.02, NORMAL CONTROL

---TIME---LOAD MODE --L1--L2--TYPE------------------USER---------CALL----------FWA LOAD--LWA LOAD--BLNK COMN--LENGTH--
FWA LOADER 045123 FWA TABLES 045111

---PROGRAM---ADDRESS--
TEST 000100

---ENTRY------ADDRESS-- REFERENCES
TEST 000110

---UNSATISFIED EXTERNALLY----- REFERENCES
ASCENT AND LOADER SEEM TO WORK
00.01,52, TEST002, READ.
00.01,55, TEST002, PP 003 SEC.
00.01,56, TEST002, TEST,17,100,50000.
00.01,56, TEST002, COMMENT, ASSEMBLE AND EXECUTE TO
00.01,56, TEST002, COMMENT, VERIFY THAT ASCENT IS
00.01,57, TEST002, ASCENT,L,LOG,PROG.
00.02,01, TEST002, PROG.
00.02,03, TEST002, CP 000.638 SEC.
00.02,07, TEST002, PP 005.543 SEC.
SCOPE OPERATING SYSTEM - VERSION 2.0, JULY 1966

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<td>4017</td>
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NUMBER OF LINES WITH DIAGNOSTICS ---
COPYN TEST CASES

PUTF(MAGTAPE, 1)
PUTF(MAGTAPE, 4)
EC3, MAGTAPE
PUTF(MAGTAPE, 2)
PUTF(MAGTAPE
PUTF(1150, 1)
NOTE

*************** WARNING - NO ENTRY POINTS ***************

ASCENT VECG

THE COPYN ROUTINE PERFORMED CORRECTLY A TEST WHICH
INCLUDED REWIND FILE, WRITE END OF FILE, SEARCH FILE BY
NAME AND NUMBER, AND COPY A RECORD,

END

NUMBER OF LINES WITH DIAGNOSTICS --- n

---

Page 4 of printout

---

Page 5 of printout
PROGRAM FNVALID (TAPE 1)
DOUBLE PRECISION X
ITAPE=1
WRITE(ITAPE,100)
FORMAT(* FORTRAN VALIDATION *)
X=DQRTE(100,0.000000)
IF(DABS(X-10.00),.LE.,0.00000010)GO TO 1
WRITE(ITAPE,101)X
FORMAT(* ERROR, TEST FAILED, X=*, N30.11)
CALL EXIT
WRITE(ITAPE,102)
FORMAT(* TEST SUCCESSFUL *)
END
PROGRAM LENGTH INCLUDING I/O BUFFERS
002117

FUNCTION ASSIGNMENTS

STATEMENT ASSIGNMENTS
1   - 000035  100   - 000050  101   - 000062  102   - 000067

BLOCK NAMES AND LENGTHS

VARIABLE ASSIGNMENTS
ITAPE - 000105  X   -  000103

START OF CONSTANTS
000043

START OF TEMPORARIES
000073

START OF INDIRECTS
000103

UNUSED COMPILER SPACE
013300
PERT/TIME
VERSION 1.0

6400/6600 PERT/TIME operating under SCOPE Version 2.0 has now been released. The release consists of:

- A tape containing a compiled absolute binary file, two end-of-files, and the source file of the program
- A sample test deck consisting of two data decks type "A" and type "B" input
- Two verification decks

PERT/TIME under SCOPE Version 2.0 differs from PERT/TIME under SCOPE Version 1.1 internally only. Overlays have been implemented and chains removed. When requesting PERT/TIME Version 1.0, the operating system under which it is to operate must be specified.

The following document is available for 6000 PERT/TIME:


INSTALLATION INSTRUCTIONS

To load the absolute binary overlay program from tape to $F_N$ PERT66, common PERT66, and execute data, the following control and data cards are required.

```
PERT, 1, 1000, 150000.
REQUEST TAPE 5.
REWIND (TAPE 5)
COPYBKF (TAPE 5, PERT66)
COMMON PERT66.
REWIND (PERT66)
PERT66.
R/S
PERT network
R/S
EOF
```

R/S=record separator 7-8-9 in column 1
EOF=end-of-file 6-7-8-9 in column 1
To execute additional networks, the following control cards are required:

PERT 2, 1, 1000, 150000.
COMMON PERT66.
REWIND (PERT66)
*
PERT66.
**
R/S
PERT network
EOF

*If tapes are required, insert as follows:

REQUEST TAPE 4. To input old master tape
REQUEST TAPE 6. To make and save new master file

**If TAPE 4 and TAPE 6 are used, these cards should follow PERT66. also.

REWIND (TAPE 4)
REWIND (TAPE 6)

To unload and save tapes the cards required are:

UNLOAD (TAPE 4)
UNLOAD (TAPE 6)

following the rewinds.

To list or punch the PERT source file, the following control cards are required:

PERT, 1, 200, 70000.
REQUEST TAPE.
REWIND (TAPE)
COPYBF (TAPE, X, 3)
COPYBF (TAPE, OPERATOR)
REWIND (TAPE)
R/S
EOF
OPERATOR=PUNCH for punched output
     =OUTPUT for listing

To execute or compile the source file, the following control cards are required:

PERT, 1, 500, 70000.
REQUEST TAPE.
REWIND (TAPE)
COPYBF (TAPE, XX, 3)
COPYBF (TAPE, TAPE 5)
REWIND (TAPE 5)
RUN (S, 150000,, TAPE 5,,, 70000)
*
LOAD (LGO)
NOGO.
**
PERT66.
R/S
PERT network
EOF

*To save load-and-go file insert:

REQUEST TAPE 8.
REWIND (LGO)
COPYBF (LGO, TAPE 8)
REWIND (LGO)

**To save overlay tape insert:

REQUEST TAPE 9.
REWIND (PERT66)
COPYBF (PERT66, TAPE 9)
REWIND (PERT66)

For larger test cases of 1000 activities or more, CPU time may be saved by assigning TAPE 1, TAPE 2, and TAPE 3 to magnetic tapes.
### Classification

#### PERT TIME ACTIVITY REPORT

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<th>ACTIVITY DESCRIPTION</th>
<th>PROB. TIME</th>
<th>EXPECTED TIME</th>
<th>DATE</th>
<th>ALLOWED COMP/SCHL</th>
<th>SLACK TIME</th>
<th>REMAINING TIME</th>
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SCOPE
VERSION 2.0

NEW FEATURES AND MODIFICATIONS

64/6600 SCOPE Version 2.0 contains a powerful relocatable loader which allows subprograms to be assembled or compiled independently and then brought together prior to execution in one of three fashions: normal loading, segmentation, overlays. A new library utility routine, 64/6600 COPYN, has been provided to aid in program file updating. The utility routine, CATALOG, has been modified to allow for the new binary formats. SCOPE Version 2.0, including COPYN and CATALOG, is described in the SCOPE Reference Manual, Pub. No. 60173800.
1. The SCOPE 2.0 version of DMP reformats the Exchange package to label the P, RA, EM, and FL parts, as well as the individual A, B, and X registers.

