**Data Processing Guide for the
Environmental Sciences Division**

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ENVIRONMENTAL SCIENCES DIVISION

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DATA PROCESSING GUIDE FOR THE ENVIRONMENTAL
SCIENCES DIVISION

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ENVIRONMENTAL SCIENCES DIVISION
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Division

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ABSTRACT

STRAND, R. H., R. J. OLSON, K. D. KUMAR, M. L. THARP,
J. A. WATTS, N. A. GRIFFITH, and R. M. ANDERSON. 1977.
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Division. ORNL/TM-5966. Oak Ridge National Laboratory,
Oak Ridge, Tennessee. pp. 58

This data processing guide provides information on the availability and use of computer facilities for Environmental Sciences Division (ESD) personnel. This guide addresses recent data processing developments in ESD, little-known capabilities for handling data and using programs, and illustrates the mechanics of these developments and capabilities. Some of the specific developments are: (a) storing data or source code on tape or disk for insertion into a computer job stream, (b) creating a DECSYSTEM10 file from punched paper tape, (c) data storage and input using a computer terminal with cassette tapes, and (d) generation of microfiche output.

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TABLE OF CONTENTS

	<u>Page</u>
ABSTRACT	v
LIST OF TABLES	ix
LIST OF FIGURES	xi
1. INTRODUCTION	1
1.1 Getting Started	2
1.1.1 Batch jobs on the IBM 360 computers	2
1.1.2 Interactive processing on the DECSYSTEM10	3
1.1.3 Time sharing option (TSO) on the IBM 360/model 75 computer	3
1.1.4 Additional assistance	3
1.2 Keypunching	3
1.3 Data Processing Services	4
1.4 Statistical Consulting	4
2. COMPUTER HARDWARE	5
2.1 Computer Terminals	5
2.2 Computer Telephone Ports	6
3. REMOTE BATCH STATION (RBS) JOB PROCESSING	7
3.1 Stand-alone computing	7
3.1.1 Memory/core	7
3.1.2 Background	9
3.1.3 Peripherals	9
3.1.4 Some special programs	11
3.1.5 MODCOMP job control language (JCL)	12
3.1.6 FORTRAN	12
3.2 Remote Job Entry	14
3.2.1 Routing DECSYSTEM10 Output to the RBS	15
3.2.2 Creating a Card-Image File on the IBM 360	15
3.2.3 Storing Data or Source Code on Magnetic Tape or Disk and Insertion of Data Set Into a Job Stream	16
3.2.4 Procedure for Creating an IBM 360 Data Set from Paper Tape	18
3.2.5 Data Storage and Input Using a Computer Terminal with Cassette Tapes	20
3.2.6 Generation of Microfiche Output	22
3.2.7 Card image output as a punched file from IBM 360 Computers to MODCOMP RBS	28
3.2.8 Data processing examples using SAS	28
3.2.9 Procedure for creating data sets on the DECSYSTEM10 from IBM's Continuous System Modeling Program (CSMP)	35
3.2.10 Computer Graphics using DISSPLA	36
4. DATA PROCESSING SOFTWARE	42

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LIST OF TABLES

<u>Table</u>	<u>Page</u>
1.1-1 Individuals and Phone Numbers for Reference to Subject Areas in the Environmental Sciences Division	2
3.1-1 Sample MODCOMP JCL for executing a FORTRAN program on the MODCOMP	13
3.2-1 Sample computer program for generating data on microfiche using SAS and LCOM	23
3.2-2 Commands for establishing an interactive TSO/SAS session using SAS 76.4	30
3.2-3 A sample execution of TSO/SAS interactive (underscored materials are user entered; each line of entered material is terminated with a carriage return)	31
3.2-4 Logical sequence of program and control statements for executing a batch FORTRAN program with DISSPLA plotting .	38

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LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
3.1-1	Environmental Sciences Division Remote Batch Station Hardware	8

DATA PROCESSING GUIDE FOR THE ENVIRONMENTAL SCIENCES DIVISION

1. INTRODUCTION

This guide provides information on the availability and use of computer facilities for Environmental Sciences Division (ESD) personnel. It is an updated and revised replacement to the first edition (ORNL/TM-4910, Strand et al., 1975). The first edition presented many of the mechanical aspects of how to obtain access to the computing facilities. Recently, the Computer Sciences Division (CSD) has published the CSD Programmer's Notebook (available from R. Graham, 3-3502) which presents the "how to" information on accessing the computers. In order to minimize duplication of CSD's work, this report addresses data processing developments in the Environmental Sciences Division and illustrates the mechanics of these developments, citing the Programmer's Notebook where appropriate.

Data processing is becoming an increasingly important tool in environmental research; at the same time, computing techniques and computer equipment continue to change at a rapid rate. The current computer facilities available to ESD personnel are: (1) three main computers located in Building 4500 at X-10 -- the DECSYSTEM10, the IBM 360 model 75, and the IBM 360 model 91 and (2) IBM 360 model 195 and IBM 370 model 155 computers at K-25. Each computer has its own peculiar characteristics and functions, requiring knowledge of the operating procedures for each. The DECSYSTEM10 provides interactive terminal capabilities, batch processing, and serves as a communications link to the IBM 360 models 75 and 91 computers. The IBM 360 models 75 and 91 primarily process batch computer jobs, with the 360 model 91 being a larger, faster machine. The 360 model 75 handles most of the magnetic tape jobs and certain IBM-compatible interactive computer terminal functions such as IBM's Time Sharing Option (TSO) and local textual interactive search programs (ORLOOK and RECON). (See Chapter 1 of Programmer's Notebook for more details on computing facilities.)

The Environmental Sciences Division has a Remote Batch Station (RBS) with 2 card readers, 2 line printers, 2 tape drives, disks, and other equipment to facilitate submitting and retrieving jobs to and from the main computers. This station has a MODCOMP II computer as a central processor. Stand-alone computing is available on this computer on a limited basis. In addition to the RBS, the Environmental Sciences Division has a number of teletype terminals in Buildings 2001, 2024, 3017 and 3504 to access the computers at X-10 and K-25. We intend that this guide will help orient and direct computer users to the available computer facilities and their required access procedures. We welcome suggestions for items to include in future updating to make the guide more useful to ESD personnel.

1.1 Getting Started

The individuals cited in Table 1.1-1 provide a reference for questions on certain subject matters related to data processing. This section outlines steps required by new users to fulfill accounting requirements for the Computer Sciences Division prior to submitting jobs to the computers. Chapter 1 of the Programmer's Notebook gives additional information.

Table 1.1-1. Individuals and Phone Numbers for Reference to Subject Areas in the Environmental Sciences Division.

Subject Area	Person	Phone
Computer Equipment	N. A. Griffith	3-6422/3-1110
Data Management Coordinator	R. H. Strand	3-6012
ESD Computer Manuals Library	R. M. Anderson	3-6012
Geographic Data Bases	R. J. Olson	3-6012
EDFB Information Center	J. A. Watts	3-0396
Programming Assistance	M. L. Tharp	3-0368
Remote Batch Station	N. A. Griffith	3-6422/3-1110
Statistical Consulting	J. J. Beauchamp	3-0368/3-7113

1.1.1 Batch jobs on the IBM 360 computers

- Obtain a computer charge (request) number from the tape librarian, 3-1214. You will be asked for a project account number, a brief title for the general subject of the project, and the ESD division number (3380) in addition to your name, building, and phone number.
- Obtain user (name) initials from the computer center dispatcher, 3-0205. You will be asked for the charge number obtained above.
- Obtain manual from John Carpenter, 3-1703: CSD Programmer's Notebook
- Computer manuals are available for reference in Room 226 of Bldg. 2001. (See Table 1.1-1 for contact person).

1.1.2 Interactive processing on the DECSYSTEM10

- Utilize a terminal to print an application form by dialing one of the DECSYSTEM10 telephone numbers listed in section 2.2, attaching phone to acoustical coupler on the terminal, depressing carriage return, and entering HELP APPLY followed by a carriage return. Complete the resulting form according to the instructions and send it to the indicated address. A project programmer number (e.g., 6200,21) and a password will be mailed which will allow you to access the DECSYSTEM10.
- Suggested manuals for the DECSYSTEM10 are currently available from John Carpenter, 3-1703:
 - DECSYSTEM10 Operating System Commands
 - DECSYSTEM10 TECO and F-10 Handbooks
- DECSYSTEM10 Hardware and Systems Software problems may be directed to Programming Assistance (3-0177) or Duane Winkler (3-0177).

1.1.3 Time sharing option (TSO) on the IBM 360/model 75 computer

- Initiate a TSO account by calling 3-6221. You will need the charge number obtained above.
- Suggested IBM manuals available from Bob Graham, 3-3502:

<u>Subject</u>	<u>Manual No.</u>
TSO Command Language Reference	GC28-6732
TSO Terminal User's Guide	GC28-6763

1.1.4 Additional assistance:

A nearly complete set of computer manuals is maintained in room 226 of Building 2001 for reference by Division users. Personal copies of any of these manuals can be purchased from CSD by calling Bob Graham, 3-3502 (IBM material only), or John Carpenter, 3-1703 (non-IBM material). Computer Sciences Division has a programming assistance (PA) office (3-0177) located in Building 4500N which is open from 8:00 to 12:00 in the morning and from 1:00 to 4:00 in the afternoon (See Table 1.1-1 for Environmental Sciences Division PA).

1.2 Keypunching

Keypunch services are provided by CSD. Forms for coding material to be keypunched can be obtained from the Division computer manuals contact in Table 1.1-1 or they may be ordered from Stationery Stores in Building 7000 area. A "Request for Services" form (UCN-1010) for

requesting the coded forms to be used as source material for keypunchers is available from the Computer Dispatcher (3-0205), or Stationery Stores; this completed form must accompany the material to be keypunched. These materials are then usually transferred to the Key-punch Services by placing them in the computer courier service "out" box located in your building. If a large volume of coded keypunch sheets are sent to Keypunch services, a copy of the keypunch sheets should be made for backup in case original sheets are lost before cards are obtained. The keypunched cards and original coding sheets will be returned to the user in the computer courier service "in" box.

