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AUTOMATIC COMPUTER SUBPROGRAM SELECTION FROM APPLICATION-PROGRAM LIBRARIES

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16. Abstract

The program ALTLIB (ALTernate LIBrary) allows a user access to an alternate subprogram library with a minimum effort. The ALTLIB program selects subprograms from an alternate library file and merges them with the user's program load file. Only subprograms that are called for (directly or indirectly) by the user's programs and that are available on the alternate library file will be selected. ALTLIB eliminates the need for elaborate control-card manipulations to add subprograms from a subprogram file. ALTLIB returns to the user his binary file and the selected subprograms in correct order for a call to the loader. The user supplies the alternate library file. Subprogram requests which are not satisfied from the alternate library file will be satisfied at load time from the system library.

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SUMMARY

A general-purpose program that enables access and use of an alternate library file with minimum programing effort by the user has been developed for the Control Data series 6000 computer systems. The program is used, prior to loading, to select and combine required subprograms from an alternate library file with the user's object file. It employs the user's program field length and is called into operation by a control card. The program structures that the user program can use include overlay or segmentation. This report describes the purpose of the program and the implementation, provides a discussion of the program's operation, and gives instructions for the user.

INTRODUCTION

Modular programing techniques are currently in widespread use in the development of scientific and engineering computer programs at the NASA Langley Research Center. These techniques involve the development of frequently used algorithms into modular (subprogram) form and the collection of application modules supporting a particular area into an application-oriented library. This library can then be employed repeatedly by programers working in the same area of application to simplify new-program development.

A major problem, however, for people maintaining their own application-oriented library is the complexity and volume of control-card programing that must be performed to achieve subprogram selection.

The Alternate Library Access (ALTLIB) program provides a solution to this problem. ALTLIB is a general-purpose digital computer program that automates the subprogram selection process. ALTLIB analyzes the user's program to determine all external requirements; ALTLIB then proceeds to select from the alternate library file all subprograms that a user's program requires. The selected subprograms and the user's object file are then merged onto a file designated by the user for subsequent loading and execution.

GLOSSARY

TEXT tables	Text and data (TEXT) tables are compiler output tables which contain data comprising the subprogram and information necessary for properly relocating the data. Each table includes an origin for the data, the data itself, and indicators describing relocation (if any) of the three possible locations in a data word which may refer to addresses in memory. TEXT tables may appear in any order and any number.
PIDL table	The Program Identification and Length table is a compiler output table which contains the subprogram identification and declarations concerning common block allocation. The PIDL table must appear before any other tables for a given subprogram.
LINK table	The LINK table is a compiler output table which indicates external references (EXTERNALS) within the subprogram. Each reference to an external symbol must appear as an entry in LINK.
ENTR table	The ENTR table is a compiler output table which contains a list of all the named entry points to the subprogram and its associated labeled common blocks. The ENTR table must immediately follow the PIDL table.
FET	The File Environment Table (FET) is a communication area initiated by the user; it is interrogated and updated by the system and the user during file processing. An FET must be declared for each file. The FET is used by the peripheral processor input-output routines and Central Program Control (CPC) subprograms as well as by the user program.
RANDOM ACCESS FILE	A RANDOM ACCESS FILE is a file created to take advantage of random access disk capability. Random access is the process of obtaining information from or placing information into storage where time required for such access is independent of the location of the information most recently obtained or placed in storage.
PRU	A physical record unit (PRU) is the smallest amount of information transmitted in one continuous burst between a computer and a specific input-output device.

RA	RA is the reference address of a program.
EOF	EOF is the designation given to denote an End-of-File, where a file represents a stored set of records, tables, or other information.

PROCESS DESCRIPTION AND IMPLEMENTATION

ALTLIB requires the user to declare three files in his ALTLIB control card: the user's program file in object form, the alternate library file in object program form, and the file upon which ALTLIB will output the user's program and selected alternate library subprograms in object form.

The user's file and alternate library file are searched for program-identification, external, and entry information. ALTLIB makes a table of these data (see ref. 1 for additional information on the PIDL, LINK, and ENTR tables). ALTLIB then makes a list of subprograms that are needed by the user program from information in the table. This list is compared with information about the alternate library. The items compared are externals from the user's program and entries from the alternate library. When a positive compare is made, the entry of the alternate library is marked selected, and all its externals are added to the list of subprograms needed. This process continues until all available subprograms are selected. The user's file and selected subprograms are then merged onto the designated file, and control is returned to the user. The method of solution for different program types varies only in the way files are manipulated. A description of this process is presented in diagram form in figure 1.

PROGRAM OPERATION OVERVIEW

The program ALTLIB is logically divided into three phases and an initialization section (see fig. 1).

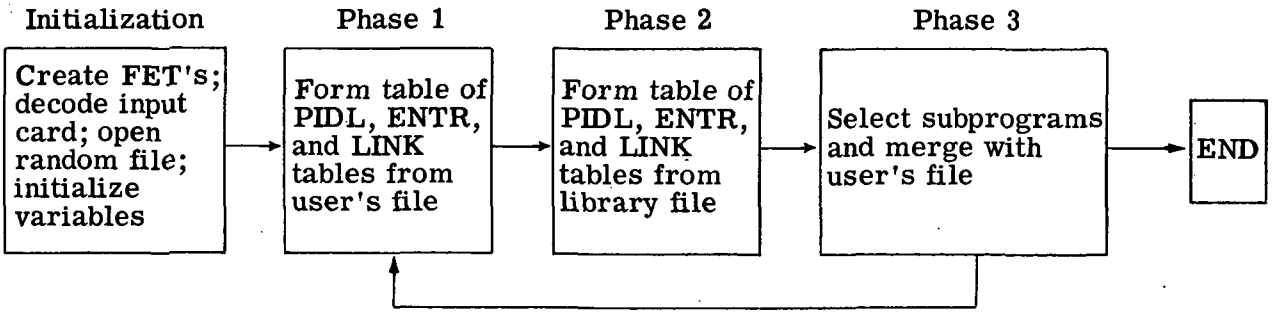
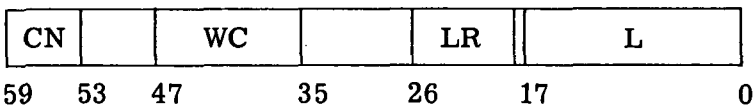


Figure 1.- ALTLIB program diagram.

In the initialization section, the File Environment Tables are created, the user's input card is decoded, the random file is opened, and variables are initialized.

Phase 1 consists of operations on the user's binary file (object file). This binary file contains one logical record for each program or subprogram, and these records consist of a number of tables (PIDL, ENTR, and LINK). Each table contains an identification word which specifies to the loader the procedure to be followed in loading the table. The identification word has the following format:



CN – Code number identifying type of data in table (PIDL, ENTR, LINK, etc.)

WC – Word count in table (excluding identification word)

LR – Method of relocation for the load address

L – Load address

From the PIDL, ENTR, and LINK tables, ALTLIB forms a table having the format shown in figure 2.

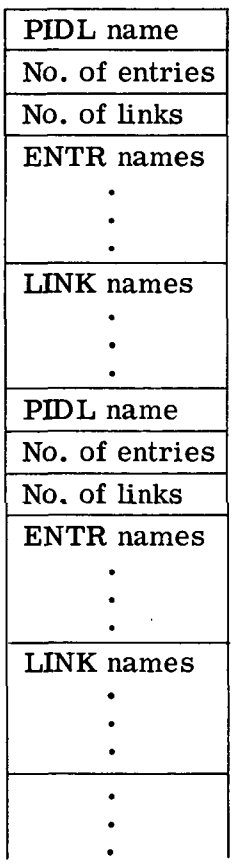


Figure 2.- Format of Phase 1 TABLE.

An index of the position of the last entry in this Phase 1 TABLE is stored for later use. Another task of Phase 1 is writing the logical records of the user's object file on the file where the user's file and selected subprogram will eventually be merged.

Phase 2 consists of reading the alternate library file to obtain information about the PIDL, ENTR, and LINK names for each subprogram. This information is appended to the Phase 1 TABLE. An index is set to indicate the last entry in this table. The procedures applied to the subprograms in Phase 2 are the procedures applied to the user's object deck for table formation. The library file is rewritten as a random file during Phase 2.

Phase 3 consists of indexing through the table formed in Phases 1 and 2 to determine which subprograms need to be selected. To accomplish this task, a table is made of all the externals of the user's object deck. This list is gathered from that portion of the table formed in Phase 1 and is an exclusive list. These externals indicate to ALTLIB which subprograms are needed directly. This list is then compared with the ENTR's in the table formed in Phase 2. When a true compare is made, this subprogram is marked for selection (a 1-bit in the rightmost position of PIDL entry). The externals from this subprogram are added to the list of EXTERNALS if they are not there. When the comparison list is completely checked, ALTLIB is ready to merge selected subprograms by searching for a select bit set in a PIDL table entry. When it is found, the appropriate subprogram is read from the random file and written on the output file. The process is completed by putting the combined user's file and selected subprogram on the file selected by the user in his ALTLIB control card.

There are some exceptions in this process for overlay programs. The first exception is in Phase 3. When the subprogram-selecting process is complete, a check is made to see if the program processed was an overlay type. If it was, the table information about the library file is moved to the low storage area of the table, and a flag is set noting that this move was made. This first exception leads to the second exception, which is in Phase 2. A check is made to see if the library information is available in the low-storage-area table. If it is, this information is restored from there rather than reading the alternate file again. The process for overlays is to treat them like individual programs and to set special flags to denote subprogram selection by a higher level overlay. For example, in the main overlay a seven is set in the PIDL word indicating that this subprogram has been selected for the entire program. For a primary overlay, a three is set which will be cleared only when another primary overlay is read. Secondary overlays are marked selected by a 1-bit which is cleared after they are selected and written on the output file.

Figure 3 shows a directed flow diagram of the ALTLIB subprograms. This figure, the discussion provided for each subprogram, and program listings provide the details for

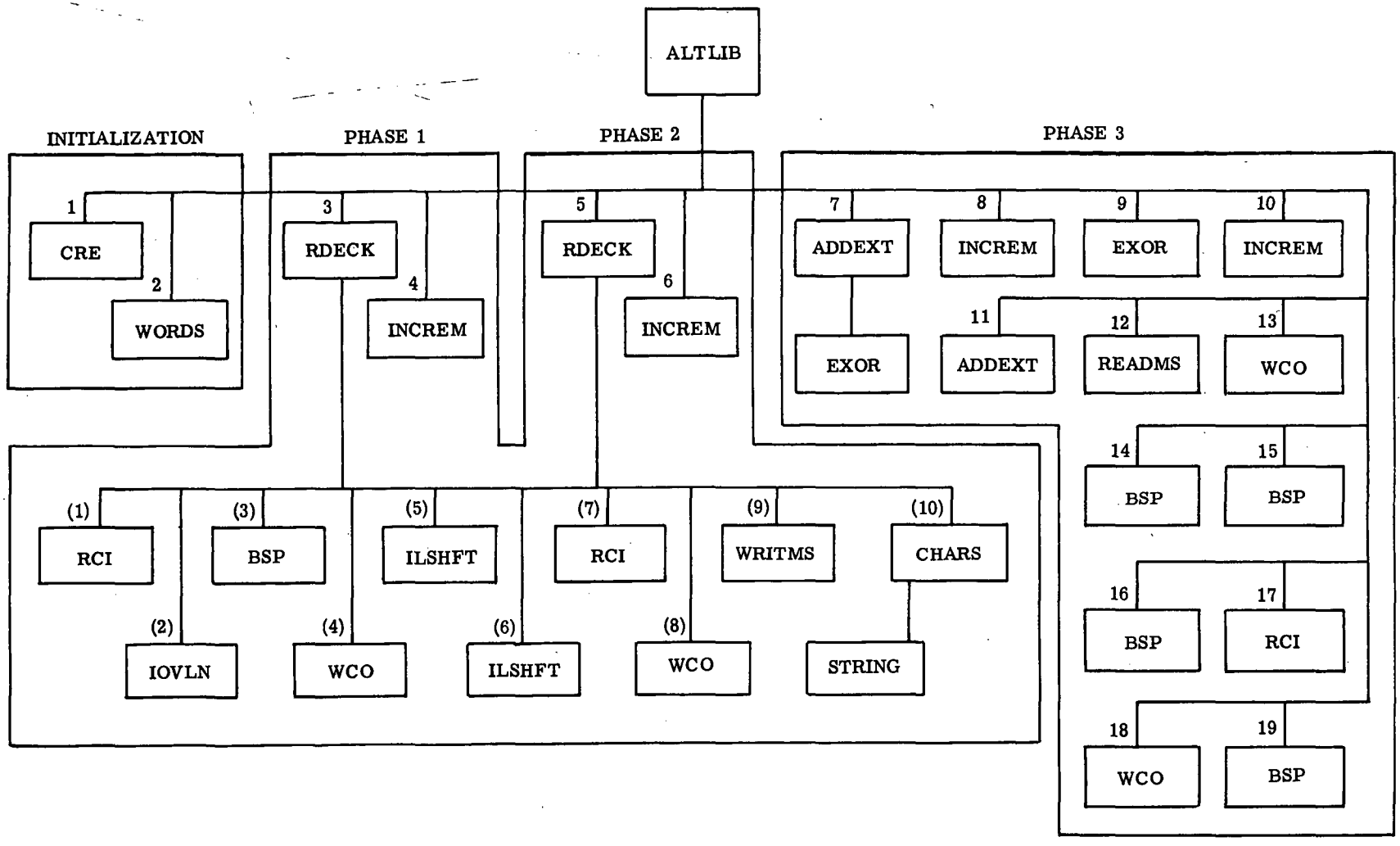


Figure 3.- Directed flow diagram of ALTLIB subprograms by phases.

the program ALTLIB. The numbers above the boxes in figure 3 indicate the order in which the subprograms are called.

PROGRAM ORGANIZATION

ALTLIB COMMON

The following list contains all the FORTRAN variables appearing in COMMON in the program ALTLIB. Dimensional information is given when applicable.