2. DMP eliminates the last \( n - 1 \) words of an \( n \)-word block of identical words in central memory. It also eliminates the last \( n - 1 \) words of an \( n \)-word block of the form \( \text{yyyyyyyyyyyyyyyy} \) in central memory. In this case, \( (Y)_{17-0} \) is compared to \( Y \) for identity. If they are not identical, no elimination takes place.

3. Up to four words per line are printed. Less than four words will be printed under the following conditions:
   a. If the initial address (first dump argument) is not divisible by four, the line is truncated in such a way that the next line begins with a word whose address is divisible by 4.
   b. If there are \( n \)-word blocks of the sort described above, either that line or the next one is truncated to make the addresses in the left column divisible by 4. The line on which this occurs is a function of the addresses which occur after deletions and the number of renumberings which may take place on the same line. Addresses are printed down the left column only, unless there have been deletions on the line. In this case, the address of the first word after the deleted block is printed to flag the presence of a deletion. In columns 2, 3, and 4 the address is separated by a special character (Display Code 65) which prints as a blank if the printer drivers in use have not been modified for a 64-character set.

4. DMP provides an automatic dump of the area around a stop location if the exchange dump is requested. If \( P > 77 \) then \((RA + P - 77)\) through \((RA + P + 77)\) is dumped. If \( P = 0 \) and \( RA > 77 \) then \((RA - 77)\) through \((RA + 77)\) is dumped. In all other cases \((RA + 0)\) through \((RA + 100)\) is dumped.

5. The entire control point area of the requesting program is dumped if a card of the form
   
   \[
   \text{DMP}(n,n) \quad n \neq 0
   \]
   
   is encountered. The label reads DMPC.

6. Absolute core dumps are produced by a
   
   \[
   \text{DMP}(4\text{xxxxx},4\text{yyyyy})
   \]
   
   where \( \text{xxxxx} \) defines the lower bound and \( \text{yyyyy} \) defines the upper bound of the absolute core locations wanted. For example:
   
   \[
   \text{DMP}(400000,413777)
   \]
   
   dumps the entire central resident (0 to 13777). Label reads DMPA.

7. The contents of \( A1 \) through \( A7 \) are printed on the same line with the corresponding \( A \) register.
8. The output buffer is emptied before the DMP output is produced. DMPs will not be lost if the output file is busy.

9. This version works with up to 5 disks. It has been checked out on a 1 disk machine.

Catalog

Catalog is a 2.0 library routine that accepts any file in the format described below as input and gives a listing of the packages contained in that file. The listing includes the length of each logical record, the names of the packages contained in each record, the length of each of these packages, and a checksum of each package.

Packages input to catalog must be divided into tables with header words conforming to one of the following four descriptions:

1. The first table has a control number (CN) of 7700 and the second table has a CN of 3400 (Standard format for ASCENT deck).
2. The first table has a CN of 7700 but the second does not have 3400 (ASPER deck).
3. The first table has a CN of 3400 (ASCENT deck with 77 table missing).
4. The first table has neither 7700 nor 3400 (ASPER deck with first table missing).

The output listing contains the following five sorts of information:

1. RECORD — The number of the logical record with respect to its position on the tape. Zero-length records produce a record number.
2. LENGTH — The entire length of the logical record, including all 77 tables of the packages on the record.
3. PACKAGE — The name of the package found at a well-defined location within the file. Any name beginning with a character which is nonalphanumeric or blank or zero is illegal and a minus sign (-) will replace the name in the listing. When this occurs no package length or checksum will appear.
4. CHKSUM — Computed by adding together all the words of the package and along with each word adding a counter that is decremented each time a new word is added in. This insures a unique checksum in the event that the program gets out of sequence. The final answer is then folded into 12 bits.
5. LENGTH — The length of the package. LENGTH contains all the words except those in a 77 table, if one appears.

Catalog input/output is accomplished using the Circular Buffer I/O routine.

To call the routine use: CATALOG (file1, file2). Information is taken from file1 and listed on file2. If the parameters are omitted, LIBRARY and OUTPUT are assumed.
COPYCR

COPYCR has been changed to correspond as closely as possible to the concept of a coded record. Internally, a coded record is a string of display coded characters terminated by a zero byte. It is usually produced by reading a card or preparing a line image destined for the printer or a display. However, coded records may be grouped together into a binary record.

COPYCR copies the requested number of the next available coded records. If the copy is from disk it reads binary records until it has copied the requested number of coded records, leaving the file positioned at the binary record following that which contained the last coded record. If the copy is from coded tape the requested number of records are copied but the tape may be left positioned beyond these records, depending on buffer size.

Example:

    JOB, 10,1000,40000.
    COPYCR (INPUT, OUTPUT, 3)
    COPYCR (INPUT, OUTPUT, 1)
    7, 8, 9
    CARD1
    CARD2
    CARD3
    CARD4
    7, 8, 9
    CARD5
    6, 7, 8, 9

    Produces on output
    CARD1
    CARD2
    CARD3
    CARD5

    Note that CARD4 in this example is not output because it is contained in the binary record read by the first copy.

LIMITATIONS AND KNOWN DEFICIENCIES

1. All PSR's have been corrected through PSR 72 except for 61, 65, 66, 67, 71.
2. When a user call contains a list of segments and single program names to be loaded, and the program names follow the segment names, the single programs are not loaded by the PPU routine LDR. LOADER produces the message "REQUESTED SEGMENT INCOMPLETE" and a fatal error flag is returned. Thus, when a segment is composed of more than a single named segment (which should be unusual since the structure permits the formation of a segment with sections and programs), the user must place all single program names in the SL list before the segment name.

3. When a user call requests a named segment or section containing a program of which there is more than one copy on the requested file, or when such a program is named in the SL list along with other programs, it is then possible for more than one copy of the program to be loaded into core. This happens if the file is positioned in such a manner that more than one copy of the program is encountered before the named segment, section or list of programs has been completely loaded from the file. Please note that the order of loading from an SL list is: named segment, named section, individual programs. Further, the load of each named segment or named section is treated independently.

If there is a danger of the above situation occurring, the user should assign the program name to a separate section or segment to isolate the search for it from other program loading. If this is not observed, and more than one copy of a program is loaded accidentally, the first copy is linked to all programs at the same or lower level, while the last copy loaded is linked to all higher level segments.

4. COPYN gets into a loop if the current input file is positioned at end of information and a record specified (p1 or p2) on the record identification card is either a non-existent record or record one of the file.