For users wishing to do limited keypunching, keypunches are provided adjacent to Room 121, Building 2001, and in Room 18, Building 3017.

1.3 Data Processing Services

Many investigators have some background in computer programming, and we encourage them to do their own programming. However, for those with extensive data processing requirements, applications programming support is available from CSD on a contract basis. The amount of programming requested from CSD depends on the requirements of the project and the computer programming funds available within the project. This computer programming estimate should be made jointly by the investigator, project supervisor, and ESD Data Management Coordinator (Table 1.1-1). Once the data processing requirements have been defined and justified and the funding has been secured, then the appropriate person(s) can be contacted to perform the work. ESD project managers must then review the computer charges to their accounts to ensure that charges fall within budget constraints.

In addition to these arrangements, a programming assistant is available to ESD members for consultation (See Table 1.1-1). This person provides assistance on programming problems to ESD computer users and performs limited data processing services; that is, this person does not become involved in projects that would require extensive amounts of time over long periods. Please make an appointment for computer programming consultation.

1.4 Statistical Consulting

Statistical support is currently obtained from the Mathematics and Statistics Research Department in CSD. A statistician assigned to the Division from this Department is available on Tuesday from 9:00 to 3:00 and Thursday 9:00 to 12:00 (see Table 1.1-1). Individuals are encouraged to contact this person prior to performing an experiment or conducting a field survey to ensure adequate statistical design. Please make an appointment for statistical consulting in order to avoid scheduling conflicts. If a large amount of data will be generated in the

project, consultation with the ESD Data Management Coordinator may eliminate the need to code and transcribe the initial observations to data sheets for computer processing and prevent unnecessary time delays.

2. COMPUTER HARDWARE

ESD currently has eight small digital computers in addition to the Remote Batch Station (RBS) facility. These minicomputers have been acquired for specific data acquisition and reduction functions. For users interested in the applications these computers are suited for, see the division computer hardware contact in Table 1.1-1. Capital equipment money can be obtained for computing hardware, and the Data Management Coordinator (Table 1.1-1) should be contacted by the program or project manager if the program or project has a need for computing hardware.

2.1 Computer Terminals

The Environmental Sciences Division has computer terminals for users who desire to communicate with a computer via a telephone transmission line. These terminals are summarized in the table below as to type, and maximum transmission speed (in characters per second). The exact location of each of these terminals varies according to the current user. Space limitations are such that no centralized area for terminals can be designated. (For contact person on exact locations and scheduling information see the computer equipment contact in Table 1.1-1).

<u>Terminal Type</u>	<u>Max. Speed (cps)</u>
TELETYPE	10
Texas Instruments (TI)	
Model 725	30
TI Model 733 ASR	30
TI Model 735	30
TI Model 745	30
IO Device Model 320	30
TEKTRONIX MODEL 4014 (CRT)	1200
with Hard Copy	
Attachment (4610)	
TEKTRONIX MODEL 4012 (CRT)	30

Print paper for these devices is stored in Room 104, Building 2001 for TELETYPES, Room 121, Bldg 2001 for TI devices, Room 119, Building 2001

for TEKTRONIX hard copy device. IO devices use standard printer paper. Recycle paper from computer batch runs should be used for these terminals.

2.2 Computer Telephone Ports

Certain telephone numbers are available as computer ports into the IBM 360/model 75 or DECSYSTEM10. The following is a tabulation of the telephone numbers, the computer and time sharing system they access, and the data transmission speed (in characters per second):

TELETYPE Compatible

<u>Telephone Number</u>	<u>System</u>	<u>Speed (cps)</u>
3-1011	TSO 360/75	10
3-1051	TSO 360/75	30
3-1881	DECSYSTEM10	10/30
3-1071	DECSYSTEM10	10/30
3-1031	DECSYSTEM10	10/30
3-1061	DECSYSTEM10	10/30

IBM 2741 Compatible

<u>Telephone Number</u>	<u>System</u>	<u>Speed</u>
3-1001	TSO 360/75	15
3-1021	TSO 360/75	15
3-1041	TSO 360/75	15

3. REMOTE BATCH STATION (RBS) JOB PROCESSING

The Remote Batch Station (RBS) consists of a Modular Computer System MODCOMP II/25 computer connected via telephone lines to the main computers (Fig. 3.1-1). The system is used to transmit jobs and data to the central computers and to receive output from the central computers. It has the capability to perform utility operations such as editing magnetic tapes and listing cards and limited capacity to execute computer programs written in FORTRAN. The system includes a 200 line-per-minute printer, a 1200 line-per-minute printer, a 200 card-per-minute and a 1000 card-per-minute card reader, disk facilities, a high-speed paper-tape reader and punch, a seven-track and a nine-track magnetic tape unit, 64K of core memory, and associated processors and controllers.

The RBS has significantly decreased the turn-around time (time between job submission and printing of results) for batch processing of ESD jobs by eliminating the transportation time required by the courier service. The MODCOMP performs data editing, listing, and processing independent of the main computers and will allow preprocessing of data with fast turnaround time and low cost.

The RBS has the capability to communicate directly with the IBM 360 computers via the CC70/8 which is a telecommunications link that performs functions similar to the DECSYSTEM10 in getting jobs into the IBM 360 queue.

3.1 Stand-alone Computing

The MODCOMP II is a minicomputer and can be used as a stand-alone computer. As a stand-alone computer it can be used for

- (1) storing and editing of numeric and textual data. (See the insert feature in section 3.2.3),
- (2) creating a user library containing programs written by users, and
- (3) compilation and execution of user written FORTRAN programs.

Before the stand-alone features of the RBS can be used, it is necessary to understand the major features of the RBS organization.

3.1.1 Memory/core

The MODCOMP II has 64K of memory. The system programs are allocated 20K, with remaining 44K available to users. If the communication link to the main computers is open, the foreground system for operating this link--the HASP work station--is allocated 10K. The remaining 34K is available to the user for stand-alone computing. If the need arises, the HASP work station can be aborted and an additional 10K will be made

Fig. 3.1-1. Environmental Sciences Division remote batch station hardware.

available to the user. This additional core is available only during non-prime time periods (between 5 P.M. and 6 A.M. weekdays and on weekends, by arrangement only).

3.1.2 Background

The user addresses the machine through a background task. A task is a system program. There are two main backgrounds namely (i) B background and (ii) C background.

The B background is always resident in core (unless the operator aborts it), while the C background is activated when needed. Both the backgrounds have the same features. However, the B background is used primarily by the computer operator for management of the peripherals. The main operator console and the main card reader (fast card reader) are assigned to the B background. The slow card reader and the second console are assigned to the C background. When both B and C background are active, the 34K memory is portioned between the two in the desired manner (only the operator has the authority to change the core assignment).

The user can communicate with the backgrounds (either B or C - though in the following paragraphs we will assume that one is using the C background) by means of the MODCOMP Job Control Language (JCL). When the user is communicating with the background, he is said to be in C background monitor and by issuing the proper commands (see below under source editor for example) the control is transferred to either other system programs or to user supplied programs.

In principle, all the features of the machine are available to the user. However, certain peripherals (like moving head disk #2) are protected and can be used only by the system operator. Sample MODCOMP JCL for assigning the 7 TRK tape drive is:

```
$ASS 9=MT1.
```

This statement, entered from a terminal connected to the MODCOMP, assigns the logical unit number 9 to the 7 track tape drive. Similarly, \$ASS 9=MT0 will assign the logical unit number 9 to the 9 track tape drive. Now the FORTRAN program can refer to the tape in the usual format.

For the assignment statements shown above, the logical record length is 80 characters.

3.1.3 Peripherals

The hardware of the RBS can be assigned by the user to his programs by using the proper MODCOMP JCL.

3.1.3.1 Tape drives

There are 7 and 9 track (TRK) tape drives available to users. Data are usually stored in compressed format (no trailing blanks on a record) on tapes. The MODCOMP will automatically uncompress the data records when they are read.

3.1.3.2 Direct-access files

There are 4 moving-head (MH) disks on the MODCOMP. They are numbered 0, 1, 2, and 3. MH2 (moving head 2) is used by the system and cannot be accessed by the user. MH1 and MH3 and approximately 80 tracks on MH0 are available to users.

Each MH pack has 406 tracks, which have been partitioned into smaller segments of varying sizes. These segments can be addressed by their symbolic names. Contact the RBS operator for a complete list of symbolic names. The partitions of MH1 and MH3 are as follow:

<u>No. of tracks</u>	<u>No. of segments</u>
25	14
31	1
50	7
56	1
100	3
106	1
200	1
206	1
406	1

The MODCOMP JCL

\$ASS 9=DC1

will assign the 2nd 100 track segment of MH3 to the program with a logical unit number of 9. Observe that the larger segments overlap the smaller segments; hence, the user must be careful not to reassign the tracks that are already in use.

3.1.3.3 Printers

The printer can be used by all the programs. For example the MODCOMP JCL

\$ASS 6=L0

will assign the printer the logical unit number 6.

3.1.3.4 Card reader

The slow card reader (200 cps) is assigned to the C background. The JCL

\$ASS 5=SI

will assign the card reader the logical unit number of 5.

3.1.4 Some special programs

Under B and C backgrounds, two special programs of interest are source editor (SED) and library Update (LIB)

3.1.4.1 SED

As the name implies, SED is useful for editing of data. The SED is executed by entering the command:

\$EXE SED.

On the execution of this command, control is transferred to the SED program. The SED commands (see Chapter 18 MODCOMP system Processors for details) do not start with the \$.

The SED can be used for

- (1) listing of data from cards, tapes, and disk packs.
- (2) creating tape and disk files,
- (3) interactive data editing, and
- (4) general data management.

An example of using SED for copying data from a 7-track tape to a 9-track tape is

```
$JOB↓
$EXE SED↓
ASS SI=MT1↓    (SI=source input)
ASS SO=MT0↓    (SO=source output)
COPY↓
EXIT↓
$EOJ↓
```

The SED can be used for changing records, deleting records, merging of two or more data sets, etc.