COMMON name	FORTRAN variable	Description
TIC	BUF(5121)	Buffer used for input and output by all files; size is set for 10 tape PRU's
IOC	IOCN	Input file record count
	IOA	Flag for type of overlay to be operated on
	IOB	Flag for type of overlay that will be operated on next
	LS	Flag to tell if final output file shall have same name as input file
INDL	INDEXL(501)	Array used for index of mass storage file; index number indicates the number-of-records-less-one that the random file can contain
TABLE	LIMTAB	Last value of TABLE
	ITAB(6000)	Array used to store program-identification, entry, and external information from user's file and library
	LIST(1000)	Array used to store subprogram names and random file index number of that subprogram
	IRNI	Index of record number used in writing the random file

Description of ALTLIB and Its Subprograms

A brief description of ALTLIB and of each subprogram is given in the following list:

Entry point	Description
ALTLIB	Control program for Alternate Library Access procedure
RDECK	Forms master TABLE of program binary records
RCI, WCO, BSP	Controls file manipulation processes for reading, writing, rewind, and backspacing
IOVLN	Determines overlay type
INCREM	Calculates position in TABLE where next PIDL name will be stored
ADDEXT	Develops list of EXTERNALS to be processed
CHARS	Interface to STRING
STRING	Moves character strings in a bit basis
EXOR	Computes exclusive OR of two names
WORDS	Decodes the ALTLIB control card
CRE	Creates File Environment Tables
ILSHFT	Moves data left circular in a specified word

Information about OPENMS, READMS, WRITMS, ABNORML, and REMARK is contained in reference 2.

The ALTLIB program and its subprograms (subroutines) are discussed briefly in the following sections. An ALTLIB program listing is included; also, subprogram listings are presented.

Program ALTLIB

ALTLIB is a FORTRAN main overlay program that coordinates the task of all subprograms, controls indexes of various tables, and selectively merges final output. The flow chart in figure 4 and the program listing that follows show how ALTLIB controls program operation. ALTLIB is an overlay program because this format allows the program to load faster and to use less storage.

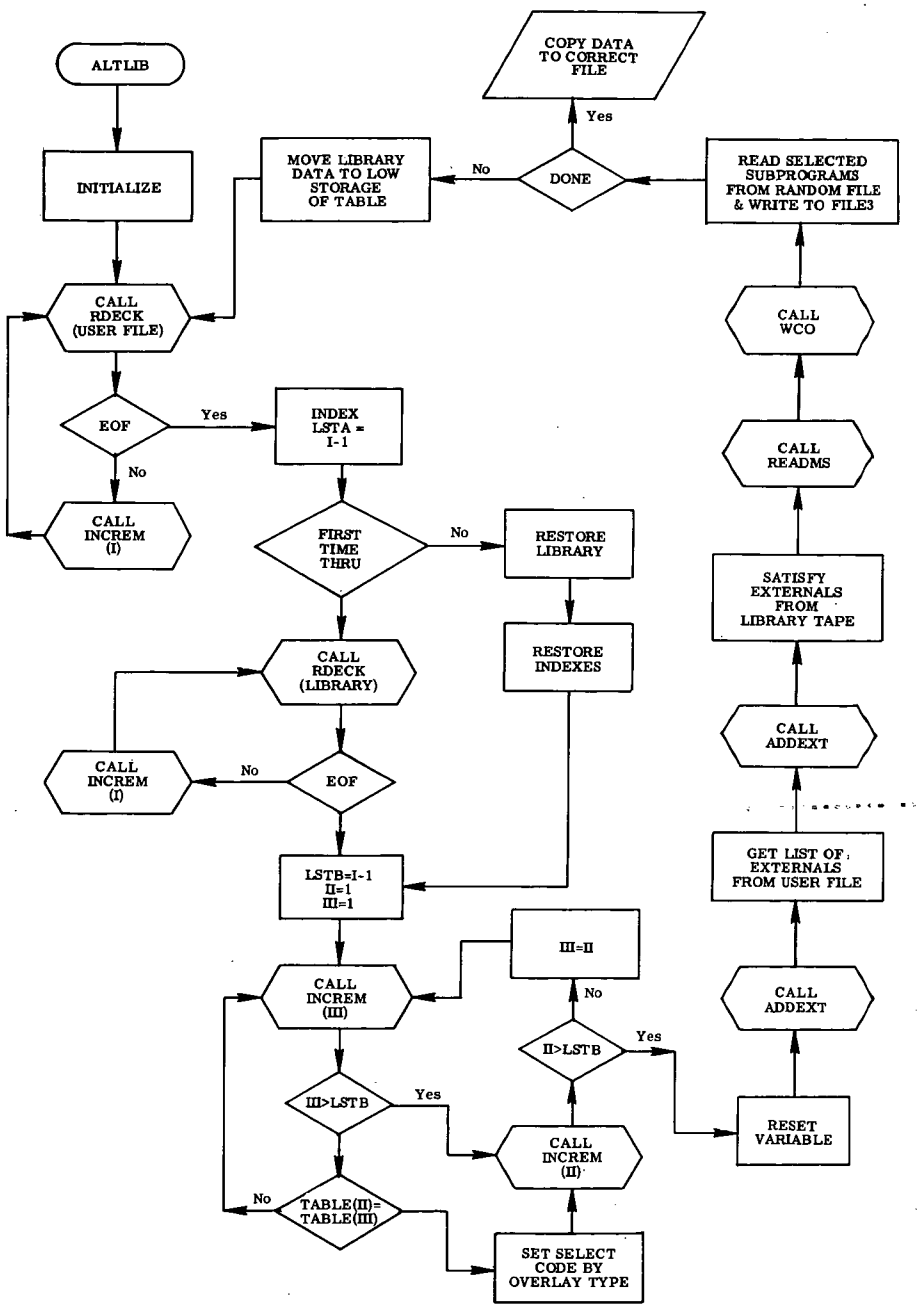


Figure 4.- ALTLIB flow chart. (LSTA denotes the last table entry of the user program file; LSTB denotes the last table entry of the library file.)

```
                      OVERLAY(ALTLIB1,0,0)                                    ALTLIB
                      PROGRAM ALTLIB                                          ALTLIB
000003                COMMON /TIC/BUF(5121)                                   ALTLIB
000003                COMMON /IOC/ ICCN,IOA,ICB,LS                            ALTLIB
000003                COMMON LIST(1000)                                       ALTLIB
000003                COMMON /INDL/INDEXL(501)                                ALTLIB
000003                COMMON IRNI                                             ALTLIB
000003                COMMON/TABLE/LIMTAB,ITAB                                ALTLIB
000003                DIMENSION ITAB(6000)                                    ALTLIB
000003                DATA LIMTAB/6000/                                       ALTLIB
000003                EQUIVALENCE (TABLE,ITAB)                                ALTLIB
000003                DIMENSION TABLE(2)                                      ALTLIB
000003                DIMENSION LNG(3)                                        ALTLIB
000003                ALTL95=001142414444000000000
000005                LNG(3)=0                                                ALTLIB
000006                LS=0                                                    ALTLIB
000007                CALL CKE                                                ALTLIB
                *                                                             ALTLIB
                *     WORDS CHECKS PARAMETERS OF LOAD CARD. SUPPLIES DEFAULTS WHERE  ALTLIB
                *     NECESSARY.                                              ALTLIB
                *                                                             ALTLIB
                *                                                             ALTLIB
                *     BSP HAS 3 FILE ACTION CODES.                            ALTLIB
                *     52B=REWIND                                              ALTLIB
                *     36B=WRITE EOF                                           ALTLIB
                *     42B=BACKSPACE                                           ALTLIB
                *                                                             ALTLIB
000010                CALL WORDS(LS)                                          ALTLIB
000012                LUN=ALTL95.CR.0
000014                IRNI=0                                                  ALTLIB
000015                CALL OPENMS(LUN,INDEXL,501,0)
000020                CALL BSP(3,52B)                                         ALTLIB
000022                CALL BSP(1,52B)                                         ALTLIB
000024                IOA=0                                                   ALTLIB
000025              1 I=1                                                     ALTLIB
000026                IOCN=0                                                  ALTLIB
                *                                                             ALTLIB
                *     RDECK WILL SEARCH LGO FILE LOOKING AT PIDL TABLE(34),ENTR(36) AND  ALTLIB
                *      LINK(44)  ORDER WILL BE  1.PROGRAM NAME,2.NUMBER ENTRIES,3.NUMBER  ALTLIB
                *      OF LINKS,4.ENTRY NAMES,5.LINK NAMES                    ALTLIB
                *     RDECK WILL USE RDECK TO DO READING.
                *                                                             ALTLIB
000027         10     IF(RDECK(1,TABLE(I)))20,30                              ALTLIB
000034         20     I = INCREM(I)                                           ALTLIB
                *                                                             ALTLIB
```

```
                *       INCREM IS FUNCTION THAN TAKES PRESENT I+3+NUMBER ENTRIES+NUMBER    ALTLIB
                *       TRANFERS TO GIVE NEW START IN TABLE. IT ALSO CHECKS FOR TABLE      ALTLIB
                *       OVERFLOW.                                                          ALTLIB
                *                                                                          ALTLIB
000037                  GO TO 10                                                           ALTLIB
000037          30      LSTA = I-1                                                         ALTLIB
                *       THIS IS A RESTORATION OF LIBRARY TABLE OF EXTERNALS AND ENTRIES---  ALTLIB
                *       THIS IS USED ONLY FOR OVERLAY PROGRMS...                           ALTLIB
                *       IT IS RECALLED FROM THE LOWER PORTION OF TABLE ...                 ALTLIB
000041                  IF(IOA.EQ.0) GO TO 39                                              ALTLIB
000042                  LSTB=LSTA+IX                                                       ALTLIB
000044                  IY=IZ                                                              ALTLIB
000045                  I=LSTB+1                                                           ALTLIB
000047                  JJ=LSTA+1                                                          ALTLIB
000050                  DO 32 J=JJ,LSTB                                                    ALTLIB
000051                  TABLE(J)=TABLE(IY)                                                 ALTLIB
000053              32  IY=IY+1                                                           ALTLIB
000057                  GO TO 60                                                           ALTLIB
000060              39  CALL BSP(2,528)                                                   ALTLIB
                *                                                                          ALTLIB
                *       THIS CALL TO RDECK GOES TO SUBROUTINES(ALTERNATE LIBRARY) WHAT CAL  ALTLIB
                *       AT STATEMENT 10 DID FOR MAIN PROGRAM,                              ALTLIB
                *                                                                          ALTLIB
000062          40      IF(RDECK(2,TABLE(I)))50,60                                         ALTLIB
000067          50      I = INCREM(1)                                                      ALTLIB
000072                  GO TO 40                                                           ALTLIB
000072          55      CALL REMARK(40H LIBRARY TAPE CONTAINS NO DATA. PLEASE  )           ALTLIB
000074                  CALL REMARK(40H CHECK. ALTLIB IS ENDING WITH NO CHANGES )          ALTLIB
000076                  CALL REMARK(20H TO YOUR FILE.      )                               ALTLIB
000100                  GO TO 365                                                          ALTLIB
                *       CHECK CARD DECK DUPLICATED ON LIBRARY                              ALTLIB
                *                                                                          ALTLIB
000101              60  LSTB=I-1                                                          ALTLIB
000103                  II=1                                                               ALTLIB
000104                  III=1                                                              ALTLIB
000105              57  III=INCREM(III)                                                   ALTLIB
000110                  IF(III.GT.LSTB) GO TO 59                                           ALTLIB
000113                  IF(EXOR(TABLE(III),TABLE(II)).EQ.0) GO TO 58                       ALTLIB
000116                  GO TO 57                                                           ALTLIB
000117              58  IF(IOA.EQ.0) TABLE(III)=TABLE(III).OR.3B                          ALTLIB
000123                  IF(IOA.EQ.1) TABLE(III)=TABLE(III).OR.7B                           ALTLIB
000130                  IF(IOA.EQ.2) TABLE(III)=TABLE(III).OR.17B                          ALTLIB
000134              59  II=INCREM(II)                                                     ALTLIB
000137                  IF(II.GT.LSTB)GO TO 61                                             ALTLIB
000142                  III=II                                                             ALTLIB
```

```
000142          GO TO 57                                                ALTLIB
000143       61 CONTINUE                                                ALTLIB
000143          IF(LSTB.EQ.LSTA) GO TO 55                               ALTLIB
000145          IEXT = I                                                ALTLIB
000147          INB  = LSTA+1                                           ALTLIB
000151          I = 1                                                   ALTLIB
000152          NEXT = 0                                                ALTLIB
000152          INA = 1                                                 ALTLIB
000153    70    IF(I.GT.LSTA)GO TO 100                                  ALTLIB
000157          CALL ADDEXT(TABLE(I),TABLE(IEXT),NEXT)                  ALTLIB
000162          IF(IEXT+NEXT.GE.LIMTAB)GO TO 700                        ALTLIB
000165          I = INCREM(I)                                           ALTLIB
000170          GO TO 70                                                ALTLIB
          C                                                             ALTLIB
          C  SATISFY EXTERNALS OF TAPE1 FROM TAPE2, AND ADD EXTERNALS OF ALTLIB
          C  ROUTINES SELECTED FROM TAPE2.                              ALTLIB
          C                                                             ALTLIB
000170    100   CONTINUE                                                ALTLIB
000170          K = 0                                                   ALTLIB
          C                                                             ALTLIB
          C  INDEX OVER UNSATISFIED EXTERNALS.                          ALTLIB
          C                                                             ALTLIB
000171    110   K = K+1                                                 ALTLIB
000173          IF(K.GT.NEXT)GO TO 200                                  ALTLIB
000176          I = 1                                                   ALTLIB
          C                                                             ALTLIB
          C  INDEX OVER ROUTINES IN TAPE2.                              ALTLIB
          C                                                             ALTLIB
000177    120   IF(I.GT.LSTB)GO TO 110                                  ALTLIB
000203          JB = I+3                                                ALTLIB
000204          JL = I+2+ITAB(I+1)                                      ALTLIB
000207          IF(JB.GT.JL)GO TO 135                                   ALTLIB
          C                                                             ALTLIB
          C  INDEX OVER ENTRY POINTS OF ROUTINE.                        ALTLIB
          C                                                             ALTLIB
000212          DO 130 J = JB,JL                                        ALTLIB
          C                                                             ALTLIB
          C  IF ENTRY EQUALS EXTERNAL, CALL ADDEXT.                     ALTLIB
          C                                                             ALTLIB
000213          IF(EXOR(TABLE(J),TABLE(LSTB+K)).EQ.0) GO TO 140         ALTLIB
000220    130   CONTINUE                                                ALTLIB
000223    135   CONTINUE                                                ALTLIB
000223          I = INCREM(I)                                           ALTLIB
000226          GO TO 120                                               ALTLIB
          *                                                             ALTLIB
```