5. When in segment mode, labeled COMMON is local to the segment that declared it and cannot be used as universal storage. This is not explicitly stated in the reference manual.

6. It is the user's responsibility to change the size of the FNT when necessary. If a large number of programs are being run at once and the size of the FNT is not reset appropriately, the FNT will fill up. No recovery is then possible.

7. When no file name is given on a BKSP card, a preset file name and number are used, and that file backspaced. This does not affect the user's program.
NEW FEATURES AND MODIFICATIONS

Version 2.0 of ASCENT is described in the ASCENT ADB, Pub. No. 60175400.

Conversion of ASCENT Programs

On Page 5-11 in the Chippewa Operating System Reference Manual (Publication No. 60134400) rules are given for coding a subroutine in such a way as to define the relocatable parts, and the point at which execution is to begin. These rules are also valid for coding a single independent program in ASCENT 1.1. They provide that the first two words of the assembled routine should be:

\[ \text{VFD} \quad \text{D24/NAME,N18/0,A18/end} \]
\[ \text{VFD} \quad \text{A18/reloc,A18/end,N24/params} \]

(Note that "D24" and "N18" in the first word are based on the assumption that the name of the program has four characters; "NAME" is used in the example.)

"params" is an integer defining the number of locations that are to be left vacant by the loader before the first instruction; at load time the parameters from the control card are normally loaded into successive locations beginning at RA+2; the space for these parameters ends at RA+params+1; and execution will begin at the first instruction, in location RA+params+3.

All the instructions in the routine, i.e., the words whose addresses may be subject to relocation, lie in the area from RA+params+3 through reloc-1. "reloc" is the address of the first constant, i.e., the first word that must not be relocated, and the last constant must be at end-1.

These rules do not hold for SCOPE 2.0. In order to convert a program coded in ASCENT machine language for Chippewa 1.1 into a program for SCOPE 2.0, remove the two VFD cards described above, the "params EQU n" card, (which is now unnecessary) the "SUBRT" card, if any (as this is not a valid pseudo-op in ASCENT 2.0), the "reloc EQU **1+1" card, and the "end EQU **+1" card, if any (as it is no longer necessary to define the areas respectively occupied by instructions and constants). Immediately after the ASCENT card at the beginning of the program, insert the card:

\[ \text{ENTRY} \quad \text{start} \]

where "start" is the symbol in the location field of the instruction at which execution is to begin. Every program in ASCENT 2.0 must have at least one entry point. Execution of a program can only begin at an entry point.

Replace the END card that terminates the program with the card:

\[ \text{END} \quad \text{start} \]

where "start" is the name of the entry point at which execution is to begin. This is the simplest way of specifying the point for beginning execution of a single independent program.
Both under Chippewa 1.1 and under SCOPE 2.0, the parameters from the control card are to be found in locations RA+2, RA+3, etc. If the program addresses these by number, or by symbolic constants that are equated to 2, 3, etc., no further change has to be made. But if they are addressed by symbols that have been defined through BSS, BSSZ, or CON cards at the beginning of the program, so as to occupy space in the area whose length was defined by params, then one of the following two changes should be made:

1. Remove those defining cards, and replace them with EQU cards that directly equate the symbols to integers 2, 3, etc.

2. Leave the defining cards in the program; immediately before the first one insert the card:

   ORG
   
   and immediately after the last one insert the card:

   ORG
   *

Suppose the following is a program for Chippewa 1.1:

<table>
<thead>
<tr>
<th>ASCENT</th>
<th>TRYME</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARAMS</td>
<td>EQU</td>
</tr>
<tr>
<td>VFD</td>
<td>D80/TRYME,N12/0,A18/TERMIN</td>
</tr>
<tr>
<td>VFD</td>
<td>A18/RELI,A18/TERMIN,N24/PARAMS</td>
</tr>
<tr>
<td>PARAM1</td>
<td>BSS</td>
</tr>
<tr>
<td>PARAM2</td>
<td>BSS</td>
</tr>
<tr>
<td>PARAM3</td>
<td>BSS</td>
</tr>
<tr>
<td>GOMAN</td>
<td>SA1</td>
</tr>
<tr>
<td></td>
<td>SA2</td>
</tr>
<tr>
<td></td>
<td>FX6</td>
</tr>
<tr>
<td></td>
<td>SA3</td>
</tr>
<tr>
<td></td>
<td>ZR</td>
</tr>
<tr>
<td></td>
<td>FX6</td>
</tr>
<tr>
<td>PUT</td>
<td>SA6</td>
</tr>
<tr>
<td></td>
<td>PS</td>
</tr>
<tr>
<td>RELIC</td>
<td>EQU</td>
</tr>
<tr>
<td>CONA</td>
<td>CON</td>
</tr>
<tr>
<td>CONB</td>
<td>CON</td>
</tr>
<tr>
<td>TERMIN</td>
<td>EQU</td>
</tr>
<tr>
<td>END</td>
<td></td>
</tr>
</tbody>
</table>
For SCOPE 2.0, this should be changed to one of the following:

Example 1:

    ASCENT    TRYME
    ENTRY     GOMAN
PARAM1 EQU 2
PARAM2 EQU 3
PARAM3 EQU 4
GOMAN SA1 CONA
        SA2 CONB
        FX6 X1*X2
        SA3 PARAM2
        ZR X3,PUT
        FX6 X1/X2
PUT    SA6 CONA
        PS
CONA   CON 1.
CONB   CON 2.
END    GOMAN

Example 2:

    ASCENT    TRYME
    ENTRY     GOMAN
ORG     2
PARAM1 BSS 1
PARAM2 BSS 1
PARAM3 BSS 4
ORG    *
GOMAN SA1 CONA
        SA2 CONB
        FX6 X1*X2
        SA3 PARAM2
        ZR X3,PUT
        FX6 X1/X2
In ASCENT 1.1, the pseudo-op ORG had no function in ASCENT programs (though it did work in ASPER programs), because a program would ordinarily be loaded starting at location RA+0.

In ASCENT 2.0, ORG does have a function, but previous ASCENT programs can be successfully modified without using ORG. In the absence of an ORG card, ASCENT 2.0 assumes that the program begins with:

```
ORG *
```

which means, "assemble the following for loading into the lowest-numbered available section of relocatable storage;" initially, that is, into relocatable 0. So the program will be assembled with addresses beginning at 0, and at load time it will be loaded into locations beginning at RA+100g; all the relocatable addresses in the program will be modified accordingly. The parameters from the control card will be stored at run time, as before, starting at location RA+2, so there is no need for the user's program to explicitly reserve space for them.