3.1.4.2 LIBRARY UPDATE (LIB)

The LIB is similar to SED except that LIB is used for the management of binary files. An example of a binary file is a compiled version of a

FORTRAN subroutine. The LIB is used for deleting, adding, or merging such files. (For more details see Chapter 14 MODCOMP System Processors.)

3.1.5 MODCOMP Job Control Language (JCL)

The MODCOMP Job Control Language is used to communicate with the machine. In the preceding paragraphs some examples of the MODCOMP JCL were shown. The MODCOMP JCL is much simpler than the IBM JCL, since the MODCOMP II is a much simpler machine. For details on MODCOMP JCL refer to Chapter 5 MODCOMP System Processors.

In Table 3.1-1 a sample MODCOMP JCL stream is shown. This JCL stream will compile, link edit and execute a user-supplied FORTRAN program. In the first step, the FORTRAN deck is read and compiled. In step 2, the program is link edited with the MODCOMP FORTRAN library and a user library (DC1). In the last step, the program is executed. The program communicates with the card reader (5=CR), printer (6=LO), the 7 track tape (7=MT1) and the disk partition DC2(8=DC2).

It is not necessary to write all the above MODCOMP JCL each time a program is run. Just as on the IBM, procedures can be set up on the MODCOMP and executed by invoking the proper name.

3.1.6 FORTRAN

MODCOMP II has a FORTRAN IV compiler. This compiler has most of the features of the IBM FORTRAN. A complete description of the MODCOMP FORTRAN is given in Chapter 9 of MODCOMP System Processors. Due to the limited core that is available for processing of the program, the user must become familiar with the concept of overlay. Overlay is a mechanism for using the same core area for processing different subroutines. An overlaid subroutine is brought into core only when it is needed. There are several rules that must be adhered to in using the overlays. These are discussed in detail in Program Chaining and Overlays, Chapter 12, MODCOMP System Processors.

The user must realize that (a) the largest integer number that can be handled by the machine is $2^{15}-1$ (b) the accuracy of the machine is not as high as an IBM and (c) the MODCOMP is slower than the IBM. Sometimes it might be necessary to store large vectors on disks or tapes and bring them into core only when needed. This will increase the execution time.

The MODCOMP does not have a card punch at the present time. If the program outputs data that must be punched, the user can use the magnetic tapes or disks in lieu of cards. This file can then be relayed to Bldg. 4500N for punching cards or kept as a MODCOMP file, listed and later used in a program.

Table 3.1-1. Sample MODCOMP JCL for executing a FORTRAN program on the MODCOMP

```
$JOB
$ASS SI=CRC SO=SCA LO=LO
$EXE FRX
```

FORTRAN SOURCE DECK

ASSEMBLE STEP

```
$$
$WEOF SO
$ASS SI=SCA BO=SCB LO=NO FM=FM
$EXE MAC
$WEOF BO
$ASS BI=SCB BO=SCA UL=DC1
$EXE EDIT
```

COMPILE STEP

LINK EDIT COMMANDS

LINK EDIT STEP

```
$WEOF BO
$ASS BI=SCA
$ASS 5=CRC 6=LO 7=MT1 8=DC2
$EXE MAIN,BI
```

DATA CARDS

GO STEP

```
$$
$EOJ
```

3.2 Remote Job Entry

Computer card decks can be submitted to the main computers for batch processing either via the courier service to Building 4500 or through the Remote Batch Station (RBS) facility. Computer output can be either returned by the courier service or routed to the RBS for printing. This section describes the various capabilities of the RBS to enter card decks into the IBM 360 queue, to create files from cards, to list or duplicate card decks, or to print computer output files. The RBS is located in Room 121, Building 2001 (see Table 1.1-1 for contact person).

Users submitting computer jobs that require tapes or disks must supply the appropriate IBM Job Control Language (JCL) in a specific sequence. The required JCL cards are detailed in the CSD Programmer's Notebook, Chapters 2, 3 and 4. A system of classifying jobs for scheduling them into the execution queue is also presented. It is important to adhere to the rules for coding of JCL and the order of the JCL cards as described in the Programmers Guide. Even a single space or mispunched character, especially in the JOB card, can mean complete failure of a job with no subsequent printout.

Since the RBS does not have a card punch, any jobs that generate punched card output must include a route card so that the punched cards will be produced at the main facility, Building 4500N. An example of the job card and route cards that would produce output on the RBS printer and punch cards at Building 4500N from any job that is not submitted through the RBS is given below: (Note the number zero has a slash through it when used in computer examples throughout this manual--the letter O does not.)

```
//ABC1 JOB (12345),'STRAND BLDG 2001'  
/*ROUTE PRINT REMOTE10  
/*ROUTE PUNCH LOCAL
```

Those jobs submitted through the RBS do not require the "ROUTE PRINT" card to have printed output occur on the RBS printers. The RBS has two line printers -- an upper case only and an upper or lower case printer. To print upper/lower case on the RBS the user must supply the following cards:

```
//ABC1 JOB (12345),'STRAND BLDG 2001'  
/*ROUTE PRINT REMOTE10  
/*OPTIONS FORM=1001
```

The JOB card must be replaced with one unique to the user. If the OPTIONS card is left off, the printed output will be upper case only.

3.2.1 Routing DECSYSTEM10 output to the RBS

Files existing on the DECSYSTEM10 may be printed on the RBS printer by coding the following information while logged onto the DECSYSTEM10 via a terminal (↓ represents a carriage return on the terminal and characters that are underlined are those generated by the system to prompt the user):

```
.R SUBMIT↓
/*RELAY PRINT REMOTE10           name bldg #↓
*=filename.extension↓
*ENDINPUT↓
↓
```

The "filename.extension" is to be replaced by the user's filename and file extension (see DECSYSTEM10 Programmer's Notebook, Chapter 17 for help on proper extensions). The character "/" is coded in column 1; the word "PRINT" begins in column 10; and the word "REMOTE10" begins in column 16. The person's name and destination of output begin in column 42.

More complete routing and relaying information is described in Chapter 4 of the Programmer's Notebook. This chapter also describes the options for obtaining single or multiple listings or copies of card decks with instructions for special print forms. Other useful procedures in this chapter are saving IBM 360 output on your DECSYSTEM10 files, creating a DECSYSTEM10 file using the /*RELAY command, and how to access these files.

3.2.2 Creating a card-image file on the IBM 360

3.2.2.1 Semi-permanent direct access files

Persons wishing to create a file on the IBM 360 disk space may do so by submitting a job containing IBM 360 JCL cards coded according to the description given in the sample program below (see Chapter 4 Programmer's Notebook for description of disk files):

```
//ABC1 JOB (12345),'STRAND 2001'
/*CLASS CPU91=10S,REGION=270K
// EXEC PGM=IEBGENER
//SYSPRINT DD SYSOUT=A
//SYSIN DD DUMMY
//SYSUT2 DD UNIT=SPDA,DISP=(NEW,CATLG),DSN=T.ABC02345.name,
// SPACE=TRK,(50,5),RLSE),DCB=(RECFM=FB,BLKSIZE=7200,LRECL=80)
//SYSUT1 DD *
[data deck]
/*
//
```

The information on the JOB card must refer to the user's job number and charge number (see Section 1.1), destination of the printed output and user's name. The information following the DSN and SPACE parameters are determined from the description in Chapter 4 of the Programmer's Notebook. The duration the data set remains on the disk depends primarily on the space required. Details on time and space requirements are also in the Programmer's Notebook.

3.2.2.2 Permanent direct access files

Division personnel wishing to create files on disk for access by programs executed on the Bldg. 4500N IBM 360 computers can do so by following the instruction below. This disk space is to be used for files which require frequent access by one or several users. However, space on the disk device described below is limited and as the disk becomes filled, it will become increasingly important to use this space efficiently. The IBM JCL and program are coded as follows:

```
//ABC1 JOB (12345),'STRAND 2001'
//*CLASS CPU91=10S,REGION=270K
//S1 EXEC PGM=IEBGENER
//SYSPRINT DD SYSOUT=A
//SYSIN DD DUMMY
//SYSUT2 DD UNIT=3330,VOL=SER=DISKAA,DISP=(NEW,CATLG),
// DCB=(LRECL=80,BLKSIZE=800,RECFM=FB),
// DSN=ENVSCI.ABC12345.name,SPACE=(TRK,(50,5),RLSE)
//SYSUT1 DD *
[data deck]
/*
//
```

In this example, the letters ABC in the DSN parameter must correspond to the user's job name initials on the job card. These letters are unique to each user. The numbers 12345 must correspond to a user's computer charge number. The "name" must be 1-8 characters long and be unique to a user's file. The "SPACE=" parameter, designated by the user, indicates the space required for storing the data. See ESD Programming Assistance (Table 1.1-1) for help in increasing this quantity.

3.2.3. Storing data or source code on magnetic tape or disk and insertion of data set into a job stream

3.2.3.1 Storing data or source code on tape or disk

Remote Batch Station users now have the option to store 80-column card images on magnetic tape or disk using the MODCOMP. The tape or disk files created differ from IBM or DECSYSTEM10 files but can be inserted

into the stream of a computer job being submitted through the RBS card reader. This eliminates reading in large program or data card decks repeatedly. It also allows a user to convert a CSD defined "set-up" job (a job requiring a magnetic tape at the main computer) to a "non-setup" job by reading the data to be used by a program from a tape or disk at the RBS. The magnetic tape or disk file is written in unblocked 80-column card images using ASCII format and can be either source or data decks. Although hex decks cannot be accommodated by the MODCOMP, this option may be added if there is sufficient interest.

Magnetic tape or disk files can be created by bringing the cards to the RBS and requesting the service. At the present time, limited storage space requires that users store their private tapes in their own offices.

