Purdue / LARS Computer
User's Guide

The Laboratory for Applications of Remote Sensing

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Purdue/LARS Computer User's Guide

by

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ABSTRACT

The Purdue/LARS Computer User's Guide is designed to document and incorporate all the basic information one needs in order to gain access to the machine and to use the equipment. Topics covered include a description of the LARS computer facility (both hardware and software), administrative procedures, documentation available, procedures for operating terminals and/or submitting jobs, and notes for programmers.

PURDUE/LARS COMPUTER USER'S GUIDE

1.0 INTRODUCTION

1.1 PURPOSE AND USE PHILOSOPHY OF THE PURDUE/LARS COMPUTER INSTALLATION

The PURDUE/LARS computer exists to supply the computation resources required for Remote Sensing research at the Purdue University Laboratory for Applications of Remote Sensing and at associated Remote Terminal Sites. To this end, facilities are available with as few restrictions as possible consistent with maintaining efficient utilization of resources and fairness to all users. The few regulations necessary for users are detailed in this guide.

1.2 WHAT FACILITIES ARE AVAILABLE

The PURDUE/LARS Computer Installation provides several types of services:

- The Technical Support Group provides and maintains the software components utilized by users of an Earth Resources Data Processing system. Providing software components is defined as analysis, design, coding, and checkout of new software applications, or modification of existing applications for enhanced function. Maintaining software components is defined as diagnosing problems in existing software and fixing or recommending circumventions for them, performing routine updates, and maintaining system documentation. Among these software components are:

  1. LARSYS Multispectral Image Processing System
  2. CMS Programming system
     a. Fortran language compilation and execution
     b. Assembler language assembly and execution
     c. Program and data management facilities (including editor)
  3. Other LARS "Supported" Programs
  4. LARS "Unsupported" Programs

- The Technical Support Group provides a human interface to the computer system. Included are the following areas:

  1. Control access to computer and allocation of resources
     a. Assign ID's and Computer Accounts
     b. Provide accounting information
     c. Assign and manage disk storage space
     d. Assign and manage magnetic tapes
  2. Present Courses and maintain Educational Material related to the use of the system

3. Provide consultation on Questions and Problems related to the use of the system

- The Data Base Administration Group provides and maintains Remote Sensing Data in the form of a library of Multispectral Image Storage Runs. This includes routine reformatting of data, geometric correction and similar pre-processing.

- The Operations Group is responsible for operation of the computer hardware.

1.3 COMPUTER STAFF (WHO'S WHO, AND WHO TO TALK TO)

1.3.1 REMOTE TERMINAL SITE SPECIALISTS

In order to expedite communications, each remote terminal site designates three contacts whose areas of responsibility are:

a) Steering Committee Member - This person serves on the Remote Terminal Steering Committee and is charged with administrative responsibility and authority for the establishment and continuance of the remote terminal installation.

b) Hardware-Software Specialist. This person should be available to all users at the terminal site to sort out user problems with the system, hardware malfunctions, and software bugs.

c) Techniques Specialist. This person should be available to all users at the terminal site to perform educational functions and be a consultant on the use of LARSYS analysis techniques.

Users at remote terminal sites should contact their site specialists with all questions and problems, instead of contacting PURDUE/LARS personnel directly. The site specialists are then responsible for interfacing with their PURDUE/LARS counterparts if necessary.

The current remote site specialists are listed below:

PURDUE/LARS - Committee Member - Terry Phillips
HW/SW Specialist - Howard Grams
Techniques Specialist - Barbara Davis

NASA/JSC - Committee Member - John Sargent
HW/SW Specialist - John Cornwell
Techniques Specialist -

NASA/GSFC - Committee Member - William Alford
HW/SW Specialist - Lottie Brown
Techniques Specialist -

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NASA/Wallops - Committee Member      - Harold Maurer
               HW/SW Specialist      - Tom Savage
               Techniques Specialist - David Hancock

ODU/Langley  - Committee Member      - Dr. E. C. Kindle/
                                       Ruth Whitman
               HW/SW Specialist      - Mary Alice Eastwood
               Techniques Specialist - Philip Renfroe
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1.3.2 PURDUE/LARS PERSONNEL. The primary contact for computer-related matters for PURDUE/LARS personnel should be the member of the Data Processing Technical Support Group whose job it is to primarily provide the human interface to the computer mentioned in section 1.2 above. This contact is presently Jeanne Etheridge (extension 228). It is her responsibility to either take care of computer-related problems, LARSYS problems, programming questions or problems, etc. or administrative tasks (ID assignment, accounting reports, tape assignments, etc.), or to refer them to other members of the staff when necessary. If she is unavailable, the secondary contact should be Howard Grams (extension 225).