In the second suggested version of the program for SCOPE 2.0, the

```
ORG 2
```

card causes everything between it and the next ORG card to be loaded into locations beginning at RA+2; thus PARAM1, PARAM2, and PARAM3 are defined correctly. The program itself must be preceded by

```
ORG *
```

so that it will be assembled as relocatable code, for eventual loading in an area beginning at RA+100g.

When two or more programs are to be assembled separately, but are expected to be loaded together at some time, they can be coded according to either of the suggested models given above. They can both find the parameter string starting at location RA+2. The first program will be loaded at RA+100g, but the others will be loaded higher up in memory.

**LIMITATIONS AND KNOWN DEFICIENCIES**

1. All PSR's through PSR 19 have been corrected except PSR 18.

2. Macros do not pass the names of parameters that are themselves other macro names.

3. DPC instructions do not expand correctly within macros.

4. The use of literal names results in UU diagnostics at the END card.
FORTRAN
VERSION 2.0

NEW FEATURES AND MODIFICATIONS

Version 2.0 of 64/6600 FORTRAN is an improvement of Version 1.1. Some changes were necessary to allow the system to operate under the 2.0 SCOPE relocatable operating system. Many new features have been added and deficiencies present in 64/6600 FORTRAN Version 1.1 have been corrected. The following is a list of changes made to the system. For a more thorough description of the additions to the system see the Conversion Guide, FORTRAN Version 1.1 to 2.0, Pub. No. 60175500.

1. The compiler now compiles subprograms independently, and produces a relocatable record on a specified file. The 2.0 SCOPE loader now takes care of loading and linking subprograms together.

2. The compiler no longer recognizes a SEGMENT card nor does it interpret CALL CHAIN as a special library call. The chaining available in Version 1.1 has been replaced by the more versatile OVERLAY and SEGMENTATION capabilities of the 2.0 operating system.

3. The compiler now recognizes overlay and segment control cards if they appear between subprograms and if they begin after column six. When finding such a control card, the compiler lists it and transfers it to the binary output file(s). This is done to aid the programmer in overlay and segment preparation.

4. The format of the beginning of each subprogram has been modified and the zero words previously saved for every subroutine argument are now only saved for each argument after the sixth. The format of subprograms is as follows.

```
[Zero words for each argument]  
[after the sixth]  
[NAME  NN]  
[ENTRY/EXIT LINE]
```

Routines written in machine language should be in this format as the error traceback routine (SYSTEM) which has been implemented depends on this.

5. The FORTRAN compiler is called by the control card:

```
RUN (cm,fl,bl,if,of,rf,lc,as,cs)
```

cm  compiler mode option; (if omitted, assume G; if unrecognized, assume S)

G  compile and execute with no source list, unless explicit LIST cards appear in the deck or unless errors are present in the source deck

S  compile with source list, no execute

P  compile with source list and punch deck on file PUNCHB, no execute

L  compile with source and object code list, no execute

M  compile with source and object code list, produce a punch deck on file PUNCHB, no execute
fl  object program field length (octal); if omitted, it is set equal to the field length at compile time.
bl  object program I/O buffer lengths (octal); if omitted, assumed to be 2011B
if  file name for compiler input; if omitted assumed to be INPUT
of  file name for compiler output; if omitted, assumed to be OUTPUT
rf  file name on which the binary information is always written; if omitted, assumed to be LGO
lc  line-limit (octal) on the OUTPUT file of an object program. If omitted, assumed to be 100008.

as  ASA switch; non-blank selects option.

6. The storage necessary for I/O buffers is now made part of the PROGRAM.

7. The operational characteristics of the compiler have been slightly modified to have more meaning under a relocatable system.
   • The length of each subprogram is written in the output file.
   • The unused compiler space for each subprogram is written in the output file.
   • The name and length of each common block is placed in the output file.
   • When the variable map is produced, if the variable is in common, the address given is relative to the start of the common block. Therefore after the address a "C" along with the octal ordinal of the common block, under block assignments, is given.
   • When the compiler has processed all input, the total number of errors detected during that compilation process is placed in the Dayfile.
   • When fatal errors are detected in a subprogram, no binary output for that subprogram is produced and no variable map is written. If the compilation mode was "G", the program will not be automatically executed.

8. The compiler is now sectioned into three overlays, (0,0), (1,0), (1,1). The (0,0) overlay, whose entry point is RUN, contains the code necessary to terminate all output buffers at the end of compilation and the code necessary to transfer to both level (1,0) of the RUN compiler and to level (1,0) of the ASCENT assembler. Level (1,0) is the main body of the compiler. Level (1,1) of the FORTRAN compiler is called when it becomes necessary to list full line diagnostics.

9. The compiler transfers control to the ASCENT assembly system when an ASCENT or ASPER header card is detected. This provides the programmer with easy linkage to and from a powerful assembly system. When the assembler completes its processing, control returns to level (0,0) of FORTRAN. If no more input is present, level (0,0) terminates the compilation. Otherwise, level (1,0) is reloaded and the compilation process continues. The assembly routines included on the Version 1.1 compiler (ASCENTF, MACHINE) are no longer part of the RUN compiler.
10. Non fatal diagnostics have been implemented. Each error results in a two or three letter
diagnostic listed at the point of error detection. All two letter codes are non fatal while all
three letter codes (which usually have an F suffixed to them) are fatal. If a listing is re-
quested or if fatal errors are detected, full line diagnostics, indicating the address at which
the error occurred are listed at the end of the subprogram.

11. The ENTRY statement has been implemented under the following rules.
   - It cannot appear with the range of a DO.
   - It cannot be labeled.
   - The name may not be followed by a list of arguments as it is assumed to have the same
     number of arguments as the subprogram in which it occurs.
   - It assumes the same type as the subprogram in which it appears.

12. LIST, NOLIST option has been implemented. If a LIST card, starting after column six
appears between subprograms, listing takes place from that point until a NOLIST card,
starting after column six is detected. After a NOLIST card is detected no listing takes
place until another LIST card appears or a fatal error occurs. If fatal errors occur all
subprograms after the NOLIST card will be then listed, as under the G compilation mode.
This is due to the extremely costly backspace problem with disk files.

13. Variable format may now be a simply subscripted integer variable.

14. The routine SYSTEM has been expanded to list all diagnostics the object routines require and
to provide full error traceback information.Capabilities exist for producing non-standard
error recovery and for changing the status of errors from non-fatal to fatal or vice versa.

15. The initialization code formerly compiled when a PROGRAM card was being processed is
now in a routine called QENTRY. This was done in order to incorporate overlays, replacing
the former usage of a SEGMENT header card.

16. Since a certain number of routines are always required at execution time, such as END,
QENTRY, and SYSTEM, these have all been included as entry points to the routine SYSTEM.