3.2.3.2 Insertion of a data set into a job stream

Accessing a tape or disk file is accomplished by inserting a special card in the deck making up an IBM 360 job stream at the position where the file is to be read. For example:

```
//ABC1 JOB (12345), 'STRAND 2001'
//*CLASS CPU91=30S
// EXEC FORTHCLG
//FORT.SYSIN DD *
@@INS 1,40,MT0
/*
//GO.FT05F001 DD *
[Data Cards]
/*
//
```

Another example executing SAS76 and reading a tape (ddname = DATA) created on the MODCOMP follows:

```
//ABC1 JOB (12345), 'STRAND 2001'
//*CLASS CPU91=10S
//S1 EXEC SAS76
//SAS.DATA DD *
@@INS 1,40,MT0
/*
//SAS.SYSIN DD *
    DATA FROG; INFILE DATA; INPUT ...;
    .   [other SAS statements]
    .
/*
//
```


In the above examples, the statement @@INS 1,40,MT0 instructs the MODCOMP system to insert at that point a file located on magnetic tape transport 0. When the first end-of-file mark is read by the magnetic tape unit, the processing of card input resumes. To submit a job using a MODCOMP tape, simply leave the card deck together with the tape in the Input Box for the RBS. Currently, if more than one file exists on the tape, the operator must be instructed by the user as to what file to position the tape prior to submitting the job.

3.2.4 Procedure for creating an IBM 360 data set from paper tape

Occasionally users may have a need for processing paper tape into a more manageable form, such as magnetic disk or magnetic tape. We will describe how to process a data set on paper tape and handle it through the main computers.

3.2.4.1 Create a file on DECSYSTEM10 from paper tape

Complete a REQUEST FOR SERVICES card (UCN-1010) and send the paper tape with card to the computer dispatcher in Bldg. 4500N by the courier service. An example of the completed REQUEST FOR SERVICES card is shown below. In this example, a file named AU3000 is created in the project programmer area [6200,52]. Each user must make changes to the user name, request number, and project-programmer number to correspond to

REQUEST FOR SERVICES			
IN	NAME	REQUEST NUMBER	OUT
	C. C. COUTANT	14359	
	BUILDING NUMBER 2001	ROOM NUMBER	
	WORK TO BE DONE	DONE BY	COMMENTS
	☐ KEYPUNCH		Please use PIP to read paper tape into 6200,52 using filename AU3000. Please return paper tape.
	☐ REPRODUCE		
	☐ SORT		
	☐ LIST		
	☐ INTERPRET		
	☒ OTHER	DECSYSTEM10	
	DEADLINE (IF URGENT)		

UCN-1010
(23 1-68)

those assigned to the user. The filename must be unique to each file created within a project-programmer area.

3.2.4.2 Obtain a listing of DECSYSTEM10 file created from paper tape

Obtaining a listing of the file after determining that the tape has been read in can be done by either waiting for the paper tape to be returned or logging onto the DECSYSTEM10 and checking the directory to see if the file exists in your disk area, e.g.,

```
._DIR AU3000↓
```

A line printer listing can be obtained from the DECSYSTEM10 line printer by using the command:

```
._Q AU3000↓
```

The listing can be routed to the remote batch station via the IBM 360 system using the following commands (Note: ↓ indicates carriage return):

```
._R SUBMIT↓
/*ROUTE PRINT REMOTE10          COUTANT 2001↓
/*AU3000↓
/*ENDINPUT↓
```

3.2.4.3 Edit the DECSYSTEM10 file created from paper tape

Edit the file to correct errors using either TECO or a special editing program such as LINDEL, a line deletion program for unacceptable values in a given data set. These procedures are documented in the DECSYSTEM10 manuals. Call J. Carpenter, 3-1703 for a copy.

3.2.4.4 Create a temporary file on the IBM 360 system using the edited DECSYSTEM10 file

Create a temporary file on the IBM 360 system using the edited file created in A as input. The example below shows a file created on the DECSYSTEM10 containing the IBM JCL needed to create an IBM 360 file. This DECSYSTEM10 file can be edited and the line following "//SYSIN DD *" modified for each new file created from the paper tape. Items italicized are those which must be changed to correspond to each new filename.

```
._MAKE COUTAN.JOB↓
/*I//CCCA JOB (14359), 'COUTANT,BLDG.2001'↓
/*CLASS CPU91=30S↓
/*ROUTE PRINT REMOTE10↓
// EXEC SPDASCR↓
//SYSIN DD *↓
  T.CCC04359.AU3000↓
/*↓
```

```
// EXEC PGM=IEBGENER↓
//SYSPRINT DD SYSOUT=A↓
//SYSIN DD DUMMY↓
//SYSUT2 DD DSN=T.CCC04359.AU3000,UNIT=SPDA,↓
// DISP=(NEW,CATLG),SPACE=(TRK,(100,5),RLSE),↓
// DCB=BLKSIZE=2048↓
//SYSUT1 DD *↓
= AU3000↓
/*↓
$$
*EX$$
-
.
```

3.2.4.5 Submit the DECSYSTEM10 file to the IBM 360

To submit the job file created above to the IBM 360, type

```
.IBM COUTAN.JOB
```

3.2.4.6 Analyze the IBM 360 file using SAS

We have presented a sample program used for analysis in the Thermal Effects Program in the Division. This series of instructions was also placed into a file on the DECSYSTEM10 for submission, as above, to the IBM 360s. It is important to note the filenames (*italicized items*) which refer to the files created above.

```
[a valid job card goes here]
//*CLASS CPU91=1M
// EXEC SAS76
//SAS.AU3000 DD DSN=T.CCC04359.AU3000,DISP=SHR
//SAS.SYSIN DD *
[SAS STATEMENTS]
TITLE ' THERMAL PREFERENCE OF THE STRIPED BASS TAG 122 28 AUG 75';
DATA TESTSAS; INFILE AU3000;
INPUT HOUR 1-2 MINUTE 3-4 SECOND 5-6 MSEC 8-11;
  Program statements and procedure statements are placed here for
  operating on data set TESTSAS.
/*
//
```

3.2.5 Data storage and input using a computer terminal with cassette tapes

The Division has a remote computer terminal with cassette tape handling capabilities. This terminal is a Texas Instrument Model 733 ASR with

dual cassette tape handlers. We have used this terminal directly connected to the MODCOMP computer as a background terminal for submitting commands, editing files, and receiving output from programs. The cassette tapes allow the user to spool output onto cassettes rather than printing an entire sequence of data values. Following rewind, the data can be selectively played back onto the terminal.

This terminal also can be used as a dial-up terminal, accessing remote computers by telephone connections and by an acoustic coupler attached to the terminal. We will not discuss all the possibilities for dial-up access. Rather we show the procedure for recording onto the magnetic cassette tape of this terminal while logged into the DECSYSTEM10. Then we show how to take the output created on the cassette while logged into the DECSYSTEM10 and reinsert these data into the DECSYSTEM10 creating an online file again. (These procedures were determined through the assistance of C. E. Hammons, formerly of the Computer Sciences Division.)

3.2.5.1 To copy a file from DECSYSTEM10 to cassette TAPE

```

LOGIN ppn+
.password is entered here. The system will print messages
describing new developments and
changes in the DECSYSTEM10.
.TTY PAGE+
.TTY NO FILL
.<CNTRL>S
- place all switches in line mode
- Set the cassette to be recorded to record mode
- Push the rewind button to rewind the cassette
- Push the load button
.TYPE filename+
- Push the record on button
.<CNTRL>Q
- Following the completion of data recording, push the record off
button
- Place all switches in local mode
- Push the record on button
.<CNTRL>Z
.<CNTRL>C
.<CNTRL>S
.<CNTRL>D
-Push the record off button

```

3.2.5.2 To play back cassette tape into DECSYSTEM10 file

```
.LOGIN ppn↓
.TTY TAPE↓
.TTY FILL 2↓
- Place all switches in line mode
- Set cassette to playback mode
- Rewind the cassette tape
- Push the load button
.R PIP↓
*filename=TTY:↓
<CNTRL>Q
- Push the continuous playback button
- Following the last record being transmitted from the tape, type
  the following control characters:
<CNTRL>Z
*<CNTRL>C
<CNTRL>S
<CNTRL>D
.
```

A cassette tape recording device for gathering data in the field on cassette tape is available. The data on tape can then be read into the computer for analysis. The cassette tapes are considerably easier to use and have fewer errors than do paper tape. See computer equipment contact (Table 1.1-1) for information on this device.

3.2.6 Generation of microfiche output

Occasionally investigators will have a need to reduce the volume of paper for a publication or of output generated by a computer program. When appendices are used in publications to provide supplementary information for a publication, e.g., computer program listings or lengthy data files, the volume of materials can be reduced by placement of the information on microfiche. Cost savings for microfiche versus paper output are dependent on the volume of material to be reproduced. Approximately 240 pages of computer printout will fit on a 5x7 microfiche at 48x reduction. Cost evaluation will not be discussed in this note, but the technical aspects of using the Statistical Analysis System (SAS) (Barr, A.J., J. H. Goodnight, J. P. Sall, and J. T. Helwig. 1976. A User's Guide to SAS76. SAS Institute, Raleigh, N.C. 329 pp.) for preparing computer output for reproduction on microfiche will be discussed. It is assumed that the user is familiar with the basic input and output instructions in SAS. Hence, there will be no discussion of the SAS statements other than those used to generate the microfiche. For new staff unfamiliar with SAS, we suggest contacting Division programming assistance (Table 1.1-1) for counseling and advice on generating microfiche with SAS. There are four categories of code within the listing presented in Table 3.2-1 which may be used to

Table 3.2-1. Sample computer program for generating data on microfiche using SAS and LCOM

```

//*NOSEQCARD
//RASCOAL JOB (14840),'STRAND 2001'
//*CLASS CPU91=2M,LINES=2,REGION=270K,SPECIAL=TAPE
// EXEC SAS76
//SAS.REP DD UNIT=3330,DISP=(OLD,KEEP),DSN=ENVSCI.RAS14840.CUSHREP,
// VOL=SER=DISKAA
//SAS.FT04P001 DD UNIT=SYSDA,DISP=(NEW,PASS),DSN=8&T,
// DCB=(RECFM=PBA,LRECL=133,BLKSIZE=1064),SPACE=(CYL,(30,10),RLSE)
//SYSIN DD *
DATA CONTEN;
INFILE CARDS;
INPUT CONTENTS $ 1-80;
CARDS;

```

ORNL/TM-5793

THE TOXICITY OF 35 TRACE ELEMENTS IN COAL TO FRESHWATER BIOTA:
A DATA BASE WITH AUTOMATED RETRIEVAL CAPABILITIES

R. M. CUSHMAN, S. G. HILDEBRAND,
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Table 3.2-1. (continued)

THE FOLLOWING IS A DESCRIPTION OF THE COAL CONVERSION TOXICITY DATA BASE. THE VARIABLES INCLUDED WITHIN THE DATA TABLES AND THEIR DEFINITION ARE INCLUDED BELOW. THE FIRST SET OF VARIABLE DEFINITIONS IS USED IN THE DATA TABLES. THE SECOND SET OF VARIABLE DEFINITIONS IS USED IN THE PERCENT FREQUENCY TABLES.