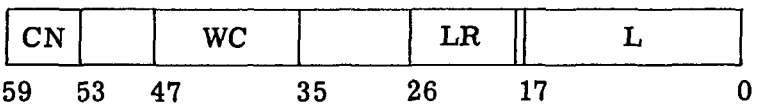
```
                *       SATISFY EXTERNALS OF SUBROUTINES                                ALTLIB
000226          140     CALL ADDEXT(TABLE(I),TABLE(IEXT),NEXT)                          ALTLIB
000232                  IF(IEXT+NEXT.GE.LIMTAB)GO TO 700                                ALTLIB
000235                  GO TO 110                                                       ALTLIB
                C                                                                       ALTLIB
                C  COPY ROUTINES SELECTED FROM TAPE2 TO TAPE3.                          ALTLIB
                C                                                                       ALTLIB
000236            200 CALL BSP(2,528)                                                 ALTLIB
000240                I = INB                                                         ALTLIB
000242          210   IF(I.GT.LSTB)GO TO 300                                          ALTLIB
                *                                                                       ALTLIB
                *       COPY SELECTED INFORMATION TO OUTPUT PROCESSING FILE             ALTLIB
                *                                                                       ALTLIB
000246            220 MTAB=TABLE(I).AND.7B                                            ALTLIB
000251                IF(MTAB.EQ.0) GO TO 240                                         ALTLIB
000252                IF(MTAB.EQ.7) GO TO 240                                         ALTLIB
000254                IF(MTAB.EQ.3) GO TO 240                                         ALTLIB
                *       WCI IS AN RCI ENTRY POINT                                       
                *                                                                       ALTLIB
                *       WCO HAS TWO OPTIONS                                             ALTLIB
                *       16B=WRITE DATA                                                  ALTLIB
                *       26B=WRITE DATA AND COMPLETE RECORD.                             ALTLIB
                *                                                                       ALTLIB
                *       RCI USES OF 12B.                                                ALTLIB
                *                                                                       ALTLIB
                *                                                                       ALTLIB
                *       THESE ARE ALL IN RCI AS ENTRY POINTS RCI,WCO AND BSP            ALTLIB
                *                                                                       ALTLIB
                *       ALLOW RECORD TO EXCEED 5120 WORDS                               ALTLIB
                *                                                                       ALTLIB
                *                                                                       ALTLIB
                *       THE FOLLOWING CODE IS FOR THE                                   ALTLIB
                *       RANDOM ACCESS OPTION.                                           ALTLIB
                *                                                                       ALTLIB
000256                  IYY=1                                                           ALTLIB
000257            230 MTAB=TABLE(I).AND.777777777777700000B                           ALTLIB
000262            235 IZZ=LIST(IYY).AND.777777777777700000B                           ALTLIB
000265                IF(IZZ.EQ.MTAB) GO TO 236                                       ALTLIB
000267                IYY=IYY+2                                                       ALTLIB
000270                IF(IYY.GT.1000) GO TO 238                                       ALTLIB
000273                GO TO 235                                                       ALTLIB
000273            236 IRN=LIST(IYY).AND.777B                                          ALTLIB
000276                LNG=LIST(IYY+1)                                                 ALTLIB
000277                MTAB=LIST(IYY+2).AND.777777777777700000B                        ALTLIB
000301                IF(MTAB.NE.IZZ) GO TO 237                                       ALTLIB
```

```
000303          LNG(3)=168                                                      ALTLIB
000304          CALL READMS(LUN,BUF,LNG,IRN)
000307          CALL WCO(3,BUF,LNG)                                             ALTLIB
000312          IYY=IYY+2                                                       ALTLIB
000314          GO TO 236                                                       ALTLIB
000314      236 CALL REMARK(30H INDEX TABLE OVERFLOW.                           ALTLIB
000316          CALL ABNORML                                                    ALTLIB
000317      237 LNG(3)=268                                                      ALTLIB
000321          CALL READMS(LUN,BUF,LNG,IRN)
000324          CALL WCO(3,BUF,LNG)                                             ALTLIB
              *                                                                 ALTLIB
              *     7 INDICATES ROUTINE SELECTED BY MAIN OVERLAY                ALTLIB
              *     3 INDICATES ROUTINE SELECTED BY PRIMARY OVERLAY             ALTLIB
              *     0 INDICATES NOT SELECTED                                    ALTLIB
              *     1 INDICATES SELECTION FOR THIS PROGRAM                      ALTLIB
000327    240   I = INCREM(I)                                                   ALTLIB
000332          GO TO 210                                                       ALTLIB
000332      300 IF(IOCN.EQ.99) GO TO 360                                        ALTLIB
              *                                                                 ALTLIB
              *     MOVE LSTA+1 TO LSTB TO TABLE(LAST UP-                       ALTLIB
              *                                                                 ALTLIB
000334          LSTAB=LSTA+1                                                    ALTLIB
000336          LSTBB=LSTB                                                      ALTLIB
000340          IX=LSTBB-LSTAB+1                                                ALTLIB
              *     MOVE DATA CONTAINING ALL LIBRARY INFORMATION.               ALTLIB
              *     MOVE IS FROM LAST POSITION TO FIRST TO AVOID OVERSTORE.     ALTLIB
              *     IYY=IS LAST POSITION OF LSTB INITIALLY                      ALTLIB
              *     IZZ=IS 400C POSITION IN TABLE...INITIALLY...                ALTLIB
              **                                                                ALTLIB
              **                                                                ALTLIB
              **                                                                ALTLIB
              **                                                                ALTLIB
000342          IZ=LIMTAB-IX                                                    ALTLIB
000343          IYY=LSTB                                                        ALTLIB
000344          IZZ=LIMTAB-1                                                    ALTLIB
000346          DO 320 J=LSTAB,LSTBB                                            ALTLIB
000347          TABLE(IZZ)=TABLE(IYY)                                           ALTLIB
000352          IZZ=IZZ-1                                                       ALTLIB
000353      320 IYY=IYY-1                                                       ALTLIB
000357          IY=IZ                                                           ALTLIB
000360      302 IF(TABLE(IY).AND.1B) 301,310                                    ALTLIB
000363      301 IF(IOA.EQ.0) TABLE(IY)=TABLE(IY).OR.2B                          ALTLIB
000367          MTAB=TABLE(IY).AND.17B                                          ALTLIB
000372          IF(MTAB.EQ.3) GO TO 310                                         ALTLIB
000374          IF((IOA.EQ.2).AND.(IOB.EQ.2).AND.(MTAB.EQ.7)) GO TO 310         ALTLIB
```

```
000407          IF((IOA.EQ.1).AND.(IOB.NE.1)) GO TO 305                 ALTLIB
000416          TABLE(IY)=TABLE(IY).AND.777777777777700000B             ALTLIB
000420          GO TO 310                                               ALTLIB
000421      305 TABLE(IY)=TABLE(IY).OR.7B                               ALTLIB
000424      310 IY=INCREM(IY)                                           ALTLIB
000427          IF(IY.LT.LIMTAB) GO TO 302                              ALTLIB
000431          GO TO 1                                                 ALTLIB
000432      700 CALL REMARK(20H TABLE OVERFLOW                          ALTLIB
000434          CALL ABNORML                                            ALTLIB
000435      360 CALL BSP(3,36B)                                         ALTLIB
000437          CALL BSP(3,52B)                                         ALTLIB
000441          IF(LS.EQ.0) GO TO 365                                   ALTLIB
000442          CALL BSP(1,52B)                                         ALTLIB
000444      361 CALL RCI(3,BUF,LNG)                                     ALTLIB
000447          IF(LNG.EQ.77777B) GO TO 364                             ALTLIB
000451          LNG(3)=2OB                                              ALTLIB
000453          IF(LNG(2).EQ.1) LNG(3)=16B                              ALTLIB
000456          CALL WCO(1,BUF,LNG)                                     ALTLIB
000461          GO TO 361                                               ALTLIB
000462      364 CALL BSP(1,36B)                                         ALTLIB
000464          CALL BSP(1,52B)                                         ALTLIB
000466      365 CONTINUE                                                ALTLIB
000466          RETURN                                                  ALTLIB
000470          END                                                     ALTLIB
```

Subprogram RDECK

RDECK is a FORTRAN function. Its parameters are the logical unit number (LUN) to be used and a position in TABLE to begin storing data. The primary job of RDECK is to compose a table of PIDL, ENTR, and LINK names. This procedure starts with a call to RCI to read one logical record. If this record is from FILE1, it is output on FILE3. If it is from FILE2, it is written on the RANDOM ACCESS FILE. A flag is then made of the code number and word count for the first table in this logical record. A slight digression might be in order here. The deck of a subprogram as it is output from COMPASS/FORTRAN and most other language translators comprises one logical record. Each record consists of a number of tables. Each table is preceded by an identification word which specifies to the loader the procedure to follow in loading the table. The identification word has the following format:



CN – Code number identifying type of data in table (PIDL, ENTR, LINK, etc.)

WC – Word count in table (excluding identification word)

LR – Method of relocation for the load address

L – Load address

The code number (CN) identifies for RDECK the three tables of interest in each logical record: a CN of 34 identifies the PIDL table, a CN of 36 identifies the ENTR table, and a CN of 44 identifies the LINK table.

The LINK entries are also commonly called externals. As they are gathered together by RDECK, these names are put in a table with the following structure for each logical record:

(1) PIDL name

(2) Number of entries

(3) Number of externals

(4) ENTR names

(5) LINK names

The word count (WC) is used to index through this logical record from one table to the next. Control is returned to ALTLIB after each logical record is searched with a true condition set. A false condition is set if an EOF has been sensed.

RDECK checks for overlay records and segmentation records. When they are read, they are written onto the output file (FILE3). RDECK then reads the next logical record.

An RDECK flow chart is presented in figure 5, and the subprogram listing follows.