17. All object routines have been modified to call the SYSTEM routine when it becomes necessary
to give diagnostics.

18. The I/O routines have been split into several routines so the coder and cracker routines only
appear once. G conversion has been implemented. An ASA switch has been implemented
which allows for proper ASA format re-scan and ASA P. scaling.

19. Two routines, OVERLAY and SEGMENT, have been included to provide linkage between the
FORTRAN and the 2.0 loader. Basically, they translate the FORTRAN call into a recogniz-
able call to the loader.

20. Multiple entry points have been implemented in Version 2.0 so many of the library routines
have been combined. Table 1 is a list of the library routines, the entry points they contain,
and the external routines they reference. SCOPE Version 2.0 allows library routines to
reference other library routines. In order to take advantage of this facility, many of the
object time library routines have been reorganized so that all repetitive coding is a separate
routine. For example, the BCD format cracker (KRAKER) which was previously contained
within both INPUTS and INPUTC is now a separate routine and can be referenced by both of
the input routines. Not only have the I/O routines been divided but the mathematical library
<table>
<thead>
<tr>
<th>Routine</th>
<th>Entry Points</th>
<th>Externals</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACGOER</td>
<td>ACGOER</td>
<td>SYSTEM, ABNORML</td>
</tr>
<tr>
<td>ALNLOG</td>
<td>ALOG, ALOG10</td>
<td>SYSTEM</td>
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<td>ASINCOS</td>
<td>ASIN, ACOS</td>
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<td>SYSTEM</td>
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<td>DLOG, DEXP, SYSTEM</td>
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<td>OUTPUTC, STOP</td>
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<td>Routine</td>
<td>Entry Points</td>
<td>Externals</td>
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</tr>
<tr>
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<td>SYSTEM, ABNORML, GETBA, XRCL, KRAKER</td>
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</tr>
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<td>LOCF</td>
<td>LOCF, XLOCF</td>
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<td>OUTPTB</td>
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<td>SYSTEM, ABNORML, GETBA, XRCL</td>
</tr>
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<td>LOADER, SYSTEM, ABNORML</td>
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<td>ALOG, EXP, SYSTEM</td>
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<td>SINCOS</td>
<td>SIN, COS</td>
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<tr>
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<td>SYSTEM</td>
</tr>
<tr>
<td>SNGL</td>
<td>SNGL</td>
<td></td>
</tr>
</tbody>
</table>
Routine | Entry Points | Externals
--- | --- | ---
SQRT | SQRT | SYSTEM
SSWITCH | SSWITCH | SYSTEM
SYSTEM | SYSTEM, SYSTEMC, SYSTEMP, Q8NTRY, STOP, END, EXIT, ABNORML | SYSTEM
TAN | TAN | SYSTEM
TANH | TANH | EXP, SYSTEM
TIME | TIME | 
XRCL | XRCL | 

has also been revised. CEXP, the routine which raises a complex number to a power, references the exponential routine and the SINCOS routine both of which may be called individually. Even though more features and diagnostics have been added, significant storage reduction will be noticed if several of the I/O routines are used by a single program.

21. The FORTRAN object routines test for many of the more common cases of incorrect arguments and call the subroutine SYSTEM to handle the error in the standard fashion. The table below lists, for each routine that makes such tests, the condition detected, the standard recovery action (either the answer supplied, or the word "fatal" for fatal errors), and the error number.

Table 2. FORTRAN Object Routine Error Diagnostics

The symbols INF and IND below denote the infinite and indefinite internal words, respectively.

Where an error condition is preceded by "also:" it indicates that the routine in question calls on a subordinate library routine, giving it the arguments indicated, and therefore the subordinate routine may detect some errors of its own and report them under its own error number.