- VARIABLES USED IN DATA TABLES -

ALK_MAX = MAXIMUM ALKALINITY OF SOLUTION (MG/L)
 ALK_MIN = MINIMUM ALKALINITY OF SOLUTION (MG/L)
 CA_ION = CALCIUM ION CONCENTRATION IN WATER (MG/L)
 CHEMPFORM = CHEMICAL FORM OF ELEMENT
 COMMENTS = COMMENTS ABOUT BIOASSAY
 CONC_MAX = MAXIMUM CONCENTRATION OF ELEMENT (MG/L)
 CONC_MIN = MINIMUM CONCENTRATION OF ELEMENT (MG/L)
 DO_MAX = MAXIMUM DISSOLVED OXYGEN CONCENTRATION (MG/L)
 DO_MIN = MINIMUM DISSOLVED OXYGEN CONCENTRATION (MG/L)
 ELEMENT = ELEMENTAL CONSTITUENT OF COMPOUND IN BIOASSAY
 EXP_END = THE END POINT OF BIOASSAY
 EXP_TIME = THE DURATION OF THE BIOASSAY
 HARD_MAX = MAXIMUM WATER HARDNESS (MG/L)
 HARD_MIN = MINIMUM WATER HARDNESS (MG/L)
 LIFE_STG = THE LIFE STAGE OF THE ORGANISM
 MG_ION = MAGNESIUM ION CONCENTRATION (MG/L)
 ORGANISM = SCIENTIFIC OR COMMON NAME OF ORGANISM
 OUR_REF1 = FIRST REFERENCE NUMBER FROM WHICH TABULATED DATA WERE OBTAINED
 OUR_REF2 = SECOND REFERENCE NUMBER FROM WHICH TABULATED DATA WERE OBTAINED
 OUR_REF3 = THIRD REFERENCE NUMBER FROM WHICH TABULATED DATA WERE OBTAINED
 PH_MAX = MAXIMUM PH VALUE
 PH_MIN = MINIMUM PH VALUE
 RECON_FQ = SOLUTION RECONCENTRATION FREQUENCY
 REF1ORIG = THE FIRST REFERENCE IN WHICH DATA WERE ORIGINALLY REPORTED
 REF2ORIG = THE SECOND REFERENCE IN WHICH DATA WERE ORIGINALLY REPORTED
 REF3ORIG = THE THIRD REFERENCE IN WHICH DATA WERE ORIGINALLY REPORTED
 TDS_MAX = MAXIMUM TOTAL DISSOLVED SOLIDS (MG/L)
 TDS_MIN = MINIMUM TOTAL DISSOLVED SOLIDS (MG/L)
 WATER_TY = TYPE AND SOURCE OF DILUTION WATER
 WTMP_MAX = MAXIMUM WATER TEMPERATURE (DEGREES C)
 WTMP_MIN = MINIMUM WATER TEMPERATURE (DEGREES C)

Table 3.2-1. (continued)

VARIABLES USED IN FREQUENCY TABLES			
ALKMN_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE ALK_MIN
ALKMX_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE ALK_MAX
CA_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE CA_ION
CHEM_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE CHEMPFORM
EXP_T_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE EXP_TIME
DO_MN_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE DO_MIN
DO_MX_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE DO_MAX
HRDMX_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE HARD_MAX
HRDMN_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE HARD_MIN
LIPST_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE LIFE_STG
MG_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE MG_ION
PH_MN_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE PH_MIN
PH_MX_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE PH_MAX
RECFQ_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE RECON_FQ
TDSMX_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE TDS_MAX
TDSMN_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE TDS_MIN
WATTY_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE WATER_TY
WT_MN_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE WTMP_MIN
WT_MX_FQ=PERCENT	FREQUENCY	OF NON-BLANK DATA	FOR VARIABLE WTMP_MAX

TO GIVE THE USER A CONDENSED SUMMARY OF THE AMOUNT OF DATA WHICH IS PRESENT FOR EACH VARIABLE WITHIN THE DATA BASE, WE HAVE SUMMARIZED THIS INFORMATION AS PERCENT FREQUENCY OF NON-BLANK DATA FOR EACH VARIABLE WITHIN EACH ELEMENTAL FORM. PLEASE REFER TO THE TABLE ABOVE FOR VARIABLE DEFINITIONS.

DATA FREQ; INFILE CARDS END=END_SW;
 INPUT ELEM_CRD 11-13 SEQ 14 ELEM \$ 26-27 CONC_MAX 38-45 4 CONC_MIN 28-36 4
 CHEMPFORM \$ 47-66 #2 ORGANISM \$ 16-45 LIFE_STG \$ 47-71 #3 EXP_TIME \$ 16-25
 EXP_END \$ 27-56 WATER_TY \$ 58-78 #4 RECON_FQ \$ 16-35 WTMP_MAX 37-40 WTMP_MIN \$
 42-45
 HARD_MAX \$ 47-56 HARD_MIN \$ 58-67 PH_MAX 69-71 PH_MIN \$ 73-76 #5 CA_ION 16-23
 MG_ION 25-32 DO_MAX 35-39 DO_MIN 41-45 TDS_MAX 47-52 TDS_MIN 54-59 #6 ALK_MAX
 16-25 ALK_MIN 27-36 COMMENTS \$ 38-67 #7 REP1ORIG \$ 16-19 REP2ORIG \$ 21-24
 REP3ORIG \$ 26-29 OUR_REF1 \$ 31-34 OUR_REF2 \$ 36-39 OUR_REF3 \$ 41-44;
 *
 ;

```

      PROGRAM STATEMENTS FOR CALCULATING
      PERCENT FREQUENCIES OF OCCURRENCE FOR EACH
      VARIABLE IN THE DATA BASE ARE INSERTED HERE
  
```

CARDS;
 @@INS 1,40,MT1

Table 3.2-1. (continued)

DATA TABCON; INFILE CARDS; INPUT CONTENTS \$ 1-80;
CARDS;

THE TABLES WHICH FOLLOW ARE FORMATTED SO AS TO CONTAIN THE INFORMATION FOR EACH EXPERIMENT ON A SINGLE PAGE. PAGE NUMBERS ARE IN UPPER RIGHT HAND CORNER OF EACH PAGE. A SINGLE OBSERVATION CONSTITUTES THE INFORMATION FROM ONE EXPERIMENT. BECAUSE THE LENGTH OF A SINGLE LINE WAS TOO GREAT TO FIT ACROSS A PAGE, THE LINE IS CONTINUED BEGINNING APPROXIMATELY HALF WAY DOWN THE SAME PAGE. THUS THE CONTINUATION OF OBSERVATION ONE (LINE ONE) BEGINS HALFWAY DOWN THE PAGE WITH THE VARIABLE WATER_TY. WHERE ONLY A SINGLE VALUE OCCURS EITHER AS A MAXIMUM OR A MINIMUM, A RANGE OF VALUES WAS NOT USED FOR THAT VARIABLE IN THE BIOASSAY TEST CONDITIONS.

```
DATA EFFECTS;
INFILE CARDS END=END_SW;
INPUT ELEM_CRD 11-13 SEQ 14 ELEMENT $ 26-27 CONC_MAX 38-45 4 CONC_MIN 28-36 4
CHEMPFORM $ 47-66 #2 ORGANISM $ 16-45 LIFE_STG $ 47-71 #3 EXP_TIME $ 16-25
EXP_END $ 27-56 WATER_TY $ 58-78 #4 RECON_FQ $ 16-35 WTMP_MAX 37-40 WTMP_MIN $
42-45
HARD_MAX $ 47-56 HARD_MIN $ 58-67 PH_MAX 69-71 PH_MIN $ 73-76 #5 CA_ION 16-23
MG_ION 25-32 DO_MAX 35-39 DO_MIN 41-45 TDS_MAX 47-52 TDS_MIN 54-59 #6 ALK_MAX
16-25 ALK_MIN 27-36 COMMENTS $ 38-67 #7 REF1ORIG $ 16-19 REF2ORIG $ 21-24
REF3ORIG $ 26-29 OUR_REF1 $ 31-34 OUR_REF2 $ 36-39 OUR_REF3 $ 41-44;
DROP SEQ;
CARDS;
  BBINS 1,40,MT1
PROC SORT; BY ELEMENT CONC_MIN;
DATA EFFECT1; SET EFFECTS; OBS + 1; KEEP OBS ELEMENT CHEMPFORM ORGANISM;
PROC SORT DATA=EFFECT1; BY ORGANISM;
PROC PRINTTO UNIT=4NEW;
PROC PRINT DATA =CONTEN N;
ID CONTENTS;
TITLE CONTENTS DESCRIPTION OF COAL CONVERSION TOXIC EFFECTS DATA BASE;
TITLE2 (N=# FOLLOWING THE LAST LINE REFERS TO NUMBER OF LINES IN FILE);
PROC PRINT N DATA=FREQ; ID ELEM;
FORMAT
  CHEM_FQ LIPST_FQ EXP_T_FQ WATTY_FQ RECFQ_FQ WT_MX_FQ WT_MN_FQ
HRDMX_FQ HRDMN_FQ PH_MX_FQ PH_MN_FQ CA_FQ MG_FQ DO_MX_FQ DO_MN_FQ
TDSMX_FQ TDSMN_FQ ALKMX_FQ ALKMN_FQ
5.;
TITLE PERCENT FREQUENCY OF DATA VALUES FOR CERTAIN VARIABLES IN THE DATA BASE;
TITLE2 THOSE VARIABLES WITH A FREQUENCY OF OCCURRENCE OF 100% ARE NOT INCLUDED;
TITLE3 (N= NUMBER OF ELEMENTS IN DATA BASE HAVING VARIOUS CHEMICAL FORMS) ;
TITLE4 (N=NUMBER, FOLLOWING THE LAST LINE, REFERS TO NUMBER OF LINES IN TABLE);
PROC PRINT DATA=TABCON N; ID CONTENTS;
TITLE CONTENTS DESCRIPTION OF COAL CONVERSION TOXIC EFFECTS DATA BASE;
PROC PRINT DATA=EFFECTS;
TITLE TOXIC EFFECTS FROM COAL CONVERSION EFFLUENTS DATA BASE;
PROC PRINT DATA=EFFECT1 N; ID OBS;
TITLE TABLE OF ORGANISMS(SORTED), ELEMENT, CHEMICAL FORM OF THE ELEMENT, AND ;
TITLE2 A CROSS REFERENCE TO THE ENTIRE RECORD(OBS) IN PRECEDING DATA TABLES;
DATA _NULL_; INFILE REF; INPUT; FILE PRINT NOPRINT; PUT _INFILE_;
TITLE BIBLIOGRAPHY OF CITED REFERENCES IN TOXIC EFFECTS DATA BASE;
PROC PRINTTO;
//COM EXEC PGM=LCON,REGION=64K
//STEPLIB DD DSN=CONQ4.LCON,DISP=SHR
//IN DD DSN=&&T,UNIT=SYSDA,DISP=(OLD,DELETE)
//DUMMY DD SYSOUT=A
//Q105TAP DD UNIT=TAPE9,DISP=(NEW,KEEP),DSNAME=CONTAPE,
// LABEL=(,SL,,OUT),
// VOL=SER=X18597
//Q105PRT DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1064)
//SYSIN DD *
ENCL TO ORNL/TM-5793,CUSHMAN,R.M.,ET AL.TOXICITY OF 35 TRACE ELEMENTS IN COAL
/*
//
```