1.4 OPERATIONAL PROCEDURES AND GOALS

The PURDUE/LARS computer is in operation 24 hours a day except between 5PM Saturdays and 3PM Sundays. In addition, scheduled preventive maintenance (currently between 8am and 10am Tuesday mornings) precludes availability to users at certain other times. Bulletin boards and the news service of the LARSYS system (see Section 3.2) will announce permanent and temporary changes in the availability schedule.

General policy is to have two computer operators on duty at all times (three during the prime shift). This will ensure adequate response to user requests as well as frequently enable operating users to obtain help in resolving any operational problems they may encounter.

Expected typical levels of system availability and reliability are described below:

1. There should not be more than an average of two unscheduled shutdowns (system crashes) experienced by any user in a week. Any such system failure should be repaired within one hour.

2. LARS terminals should be operational the same hours as the system, with less than an average of one failure per week per terminal of not more than one working day.

3. User requests (such as tape mounting and device attachment) should be honored within

two minutes. Card or printer output at the central computer site should be available within five minutes of production.

4. There should be sufficient tape units available so that LARSYS users can obtain one tape unit within 10 minutes of a request or two tape units within 30 minutes of a request or more than two units within 10 hours.

5. The digital display at the central computer site should be operational the same hours the system is in operation, with less than an average of one hardware failure per week. Maximum recovery period from hardware failures should be less than five working days.

1.5 ADMINISTRATIVE PROCEDURES

Before a user can have access to the PURDUE/LARS computer, he must have an ID assigned to him. This ID assignment defines the resources available in a user's virtual machine when he logs in at a terminal. Access is controlled by predefined user ID's established in the computer's operating system CP-67. System accounting information is produced for each user ID.

Associated with each ID is a "user-id" and a "password". To use the computer a user must give the login command with the "user-id". The machine will ask for his password, and the user must type the correct "password" to gain access to the machine. An account number is also assigned to each "user-id". The accounting procedures keep track of the number of times each user-id has obtained access to the computer, how much CPU time is used, what dedicated devices are used, and other accounting information useful to determine resource needs and usage.

All usage of the computer is charged for according to the number of total CPU hours used. No other parameters currently affect the charges.

1.5.1 HOW TO ESTABLISH A PURDUE/LARS COMPUTER ID.
Users at remote terminal sites must establish ID's through his site's Hardware/Software specialist.

Users at PURDUE/LARS should fill out in duplicate the form "REQUEST FOR PURDUE/LARS COMPUTER ID". (One copy will be returned to the person whose name is on line (1) and is the person responsible for the account. The second copy will be retained by the Technical Support Group.) A sample copy is shown on the next page. The request should be signed on line (2) by the supervisor for the project to be charged (i.e., the Project Leader or Principal Investigator) and then sent to Jeanne Etheridge for processing.

LARS FORM 115

REQUEST FOR LARS COMPUTER ID

This Box for
System Programmer Use Only!

(1) Requested by _Swaingartner_   Date _1-7-74_
    (Person responsible for account)

Account No. _____

(2) Approved by _____ Date _____
    (Supervisor for Project checked below)

USERID _____

Password _____

(3) Source of funding (check one):

Approved _____ Init ___

               SR&T

Installed _____ Init ___

☐ COMP FAC	☐ SOCIO ECO	
☐ DATA HDL	☐ ERTS-WV	
☐ DATA ANAL	☐ ERTS-COL	
☐ MEASMETH	☐ ERTS-CS	
☐ SOIL VEG	☐ SKYLABWV	
☐ CRP PROD	☐ SKY-COLO	
☐ SOIL STUD	☐ REMOTE T	
☒ _ERTS Phantastic Experiment_		

Deleted _____ Init ___

Modifications: Date   Init

              Other

☐ PY	☐ NE69
☐ DOT	☐ ILLIAC
☐	

(4) Hours allowed @ $250/hr   50

(5) ☒ New Account
    ☐ Same Account as ID _____

(6) Expiration Date for Account _Dec 1975_

(7) ID Requested _PHANTAS1 & PHANTAS_ Password Requested (Used at login time) _INCRED_
        (8 Char. or less)
                                             (8 Char. or less)

(8) Capability Requested:

Special Facilities: (e.g., special disks, disk-link, passwords, core size, etc.)