<table>
<thead>
<tr>
<th>Routine</th>
<th>Condition</th>
<th>Standard Recovery</th>
<th>Error Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGGOER</td>
<td>This routine is only called upon detection of a computed or assigned GO TO error.</td>
<td>Fatal</td>
<td>1</td>
</tr>
<tr>
<td>ACOS (R)</td>
<td>R = INF or R = IND or abs (R) .GT. 1.0</td>
<td>+IND</td>
<td>2</td>
</tr>
<tr>
<td>ALOG (R)</td>
<td>R = INF or R = IND or R .LT. 0 R = 0</td>
<td>+IND -INF</td>
<td>3</td>
</tr>
<tr>
<td>ALOG10 (R)</td>
<td>R = INF or R = IND or R .LT. 0 R = 0</td>
<td>+IND -INF</td>
<td>4</td>
</tr>
<tr>
<td>ASIN (R)</td>
<td>R = INF or R = IND or abs (R) .GT. 1.0</td>
<td>+IND</td>
<td>5</td>
</tr>
<tr>
<td>Routine</td>
<td>Condition</td>
<td>Standard Recovery</td>
<td>Error Number</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>ATAN (R)</td>
<td>$R = \text{INF}$ or $R = \text{IND}$</td>
<td>+IND</td>
<td>6</td>
</tr>
<tr>
<td>ATAN2 (R1, R2)</td>
<td>$(R1 \text{ or } R2) = (\text{INF or IND})$</td>
<td>+IND</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>$R1 = R2 = 0$</td>
<td>+IND</td>
<td></td>
</tr>
<tr>
<td>CABS (Z)</td>
<td>$(\text{real } (Z) \text{ or } \text{imag } (Z) ) = (\text{INF or IND})$</td>
<td>+IND</td>
<td>8</td>
</tr>
<tr>
<td>CBAIEX:Z**I</td>
<td>$(\text{real } (Z) \text{ or } \text{imag } (Z) ) = (\text{INF or IND})$</td>
<td>$(+\text{IND},+\text{IND})$</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>$Z = (0,0)$ and $1 \ LE. 0$</td>
<td>$(+\text{IND},+\text{IND})$</td>
<td></td>
</tr>
<tr>
<td>CCOS (Z)</td>
<td>$(\text{real } (Z) \text{ or } \text{imag } (Z) ) = (\text{INF or IND})$</td>
<td>$(+\text{IND},+\text{IND})$</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>also: $\text{COS} (\text{real } (Z))$ and $\text{EXP} (\text{imag } (Z))$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEXP (Z)</td>
<td>$(\text{real } (Z) \text{ or } \text{imag } (Z) ) = (\text{INF or IND})$</td>
<td>$(+\text{IND},+\text{IND})$</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>also: $\text{SIN} (\text{imag } (Z))$ and $\text{EXP} (\text{real } (Z))$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLOG (Z)</td>
<td>$(\text{real } (Z) \text{ or } \text{imag } (Z) ) = (\text{INF or IND})$</td>
<td>$(+\text{IND},+\text{IND})$</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>also: $\text{ ALOG} (\text{CABS}(Z))$ and $\text{ATAN2} (\text{imag } (Z), \text{real } (Z))$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COS (R)</td>
<td>$R = \text{INF}$ or $R = \text{IND}$ or abs $(R) .GT.1.1E14$</td>
<td>+IND</td>
<td>13</td>
</tr>
<tr>
<td>CSIN (Z)</td>
<td>$(\text{real } (Z) \text{ or } \text{imag } (Z) ) = (\text{INF or IND})$</td>
<td>$(+\text{IND},+\text{IND})$</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>also: $\text{SIN}(\text{real}(Z))$ and $\text{EXP} (\text{imag } (Z))$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSQRT (Z)</td>
<td>$(\text{real } (Z) \text{ or } \text{imag}(Z) ) = (\text{INF or IND})$</td>
<td>$(+\text{IND},+\text{IND})$</td>
<td>15</td>
</tr>
<tr>
<td>DABS (D)</td>
<td>$D = \text{INF}$</td>
<td>+INF</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>$D = \text{IND}$</td>
<td>+IND</td>
<td></td>
</tr>
<tr>
<td>DATAN (D)</td>
<td>$D = \text{INF}$ or $D = \text{IND}$</td>
<td>+IND</td>
<td>17</td>
</tr>
<tr>
<td>DATAN2 (D1, D2)</td>
<td>$(D1 \text{ or } D2) = (\text{INF or IND})$</td>
<td>+IND</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>$D1 = D2 = 0$</td>
<td>+IND</td>
<td></td>
</tr>
<tr>
<td>DBADEX:</td>
<td>$(D1 \text{ or } D2) = (\text{INF or IND})$</td>
<td>+IND</td>
<td>19</td>
</tr>
<tr>
<td>D1**D2</td>
<td>$D1 = 0$ and $D2 .LE. 0$</td>
<td>+IND</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$D1 .LT. 0$</td>
<td>+IND</td>
<td></td>
</tr>
<tr>
<td>DBAIEX:</td>
<td>$D1 = \text{INF}$ or $D1 = \text{IND}$</td>
<td>+IND</td>
<td>20</td>
</tr>
<tr>
<td>D1**I2</td>
<td>$D1 = 0$ and $I2 .LE. 0$</td>
<td>+IND</td>
<td></td>
</tr>
<tr>
<td>DBAREX:</td>
<td>$(D1 \text{ or } R2) = (\text{INF or IND})$</td>
<td>+IND</td>
<td>21</td>
</tr>
<tr>
<td>D1**R2</td>
<td>$D1 = 0$ and $R2 .LE. 0$</td>
<td>+IND</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$D1 .LT. 0$</td>
<td>+IND</td>
<td></td>
</tr>
<tr>
<td>DCOS (D)</td>
<td>$D = \text{INF}$ or $D = \text{IND}$ or abs $(D) .GT.1.1E14$</td>
<td>+IND</td>
<td>22</td>
</tr>
<tr>
<td>DEXP (D)</td>
<td>$D = \text{INF}$ or $D = \text{IND}$</td>
<td>+IND</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>$D .GT. 741.67$</td>
<td>+INF</td>
<td></td>
</tr>
<tr>
<td>DLOG (D)</td>
<td>$D = \text{INF}$ or $D = \text{IND}$ or $D .LT. 0$</td>
<td>+IND</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>$D = 0$</td>
<td>-INF</td>
<td></td>
</tr>
<tr>
<td>DLOG10 (D)</td>
<td>$D = \text{INF}$ or $D = \text{IND}$ or $D .LT. 0$</td>
<td>+IND</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>$D = 0$</td>
<td>- INF</td>
<td></td>
</tr>
<tr>
<td>Routine</td>
<td>Condition</td>
<td>Standard Recovery</td>
<td>Error Number</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>DMOD (D1,D2)</td>
<td>(D1 or D2) = (INF or IND)</td>
<td>+IND</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>D2 = 0</td>
<td>+IND</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D1 / D2 .GE. 2 ** 96</td>
<td>+IND</td>
<td></td>
</tr>
<tr>
<td>DSIGN (D1,D2)</td>
<td>D1 = IND or D2 = ( 0 or INF or IND)</td>
<td>+IND INF with sign of D2</td>
<td></td>
</tr>
<tr>
<td>DSIN (D)</td>
<td>D = INF or D = IND or abs (D) .GT.1.1E14</td>
<td>+IND</td>
<td>28</td>
</tr>
<tr>
<td>DSQRT (D)</td>
<td>D = INF or D = IND or D .LT. 0</td>
<td>+IND</td>
<td>29</td>
</tr>
<tr>
<td>EXP (R)</td>
<td>R = INF or R = IND</td>
<td>+IND INF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R .GT. 741.67</td>
<td>+INF</td>
<td></td>
</tr>
<tr>
<td>IBAIEX:</td>
<td>I1 = 0 and I2 .LE. 0</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>I1 ** I2 .GE. 2 ** 48</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>IDINT (D)</td>
<td>D = +INF or D = IND or D .GE. 2 ** 59</td>
<td>2 ** 59-1</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>D = -INF or D .LE. -2 ** 59</td>
<td>1 - 2 ** 59</td>
<td></td>
</tr>
<tr>
<td>RBADEX:</td>
<td>(R1 or D2) = (INF or IND)</td>
<td>+IND</td>
<td>33</td>
</tr>
<tr>
<td>R1**D2</td>
<td>R1 = 0 and D2 .LE. 0</td>
<td>+IND</td>
<td></td>
</tr>
<tr>
<td>R1 .LT. 0</td>
<td>+IND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RBAIEX:</td>
<td>R1 = INF or R1 = IND</td>
<td>+IND</td>
<td>34</td>
</tr>
<tr>
<td>R1**I2</td>
<td>R1 = 0 and I2 .LE. 0</td>
<td>+IND</td>
<td></td>
</tr>
<tr>
<td>RBAREX:</td>
<td>(R1 or R2) = (INF or IND)</td>
<td>+IND</td>
<td>35</td>
</tr>
<tr>
<td>R1**R2</td>
<td>R1 = 0 and R2 .LE. 0</td>
<td>+IND</td>
<td></td>
</tr>
<tr>
<td>R1 .LT. 0</td>
<td>+IND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIN (R)</td>
<td>R = INF or R = IND or abs (R) .GT.1.1E14</td>
<td>+IND</td>
<td>36</td>
</tr>
<tr>
<td>SLITE (I)</td>
<td>I .GT. 6 or I .LT. 0</td>
<td>Proceed</td>
<td>37</td>
</tr>
<tr>
<td>SLITET (I1,I2)</td>
<td>I1 .GT. 6 or I1 .LE. 0</td>
<td>I2 = 2</td>
<td>38</td>
</tr>
<tr>
<td>SQRT (R)</td>
<td>R = INF or R = IND or R .LT. 0</td>
<td>+IND</td>
<td>39</td>
</tr>
<tr>
<td>SSWITCH (I1,I2)</td>
<td>I1 .GT. 6 or I1 .LE. 0</td>
<td>I2 = 2</td>
<td>40</td>
</tr>
<tr>
<td>TAN (R)</td>
<td>R = INF or R = IND or abs (R) .GT.8.4E14</td>
<td>+IND</td>
<td>41</td>
</tr>
<tr>
<td>TANH (R)</td>
<td>R = INF or R = IND</td>
<td>+IND</td>
<td>42</td>
</tr>
<tr>
<td>OVERLAY</td>
<td>Fatal error reported by LOADER</td>
<td>Fatal</td>
<td>50</td>
</tr>
<tr>
<td>SEGMENT</td>
<td>Fatal error reported by LOADER</td>
<td>Fatal</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>Non-fatal error reported by LOADER</td>
<td>Proceed</td>
<td>52</td>
</tr>
<tr>
<td>Routine</td>
<td>Condition**</td>
<td>Standard Recovery</td>
<td>Error Number</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>BACKSP</td>
<td>Unassigned medium*</td>
<td>FATAL</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>Attempt to read past EOF on Buffer In.</td>
<td>FATAL</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Last operation was a write, no data available to read.</td>
<td>FATAL</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Starting address greater than terminal address.</td>
<td>FATAL</td>
<td>56</td>
</tr>
<tr>
<td>BUFEI</td>
<td>Unassigned medium*</td>
<td>FATAL</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>Starting address greater than terminal address.</td>
<td></td>
<td>58</td>
</tr>
<tr>
<td>BUFEIO</td>
<td>Unassigned medium*</td>
<td>FATAL</td>
<td>59</td>
</tr>
<tr>
<td>ENDFIL</td>
<td>Unassigned medium*</td>
<td>FATAL</td>
<td>60</td>
</tr>
<tr>
<td>IFENDF</td>
<td>Unassigned medium*</td>
<td>FATAL</td>
<td>61</td>
</tr>
<tr>
<td>INPUTB</td>
<td>Unassigned medium*</td>
<td>FATAL</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>Attempt to read past EOF - coded input.</td>
<td>FATAL</td>
<td>65</td>
</tr>
<tr>
<td>INPUTS</td>
<td>Attempt to transfer more than 150 characters/rec. on DECODE processing.</td>
<td>FATAL</td>
<td>66</td>
</tr>
<tr>
<td>IOCHEK</td>
<td>Unassigned medium* for IF UNIT statement.</td>
<td>FATAL</td>
<td>67</td>
</tr>
<tr>
<td>KODER</td>
<td>Illegal Letter used as format specification.</td>
<td>FATAL</td>
<td>68</td>
</tr>
<tr>
<td>(Coded output)</td>
<td>Format specification with more than 2 levels of parentheses (3 levels under ASA).</td>
<td>FATAL</td>
<td>69</td>
</tr>
</tbody>
</table>