generate a microfiche. These categories are: (a) IBM Job Control Language--primarily those lines in Table 3.2-1 beginning with '///', (b) SAS statements--those lines in Table 3.2-1 ending with a ';', (c) data--80-column card input from cards, tape or disk, and (d) a program to generate the microfiche file from a file comprised of data arranged in the desired order for microfiche generation. Once the code has been executed and a microfiche file generated on magnetic tape, the final step is to request that a microfiche be generated. A request-for-services form (UCN-7342) is used to complete the instructions, e.g., number of copies, tape number, charge number, etc., to the computer operator for generating the microfiche.

The major effort required for microfiche generation is file preparation--particularly when a specific format is desired. SAS is very helpful in this effort, since it allows descriptive textual material and it will prepare data tables with titles and variable names as the column headings. In Table 3.2-1, six different data files are created and prepared for output to a disk file--&&T. The disk file is used in the generation of the microfiche tape file.

The first of the six data files is called CONTEN and contains textual material entered into 80-column card images. It is important to note that the text for this file will appear in the microfiche exactly as it appears on the cards. The data for file CONTEN ends with the creation of another data file--FREQ. This data file contains percent frequencies of occurrence of data for each variable defined in the input data. The frequencies are calculated using SAS program statements. The final form of the data file will be a single page of percentage frequencies showing the amount of non-missing data for each variable over all observations. The raw data are inserted (@@INS 1,40,MT0) into the program as described in section 3.2.3.

The third data file (TABCON) contains textual data that will precede the tabular summary of the raw data contained in the fourth data file EFFECTS. The fifth data file -EFFECT1-is a subset of the EFFECTS data file and contains fewer variables than the EFFECTS data file. The EFFECT1 data file is sorted prior to the initiation of the SAS procedure for creating the disk file '&&T' using the command "PROC PRINTTO UNIT=4NEW;". The number 4 in this command corresponds to a 4 in the IBM Job Control Language "//SAS.FT04F001" in the beginning of Table 3.2-1. The code which is included between the "PROC PRINTTO" commands is used to output the data files which have been created and arranged with the previous code. Even though the commands imply printing, the data will be output to the "FT04F001" data file. Imbedded within these output statements is the sixth and final data file to be included in the disk file. The statements begin with "DATA _NULL_;" and end with "PUT _INFILE;". These five statements are used to output a file which has been created on the DECSYSTEM10 and contains citations for the "References" portion of the disk data file.

The final 12 IBM JCL statements execute a program, LCOM, which uses the previously created disk file as input and creates a magnetic tape file with the desired format for microfiche generation.

The listing presented in Table 3.2-1 has been used to generate a microfiche as a pocket insert to a Division publication (Cushman, R. M., S. G. Hildebrand, R. H. Strand, R. M. Anderson. 1977. Toxicity to Freshwater Biota of 35 Trace Elements in Coal: A Data Base with Automated Retrieval Capabilities. ORNL/TM-4792). The reader is referred to this document for the actual microfiche discussed above. While we realize this is a very lengthy example, it illustrates very nicely the way an entire document could be placed on microfiche or just the appendix material, if desired. The simplicity of only two SAS statements, a JCL statement describing the disk file for saving the output for a second program, and the CSD's computer program "LCOM" for generating the magnetic tape is quite encouraging to those who desire to use microfiche in their SAS programming. It should be noted that the magnetic tape must then be transferred to K-25 along with a microfiche request form (UCN-7342) properly instructing the operator at K-25 on the number of copies desired, tape number, and other information requested on this form.

For authors desiring to include microfiche in their publications, there are requirements set by National Technical Information Service for publishing a paper or report with microfiche. These requirements would cause the microfiche generated by the program LCOM in our example to be unacceptable. For details on these requirements, see the Division editor. The senior author of this guide has a computer program available which will generate a microfiche acceptable to NTIS.

3.2.7 Card image output as a punched file from IBM 360 Computers to MODCOMP RBS

If a user wants punched output from an IBM 360 computer job saved as a card image file rather than a physical card deck, it is possible to have this data saved as a magnetic tape card image file on the MODCOMP. This would allow a user to submit this "punched" output repeatedly into successive jobs. To perform this, the user must inform the MODCOMP RBS operator of the job name and place the following card in his program deck:

```
/*ROUTE PUNCH REMOTE10
```

3.2.8 Data processing examples using SAS

With this note we intend to introduce the interested user to the capabilities of the Statistical Analysis System (SAS), (illustrating the batch and interactive commands and showing some of the ways SAS handles data.)

3.2.8.1 Batch SAS

Table 3.2-1 in section 3.2.6 gives a listing of a batch version of a SAS program to input data files and print them in tabular form with variables being modified, created, and/or deleted. The interested user will find that the SAS User's Manual contains explicit examples of SAS output in batch mode. We suggest users consult this manual for suggestions on how to use SAS in the batch mode.

The user is able, with SAS, to perform various statistical calculations on the data sets created with INPUT, SET, MERGE or OUTPUT statements as described in the SAS User's Guide (See Table 1.1-1 for contact person to obtain this computer manual).

3.2.8.2 Interactive SAS

SAS (version 76.4) has been implemented on the IBM 360 model 75 as an interactive program. This allows data sets which are stored on disk to be analyzed and displayed interactively. The user may also analyze data by entering it directly at the terminal.

Users who wish to take advantage of the facilities for interactive SAS programming should read the section on Time Sharing Option (TSO) operation of SAS in the SAS76 User's Guide (pages 296-299). The SAS system also has an editor for use with SAS interactive. This editor allows for editing of files as lines created in a TSO/SAS session. All the details of the TSO/SAS version are not explained in this note. Instead, the commands necessary to set up a TSO/SAS session, the procedures for invoking these commands, and a sample run showing the examples of a TSO/SAS session are presented.

The commands necessary for setting up a TSO/SAS session are given in Table 3.2-2. These commands should be entered exactly as shown into a file in the user's area. This file is called SAS76.CLIST for this example.

After logging onto TSO, the procedure for executing this file is to type "EXEC SAS76" (Table 3.2-3). Messages are returned to the user as the commands are executed. The successful setup of a TSO/SAS session will be indicated to the user by a "1?" typed on the terminal. In our example we name a data set "FISH" and after defining the variables, enter the data at the terminal. The "RUN;" command tells SAS to execute what has been entered up to the last "RUN;" statement or from the beginning of the session, whichever is first. The user may then specify a procedure or a number of procedures for execution. When the user desires that these procedures be executed, the "RUN;" statement followed by a carriage return is entered. (Each line is terminated with a carriage return in the example).

Table 3.2-2. Commands for establishing an interactive TSO/SAS session using SAS 76.4

```

00010 PROC 0 ENTRY(SAS) OUTPUT(*) WORK(10) SORTWORK(10)
00011 FREE F(WORK FT12F001) ATTRLIST(PRPR)
00012 STEPLIB
00014 STEPLIB ('SYS1.LINKLIB' 'A.JDA10307.SASLIBR')
00040 ALLOC F(WORK) BLOCK(6394) SPACE(&WORK. 10)
00050 ATTRIB PRPR RECFM(V A S) LRECL(137) BLKSIZE(141)
00060 ALLOC F(FT12F001) DA(&OUTPUT.) MOD BLOCK(133) SPACE(10 10) USING(PRPR)
00070 ALLOC F(SORTLIB) DA('SYS1.SORTLIB') SHR
00080 ALLOC F(SORTWK01) BLOCK(13030) SPACE(&SORTWORK.)
00090 ALLOC F(SORTWK02) BLOCK(13030) SPACE(&SORTWORK.)
00100 ALLOC F(SORTWK03) BLOCK(13030) SPACE(&SORTWORK.)
00110 ALLOC F(SYSOUT) DA(*)
00120 CALL 'A.JDA10307.SASLIBR(&ENTRY.)'