☐ LARSYS Ver 2
☒ LARSYS Ver 3 and Ver 2
☐ 44 PS
☐ CMS

(9) Person(s) who will be using this ID

(10) Description of work to be done _Detecting groundhogs using ERTS-F data._

(11) Tapes allowed to be written on using this ID:

Tape No.	Owner's Name	Tape No.	Owner's Name	Tape No.	Owner's Name
543	SWAINGARTNER				
544	SWAINGARTNER				
781	SWAINGARTNER				
967	SWAINGARTNER				

The source of funding entered on line (3) will be used to determine the account category into which this ID will be placed and in which category of the monthly accounting reports it will appear. The project supervisor will receive monthly accounting reports.

The ID will be removed on the date specified on line (5), or whenever the number of hours of CPU time on line (4) is exhausted, whichever comes first. However, before an ID is removed, a notice will be sent to the person responsible for the account notifying him of that fact.

One or more boxes, as appropriate, should be checked in item (8) to indicate what virtual machine capabilities are requested. If "LARSYS Ver 3" is requested, it will include as much CMS as is needed (including one cylinder of permanent disk storage space). In general, one should check "CMS" only if facilities for writing and debugging programs (instead of only running operational programs) are to be included. If CMS is requested and approved, this will normally include 4 cylinders of permanent disk storage space. If unusual characteristics (unusual core size, unusual disk size, access to special disks, etc.) are required, they can be described under "SPECIAL FACILITIES". It is expected that users requesting CMS will attend an introductory course on CMS. (For more information on this course, contact Jeanne Etheridge.)

If any magnetic tapes are to be written on using this ID, they should be listed in section (11). The "owner's name" listed there (and on the tape itself) presumably ought to match either the name on line (1) or one of the names on line (9). (See section 1.4.4 for more information on magnetic tape usage.)

It is sometimes desirable to establish more than one ID to draw on the same account number. If this is desired, each requested ID should be entered on line (7) -- the example shows two related ID's. If each of a group of related ID's is to draw on its own account number, or to have its own unique information on lines (4) and (6), then a separate request form should be used for each one. Checking the appropriate box in line (5) allows one to request a new ID with the same account number as a previously existing one. Note that if more than one ID exists for a given account number, they will <u>not</u> appear separately in the monthly account reports.

1.5.2 <u>HOW TO REQUEST CHANGES IN A COMPUTER ID OR ACCOUNT</u> Any request for modifications to a computer ID or account should be directed to Jeanne Etheridge and should come from either the person responsible for the account, or from his project supervisor (the project supervisor must approve funding changes). Most requests for changes can be handled over the telephone, or by sending an informal note. Examples of changes include funding changes (add to or decrease the number of CPU hours funded, or change

expiration date), deletion of the account or ID, additions to or deletions from the list of tapes authorized to be written by an ID.

1.5.3 ACCOUNTING PROCEDURES AND REPORTS

Each week the system accounting data is run through an accounting program. A memo is generated and sent to the person responsible for the account if an ID will expire within the next two weeks or if it has overrun the hours funded, or if it is about to overrun the hours funded. A form is attached to the memo which the project supervisor may fill out, for example, to request more hours, delete the ID, or change the expiration date. If no response is received within the seven day grace period and the ID has overrun the hours funded, the ID will automatically be deleted.

At the end of each month, two accounting reports are sent to each project supervisor or remote terminal site specialist concerning each account category for which he is responsible. The first one is a one-page report giving the computer time used by each ID in the category, with totals for the category appearing at the top of the page. Included in the information given are the number of terminal sessions, number of batch jobs (see section 4.3) run, total hours (clock-time) attached to the system (broken down by terminal sessions and batch jobs), total CPU hours used this month (also broken down by terminal sessions and batch jobs). At the far right of the page are summaries of the account status, including the number of CPU hours requested for the account and the total number of hours already used since June 1st of the current fiscal year. The total of all these "hours requested" for all the accounts in an account category will be less than or equal to the number of hours authorized to be requested for that account category.

The second monthly report gives details of LARSYS Version 3 usage for the month. It is a one page report for the category and contains the following items for each LARSYS function: number of times used, number of check-out runs, elapsed clock time, virtual CPU time, and total CPU time. Each of these three times is further subdivided into total, minimum, average, and maximum times. Totals are included.

1.5.4 MAGNETIC TAPE USAGE POLICY AND PRACTICE

The PURDUE/LARS Computer Center currently manages about 2500 reels of magnetic tape. Many of these reels comprise a data base of remote sensing multispectral image data. In addition, individual users may have tapes assigned to them for use in storing their own data or results.