* The execution time diagnostic "Unassigned medium" is a result of a variable file name being undefined. The diagnostic printed out is actually "Unassigned medium," file xxxxxx (where xxxxxx is the name of the undefined file)

**All Input/Output errors at execution time are fatal errors. Therefore the standard error recovery for all of the above cases is (after standard error tracing is provided) to abort the job.
<table>
<thead>
<tr>
<th>Routine</th>
<th>Condition**</th>
<th>Standard Recovery</th>
<th>Error Number</th>
</tr>
</thead>
</table>
| KRAKER (Coded input) | Coded write past end of record.  
Field width specified as zero.  
Field width specified is less than or equal to the specified decimal width.  
Attempt to output data under Hollerith format. | FATAL | 70  
FATAL | 71  
FATAL | 72  
FATAL | 73 |
| KRAKER (Coded input) | Illegal letter used as format specification.  
Format specification with more than 2 levels of parentheses.  
Field width specified as zero.  
Coded read past end of record.  
Illegal data in the external field.  
Data converted is out of range.  
Attempt to input data under Hollerith format. | FATAL | 74  
FATAL | 75 |
| LENGTH | Unassigned medium* | FATAL | 81 |
| OUTPTB | Unassigned medium* | FATAL | 82 |
| OUTPTC | Unassigned medium*  
Line limit as specified on RUN card exceeded. | FATAL | 83  
FATAL | 84 |
| OUTPTS | Attempt to transfer more than 150 characters/record on ENCODE processing. | FATAL | 85 |
| REWINM | Unassigned medium* | FATAL | 86 |
| KODER (Coded output) | Attempt to output a single array under "D" format specification. | FATAL | 87 |

* The execution time diagnostic "Unassigned medium" is a result of a variable file name being undefined. The diagnostic printed out is actually "Unassigned medium," file xxxxxxx (where xxxxxxx is the name of the undefined file).

**All Input/Output errors at execution time are fatal errors. Therefore the standard error recovery for all of the above cases is (after standard error tracing is provided) to abort the job.
LIMITATIONS AND KNOWN DEFICIENCIES

1. The following description of BUFFER IN/BUFFER OUT is intended to clarify their use.

When a BUFFER IN is performed on any medium, besides BCD 1/2-inch tape, one and only one logical record is read each time BUFFER IN is called. If the block length specified by the call is longer than the logical record, the excess block locations will not be changed by the read. If the logical record is longer than one block, the excess words in the logical record are passed over. They will be counted but not transmitted to the program area. The number of central memory words in the logical record may be obtained by referencing LENGTH.

Since there is no logical record concept per se on BCD 1/2-inch tape, the above must be modified slightly. In this case as many 136-character physical records will be read as is necessary to fill the block. If not all of the last physical record read is needed, the physical record will be passed over and counted, but the excess words will not be transmitted to the program area.

When a BUFFER OUT is performed on any medium, besides BCD 1/2-inch tape, one logical record is written each time the routine is called. The record consists of a number of standard physical records (the size depending upon the medium) and a short record, or just a short record if the block length is less than the physical record size.

For BCD output on 1/2-inch tape the record consists of 136-character physical records. If the block length is less than 136 characters the physical record is blank-filled to 136 characters. If the block length requires several physical records the last record is blank-filled to 136 characters if necessary.

There are two restrictions on the use of BUFFER IN/BUFFER OUT:

a. BUFFER IN does not read a mixed mode (both binary and BCD) file on 1/2-inch tape, although BUFFER OUT will write it. Parity errors occur while reading tape.

b. When buffering out more than 136 characters on BCD 1/2-inch tape every fourteenth word loses its last 4 characters. Since the tape drive is designed to write only 136-character records, it picks up 14 words and writes the first 136 characters; the second physical record begins with the fifteenth word. When buffering in more than 136 characters the same process occurs. Every fourteenth word is zero-filled for its last 24 bits. The number of central memory words obtained by referencing LENGTH counts every physical record as 14 words.