```

Table 3.2-3. A sample execution of TSO/SAS interactive (underscored materials are user entered; each line of entered material is terminated with a carriage return)

EXEC SAS76

IKJ56234I ATTR-LIST-NAME PRPR NOT FOUND

IKJ56247I UTILITY DATA SET NOT FREED, IS NOT ALLOCATED

IKJ56247I UTILITY DATA SET NOT FREED, IS NOT ALLOCATED

IKJ56103I MOD,BLOCK,SPACE OPERAND IGNORED FOR TERMINAL DATA SET

1?DATA FISH; INFILE CARDS; INPUT X Y1 Y2 Y3 Y4 GROUP;

2?CARDS;

3?10 35 45 56 76 1

4?12 37 44 58 68 1

5?13 44 39 59 77 1

6?11 34 47 55 79 1

7?10 39 54 62 85 2

8?12 39 47 61 85 2

9?13 49 42 63 89 2

10?11 36 51 58 83 2

11?RUN;

NOTE: DATA SET WORK.FISH HAS 8 OBSERVATIONS AND 6 VARIABLES.

12?PROC GLM; MODEL Y1=X; RUN;

Table 3.2-3. (continued)

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE INFORMATION

NUMBER OF OBSERVATIONS IN DATA SET = 8

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: Y1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	1	99.22500000	99.22500000
ERROR	6	79.65000000	13.27500000
CORRECTED TOTAL	7	178.87500000	

MODEL F = 7.47 PR > F = 0.0340

R-SQUARE	C.V.	STD DEV	Y1 MEAN
0.554717	9.3124	3.64348734	39.12500000

SOURCE	DF	TYPE I SS	F VALUE	PR > F
X	1	99.22500000	7.47	0.0340

SOURCE	DF	TYPE IV SS	F VALUE	PR > F
X	1	99.22500000	7.47	0.0340

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > T	STD ERROR OF ESTIMATE
INTERCEPT	2.90000000	0.22	0.8348	13.31244718
X	3.15000000	2.73	0.0340	1.15217186

13?PROC MEANS DATA=FISH; VAR X Y1 Y2 Y3 Y4; RUN;

Table 3.2-3. (continued)

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
X	8	11.50000000	1.19522861	10.00000000	13.00000000
Y1	8	39.12500000	5.05505405	34.00000000	49.00000000
Y2	8	46.12500000	4.79396943	39.00000000	54.00000000
Y3	8	59.00000000	2.82842712	55.00000000	63.00000000
Y4	8	80.25000000	6.64938236	68.00000000	89.00000000

14?OPTIONS PS=34 TLS=72;

15?PROC SCATTER; PLOT X*Y1; RUN;

PLOT OF X*Y1 LEGEND: A = 1 OBS , B = 2 OBS , ETC

16?/*

NOTE: SAS INSTITUTE INC., P.O. BOX 10066, RALEIGH, N.C. 27605

For the hypothetical data set "FISH", the SAS procedures GLM, MEANS, and SCATTER are executed. The output from these procedures is indicated after each procedure call. Note that the procedure for setting the height (PS=34) and width (TLS=72) of the page for PROC SCATTER is necessary to include the plotted output on a single page of an 80-column wide terminal.

The statements and data which have been entered in this terminal session can be entered by using the TSO/SAS editor. This procedure is invoked by typing "PROC EDITOR; RUN;" The user is instructed by SAS from that point forward as to what commands to enter.

Some users may find it useful to know that they can access their online IBM 360 disk data sets (at Bldg. 4500N) by allocating these data sets prior to executing SAS76.CLIST. The command for allocating a data set is as follows:

```
ALLOC F(name) DA('data set name') SHR+
```

A "name" is 1-8 characters; the 'data set name' corresponds to the job control language data set name under which it is stored on a disk in the computer. To use this data set in a TSO/SAS session, the following can be specified:

```
1? DATA A; INFILE name; INPUT ...;+
2? RUN;+
```

Here the data set is a card image data set which requires definition of the variables, their type, and card column location in the SAS INPUT statement. If the data set is stored as a SAS data set, the user can specify the data set as follows:

```
1? DATA A; SET name.level; RUN;+
```

In this example the "name" is the valid name as specified in the "F(name)" of the ALLOC command above, while the "level" is the level specified for the data set when it was created by the SAS user.

Several other ways of allocating data sets and accessing files are possible. Not all of them are shown here, but if a user can master the material presented here, the available manuals can be read, and the other ways of data access and data set processing can be determined.

3.2.9 Procedure for creating data sets on the DECSYSTEM10 from IBM's Continuous System Modeling Program (CSMP)

A procedure for creating data sets on the DECSYSTEM10 containing variables for statistical routines or graphical display from CSMP* is described. A single data set or multiple data sets can be created with a single CSMP run. Data set reference numbers 01, 02, 03, 05, 06, 07, 08, 13, 14, and 15 may not be used for defining user data sets. These data set reference numbers are used in CSMP for various data sets created by CSMP during the simulation.

An example of the IBM JCL followed by an explanation of the coded instructions (enclosed in parentheses) follows:

```
//JAW20 JOB (15429),'SAVE 6200,64 WATTS' (Defines DECSYSTEM10 disk
area)
//*CLASS CPU91=30S,CARDS=50 (CARDS option needed if more than 1000
cards punched)
//*ROUTE PRINT REMOTE10 (Routes print to RBS in 2001)
//*ROUTE PUNCH REMOTE5 (Needed if job submitted via cards rather
than through the DECSYSTEM10)
// EXEC CSMPIII
user-supplied CSMP routines
//FT20F001 DD SYSOUT=(K,,9900) (Routes output defined by data set
reference number 20 to
DECSYSTEM10 as a punch file)
//FT21F001 DD SYSOUT=(K,,9950) (Routes output defined by data set
reference number 21 to
DECSYSTEM10 as a punch file)

/*
//
```

Note: The last two digits of SYSOUT field, i.e., 99xx can be any two digits, as long as each is unique for a data set being created.

In the INITIAL section of the CSMP deck, the filenames corresponding to the data set reference number in the IBM JCL are defined.

```
EXAMPLE:
INITIAL
NOSORT
10    WRITE (20,10)
      FORMAT ('NAMEBETA3.DAT')
      WRITE (21,11)
      FORMAT ('NAMEBETA4.DAT')
11
SORT
```

*IBM. Continuous System Modeling Program III. Programmers Reference Manual. SH19-7001-2.

The criterion for variables to be defined in the appropriate data set is given in the DYNAMIC section of CSMP.

EXAMPLE:

NOSORT

```
BETMOD=AMOD(YEAR,OUTDEL)
IF (BETMOD .NE. 0.00) GO TO 43
IF (BETA0 .EQ. 0.3 .AND. KEEP .EQ.1) WRITE (20,20) YEAR, C1,
1C3, C4, C7, C8
```

```
20  FORMAT(F5.0,5E12.3)
    IF(BETA0.EQ. 0.4. AND. KEEP. EQ.1) WRITE (21,20) YEAR, C10,
1C11, C12, C13, C14
```

```
43  CONTINUE
SORT
```

The KEEP variable is tested at each integration step, with KEEP=1 at the end of the integration step. Thus results are written into the file only at the end of each integration after all the intermediate trial and prediction calculations have been completed and the error criteria satisfied.

If results had been desired only at the completion of a simulation run, i.e., FINISH TIME, then FORTRAN statements reflecting this could be placed in the TERMINAL section of the CSMP deck as in the DYNAMIC section.

The DECSYSTEM10 data set output is in addition to that obtained in the OUTPUT or PRINT mode of CSMP, printed on the line printer. In no way is the normal output altered.

There are a number of CSMP variables available to the user for testing and user control. The Continuous System Modeling Program III (CSMP III) Program Reference Manual (SH19-7001-2) should be consulted for further information. (See Table 1.1-1 for contact persons within the Environmental Sciences Division.)

An interactive version of CSMP is available on the DECSYSTEM10. For information on this program, type "HELP CSMP" after logging into the DECSYSTEM10.

3.2.10 Computer Graphics using DISSPLA

3.2.10.1 Batch--DISSPLA on the DECSYSTEM10

The DISSPLA Computer graphics package is available at the main computer, X-10 and K-25 sites. The available manuals can be obtained from CSD computer librarian, 3-1703, or see the ESD computer manuals contact person listed in Table 1.1-1. The structuring of a computer

program example for this guide, that would be generally useable, was considered impractical and would depart from the intent of the guide. We recommend ESD programming assistance (See Table 1.1-1) for users interested in further plotting assistance and examples. The JCL is the same at both sites but the user does need to determine that the device requested is available at that particular site.

To use DISSPLA in a FORTRAN program that is being submitted as a batch job to the IBM 360s and generate a CALCOMP-type copy of the plot, a table is presented to give the user logical sequence of control cards and program cards (Table 3.2-4). The exact description of each card is not presented in this table but is referred to in the discussion which follows.

DISSPLA was written to be as machine independent as possible. When DISSPLA is used, you must have in your FORTRAN program a call to a device initialization routine prior to any plotting subroutine calls. These device declarations and the necessary IBM Job Control Language for each are as follows:

CALL CALCMP

This CALL initializes DISSPLA for the CALCOMP drum plotter using a plot tape. IBM JCL is given in Chapter 13 of the Programmers Notebook. We will reproduce some of the JCL here to illustrate our examples. IBM JCL for the Linkage Editor (LKED) step would be

```
//LKED.SYSLIB DD
// DD
// DD
// DD DSN=DISSPLA.LOAD,DISP=SHR
```

and JCL for the GO step

```
//GO.PLOTTAPE DD UNIT=TAPE7,VOL=SER=01,LABEL=(,NL),DISP=OLD
```

Disk plots are also available. Initialize the device for a disk plot with a call to CALCMP and the following IBM JCL for the LKED step:

```
//LKED.SYSLIB DD
// DD
// DD
// DD DSN=DISSPLA.LOAD,DISP=SHR
//LKED.PLOTSUBS DD DSN=JGSPLOTH,DISP=SHR
//LKED.SYSIN DD *
    INCLUDE PLOTSUBS
/*
```

Table 3.2-4. Logical sequence of program and control statements for executing a batch FORTRAN program with DISSPLA plotting