All magnetic tapes used at PURDUE/LARS have tape numbers assigned and are kept in correspondingly numbered slots in the tape racks. The computer center staff will

ensure that each assigned reel bears a "tape identification label" containing the following information:

    a. Tape Number
    b. General use for which tape is intended
    c. Name of person responsible for tape
    d. List of user-id's authorized to write on tape

Each project area or remote terminal site may be assigned one or more contiguous blocks of tapes. This is arranged by the project supervisor together with Jeanne Etheridge. As part of this procedure an "owner" will be designated for each tape. This "owner" may make changes (e.g. add or delete items from list of user-id's authorized to write on tape) by contacting Jeanne Etheridge, or by including the information on a new "Request for PURDUE/LARS Computer ID."

Although each tape is assigned to a specific person (the "owner") who is responsible for its contents, the computer operators and operations supervisor are responsible for the physical handling of the reels. (No tapes are to be removed from the computer room, except by going through the computer operations supervisor.) Any tape may be read and requested by any user; however, only user-id's authorized by the tape "owner" and listed on the "tape identification label" will be able to request that a tape be mounted so that it can be written on.

In addition, users are strongly urged to request that a "tape contents label" describing current contents and date last written be made for each tape each time it is written. This can be done as suggested by the following examples:

Example 1 - To create a new contents label (which replaces all current contents labels):
M CP TAPE 999 NEWLABEL = "CLASSIFICATION RESULTS - RUN 66000600"

In this case the computer operator will write out a label with today's date and the requested information and use it to replace all current labels on the tape. The information will also be recorded in the tape usage log.

Example 2 - To add to a label:
M CP TAPE 999 ADDLABEL = "FILE 3 - RUN 66000601"

In this case, all labels on the tape will remain, and a new one with today's date and the requested information will be added.

2.0 DESCRIPTION OF FACILITIES

2.1 THE COMPUTER AND ASSOCIATED HARDWARE

The PURDUE/LARS computer facility is based around an IBM 360 Model 67 machine. The current configuration includes 512K bytes of core memory (i.e., 128K 32-bit words). Unit record equipment (two card readers, one punch, and two printers) as well as user terminals are connected to the CPU via a multiplexor channel. Nine 9-track and one 7-track magnetic tape units are connected to the CPU via two selector subchannels. A drum storage unit has a dedicated selector channel, while eight disk storage drives share a second selector channel with a special digital image display and editing unit.

The Model 67 is a unique member of the 360 series in that it has special hardware features to perform dynamic address translation and hence to operate efficiently in a time sharing mode.

2.2 COMPUTER SYSTEM SOFTWARE

2.2.1. CP-67 AND THE VIRTUAL MACHINE CONCEPT
The basic monitor program or control program under which the PURDUE/LARS computer operates is called CP-67. It is a multi-programming package which uses the special time sharing hardware features of the Model 67 to create an environment in which it appears to each one of several users that he has complete control of a dedicated model 360 machine, complete with I/O devices. These apparent machines are called virtual machines since they are software created and do not exist in any physical sense. The virtual 360 is indistinguishable to the user and his programs from a real System/360, but it is really one of many that CP is managing. CP allocates the resources of the real machine to each virtual machine in turn for a short "slice" of time, then moves on to the next user's virtual machine -- thus time sharing.

Since the real machine does not have sufficient real core storage for all users' virtual core, a technique called "paging" is used by CP. Virtual core is divided into 4096 byte blocks called "pages". All pages except those currently in use are kept by the system on secondary storage (drum or disk), and are called into and swapped out of real core on a demand basis. In addition, all virtual machine input-output is handled by CP -- however, all these operations are completely transparent to a user and his virtual machine.

Since the virtual machines are simulated, in principle

their configurations may differ from each other and from the real machine. In practice, most virtual machines have the following configuration:

```
512 bytes of core storage
Operator's console            -        (address 009)
Spooled card reader           -        (address 00c)
Spooled card punch            -        (address 00d)
Spooled printer               -        (address 00e)
Disk storage drive            -        (address 190)
Disk storage drive            -        (address 191)
Disk storage drive            -        (address 19c)
```

CP also provides, as part of the virtual computer, commands that parallel the buttons and switches on a real machine's operator's console. The user can issue these commands from his terminal, and thus, his terminal becomes the pseudo-console for his virtual machine.