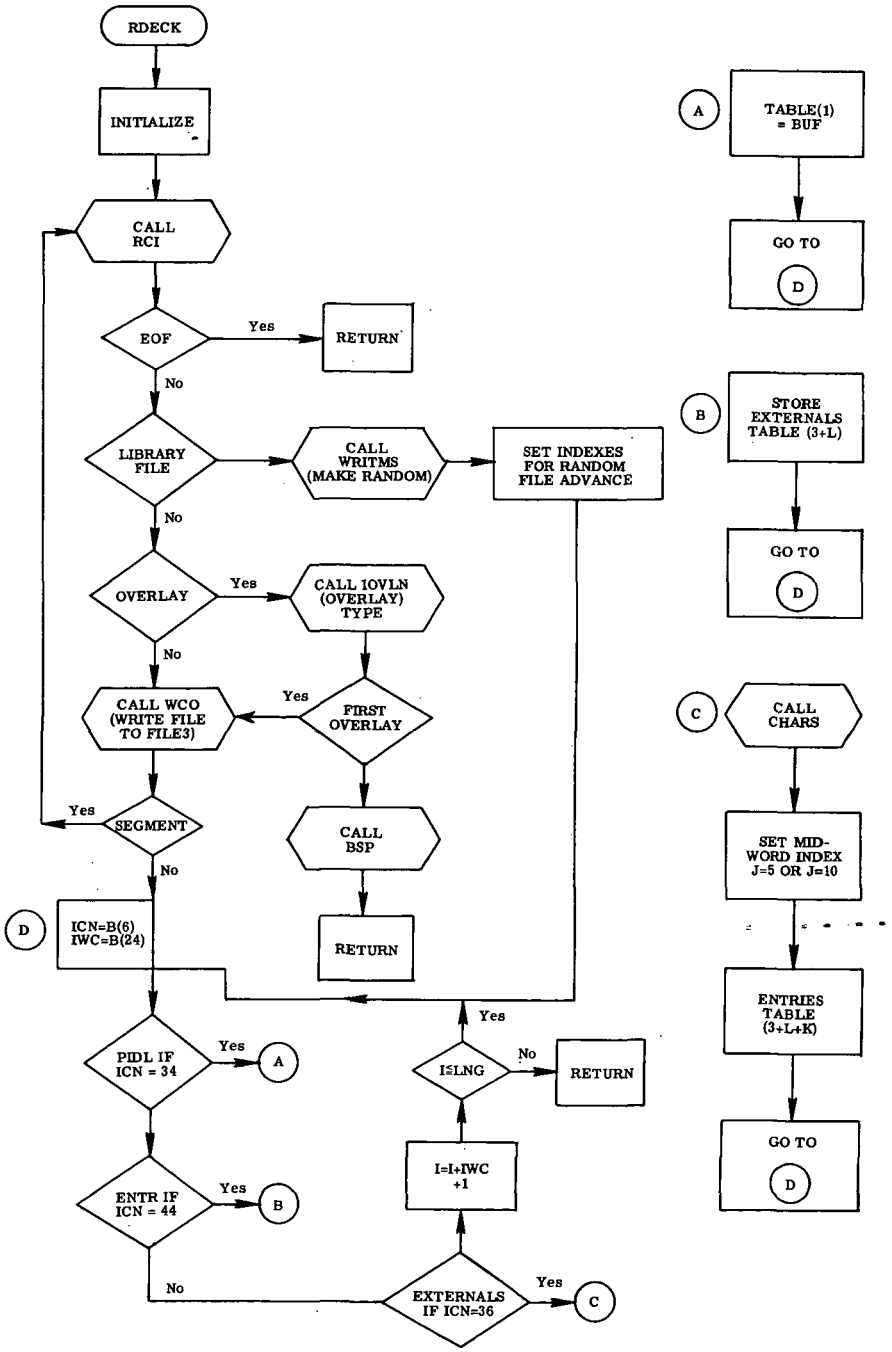


Figure 5.- RDECK flow chart.

```
                      FUNCTION RDECK(LUN,TABLE)                                  ALTLIB
000005                COMMON /TIC/BUF(5121)                                      ALTLIB
000005                COMMON /IOC/ ICCN,ICA,IOB,LS                               ALTLIB
000005                COMMON LIST(1000)                                          ALTLIB
000005                COMMON /INDL/INDEXL(501)                                   ALTLIB
000005                COMMON IRNI                                                ALTLIB
000005                DIMENSION TABLE(2)                                         ALTLIB
000005                DIMENSION LNG(3)                                           ALTLIB
000005                ALTLSS=C011424144440CCCC0000
000006                LNG(2)=0                                                   ALTLIB
000007              1 RDECK = .F.                                                ALTLIB
000010                CALL RC1(LUN,BUF,LNG)                                      ALTLIB
000012                IF(LNG.EQ.77777B) GO TO 800                                ALTLIB
000016                IF(LNG.EQ.0) GO TO 1                                       ALTLIB
000017          10    RDECK = .T.                                                ALTLIB
000020                I=1                                                        ALTLIB
000021                IF(LUN.EQ.2) GO TO 700                                     ALTLIB
000023                ICCN=ICCN+1                                                ALTLIB
000024                IOVL=BUF(I).AND.777777777777C000000B                       ALTLIB
000026                IF((IOVL.EQ.172605221403131C000000B).AND.(ICCN.GT.1)) GO TO 650  ALTLIB
000036                LNG(3)=26B                                                 ALTLIB
000037                IF(LNG(2).EQ.1) LNG(3)=16B                                 ALTLIB
000043                CALL WCC(3,BUF,LNG)                                        ALTLIB
                    *                                                          ALTLIB
                    *     OUTPUT ORIGINAL LGO STUFF                            ALTLIB
                    *                                                          ALTLIB
                    *                                                          ALTLIB
                    *     THIS PROGRAM CALL READS ROUTINES AND FORMS THE       ALTLIB
                    *     TABLES  OF PIDL         PROGRAM IDENTICATION         ALTLIB
                    *                 ENTRY       ENTRY POINTS OR CALLS        ALTLIB
                    *                 EXTERNALS   LINKS                        ALTLIB
                    *     FOR USER BINARY FILE                                 ALTLIB
                    *     AND LIBRARY                                          ALTLIB
000046                IF(IOVL.EQ.7LOVERLAY) GO TO 610                            ALTLIB
000052                  IF(IOVL.EQ.7LSEGMENT) GO TO 1                            ALTLIB
000054                  IF(IOVL.EQ.7LSECTION) GO TO 1                            ALTLIB
000056                  IF(IOVL.EQ.7LSEGZERO) GO TO 1                            ALTLIB
000060            821 CONTINUE                                                   ALTLIB
000060                K = 0                                                      ALTLIB
000061                L = 0                                                      ALTLIB
000061                RDECK = .T.                                                ALTLIB
000063          100   ICN = ILSHFT(BUF(I),6).AND.77B                             ALTLIB
000067                IWC = ILSHFT(BUF(I),24).AND.77777B                         ALTLIB
000074                IX=IWC+I                                                   ALTLIB
000076                IF(IX.GT.LNG ) GO TO 140                                   ALTLIB
```

```
000104          IF(ICN.EQ.34B)GO TO 200                                 ALTLIB
000106          IF(ICN.EQ.44B)GO TO 300                                 ALTLIB
000110          IF(ICN.EQ.36B)GO TO 400                                 ALTLIB
000112    110   I = I+IWC+1                                             ALTLIB
000114          IF(I.LE.LNG) GO TO 100                                  ALTLIB
000117          IF(LNG(2).EQ.1) GO TO 138                               ALTLIB
000120          TABLE(2) = L.AND.7777B                                  ALTLIB
000122          TABLE(3) = K.AND.7777B                                  ALTLIB
000124          GO TO 900                                               ALTLIB
000124      138 LL=1                                                    ALTLIB
000125          GO TO 139                                               ALTLIB
          *                                                             ALTLIB
          *     LOGIC FOR RECORDS EXCEEDING 5120 WORDS                  ALTLIB
          *     ROUTINE RDECK                                           ALTLIB
          *                                                             ALTLIB
000126    140   IF(LNG(2).EQ.0) GO TO 150                               ALTLIB
000127          LL=1                                                    ALTLIB
000130          LNGX=LNG(1)                                             ALTLIB
000132          DO 141 JLL=I,LNGX                                       ALTLIB
000132          BUF(LL)=BUF(JLL)                                        ALTLIB
000132      141 LL=LL+1                                                 ALTLIB
000143    139   CALL RDI(LUN,BUF(LL),LNG)                               ALTLIB
000146          IF(LUN.EQ.2) GO TO 750                                  ALTLIB
000151          LNG(3)=26B                                              ALTLIB
000152          IF(LNG(2).EQ.1) LNG(3)=16B                              ALTLIB
000156          CALL WCO(3,BUF(LL),LNG)                                 ALTLIB
000162      142 I=1                                                     ALTLIB
000163          LNG=LNG+LL-1                                            ALTLIB
000166          GO TO 100                                               ALTLIB
          *                                                             ALTLIB
          *     WRITMS SECTION FOR RANDOM ACCESS BOTH FOR SHORT OR LONG RECORDS.  ALTLIB
          *                                                             ALTLIB
000167      700 IRNI=IRNI+1                                             ALTLIB
000171          CALL WRITMS(ALTLS5,BUF,LNG,IRNI)
000174          LISTX=2*IRNI-1                                          ALTLIB
000176          IF(LISTX.GT.1000) GO TO 751                             ALTLIB
000203          LIST(LISTX)=BUF(2).AND.777777777777700000B              ALTLIB
000205          LIST(LISTX)=LIST(LISTX)+IRNI                            ALTLIB
000206          LIST(LISTX+1)=LNG                                       ALTLIB
000210          GO TO 821                                               ALTLIB
000211      750 IRNI=IRNI+1                                             ALTLIB
000213          CALL WRITMS(ALTLS5,BUF(LL),LNG,IRNI)
000217          LISTY=2*IRNI-1                                          ALTLIB
000221          IF(LISTY.GT.1000) GO TO 751                             ALTLIB
000226          LIST(LISTY)=LIST(LISTX).AND.777777777777700000B         ALTLIB
```

```
000230          LIST(LISTY)=LIST(LISTY)+IRNI                                    ALTLIB
000232          LIST(LISTY+1)=LNG                                               ALTLIB
000234          GO TO 142                                                       ALTLIB
000234    751   CALL REMARK(30H INDEX TABLE OVERFLOW                )           ALTLIB
000236          CALL ABNORML                                                    ALTLIB
000237    150   CALL REMARK(20H READ ERROR            )                         ALTLIB
000241          CALL ABNORML                                                    ALTLIB
000242    200   TABLE(1) = BUF(I+1).AND.7777777777777700000B                    ALTLIB
000246          GO TO 110                                                       ALTLIB
000246    300   J = 1                                                           ALTLIB
000247          ICHS = IWC*10                                                   ALTLIB
000251    310   IF(J.GT.ICHS)GO TO 110                                          ALTLIB
000255          CALL CHARS(BUF(I+1),J,DUM,1,10)                                 ALTLIB
000261          IF(DUM.EQ.C.)GO TO 330                                          ALTLIB
000264          IF(DUM.AND.770000000000000000000B)320,330                       ALTLIB
000266    320   K = K+1                                                         ALTLIB
000270          TABLE(3+L+K)=DUM                                                ALTLIB
000273          J = J+10                                                        ALTLIB
000275          GO TO 310                                                       ALTLIB
000276    330   J = J+5                                                         ALTLIB
000300          GO TO 310                                                       ALTLIB
000300    400   J = 1                                                           ALTLIB
000301    410   IF(J.GT.IWC)GO TO 110                                           ALTLIB
000305          L = L+1                                                         ALTLIB
000306          TABLE(3+L)=BUF(I+J)                                             ALTLIB
000312          J = J+2                                                         ALTLIB
000314          GO TO 410                                                       ALTLIB
000314      610 ICA=IOVLN(BUF)                                                  ALTLIB
              *                                                               ALTLIB
              *       OVERLAY TYPE                                            ALTLIB
              *                                                               ALTLIB
000317          GO TO 1                                                         ALTLIB
000321      650 ICB=IOVLN(BUF)                                                  ALTLIB
000324          CALL BSP(1,42B)                                                 ALTLIB
000326          RDECK=.F.                                                       ALTLIB
000327          ICCN =1                                                         ALTLIB
000330          GO TO 900                                                       ALTLIB
000332    800   CONTINUE                                                        ALTLIB
              *                                                               ALTLIB
              *       SET TRUE EOF INDICATOR AT 800                           ALTLIB
              *                                                               ALTLIB
000332          IF(LUN.EQ.1) ICCN=99                                            ALTLIB
000335    900   CONTINUE                                                        ALTLIB
000335          RETURN                                                          ALTLIB
000337          END                                                             ALTLIB
```

Subprogram RCI

RCI is a COMPASS subprogram that initiates all file action requests for the ALTLIB program, except those for the RANDOM ACCESS FILE. RCI calls the Circular Input/Output (CIO) subprograms to complete the file action requests. To carry out its purpose, RCI has three entry points:

(1) Entry point RCI is for reading information into the common buffer BUF. CIO issues a binary read function code 12B, the B indicating octal representation. The parameters for this entry point are LUN, which is the logical unit number; BUF, which is the first word address of the buffer for data read; and LNG, which will contain the number of central memory words read and indicate whether the read is complete.

(2) Entry point WCO is for writing data from the common buffer BUF. Its parameters are the same as those for RCI except that LNG is a three-element array. LNG(1) is length if LNG(3) = 0. LNG(2) is 1 or 0 depending on whether or not the write is complete. LNG(3) is equal to 0 if no End-of-File is detected or is equal to 1 if an End-of-File is detected. LNG also contains the CIO write function codes (16B or 26B). A 16B code writes full PRU's. A 26B code writes available information terminated by short- or zero-length record to indicate End-of-Record. (See ref. 1, p. 3-29.)

(3) Entry point BSP is for the file action requests for BACKSPACE, REWIND, and WRITE EOF. Its parameters are LUN, which is the logical unit number, and LAC, which is the file action code to be used.