ITEM NO.	DESCRIPTION	
1	NO SEQUENCE CARD	(OPTIONAL-FOR TAPES, DISKS OR SPECIAL INSTRUCTIONS)
2	JOB CARD	(REQUIRED-UNIQUE TO EACH USER)
3	CLASS CARD	(REQUIRED-GIVES REQUIREMENTS OF JOB)
4	PLOT CARD	(OPTIONAL-FOR TAPE OR SPECIAL PLOTS)
5	ROUTE CARD	(OPTIONAL-FOR ROUTING PRINT OR PUNCH OUTPUT)
6	EXECUTE FORTRAN COMPILE, LINK, & GO	(REQUIRED)
7	SYSIN DD * CARD	(REQUIRED-PRECEDES FORTRAN DECK)
8	FORTRAN PROGRAM & DISSPLA CARDS	(REQUIRED)
9	LINKAGE EDITOR COMMAND CARDS	(REQUIRED-DIFFERENT FOR DISK THAN TAPE)
10	GO STEP OUTPUT CARDS	(REQUIRED-DIFFERENT FOR DISK THAN TAPE)

JCL for the GO step would be

```
//GO.FT49F001 DD UNIT=IN2OU2,DISP=(NEW,KEEP),
// SPACE=(3208,40,RLSE),DSN=PLOT00.name,
// DCB=(RECFM=VS,LRECL=3204,BLKSIZE=3208)
```

CALL FILM ('name\$')

This initializes DISSPLA for the CALCOMP Cathode Ray Tube (CRT) plotter. The character string 'name\$' is used as plot identification and is passed to the CRT programs. IBM JCL for the LKED step would be the same as in part 1 of this section and JCL for the GO step would be

```
//GO.CRT TAPE DD UNIT=TAPE9,VOL=SER=nn,
// LABEL=(,NL),DISP=OLD
```

CALL PRTPPL

This initializes DISSPLA to output graphs to the line printer. This type of plot should be used for debugging purposes. JCL for the LKED step would be the same as in part 1 of this section. Output in the GO step is on the standard FORTRAN output file FT06F001 and will be supplied by the cataloged procedure FORTHCLG or FORTGCLG (See Chapters 8 and 16, Programmers Notebook).

CALL EAI

This initializes DISSPLA to use the flatbed plotter with 11 x 17 inch paper. It is mandatory that the library DISSPLA.LOAD precede the normal EAI library SYS1.EAILIB. IBM JCL for the LKED step would be the same as in part 1 of this section, and JCL for the GO step would be

```
//GO.FT15F001 DD DSN=PLOTTAPEX,UNIT=TAPE7,
// DISP=(NEW,KEEP)
```

CALL EAI30

This initializes the flatbed plotter with 30 x 30 inch paper. Again the library DISSPLA.LOAD must precede the EAI library SYS1.EAILIB. The JCL is identical to that used in the CALL EAI.

CALL TEKTRN(ICPS)

This initializes DISSPLA to produce graphs on a TEKTRONIX terminal screen where ICPS is the line speed; i.e., ICPS=30 for 300 BAUD (30 cps). The batch mode LKED JCL would be

```
//LKED.SYSLIB DD
// DD
// DD
// DD DSN=DISSPLA.LOAD,DISP=SHR
// DD DSN=TEK.TEKLOAD.LOAD,DISP=SHR
```

where TEK.TEKLOAD.LOAD is the TEKTRONIX Terminal Control System (TCS). IBM's Time Sharing Option (TSO) online link edit would include

```
LIB('DISPPLA.LOAD' 'TEK.TEKLOAD.LOAD')
```

to allocate the DISSPLA and the TEKTRONIX TCS.

CALL COMPRS

This initializes DISSPLA to generate the device independent compressed DISSPLA data set. JCL for the LKED step would be

```
//LKED.SYSLIB DD
// DD
// DD
// DD DSN=DISSPLA.LOAD,DISP=SHR
```

JCL for the GO step must allocate to the DDNAME COMPOUT, the dataset to receive compressed data. The compressed data set can reside on any device supporting fixed records of length 4000. SPDA datasets would be a good choice for these datasets. JCL for the GO step might be

```
//GO.COMPOUT DD DSN=T.ABC02345.name,DISP=(NEW,CATLG),
// UNIT=SPDA,SPACE=(TRK,(5,5),RLSE)
```

(See ESD Programming Assistance, Table 1.1-1, for assistance on DSN naming conventions on SPDA.) The postprocessor of DISSPLA reads the data set generated by a COMPRS call. This allows the user to manipulate the plots generated and stored by DISSPLA on a disk file. More details on using the postprocessor commands are available in documentation distributed by CSD (call J. Carpenter, 3-1703, for copy). The CLIST required for executing the postprocessor is given below:

```
FREE FILE(FT05F001)
FREE FILE(FT06F001)
FREE FILE(COMPIN)
ALLOC F(FT05F001) DA(*)
ALLOC F(COMPIN) DA( DATA.) OLD
FREE ATTRLIST(CRT)
ALLOC F(FT06F001) DA(*) USING(CRT)
CALL DISSPLA.DISSPOP.LOAD(TEKPOP)
```

Replace DATA. by the appropriate dataset name (DSN=) used in "GO.COMPOUT" data set.

It should be noted that with the CALL CALCMP for tape plots and CALL FILM for CRT plots, your deck should contain the following three cards in order to generate a plotter work request card. (See CSD Programmer's Notebook for details on these cards.)

- (1) a `//*NOSEQCARD` must be present before the JOB card
- (2) the `//*CLASS` card must have `SPECIAL=TAPE` option
- (3) a `//*PLOT` card must be present within the front portion of the JCL.

3.2.10.2 Interactive--DISSPLA on the DECSYSTEM10

The plotting of data using DISSPLA in an interactive mode differs from the batch mode previously described--no control cards precede or follow the FORTRAN program. A user needs only to be logged into the DECSYSTEM10 and have or create a FORTRAN program with a file name.

In order to have a program plot directly on a TEKTRONIX (4012, or 4014) terminal screen, the first plotting call in your FORTRAN program must be

```
CALL TKTRN(ICPS,IMODE)
ICPS - characters per second of line; i.e., ICPS=30 for a
      300 baud line (30 cps).
IMODE = 0 (terminal has no extended graphics)
      = 1 (terminal has extended graphics)
```

To execute the program:

```
.ASSIGN TTY LPT+
.EX yourpgm,@SYS:DISTEK+
```

These plots may be submitted to the IBM 360 for plotting on other devices. See CSD documentation on using DISSPLA's postprocessor.

Also plot data created on the IBM 360 machines at Bldg. 4500N may be sent to the DECSYSTEM10 for viewing on a TEKTRONIX terminal screen by generating a device-independent compressed data (CALL COMPRS) set and sending this dataset in its compressed form to the DECSYSTEM10. (See Chapter 13 Programmer's Notebook for sending plot data to the DECSYSTEM10).

4. DATA PROCESSING SOFTWARE

Several computer programs are available to users for data processing. These programs fall into three general categories: (1) complete systems which have their own syntax and language as an independent data processing system, (2) subroutine packages which are aggregates of subroutines to which the user must supply a main program, and (3) special purpose programs designed for a specific data processing function and implemented with a single user in mind. All of these approaches have their conveniences and inconveniences. The systems are powerful, widely applicable, and production-oriented, but require the user to learn a programming syntax and command structure. The subroutine packages are convenient pieces which can be attached to a user's main program, but require the user to program a main routine and interface the main and subroutine portions of the program. Special purpose programs are severely restricted in their applications and difficult to modify for another purpose. The user who is interested in determining the software available for his particular needs is referred to ESD programming assistance (Table 1.1-1).

INTERNAL DISTRIBUTION

1.	S. M. Adams	118.	R. L. Kroodsma
2.	C. P. Allen	119.	D. Kumar
3.	R. M. Anderson	120.	S. E. Lindberg
4-11.	S. I. Auerbach	121.	R. J. Luxmoore
12.	L. Barnthouse	122.	J. B. Mankin
13.	J. J. Beauchamp	123.	L. K. Mann
14.	B. G. Blaylock	124.	D. Matt
15.	W. J. Boegly, Jr.	125.	J. S. Mattice
16.	E. A. Bondietti	126.	R. K. McConathy
17.	D. M. Bradburn	127.	S. B. McLaughlin
18-80.	L. H. Bradley	128.	R. B. McLean
81.	F. S. Brinkley	129.	J. D. Newbold
82.	A. A. Brooks	130.	J. S. Olson
83.	R. L. Burgess	131.	R. J. Olson
84.	D. S. Carroll	132.	R. V. O'Neill
85.	S. W. Christensen	133.	B. R. Parkhurst
86.	C. C. Coutant	134.	P. D. Parr
87.	D. K. Cox	135.	D. C. Parzyck
88.	R. B. Craig	136.	G. B. Raine
89.	R. M. Cushman	137.	D. E. Reichle
90.	D. L. DeAngelis	138.	C. R. Richmond
91.	G. J. Dodson	139.	M. Ross
92.	S. Draggan	140.	R. K. Schreiber
93.	L. L. Dye	141.	M. H. Shanks
94.	G. K. Eddlemon	142.	D. S. Shriner
95.	N. T. Edwards	143.	H. H. Shugart
96.	J. W. Elwood	144.	G. R. Southworth
97.	W. R. Emanuel	145.	J. D. Story
98.	L. D. Eyman	146-167.	R. H. Strand
99.	C. W. Francis	168.	E. G. Struxness
100.	M. L. Frank	169.	J. S. Suffern
101.	R. H. Gardner	170.	F. H. Sweeton
102.	C. W. Gehrs	171.	F. G. Taylor, Jr.
103.	F. G. Goff	172.	M. L. Tharp
104.	J. W. Gooch, Jr.	173.	D. E. Todd, Jr.
105.	J. S. Griffith	174.	R. R. Turner
106.	N. A. Griffith	175.	R. I. Van Hook, Jr.
107.	T. Grizzard	176.	P. Van Voris
108.	W. F. Harris	177.	W. Van Winkle, Jr.
109.	G. S. Henderson	178.	J. A. Watts
110.	S. E. Herbes	179.	D. C. West
111.	S. G. Hildebrand	180-181.	Biology Library
112.	J. W. Huckabee	182-183.	Central Research Library
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