2. The 64/6600 FORTRAN Version 2.0 compiler has been corrected through PSR number 213 with the following exceptions: 13, 208.

3. The 64/6600 FORTRAN Version 2.0 object time routines have been corrected through PSR 213 with the following exceptions: 162, 192.
4. The following DO loop compiles incorrectly if A and Z are TYPE COMPLEX.

   DO 1 I = 1, 3
   DO 1 J = 1, 3
   A (I,J) = Z (I,J) ** K

5. A DATA declaration such as the following, which attempts to store excess elements into an array, receives a non-fatal **DR** diagnostic, as per specifications. However, an arithmetic error may occur during the compilation of the program.

   DIMENSION A (3)
   DATA A/1., 2., 3., 4./

6. If an ASCENT subroutine precedes the main FORTRAN program, the job will abort at execution time with a buffer argument error.

7. DBAIEX does not do the published error testing.

8. Non-standard error recovery for the ** power routines is of limited usefulness because the arguments of the routines are not available to the non-standard recovery, and the contents of A0 is destroyed in transferring to the non-standard recovery. Therefore, return should not be made to the place the power routine was called.

9. The interpretation of the fourth argument in calls to SEGMENT is backwards. If the argument is zero, unsatisfied externals are not satisfied from the library, if it is non-zero, they are satisfied from the library.

10. A mode 4 arithmetic error may occur in EXP for a very large negative argument. (This is also present in the 1.1 EXP routine.)

11. DATA statements of the CDC form:

    DATA (i = n, n), . . . , (m = n, n . . . n)

    are illegally flagged if a complex constant is the last element in a parenthetical group other than the last group. For example:

    DATA (C = (1., 2.)), (R = 3.), where C is complex

    does not compile whereas:

    DATA (A = 1.), (C = (1., 2.))

    does compile. (This also happened in Version 1.1.)

12. Inaccuracies in the results of calls to TAN may occur if the result is very large. (This is also present in the Version 1.1 TAN routine.)
13. The format conversion specification:

\[ k \text{ (nH...)} \text{ or } k \text{ (*...*)} \]

fails if the associated PRINT or WRITE statement contains no list or if the above specification appears after all list elements have been converted. For example:

\begin{verbatim}
WRITE (10, 500)
500   FORMAT (50(1H*))
\end{verbatim}

outputs only one asterisk whereas:

\begin{verbatim}
WRITE (10, 500) A
500   FORMAT (1X, 3(1H*), E10.3, 5(2HXX))
\end{verbatim}

terminates output with only one of the five "XX".

14. End-file marks are not always detected if both binary and BCD operations have been performed on the same unit. In the following example, the end-file at statement 500 is not detected.

\begin{verbatim}
WRITE (10, 1) A
ENDFILE 10
WRITE (10) I
ENDFILE 10
REWIND 10
READ (10, 1) A
READ (10)
500   IF (EOF, 10) 2,3
\end{verbatim}

15. The printer carriage control character + suppresses spacing after, rather than before, printing.

16. BUFFEI does not give a diagnostic when an attempt is made to read past an EOF. Every BUFFER I/O operation must be followed by an IF (UNIT, i) statement to check this.

17. The use of an erroneous file name in the RUN card causes the compiler to revert to the system name which would otherwise have been assumed for that parameter.
LIMITATIONS AND KNOWN DEFICIENCIES

1. Erroneous completion dates are entered for the beginning event of the network if conflicting actual and scheduled dates are input. This can be corrected by the user by removing the scheduled date on the beginning event.

Page 3-2  Under PUNCHB change the fifth line of the example to read:

COPYBR (DAYFILE,A)

Page 7-10  The following error messages replace those in Section 7.3.8:

GF1  A PARAMETER IS GREATER THAN 7 CHARACTERS
    The first separator or parameter terminator appears after eight alphanumeric characters. GF1 can appear for any of the three parameters.

GF2  A NUMERIC EXTENDS BEYOND AN END OF FILE
    P2 is numeric and is too large. The double end of file is reached before P2 is satisfied.
    COPYN writes all the existing records, one end of file, and then rewinds the file.

GF3  AN ID(P1) IS REQUIRED ON ALL TEXT CARDS
    A comma or separator is the first character, causing the first parameter to be a zero.

GF4  TEXT CARD CONTAINS AN ILLEGAL SEPARATOR
    Only ,, blank + - / * are acceptable in addition to the alphanumeric characters.

GF5  CONTROL CARD REWIND (INPUT) IS ILLEGAL
    COPYN could not reposition INPUT. Therefore the card is rejected and the message printed. INPUT is left unchanged.

GF6  TOO MANY INPUT FILE NAMES ON COPYN
    The current limit is ten files.
    COPYN gives an error message, attempts to use the first 10 parameters, and begins execution of the program.

GF7  NO OUTPUT FILE ON THE COPYN CONTROL CARD
    The second parameter on the COPYN control card is zero. COPYN sets a disk file, TEMP, as the output file and continues to process the control card.
GF8  FIELD IS NON NUMERIC ILLEGAL TEXT CARD
The SKIPR and SKIPF requests cause this error message to be given when I
is not numeric.

GF9  NO INPUT FILE ON THE COPYN CONTROL CARD
Parameters three through ten on the COPYN card are zero. A disk file, TEMP,
is set as the only file searched when P3 is zero (exception—an existing P3 will
be searched first).

GF10 BINARY RECORD MISSING FROM INPUT
P3 is INPUT and the next record on INPUT is not the expected binary record.

GF11 ID NAME NOT IN INPUT FILES SEARCHED
The P1 parameter was not found in either P3 or any of the input files listed on
the COPYN control card.

GF12 TOO MANY TEXT CARDS IN THE INPUT RECORD
BUFF is the size of the input buffer. If there are more TEXT cards than are
allocated by BUFF, all the cards in the buffer are processed, then the error
message is printed.

GF13 P2 IS NOT IN THE FILE OR IS UNDEFINED
Either P2 was not found in the file or it began with * or /. P2 was
not *, ** or /.

GF14 A DOUBLE EOF WAS FOUND BEFORE A /
When P2 is a / and the end-of-file is encountered before a zero length record,
G14 is printed and all records to the EOF are written on the output file.

GF15 A PARAMETER BEGINS BEYOND AN EOF-EOF
P1 is numeric and causes a skipping to the double end of file before P1 is
satisfied. The tape is positioned before the double end of file.