An RCI listing follows.

```
                                        IDENT  RCI                                                                  ALTLIB
                                        LIST M,S                                                                     ALTLIB
                                        ENTRY  RCI                                                                   ALTLIB
 0  22031100CCCCCCCC0144        NAME    VFD    42/0LRCI,18/100                                                       ALTLIB
                                *                                                                                    ALTLIB
                                *       INPUT ROUTINE                                                                ALTLIB
                                *       CALL RCI(LUN,BUF,LNG)                                                        ALTLIB
                                *                                                                                    ALTLIB
                                *                                                                                    ALTLIB
                                *       ALL I/O IS DONE IN THIS ROUTINE BY CIO CALLS.                                ALTLIB
                                *       12B IS FOR READ                                                              ALTLIB
                                *       26B IS FOR WRITE                                                             ALTLIB
                                *       42B IS FOR BACKSPACE                                                         ALTLIB
                                *      BUFFER SIZE IS 5120,COMMON AREA BUF.                                          ALTLIB
                                *                                                                                    ALTLIB
 1  03111720CCCCCCCCCCCC        MASK3   CATA   03111720000000CCCCCCCB        CIO   WITH AUTO RECALL                  ALTLIB
 2  CCCCCCCCCCCCCCCCCCCC        RCI     CATA   0                                                                     ALTLIB
 3  56110                               SA1    B1        B1 HAS UNIT NUMBER 1,2, OR 3 WHICH ARE                   ALTLIB
        7221CCCCC1                       SX2    X1+1      IN RA+2,+3,+4.   X2 CONTAINS FET ADDR.                   ALTLIB
                 53320                   SA3    X2                                                                  ALTLIB
 4  73230                               SX2    X3                                                                   ALTLIB
        63520                            SB5    X2                                                                   ALTLIB
             56150                       SA1    B5                                                                   ALTLIB
                  43352                  MX3    42                                                                   ALTLIB
 5  11113                               BX1    X1*X3                                                                ALTLIB
        7140CCCCC2                       SX4    12B           BINARY READ                                            ALTLIB
                 36714                   IX7    X1+X4         TAPEX---12                                             ALTLIB
 6  5675C                               SA7    B5                                                                   ALTLIB
        76620                            SX6    B2            BUF ADDR                                               ALTLIB
             5165CCCCC2                  SA6    B5+2          IN                                                     ALTLIB
 7  5165CCCCC3                          SA6    B5+3          OUT                                                    ALTLIB
             5115000001                  SA1    B5+1                                                                 ALTLIB
10  43552                               MX5    42                                                                   ALTLIB
        11715                            BX7    X1*X5                                                                ALTLIB
             36776                       IX7    X7+X6                                                                ALTLIB
11  5175CCCCC1                          SA7    B5+1                                                                 ALTLIB
                                *                                                                                    ALTLIB
                                *       FIRST AND LIMIT ARE SET IN CRE,CREATE FET ROUTINE                            ALTLIB
                                *                                                                                    ALTLIB
             513CCCCCC1 +               SA3    MASK3                                                                ALTLIB
12  12632                               BX6    X3+X2         CIO----FET-ADDR.                                       ALTLIB
13  515CCCCCC1              +           SA5    1                                                                    ALTLIB
             C315CCCC13 +               NZ     X5,*                                                                 ALTLIB
14  5160CCCCC1                          SA6    1             CIC  FET                                               ALTLIB
15  0130CCCCCC                          XJ                                                                          ALTLIB
16  515CCCCCC1              +           SA5    1                                                                    ALTLIB
             C315CCCC16 +               NZ     X5,*               RECALL WAITINT FOR COMPLETE                       ALTLIB
17  56150                   ONEB        SA1    B5                                                                   ALTLIB
        7120CCCCC1                       SX2    1B                                                                   ALTLIB
                 11312                   BX3    X1*X2                                                                ALTLIB
```

```
20  0303000017 +                        ZR    X3,ONEB                                    ALTLIB
            7120000030                  SX2   30B                                        ALTLIB
21  11321                               BX3   X2*X1                                     ALTLIB
         37432                          IX4   X3-X2      IF ZERO EOF                    ALTLIB
               0304000032 +             ZR    X4,ECF                                     ALTLIB
22  7120000010                          SX2     10B                                      ALTLIB
            11321                       BX3     X2*X1                                    ALTLIB
                 37432                  IX4     X3-X2                                    ALTLIB
23  0304000030 +                        ZR      X4,TMESS                                 ALTLIB
            7160000000                  SX6      0                                       ALTLIB
24  5163000001                          SA6      B3+1                                    ALTLIB
25  5115000003              RESUME      SA1     B5+3                                     ALTLIB
            73110                       SX1     X1            *                          ALTLIB
26  5125000002                          SA2     B5+2          * COMPUTE LENGTH           ALTLIB
            37621                       IX6     X2-X1         *                          ALTLIB
                 56630                  SA6     B3            *                          ALTLIB
27  0400000002 +                        EQ      RCI                                      ALTLIB
30  7160000001              TMESS       SX6     1                                        ALTLIB
            5163000001                  SA6     B3+1                                     ALTLIB
31  0400000025 +                        EQ      RESUME                                   ALTLIB
32  7160077777              EOF         SX6     77777B                                   ALTLIB
            5663B                       SA6   B3                                         ALTLIB
33  0400000002 +                        EQ    RCI                                        ALTLIB
                            *                                                            ALTLIB
                            *       WRITE ROUTINE                                        ALTLIB
                            *       CALL WCO(LUN,BUF,LNG)                                ALTLIB
                            *                                                            ALTLIB
                                    ENTRY   WCO                                          ALTLIB
34  0000000000000000000000  WCO     DATA    0                                          ALTLIB
35  56110                           SA1     B1          B1 HAS UNIT NUMBER 1,2, OR 3 WHICH ARE  ALTLIB
         7221000001                 SX2     X1+1        IN RA+2,+3,+4.   X2 CONTAINS FET ADDR.   ALTLIB
                  53320             SA3     X2                                         ALTLIB
36  73230                           SX2     X3                                         ALTLIB
         63520                      SB5     X2                                         ALTLIB
               5143000002           SA4     B3+2            BINARY WRITE 16B OR 26B    ALTLIB
37  56150                           SA1     B5              FET 1ST WORD               ALTLIB
         43352                      MX3     42                                         ALTLIB
               11113                BX1     X1*X3                                      ALTLIB
                    36714           IX7     X1+X4                                      ALTLIB
40  56750                           SA7     B5              FILE NAME +CODE            ALTLIB
         76620                      SX6     B2              BUF ADD                    ALTLIB
               5165000003           SA6     B5+3            OUT                        ALTLIB
41  5115000001                      SA1     B5+1                                       ALTLIB
               43552                MX5     42                                         ALTLIB
                    11715           BX7     X1*X5                                      ALTLIB
42  36776                           IX7     X7+X6                                      ALTLIB
         5175000001                 SA7     B5+1                                       ALTLIB
```

```
                                    *                                                                   ALTLIB
                                    *       FIRST AND LIMIT ARE SET IN FET CREATION ROUTINE,CRE         ALTLIB
                     76620                    SX6     B2                                                 ALTLIB
43  56430                                    SA4     B3                                                 ALTLIB
          36646                               IX6     X4+X6                                              ALTLIB
               5165C00CC2                     SA6     B5+2        IN                                     ALTLIB
44  5130000001 +                             SA3     MASK3       CIO                                    ALTLIB
               12632                          BX6     X3+X2       CIO----FET ADDR                        ALTLIB
45  5150CC0001                    +          SA5     1                                                  ALTLIB
               C315000045 +                   NZ      X5,*                                               ALTLIB
46  5160000001                               SA6     1                                                  ALTLIB
47  0130000000                               XJ                                                         ALTLIB
50  5150000001                    +          SA5     1                                                  ALTLIB
               C315000050 +                   NZ      X5,*            RECALL WAITINT FOR COMPLETE        ALTLIB
51  56150                         +          SA1     B5          CHECK FOR COMPLETE                     ALTLIB
          7120000001                          SX2     1B                                                 ALTLIB
                    11312                    BX3     X1*X2                                              ALTLIB
52  0303000051 +                             ZR      X3,*-1                                             ALTLIB
               C4CCCCCC34 +                   EQ      WCC                                                ALTLIB
                                              ENTRY   BSP                                                ALTLIB
53  CCCCCCCCCCCCCCCCCCCC      BSP            DATA    0                                                  ALTLIB
54  56110                                    SA1     B1          B1 HAS UNIT NUMBER 1,2, OR 3 WHICH ARE ALTLIB
          7221CCCCC1                          SX2     X1+1        IN RA+2,+3,+4.   X2 CONTAINS FET ADDR.  ALTLIB
                    53320                    SA3     X2                                                 ALTLIB
55  73230                                    SX2     X3                                                 ALTLIB
          63520                               SB5     X2                                                 ALTLIB
               5615C                          SA1     B5                                                 ALTLIB
                    43352                    MX3     42                                                 ALTLIB
56  11113                                    BX1     X1*X3                                              ALTLIB
          56420                               SA4     B2                                                 ALTLIB
               36714                          IX7     X1+X4       TAPEX---42                             ALTLIB
                    5675C                    SA7     B5                                                 ALTLIB
57  5130000001 +                             SA3     MASK3                                              ALTLIB
               12632                          BX6     X3+X2       CIO----FET-ADDR.                       ALTLIB
60  5150000001                    +          SA5     1                                                  ALTLIB
               C315CCCC6C +                   NZ      X5,*                                               ALTLIB
61  5160CCCC01                               SA6     1           CIO  FET                               ALTLIB
62  0130000000                               XJ                                                         ALTLIB
63  5150CC0001                    +          SA5     1                                                  ALTLIB
               C315000063 +                   NZ      X5,*            RECALL WAITINT FOR COMPLETE        ALTLIB
64  56150                         BSPWT      SA1     B5                                                 ALTLIB
          7120CC0001                          SX2     1B                                                 ALTLIB
                    11312                    BX3     X1*X2                                              ALTLIB
65  0303000064 +                             ZR      X3,BSPWT                                           ALTLIB
               C400000053 +                   EQ      BSP                                                ALTLIB
66                                            END                                                        ALTLIB

                    37300     STORAGE USED              143 STATEMENTS        10 SYMBOLS
                    6400 ASSEMBLY             0.818 SECONDS             25 REFERENCES
```

Subprogram IOVLN

IOVLN is a COMPASS function that decodes an overlay identification record. The parameter passed to IOVLN is the first word address of the overlay record. IOVLN returns the following information to the calling program:

IOVLN = 0	indicates a main overlay record decoded.
IOVLN = 1	indicates a primary overlay record decoded.
IOVLN = 2	indicates a secondary overlay record decoded.

An IOVLN listing follows.

```
                                IDENT  IOVLN                                                    ALTLIB
                                LIST M,S
                                ENTRY  IOVLN                                                    ALTLIB
                           *    IOVLN DETERMINES THE TYPE OF OVERLAY RECORD IT IS PRESENTED WITH.  ALTLIB
                           *    0=MAIN                                                          ALTLIB
                           *    1=PRIMARY                                                       ALTLIB
                           *    2=SECONDARY                                                     ALTLIB
                           *                                                                    ALTLIB
 0  0000000000C0000C00000  IOVLN  DATA   0                                                      ALTLIB
 1  614CC00000             SB4    0                                                            ALTLIB
          6150000000       SB5    0                                                            ALTLIB
 2  56110                  SA1    B1                                                           ALTLIB
       6120000012          SB2    10          CHARACTER COUNT                                  ALTLIB
 3  712CC00C52             SX2    52B         ) RIGHT PARENTHESIS
          7130000056       SX3    56B         , COMMA                                          ALTLIB
 4  20106                  SHF    LX1    6            MOVE 6 BITS                              ALTLIB
       7150000077          SX5    77B                                                          ALTLIB
             11415         BX4    X1*X5                                                        ALTLIB
 5  13443                  BX4    X4-X3                                                        ALTLIB
       0304000012 +        ZR     X4,COM1      COMPARE FOR COMMA                               ALTLIB
 6  6122777776             SB2    B2-1         10 CHARS PER WD.                                ALTLIB
          C420000C10 +      EQ     B2,B0,INC                                                    ALTLIB
 7  0400000004 +           EQ     SHF                                                          ALTLIB
10  6111000001             INC    SB1    B1+1          SET FOR NEXT WORD                      ALTLIB
          56110             SA1    B1                                                           ALTLIB
11  6120000012             SB2    10                                                           ALTLIB
          C4000C00C4 +      EQ     SHF                                                          ALTLIB
12  6122777776             COM1   SB2    B2-1                                                  ALTLIB
          C520000C15 +      NE     B2,B0,COM1A                                                  ALTLIB
13  6111000001             SB1    B1+1                                                         ALTLIB
          56110             SA1    B1                                                           ALTLIB
14  6120000012             SB2    10       SET IN NEXT BUF WORD                                ALTLIB
15  20106                  COM1A  LX1    6                                                     ALTLIB
       7150000077          SX5    77B      MASK 6BITS                                         ALTLIB
             11415         BX4    X1*X5                                                        ALTLIB
16  37534                  IX5    X3-X4    COMMA CHECK                                       ALTLIB
       0305000023 +        ZR     X5,COM2                                                     ALTLIB
17  7150000055             SX5    55B                                                          ALTLIB
          37554             IX5    X5-X4                                                        ALTLIB
20  C305000022 +           ZR     X5,JMP   SKIP BLANK                                         ALTLIB
```

```
                715CCCCC33                SX5     33B                                          ALTLIB
21  37445                                 IX4     X4-X5                                        ALTLIB
          63444                           SB4     B4+X4                                        ALTLIB
22  040CCCCC12 +                  JMP     EC      COM1                                         ALTLIB
23  0440000037 +                  COM2    EQ      B4,B0,CCMP                                   ALTLIB
                614CCCCCC1                SB4     1               SEC OR MORE                  ALTLIB
24  6122777776                            SB2     B2-1                                         ALTLIB
                C520000C27 +              NE      B2,B0,COM2C                                  ALTLIB
25  6111C00001                    CCM2AB  SB1     B1+1                                         ALTLIB
                56110                     SA1     B1                                           ALTLIB
26  6120000012                            SB2     10                                           ALTLIB
27  20106                         CCM2C   LX1     6               LCCK AT                      ALTLIB
          715CCCCC77                      SX5     77B             6 BITS RIGHT MOST            ALTLIB
                    11415                 BX4     X1*X5                                        ALTLIB
30  37542                                 IX5     X4-X2                                        ALTLIB
          0305CCC037 +                    ZR      X5,COMP                                      ALTLIB
31  7150C00055                            SX5     55B                                          ALTLIB
                37554                     IX5     X5-X4                                        ALTLIB
32  0305C00034 +                          ZR      X5,JMP2                                      ALTLIB
                715CCCCC33                SX5     33B                                          ALTLIB
33  37545                                 IX5     X4-X5                                        ALTLIB
          0315CC0036 +                    NZ      X5,JMP3                                      ALTLIB
34  6122777776                    JMP2    SB2     B2-1                                         ALTLIB
                C420C0C025 +              EQ      B2,B0,COM2AB                                 ALTLIB
35  040CC00C27 +                          EQ      CCM2C                                        ALTLIB
36  6140000002                    JMP3    SB4     2                                            ALTLIB
37  76640                         CCMP    SX6     B4                                           ALTLIB
          C400CCC000 +                    EQ      IOVLN                                        ALTLIB
40                                        END                                                  ALTLIB

                    37300   STORAGE USED              69 STATEMENTS       12 SYMBOLS
                    6400 ASSEMBLY           0.410 SECONDS         29 REFERENCES
```

Subprogram INCREM

INCREM is a FORTRAN function that calculates the TABLE location where the next PIDL name will be stored. INCREM is equal to the present index + 3 + number of entries for the last logical record + number of links (externals) for the last logical record. The parameter passed to INCREM is the present PIDL name location.

An INCREM listing is presented on the opposite page.

```
                      FUNCTION INCREM(II)                                   ALTLIB
000003                COMMON/TABLE/LIMTAB,ITAB(2)                           ALTLIB
                *                                                           ALTLIB
                *     THIS ROUTINE LOCATES POSITION                         ALTLIB
                *     FOR NEXT PIDL ENTRY.                                  ALTLIB
                *                                                           ALTLIB
000003                I = II                                                ALTLIB
000004                NEN = ITAB(I+1)                                       ALTLIB
000006                NEX = ITAB(I+2)                                       ALTLIB
000007                INCREM = I+3+NEN+NEX                                  ALTLIB
000012                IF(INCREM.GT.LIMTAB)GO TO 10                          ALTLIB
000016                RETURN                                                ALTLIB
000017           10   CALL REMARK(60HTABLE OVERFLOW.                        ALTLIB
                    X                 )                                   ALTLIB
000021                CALL ABNORML                                          ALTLIB
000022                END                                                   ALTLIB
```

Subprogram ADDEXT

ADDEXT is a FORTRAN subprogram. Its parameters are TABLE (I), TABLE (IEXT), and NEXT. TABLE (I) is a location in TABLE that specifies the beginning of a list of EXTERNALS to be operated on. TABLE (IEXT) specifies a position in TABLE where a list of EXTERNALS will be stored. NEXT is the number of externals found. The purpose of ADDEXT is to make a unique list of all externals to be satisfied and mark subprograms as selected for subsequent merging with the user's binary program file. A call to ADDEXT is made only when the user program needs this subprogram. When ADDEXT is called, it puts a 1-bit in the rightmost position of the PIDL name entry. ADDEXT then searches the list of EXTERNALS for this subprogram. If there are any externals that are not on the list of TABLE from TABLE (IEXT) to TABLE (IEXT + NEXT), these externals are added to the list and next incremented by the number found. The list is composed from the user's binary file program and selected subprograms.

An ADDEXT listing is presented on the opposite page.

```
                SUBROUTINE ADDEXT(SUBTAB,EXTAB,NNEX)                              ALTLIB
000000          DIMENSION SUBTAB(2),EXTAB(2)                                      ALTLIB
000000          EQUIVALENCE (XEN,NEN),(XEX,NEX)                                   ALTLIB
                *                                                                 ALTLIB
                *       ADDEXT MARKS THOSE ROUTINE THAT ARE SELECTED              ALTLIB
                *       BY USER PROGRAM AND ROUTINES THAT SELECTED ROUTINES NEED. ALTLIB
                *       A LIST(EXCLUSIVE)OF THE EXTERNALS OF THESE ROUTINES ARE FORMED, ALTLIB
                *       AND PLACED AFTER LSTB(INDEX) IN TABLE.                    ALTLIB
                *                                                                 ALTLIB
000000          NEXT = NNEX                                                       ALTLIB
                C                                                                 ALTLIB
                C   IF ALREADY SELECTED, RETURN.                                  ALTLIB
                C                                                                 ALTLIB
000007          IF((SUBTAB.AND.1B).NE.0)GO TO 900                                 ALTLIB
                C                                                                 ALTLIB
                C   MARK SELECTED.                                               ALTLIB
                C                                                                 ALTLIB
000011          SUBTAB = SUBTAB.OR.1B                                             ALTLIB
000012          XEN = SUBTAB(2)                                                   ALTLIB
000013          XEX = SUBTAB(3)                                                   ALTLIB
000014          IB = 4+NEN                                                        ALTLIB
000016          IL = 3+NEN+NEX                                                    ALTLIB
000021          IF(IB.GT.IL)GO TO 900                                             ALTLIB
                C                                                                 ALTLIB
                C   INDEX OVER EXTERNALS OF THIS ROUTINE.                        ALTLIB
000024          DO 200 I = IB,IL                                                  ALTLIB
000025          IF(NEXT.EQ.0)GO TO 110                                            ALTLIB
                C   INDEX OVER LIST OF EXTERNALS TO BE SATISFIED.                 ALTLIB
000026          DO 100 J = 1,NEXT                                                 ALTLIB
                C                                                                 ALTLIB
                C   IF EXTERNAL ALREADY ON LIST, DONT ADD.                       ALTLIB
                C                                                                 ALTLIB
000027          IF(EXOR(SUBTAB(I),EXTAB(J)).EQ.0) GO TO 120                       ALTLIB
000036  100     CONTINUE                                                          ALTLIB
000040  110     NEXT = NEXT+1                                                     ALTLIB
000042          EXTAB(NEXT) = SUBTAB(I)                                           ALTLIB
000045  120     CONTINUE                                                          ALTLIB
000045  200     CONTINUE                                                          ALTLIB
000050  900     NNEX = NEXT                                                       ALTLIB
000051          RETURN                                                            ALTLIB
000052          END                                                               ALTLIB
```

Subprogram CHARS

CHARS is a FORTRAN subprogram that was written as an interface to subprogram STRING. This subprogram is needed to position words of the LINK table properly. LINK table names can be split between two words in the following manner:

LINK name Q8ENTRY

Word 1						Q	8	E	N	T
Word 2	R	Y								

CHARS puts them into one word (B) in the following format:

B =	Q	8	E	N	T	R	Y			

The parameters for CHARS are A, B, I, J, and N. A is the first word address of the array from which data are removed. B is the first word address of the array to which data are moved. I is the byte position in A from which the first byte is moved. J is the byte position in B to which the first byte is moved. N is the number of bytes to be moved.

CHARS is written in a general form, but for the present purpose I is always of the form 1, 6, 11, 16, 26, . . ., 5(n-1) + 1, . . .; J = 1; and N = 10.

A CHARS listing is presented on the opposite page.

```
                SUBROUTINE CHARS(A,I,B,J,N)                                     ALTLIB
000010          DIMENSION A(1),B(1)                                             ALTLIB
          *     CHARS IS THE INTERFACE RCUTINE TO STRING.                       ALTLIB
          *                                                                     ALTLIB
          *                                                                     ALTLIB
000010          IA = (I+9)/10                                                   ALTLIB
000013          II = 6*(I-10*(IA-1))-5                                          ALTLIB
000020          JB = (J+9)/10                                                   ALTLIB
000024          JJ = 6*(J-10*(JB-1))-5                                          ALTLIB
000031          NN = 6*N                                                        ALTLIB
000034          CALL STRING(A(IA),II,B(JB),JJ,NN)                               ALTLIB
000043          RETURN                                                          ALTLIB
000044          END                                                             ALTLIB
```

Subprogram STRING

STRING is a COMPASS subprogram that moves a string of N bits. The first bit moved is the Ith bit of A. It is moved to array B starting at the Jth bit. I and J are in the range 1 to 60. STRING is written in a general form, but for this problem, N = 60, J = 1, and I = 1 to 31.

The parameters are A, B, I, J, and N. A is the first word address of the array from which data are removed. B is the first word address of the array to which data are moved. I is the bit position in A from which the first bit is moved. J is the bit position in B to which the first bit is moved. N is the number of bits to be moved.

A STRING listing follows.

```
                                        IDENT    STRING                                                ALTLIB
                                *        SUBROUTINE STRING(A,I,B,J,N)                                  ALTLIB
                                *          THIS ROUTINE MOVES A STRING OF                              ALTLIB
                                *          N BITS, WHERE THE FIRST BIT MOVED                           ALTLIB
                                *          IS THE ITH BIT OF WORD A, AND IT IS                         ALTLIB
                                *          MOVED TO THE JTH BIT OF WORD B.                             ALTLIB
                                *          I AND J MUST BE IN THE RANGE 1-60.                          ALTLIB
                                *          N MAY BE ANY POSITIVE INTEGER.                              ALTLIB
                                *          IF THE STRINGS IN A AND B OVERLAP,                          ALTLIB
                                *          A SHOULD NOT BE LESS THAN B.                                ALTLIB
                                        ENTRY STRING                                                   ALTLIB
                                 FMASK  MACRO XA,BA,FMASKN                                             ALTLIB
                                        S*XA  0                                                        ALTLIB
                                        EQ       BA,B0,FMASKN                                          ALTLIB
                                        S*XA  1                                                        ALTLIB
                                        L*XA  59                                                       ALTLIB
                                        S*BA  BA-1                                                     ALTLIB
                                        A*XA  BA,XA                                                    ALTLIB
                                        S*BA  BA+1                                                     ALTLIB
                                        ENDM                                                           ALTLIB
 0  0000000000000000000C0  0000        DATA  0                                                        ALTLIB
 1  0000000000000000000C0  STRING      DATA  0                                                        ALTLIB
 2  56110                              SA1   B1          . X1=A                                       ALTLIB
         56220                         SA2   B2                                                       ALTLIB
              6222777776               SB2   X2-1        . B2=I-1                                     ALTLIB
 3  56240                              SA2   B4                                                       ALTLIB
         6242777776                    SB4   X2-1        . B4=J-1                                     ALTLIB
 4  7100000000                         FMASK X0,B2,STR2                                               ALTLIB
10  15110                   STR2       BX1   -X0*X1      . X1 = LO ORD OF A(1)                        ALTLIB
         56230                         SA2   B3                                                       ALTLIB
              7100C00CC0               FMASK X0,B4,STR3                                               ALTLIB
14  11602                   STR3       BX6   X0*X2       . X6 = HI ORD OF B(1)                        ALTLIB
         56550                         SA5   B5                                                       ALTLIB
              63550                    SB5   X5          . B5=N                                       ALTLIB
                   67624               SB6   B2-B4       . B6=I-J=M                                   ALTLIB
15  0700C00041 +                       LT    B6,B0,STR8  . JUMP IF I LT J                             ALTLIB
              22161                    LX1   B6,X1       . SHIFT A(1) LEFT M                          ALTLIB
                   12661               BX6   X6+X1       . ADD LO ORD A(1) TO B(1)                    ALTLIB
16  66552                              SB5   B5+B2                                                    ALTLIB
         6155777703                    SB5   B5-60       . N= N-(60-(I-1))                            ALTLIB
17  0605000031 +                       GE    B0,B5,STR5  . JUMP IF N BITS MOVED                       ALTLIB
              617C00CC74               SB7   60                                                       ALTLIB
20  67776                              SB7   B7-B6       . B7=60-M                                    ALTLIB
         7100CC0000                    FMASK X0,B7,STR4                                               ALTLIB
24  5011C00001              STR4       SA1   A1+1        . GET NEXT WORD OF A                         ALTLIB
              22161                    LX1   B6,X1                                                    ALTLIB
                   15210               BX2   -X0*X1      . CRIG HI ORD A TO X2                        ALTLIB
25  12662                              BX6   X6+X2       . ADC IT TO B                                ALTLIB
         67556                         SB5   B5-B6       . N=N-M                                      ALTLIB
              0605000032 +             GE    B0,B5,STR6  . JUMP IF N BITS MOVED                       ALTLIB
```

```
26  56630                          SA6   B3          . STORE B                    ALTLIB
        11601                      BX6   X0*X1       . ORIG LO ORD A TO NEXT B    ALTLIB
            67557                  SB5   B5-B7       . N=N-(60-M)                 ALTLIB
27  6133C0C001                     SB3   B3+1        . READY NEXT B               ALTLIB
            C6C5C00C31 +           GE    B0,B5,STR5  . JUMP IF N BITS             ALTLIB
30  04CCCC0024 +                   EQ    B0,B0,STR4                               ALTLIB
31  67556                  STR5    SB5   B5-B6       . SAVE M-N BITS OF OLD B     ALTLIB
32  6160000074             STR6    SB6   60          . SAVE-N BITS OF OLD B       ALTLIB
            66665                  SB6   B6+B5                                    ALTLIB
33  7100000000                     FMASK X0,B6,STR7                               ALTLIB
37  56130                  STR7    SA1   B3          . GET OLD B                  ALTLIB
        15110                      BX1   -X0*X1      . EXTRACT GOOD BITS OF OLD B ALTLIB
            11606                  BX6   X0*X6       . MASK BAD BITS OF NEW B     ALTLIB
                12661              BX6   X6+X1       . ADD THEM                   ALTLIB
40  56630                          SA6   B3          . STORE B                    ALTLIB
        020CCC0001 +               JP    STRING                                   ALTLIB
41  6166000074             STR8    SB6   B6+60       . B6=60-(J-I)=M              ALTLIB
            22161                  LX1   B6,X1       . SHIFT A(1) LEFT M          ALTLIB
                15210              BX2   -X0*X1                                   ALTLIB
42  12626                          BX6   X2+X6                                    ALTLIB
        66554                      SB5   B5+B4                                    ALTLIB
            6155777703             SB5   B5-60       . N=N-(60-(J-1))             ALTLIB
43  0605CCC032 +                   GE    B0,B5,STR6  . JUMP IF N BITS MOVED       ALTLIB
            617CCC0074             SB7   60                                       ALTLIB
44  67776                          SB7   B7-B6       . B7=60-M                    ALTLIB
        7100CC0000                 FMASK X0,B7,STR9                               ALTLIB
50  56630                  STR9    SA6   B3          . STORE B                    ALTLIB
        6133CC0001                 SB3   B3+1        . READY NEXT B               ALTLIB
                11601              BX6   X0*X1       . ORIG LO ORD A TO B         ALTLIB
51  67557                          SB5   B5-B7       . N=N-(60-M)                 ALTLIB
        0605CC0031 +               GE    B0,B5,STR5  . JUMP IF N BITS MOVED       ALTLIB
52  5011000001                     SA1   A1+1        . GET NEXT A                 ALTLIB
            22161                  LX1   B6,X1       . SHIFT A LEFT M             ALTLIB
                15210              BX2   -X0*X1      . ORIG HI ORD A TO X2        ALTLIB
53  12662                          BX6   X6+X2       . ADD IT TO B                ALTLIB
        67556                      SB5   B5-B6       . N=N-M                      ALTLIB
            C605000032 +           GE    B0,B5,STR6  . JUMP IF N BITS             ALTLIB
54  04CCCCC050 +                   EQ    B0,B0,STR9                               ALTLIB
55                                 END                                            ALTLIB

                37300   STORAGE USED          124 STATEMENTS      9 SYMBOLS
                6400 ASSEMBLY           0.736 SECONDS         25 REFERENCES
```

Subprogram EXOR

EXOR is a COMPASS function that performs an exclusive OR between the two items specified in the parameter list. EXOR is equal to the result of the exclusive OR.

An EXOR listing is presented on the next page.

```
                                    IDENT  EXCR                                    ALTLIB
                                    ENTRY  EXCR                                    ALTLIB
                               *    EXOR FORMS AN EXCLUSIVE OR OF NAMES FOR COMPARES.  ALTLIB
                               *    0 RESULT INDICATES SAME NAME.                  ALTLIB
                               *    NON 0 INDICATES NO COMPARE.                    ALTLIB
                               *                                                   ALTLIB
                               *                                                   ALTLIB
0  0000000000000000000000       EXOR    DATA   0                                  ALTLIB
1  56110                               SA1    B1                                 ALTLIB
       56220                           SA2    B2                                 ALTLIB
            13612                      BX6    X1-X2                              ALTLIB
2  0400000000 +                        EC     EXOR                               ALTLIB
3                                      END                                       ALTLIB

                  37300    STORAGE USED              13 STATEMENTS       1 SYMBOLS
                           6400 ASSEMBLY          0.106 SECONDS          3 REFERENCES
```

Subprogram WORDS

WORDS is a COMPASS subprogram used to check and set default parameters of the program call card (control card for ALTLIB operation). This task is accomplished by a check of information in RA + 70 to RA + 77. An example of the control card for ALTLIB is ALTLIB (LGO, TAPEX, TAPEY). LGO is the user's binary program file. TAPEX is the alternate library file. TAPEY is the object load file.

The default parameters for this card are as follows: LGO for user's file, BNFILE for library file, and LGO for object file (user's file and selected subprograms). WORDS has one parameter, LLGO. LLGO is set at 0 if the object load file will not be the user's file, and it is set at 1 if they are to be the same.

The following are examples of acceptable variations of the ALTLIB control card:

```
ALTLIB.
ALTLIB (LGO)
ALTLIB (LGO, BNFILE)
ALTLIB (,TAPEX,)
ALTLIB (,TAPEX, TAPEY)
ALTLIB (,,TAPEY)
ALTLIB (LGO,,LGO)
ALTLIB (LGO, TAPEX, LGO)
ALTLIB (LGO, TAPEX,)
ALTLIB (LGO, BNFILE, LGO)
```

A WORDS listing is presented next.

```
                                IDENT  WORDS                                                                ALTLIB
                                ENTRY  WORDS                                                                ALTLIB
                                LIST M,S
 0  27172204230CC0000C144       NAME   VFD    42/0LWORDS,18/100                                             ALTLIB
                               *                                                                            ALTLIB
                               *     WORDS IS ROUTINE TO CHECK LOAD AND GO CARD                             ALTLIB
                               *     AND INSERT DEFAULT PARAMETERS WHEN NECESSARY.                          ALTLIB
                               *                                                                            ALTLIB
                               *                                                                            ALTLIB
 1  0CCCCCCCCCCCCCCCCCCC        WORDS  DATA   0                                                             ALTLIB
                               *                                                                            ALTLIB
                               *     DECODE LGO CARD AS IT IS PUT IN RA+70 TO RA+77                         ALTLIB
                               *     DEFAULTS  TAPE1=LGO                                                    ALTLIB
                               *               TAPE2=BNFILE                                                 ALTLIB
                               *               TAPE3=LGO                                                    ALTLIB
                               *                                                                            ALTLIB
 2  6120000011                         SB2    9            CHARACTER COUNT OF RA WORDS                    ALTLIB
            5110C00070                 SA1    70B          1ST PARAMETER LGO CARD.                        ALTLIB
 3  0100000024 +                JMP    RJ     SHFT         JUMP TO SHIFT LEFT AND MASK CHARACTER          ALTLIB
 4  7130000057                         SX3    57B          PERIOD .  (DEFAULT TERMINATOR)                 ALTLIB
            37432                      IX4    X3-X2                                                       ALTLIB
 5  030400006C +                    ZR     X4,COMP       BRANCH ON PERIOD                               ALTLIB
            7130000052                 SX3    52B         RIGHT PAREN IS TERMINATOR                      ALTLIB
 6  37432                              IX4    X3-X2       JUST AS PERIOD IS.                             ALTLIB
       0304CC006Q +                    ZR     X4,CCMP                                                    ALTLIB
 7  7130000045                         SX3    45B         CHECK FOR LEADING SEPARATOR                    ALTLIB
            37423                      IX4    X2-X3                                                       ALTLIB
10  0324000034 +                       PL     X4,PAR                                                     ALTLIB
            20106                      LX1    6                                                           ALTLIB
11  6122777776                         SB2    B2-1         CHARACTER COUNT                               ALTLIB
            042CCCCC13 +               EQ     B2,B0,WHY    NO . OR ( IN 10 CHARACTERS. BAD NEWS...       ALTLIB
12  04CCCCCCC3 +                       EQ     JMP                                                        ALTLIB
13                              WHY    MESSAGE  M1,,RECALL                                               ALTLIB
                      0         SCP=90 SET      C                                                        MESSAGE .1
                                       IFC      NE,*RECALL**,1                                           MESSAGE .1
                      1         SCP=90 SET      1                                                        MESSAGE .1
13  0100000000 X                 RJ =XCPC                                                                MESSAGE .1
                      0         SCP=9T SET      C                                                        MESSAGE .1
                                       IFC      NE,***,1                                                 MESSAGE .1
                                       IFC      EQ,**0*,1                                  030568L122    MESSAGE .1
14  1523C76CCCCCCCCCCCC17 +  +          VFD      18/3RMSG,1/1,1/SCP=90,4/,12/SCP=9T,24/M1                 MESSAGE .1
                                       ENDM                                                              MESSAGE .1
15                                     ENDRUN                                                             ALTLIB
15  0100000000 X                 RJ =XCPC                                                                ENDRUN  .1
16  0516046000CCCCCCCCCC0    +         VFD      18/3REND,2/3,40/0                                        ENDRUN  .1
                                       ENDM                                                              ENDRUN  .1
17  5520052211170455172 2       M1     DATA   L* PERIOD OR  PARENTHESIS IS MISSING FROM LOAD CARD *       ALTLIB
24  46000                       SHFT   NO                                                                 ALTLIB
25  6140000C66                  SHFTX  SB4    54                                                          ALTLIB
```

```
                23241                    AX2     B4,X1          RETURN LEADING CHARACTER                    ALTLIB
26  7130000077                           SX3     77B            FROM X1 RIGHT JUSTIFIED                     ALTLIB
                11232                    BX2     X3*X2          IN X2.                                      ALTLIB
27  0400000024 +                         EQ      SHFT                                                       ALTLIB
30  140717CCCCCCCCCCCCCC     V1          VFD     60/OLLGO                                                   ALTLIB
31  021606111405CCCCCCCC     V2          VFD     60/OLBNFILE                                                ALTLIB
32  140717CCCCCCCCCCCCCC     NWD         VFD     60/OLLGO                                                   ALTLIB
33  CCCCCCCCCCCCCCCCCCCC                 DATA    0                                                          ALTLIB
34  6160777775               PAR         SB6     -2                                                         ALTLIB
                6130777771               SB3     -6                                                         ALTLIB
35  76400                                SX4     B0             COMPOSITION WORD                            ALTLIB
36  6122777776               LOOK        SB2     B2-1           DECREMENT CHAR. COUNT                       ALTLIB
                20106                    LX1     6                                                          ALTLIB
37  01CCCCCCCC +                         RJ      SHFT                                                       ALTLIB
40  7150000055               CMP         SX5     55B            IGNORE BLANKS ANYWHERE                      ALTLIB
                37552                    IX5     X5-X2                                                      ALTLIB
41  0305000047 +                         ZR      X5,BLK                                                     ALTLIB
                7150000052               SX5     52B            TERMINATE ON PERIOD OR RIGHT PAREN          ALTLIB
42  37552                                IX5     X5-X2                                                      ALTLIB
        0305000052 +                     ZR      X5,NWA                                                     ALTLIB
43  7150000057                           SX5     57B                                                        ALTLIB
                37552                    IX5     X5-X2                                                      ALTLIB
44  0305000052 +                         ZR      X5,NWA                                                     ALTLIB
                7150000045               SX5     45B            SEPARATOR IS ANYTHING GREATER THAN 44B      ALTLIB
45  37525                                IX5     X2-X5                                                      ALTLIB
        0325CCCCC4 +                     PL      X5,NW                                                      ALTLIB
                    12442                BX4     X4+X2                                                      ALTLIB
46  20406                                LX4     6                                                          ALTLIB
47  0502000036 +             BLK         NE      B0,B2,LOOK     LOOP FOR TEN CHARACTERS                     ALTLIB
                5113000077               SA1     77B+B3         NEXT WORD FROM RA+70 TO RA+77B              ALTLIB
50  6133000001                           SB3     B3+1                                                       ALTLIB
                C43CCCCC13 +             EQ      B3,B0,WHY                                                  ALTLIB
51  6120000011                           SB2     9              RESET CHARACTER COUNT                       ALTLIB
                C4CCCCCC37 +             EQ      CMP-1                                                      ALTLIB
52  0304CCCC6C +             NWA         ZR      X4,COMP                                                    ALTLIB
                10644                    BX6     X4                                                         ALTLIB
53  5166CCCC32 +                         SA6     NWD+B6                                                     ALTLIB
                C4CCCCCC6C +             EQ      COMP                                                       ALTLIB
54  0304CCCC56 +             NW          ZR      X4,NSTR                                                    ALTLIB
                10644                    BX6     X4                                                         ALTLIB
                    764C0                SX4     B0                 RESET X4=0                              ALTLIB
55  5166CCCC32 +                         SA6     NWD+B6                                                     ALTLIB
56  0460000060 +             NSTR        EQ      B6,B0,COMP       3 PARENTHESIS IS ALL WE NEED              ALTLIB
                6166CCCCC1               SB6     B6+1                                                       ALTLIB
57  0400000047 +                         EQ      BLK                                                        ALTLIB
60  6130777775               COMP        SB3     -2                                                         ALTLIB
                43106                    MX1     6                                                          ALTLIB
61  5123000032 +             COMPA       SA2     NWD+B3             CHECK TO SEE IF                         ALTLIB
                C302CCCC67 +             ZR      X2,CLGO            NAME IS LEFT JUSTIFIED                  ALTLIB
62  11621                    COMPA1      BX6     X2*X1                                                      ALTLIB
        0316CCCCC4 +                     NZ      X6,COMPA2                                                  ALTLIB
```

```
                     20206                LX2    6                                                  ALTLIB
 63  0400000062 +                         EQ     CCMPA1                                             ALTLIB
 64  10622                      CCMPA2    BX6    X2                                                 ALTLIB
           5163000032 +                   SA6    NWD+B3                                             ALTLIB
 65  0400000067 +                         EQ     CLGC                                               ALTLIB
 66  6133000001                 CONT      SB3    B3+1                                               ALTLIB
                0400000061 +              EQ     CCMPA                                              ALTLIB
 67  0430000076 +               CLGO      EQ     B3,B0,WORLD                                        ALTLIB
                6143000001                SB4    B3+1                                               ALTLIB
 70  0440000073 +                         EQ     B4,B0,TAPE2                                        ALTLIB
                5140000002                SA4    2                                                  ALTLIB
 71  73540                                SX5    X4                                                 ALTLIB
           5140000030 +                   SA4    V1                                                 ALTLIB
                     10644                BX6    X4                                                 ALTLIB
 72  53650                                SA6    X5                                                 ALTLIB
           0400000066 +                   EQ     CONT                                               ALTLIB
 73  5140000003                 TAPE2     SA4    3                                                  ALTLIB
                73540                     SX5    X4                                                 ALTLIB
 74  5140000031 +                         SA4    V2                                                 ALTLIB
                10644                     BX6    X4                                                 ALTLIB
                     53650                SA6    X5                                                 ALTLIB
 75  0400000066 +                         EQ     CONT                                               ALTLIB
 76  5110000032 +               WORLD     SA1    NWC                                                ALTLIB
                5120000030 +              SA2    V1                                                 ALTLIB
 77  15312                                BX3    -X2*X1                                             ALTLIB
           0313000102 +                   NZ     X3,CX                                              ALTLIB
100  7160000001                           SX6    1                ZERO INDICATED LGO                ALTLIB
                56610                     SA6    B1               PRESENT-LEAVE FET ALONE           ALTLIB
101  0400000001 +                         EQ     WORDS                                              ALTLIB
102  5120000004                 OX        SA2    4                                                  ALTLIB
                73420                     SX4    X2                                                 ALTLIB
103  7130000003                           SX3    3                                                  ALTLIB
                36613                     IX6    X1+X3                                              ALTLIB
                     53640                SA6    X4                                                 ALTLIB
104  0400000001 +                         EQ     WORDS                                              ALTLIB
105                                       END                                                       ALTLIB

                     37300    STORAGE USED              138 STATEMENTS        29 SYMBOLS
                              6400 ASSEMBLY           0.778 SECONDS           75 REFERENCES
```

Subprogram CRE

CRE is a COMPASS subprogram that creates the File Environment Tables used in ALTLIB. The File Environment Tables are created to facilitate the use of a common data buffer for all files and to use less storage. All four files that are created by CRE have the same buffer area BUF.

A CRE listing follows.

```
                                        IDENT  CRE                                                                  ALTLIB
                                        LIST   M,S
                                    *       THIS PROGRAM CREATES FETS NEEDED FOR ALTLIB
                                        LIST   G                                                                    ALTLIB
                                        ENTRY  CRE                                                                  ALTLIB
                                        USE    /TIC/                                                                ALTLIB
0                                        BUF    BSS    5121                                                         ALTLIB
                                        USE    *                                                                    ALTLIB
                                        USE    /INDL/                                                               ALTLIB
0                                        INDEXL BSS    501                                                          ALTLIB
                                        USE    *                                                                    ALTLIB
0  032205000CCCC00000144                 NAME   VFD    42/0LCRE,18/100                                              ALTLIB
                     12001               L1     EQU    5121                                                         ALTLIB
                       765               L2     EQU    501                                                          ALTLIB
1                                        FILE1Q FILEB  BUF,L1                                                       ALTLIB
                         3          SCP=2C  SET      3                                                            FILEB   .1
                         0          SCP=2R  SET      C                                                            FILEB   .1
1                                        SCP=20 FILE1Q,BUF,L1,(),(),(),(),(),(),(),()                              FILEB   .1
1  061114053421000000C3                  FILE1Q    VFD      42/0L*FILE1Q,18/SCP=2C                                 SCP=20  .2
                         C          SCP=DIS SET      C                                                            SCP=20  .2
                         0          SCP=DTY SET      C                                                            SCP=20  .2
                         0          SCP=2L  SET      C                                                            SCP=20  .2
                         0          SCP=UPR SET      C                                                            SCP=20  .2
                         0          SCP=EPR SET      C                                                            SCP=20  .2
                         0          SCP=MLR SET    0                                                  120370L515SCP=20  .2
                         0          SCP=UBC SET    0                                                  120370L515SCP=20  .2
                                        IFC      NE,***                                                           SCP=20  .2
                                        ENDIF                                                                     SCP=20  .2
2                                        CRG      FILE1Q+1                                                         SCP=20  .2
2  00000000                              VFD       12/SCP=DTY,1/SCP=2R,1/,1/SCP=UPR,1/SCP=EPR,8/                 SCP=20  .2
         CCCCCCCCCCCC C                  VFD      12/SCP=DIS,6/SCP=2L,18/BUF                                       SCP=20  .2
3  CCCCCCCCCCCCCCCCCCCC C                VFD      60/BUF                                                           SCP=20  .2
4  CCCCCCCCCCCCCCCCCCCC C                VFD      60/BUF                                                           SCP=20  .2
5  CCCCCCCCCCCCCCC12001 C                VFD      60/BUF+L1                                                        SCP=20  .2
6                                        ORG      FILE1Q+5+SCP=2L                                                  SCP=20  .2
6                                        BSS      C                                                                SCP=20  .2
                                        ENDM                                                                      SCP=20  .2
                                        ENDM                                                                      FILEB   .1
6                                        FILE2Q FILEB  BUF,L1                                                       ALTLIB
                         3          SCP=2C  SET      3                                                            FILEB   .1
                         C          SCP=2R  SET      C                                                            FILEB   .1
6                                        SCP=20 FILE2Q,BUF,L1,(),(),(),(),(),(),(),()                              FILEB   .1
6  061114053521CCCCCCC3                  FILE2Q    VFD      42/0L*FILE2Q,18/SCP=2C                                 SCP=20  .2
                         0          SCP=DIS SET      C                                                            SCP=20  .2
                         C          SCP=DTY SET      C                                                            SCP=20  .2
                         0          SCP=2L  SET      C                                                            SCP=20  .2
                         0          SCP=UPR SET      C                                                            SCP=20  .2
                         0          SCP=EPR SET      C                                                            SCP=20  .2
                         C          SCP=MLR SET    0                                                  120370L515SCP=20  .2
                         C          SCP=UBC SET    0                                                  120370L515SCP=20  .2
```

```
                                        IFC       NE,***                                                    SCP=20   .2
                                        ENDIF                                                               SCP=20   .2
 7                                      ORG       FILE2Q+1                                                  SCP=20   .2
 7  00000000                            VFD        12/SCP=DTY,1/SCP=2R,1/,1/SCP=UPR,1/SCP=EPR,8/           SCP=20   .2
          0000000000000 C               VFD       12/SCP=DIS,6/SCP=2L,18/BUF                                SCP=20   .2
10  0000000000000000000000 C            VFD       60/BUF                                                    SCP=20   .2
11  0000000000000000000000 C            VFD       60/BUF                                                    SCP=20   .2
12  0000000000000012001 C               VFD       60/BUF+L1                                                 SCP=20   .2
13                                      ORG       FILE2Q+5+SCP=2L                                           SCP=20   .2
13                                      BSS       C                                                         SCP=20   .2
                                        ENDM                                                                SCP=20   .2
                                        ENDM                                                                FILEB    .1
13                           FILE3Q     FILEB     BUF,L1                                                    ALTLIB
                      3      SCP=2C     SET       3                                                         FILEB    .1
                      0      SCP=2R     SET       0                                                         FILEB    .1
13                                      SCP=20    FILE3Q,BUF,L1,(),(),(),(),(),(),(),()                     FILEB    .1
13  0611140536210000000     FILE3Q        VFD       42/0L*FILE3Q,18/SCP=2C                                    SCP=20   .2
                      0      SCP=DIS    SET       0                                                         SCP=20   .2
                      0      SCP=DTY    SET       0                                                         SCP=20   .2
                      0      SCP=2L     SET       0                                                         SCP=20   .2
                      0      SCP=UPR    SET       0                                                         SCP=20   .2
                      0      SCP=EPR    SET       0                                                         SCP=20   .2
                      0      SCP=MLR    SET     0                                          120370L515SCP=20   .2
                      0      SCP=UBC    SET     0                                          120370L515SCP=20   .2
                                        IFC       NE,***                                                    SCP=20   .2
                                        ENDIF                                                               SCP=20   .2
14                                      ORG       FILE3Q+1                                                  SCP=20   .2
14  00000000                            VFD        12/SCP=DTY,1/SCP=2R,1/,1/SCP=UPR,1/SCP=EPR,8/           SCP=20   .2
          0000000000000 C               VFD       12/SCP=DIS,6/SCP=2L,18/BUF                                SCP=20   .2
15  0000000000000000000000 C            VFD       60/BUF                                                    SCP=20   .2
16  0000000000000000000000 C            VFD       60/BUF                                                    SCP=20   .2
17  0000000000000012001 C               VFD       60/BUF+L1                                                 SCP=20   .2
20                                      ORG       FILE3Q+5+SCP=2L                                           SCP=20   .2
20                                      BSS       C                                                         SCP=20   .2
                                        ENDM                                                                SCP=20   .2
                                        ENDM                                                                FILEB    .1
20                           ALTL95     RFILEB    BUF,L1,(IND=INDEXL,L2)                                    ALTLIB
                      3      SCP=2C     SET       3                                                         RFILEB   .1
                      1      SCP=2R     SET       1                                                         RFILEB   .1
20                                      SCP=20    ALTL95,BUF,L1,(IND=INDEXL,L2),(),(),(),(),(),(),()        RFILEB   .1
20  0114241444400000003     ALTL95        VFD       42/0L*ALTL95,18/SCP=2C                                    SCP=20   .2
                      0      SCP=DIS    SET       0                                                         SCP=20   .2
                      0      SCP=DTY    SET       0                                                         SCP=20   .2
                      0      SCP=2L     SET       0                                                         SCP=20   .2
                      0      SCP=UPR    SET       0                                                         SCP=20   .2
                      0      SCP=EPR    SET       0                                                         SCP=20   .2
                      0      SCP=MLR    SET     0                                          120370L515SCP=20   .2
                      0      SCP=UBC    SET     0                                          120370L515SCP=20   .2
                                        IFC       NE,*IND=INDEXL,L2**                                       SCP=20   .2
25                                      ORG       ALTL95+5                                                  SCP=20   .2
```

```
25  0000000000CCCCCCCCCC0      DATA ,,,,,,,                                                    SCP=20   .2
26  0CCCC0000CCCCC0CCCCC0
27  00CCC0C0CCCCCC0CCC000
30  C000000000CCCCCCCCCC0
31  0CCCCC0C0C0C0CCCCC0C0
32  00C0C0000CCC000CCCCCC
33  CCCC0C0CCCCCCCCCC000
34  00CCCCC0CCCCCCCCCCC0
35                                 SCP=30   ALTL95,(IND=INDEXL,L2)                            SCP=20   .2
                          SCP=M10  MICRO    1,3,*IND=INDEXL,L2*                             SCP=30   .3
                          SCP=M11  MICRO    5,,*IND=INDEXL,L2*                              SCP=30   .3
35                                #SCP=M10# ALTL95,#SCP=M11#                                SCP=30   .3
27                                ORG       ALTL95+7                                        IND      .4
27  000000000007650000000 C       VFD       24D/0,18D/L2,18D/INDEXL                 120370L5IND      .4
                                  IFLT      SCP=2L,3,1                                      IND      .4
                        3  SCP=2L  SET       3                                               IND      .4
                                  ENDM                                                      IND      .4
                                  ENDM                                                      SCP=30   .3
                                  IFC       NE,***                                          SCP=20   .2
                                  ENDIF                                                     SCP=20   .2
21                                CRG       ALTL95+1                                        SCP=20   .2
21  00004000                      VFD        12/SCP=DTY,1/SCP=2R,1/,1/SCP=UPR,1/SCP=EPR,8/  SCP=20   .2
          CCC003CCCCCC C          VFD       12/SCP=DIS,6/SCP=2L,18/BUF                      SCP=20   .2
22  0000C0000CCC0000000000 C      VFD       60/BUF                                          SCP=20   .2
23  CCCCCCCCCCCCCCCCCCCC C        VFD       60/BUF                                          SCP=20   .2
24  00000000CCC0000126C1 C        VFD       60/BUF+L1                                       SCP=20   .2
30                                ORG       ALTL95+5+SCP=2L                                 SCP=20   .2
30                                BSS       C                                               SCP=20   .2
                                  ENDM                                                      SCP=20   .2
                                  ENDM                                                      RFILEB   .1
30                                BSSZ      15                                               ALTLIB
47  CCCCCCCCCCCCCCCCCCCC     CRE  DATA      0                                                ALTLIB
50  76100                         SX1       B0                                               ALTLIB
        10611                     BX6       X1                                               ALTLIB
              5160000005          SA6       5                                                ALTLIB
51  5160000006                    SA6       6                                                ALTLIB
              5160000007          SA6       7                                                ALTLIB
52  5160000010                    SA6       10B                                              ALTLIB
              7110777775 +        SX1       FILE1Q-3                                         ALTLIB
53  5120000001 +                  SA2       FILE1Q                                           ALTLIB
              36612               IX6       X1+X2                                            ALTLIB
54  5160000002                    SA6       2                                                ALTLIB
              7110000003 +        SX1       FILE2Q-3                                         ALTLIB
55  5120000006 +                  SA2       FILE2Q                                           ALTLIB
              36612               IX6       X1+X2                                            ALTLIB
56  5160000003                    SA6       3                                                ALTLIB
              7110000010 +        SX1       FILE3Q-3                                         ALTLIB
57  5120000013 +                  SA2       FILE3Q                                           ALTLIB
              36612               IX6       X1+X2                                            ALTLIB
```

```
60  5160C00004                      SA6    4                                ALTLIB
            711CC00020 +            SX1  ALTLS5                             ALTLIB
61  5120000020 +                    SA2  ALTLS5                             ALTLIB
            43352                   MX3    42                               ALTLIB
                 11632              BX6    X3*X2                            ALTLIB
62  53610                           SA6    X1                               ALTLIB
         36761                      IX7    X6+X1                            ALTLIB
            5170CC00C5              SA7    5                                ALTLIB
63  C4C0000C47 +                    EC     CRE                              ALTLIB
64                                  END                                     ALTLIB
37400     STORAGE USED                221 STATEMENTS        19 SYMBOLS
          6400 ASSEMBLY             1.028 SECONDS          121 REFERENCES
```

Subprogram ILSHFT

ILSHFT is a function written in COMPASS. Its parameters are BUF and N. BUF is a word that is shifted N bit positions in a left circular direction. ILSHFT is used as a positioning technique prior to masking.

An ILSHFT listing is presented on the opposite page.

```
                                IDENT  ILSHFT                                  ALTLIB
                                ENTRY  ILSHFT                                  ALTLIB
                          *     ILSHFT IS A LEFT CIRCULAR SHIFT TO PUT DATA IN A ALTLIB
                          *     RIGHT JUSTIFIED POSITION. IT IS USED NORMALLY WITH ALTLIB
                          *     A MASKING OPERATION.                             ALTLIB
                          *                                                      ALTLIB
                          *                                                      ALTLIB
0  0000000000CC000CC00C0  ILSHFT  DATA   0                                       ALTLIB
1  56120                          SA1    B2          ADDRESS OF SHIFT COUNT     ALTLIB
       63310                      SB3    X1          SHIFT COUNT                ALTLIB
            56210                 SA2    B1          WORD TO SHIFT              ALTLIB
                 22632            LX6    B3,X2       X6 HAS RESULT              ALTLIB
2  0400000CCC +                   EQ     ILSHFT                                 ALTLIB
3                                 END                                           ALTLIB

                   37300  STORAGE USED              14 STATEMENTS      1 SYMBOLS
                          6400 ASSEMBLY          0.140 SECONDS         3 REFERENCES
```

PROGRAM USAGE

Requirements and Performance

The program ALTLIB requires 37 400_8 central memory words of storage.

On the Control Data series 6600 computer system, ALTLIB uses 15 to 60 seconds of elapsed time for most jobs. The following time summary is taken from jobs used in the development of ALTLIB and can be used as a guide to expected performance:

Parameter	Case 1	Case 2	Case 3
Number of overlays in job	6	22	7
Number of subprograms in library	*11	*11	90
Elapsed time, sec	25	44	40

*The length of some of these subprograms was above average (5000_8 to $30\ 000_8$ central memory words).

Control-Card Operation

The program ALTLIB is called into operation by a control card. The control card has three parameters: the user's binary file, the alternate library file, and the object load file (user's program and selected subprograms). The default values for these parameters are LGO, BNFILE, and LGO, respectively. The accepted delimiters for the ALTLIB card are standard SCOPE delimiters.

The following are acceptable forms of control-card calls:

```
ALTLIB.
ALTLIB (LGO)
ALTLIB (LGO, BNFILE)
ALTLIB (,BNFILE)
ALTLIB (LGO,,)
ALTLIB (,TAPEX,)
ALTLIB (,TAPEX, TAPEY)
ALTLIB (,,TAPEY)
ALTLIB (LGO,,LGO)
ALTLIB (LGO, TAPEX, LGO)
ALTLIB (LGO, TAPEX,)
ALTLIB (LGO, BNFILE, LGO)
ALTLIB (LGO, TAPEX, TAPEY)
```

The following sample demonstrates the use of ALTLIB as it might appear with a group of control cards:

```
JOB,1,200,60000.      P0008      90930
USER, DROZDOWSKI, JOSEPH M.
RUN(S)
FETCH (P0094,SPRA01,BINARY)
ALTLIB (LGO, BNFILE, LGO)
SETINDF.
LGO.
EXIT.
DMP(FL)
7
8
9
.
.
.
```

Error Messages

Messages indicating errors are defined in the following list:

Message	Definition
LIBRARY TAPE CONTAINS NO DATA. PLEASE CHECK. ALTLIB IS ENDING WITH NO CHANGES TO YOUR FILE.	The file supplied as parameter 2 of ALTLIB call card is blank. Check out this file.
TABLE OVERFLOW	Table storage has been exceeded. User program is not able to use ALTLIB in present form because of lack of storage. This problem is caused by exceeding storage when adding PIDL, ENTR, and EXTERNAL data or when forming the unique EXTERNALS list in ADDEXT.
PERIOD OR PARENTHESIS MISSING FROM LOAD CARD	Incorrect parameters on ALTLIB card; see discussion of program usage.
READ ERROR	This is a message caused by system malfunction. It should never appear under normal running conditions.
INDEX TABLE OVERFLOW	Library cannot exceed 500 subprograms. This is an arbitrary program limitation chosen when RANDOM ACCESS FILE parameters were set.

Restrictions

The following restrictions are imposed:

(1) Central memory storage for tables of program-identification, entry, and external information is limited to 6000_{10} words.

(2) The alternate library is limited to 500 subprograms.

(3) The following file names cannot be used for requested files in the user's program when using ALTLIB:

FILE1Q
FILE2Q
FILE3Q
ALTL95

GENERAL INFORMATION

ALTLIB is run at NASA Langley Research Center under a modified SCOPE 3.2 system. ALTLIB should run as specified under any 6000 series operating system that Control Data Corporation (CDC) now has in use.

There is one instruction (XJ) appearing in subprogram RCI that is a CDC option. It is used at locations 15, 47, and 62 in RCI. If an installation does not have this option, these instructions should be removed. The necessary code is in RCI to run with these instructions removed. If XJ is in the system being used, this code operates in a passive manner.

Langley Research Center,
National Aeronautics and Space Administration,
Hampton, Va., November 24, 1971.

REFERENCES

1. Anon.: Control Data 6400/6500/6600 Computer Systems SCOPE 3.1 Reference Manual. Publ. No. 60189400 A, Control Data Corp., Feb. 1968.

2. Anon.: Control Data 6400/6500/6600 Computer Systems FORTRAN Reference Manual. Publ. No. 60174900, Revision C, Control Data Corp., c.1969.

NASA-Langley, 1972 —— 8 L-8024

"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

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