CP-67 simulates card reader, punch and printer operations for a virtual machine. If a program running on a virtual machine is to process a card file, that card file must first be read in to CP, headed by an ID card to identify which user's virtual machine it is intended for. It is then stored as a disk file in CP's so-called spooling area. When the virtual machine requests card-reader input, CP supplies it with card images from the spooled input file. The same process works in reverse for printer and punch output: a disk spooling file is created, which is later transferred by CP from disk to a real printer or punch.

2.2.2   CMS   After the control program creates the virtual computer, that virtual computer must be equipped with its own operating system to provide support for the programs to be run. The programming system most commonly used at PURDUE/LARS is called CMS.

CMS (Cambridge Monitor System) is a single-user, conversational operating system designed to provide full use of a System 360 machine using a simple command language that can be entered at the terminal. CMS provides a full range of capabilities - creating and managing files, compiling, debugging, and executing programs, etc.

Section 5.1 contains more information on CMS.

The LARSYS Version 3 system (Section 2.3) is based on CMS.

2.3   APPLICATIONS PROGRAMMING SYSTEMS - LARSYS

LARS' capability for processing multispectral remote sensing data is implemented as a computer software package known as LARSYS. The basic intention of the data analysis part of the package is to facilitate man-machine conversation so that the analysis scientist may more quickly

pose questions and obtain results.

The LARSYS system is extensively documented (See Section 3.3) and the user is referred there.

2.4 DATA LIBRARY

The basic data processed by LARSYS is maintained in a library of Multispectral Image Storage Tapes (data storage tapes). In general, the data from an airborne or satellite-borne multispectral scanner is sampled and digitized if necessary, and then reformatted to produce the computer-compatible multispectral image tape in the particular format required by the LARSYS system. The latter contains the data for each resolution element stored in a packed format, and has a specific address for each point in the form of a scan line number and sample number. Certain other information, such as run number and date, necessary for machine storage and retrieval are also stored in a convenient format.

The system has a disk data file called "RUNTABLE" that can be accessed by anyone. It contains the essential information about all runs in the data library available for analysis. A listing of it is maintained in the LARSYS system and can be conveniently obtained when desired (using the LARSYS command 'REFERENCE RUNTABLE'). Copies of the listings of RUNTABLE should also be posted at each terminal site for general reference.

3.0 DOCUMENTATION

3.1 PURDUE/LARS COMPUTER USER'S GUIDE

The Computer User's Guide is designed to document the basic information needed to use the computer. It will be distributed to any PURDUE/LARS computer user upon request, and copies will also be supplied to the Hardware/Software specialist at remote terminal sites. Requests for the Guide (as well as requests for all documentation) should be made to the Data Processing secretary (extension 239). (Users at remote terminal sites should request all documentation from their local Hardware/Software Specialist.) As changes in information occur, the guide will be kept up to date by preparing replacement pages containing the new information and distributing them to all people who have copies of the Guide. To this end, the data processing secretary will maintain a list, and anyone who wants to receive such updates should make certain his name is on the list. Notices of updates will also be posted via the system "NEWS" facility (Section 3.2).

Suggestions for changes in the User's Guide (this especially includes items which are unclear, misleading, or incorrect) should be directed to Howard Grams.

3.2 THE SYSTEM "NEWS" FACILITY

Users of the computer have access to a "bulletin board" or "news" facility to alert them to updates or changes in programs, facilities, schedules, and documentation. To obtain the latest system news, a user need only (1) login, (2) type "i larsys", and (3) type "news".

The command "NEWS" will type out the latest system news - a brief file containing items of general interest. More specific information about the LARSYS programming system can be obtained by typing the command "NEWS LARSYS". The latest operations schedule can be obtained from the command "NEWS SCHEDULE".

3.3 LARSYS PROGRAM DOCUMENTATION

The formal documentation of the LARSYS system is divided into three parts: The "LARSYS Users Manual", the "LARSYS System Manual", and the "LARSYS Program Abstracts."

The "LARSYS User's Manual" (in three volumes) contains a comprehensive description of the functional organization of the system, the processing functions provided, and the manner in which the functions are invoked and controlled.

While it is written for the system user, a good knowledge of its contents is essential for any individual who intends to work with the system - be he a user, an analyst, or a programmer.

The "LARSYS System Manual" is directed primarily to programmers and analysts who maintain or revise the system, or write new functions that must be interfaced with LARSYS. It contains detailed information about the hardware and software framework upon which the system was built, the internal organization of the data files, and a discussion of special techniques that were used in the implementation of LARSYS.

The "LARSYS Program Abstracts" comprise a collection of individual documents, each with its unique identifying Abstract number, one for each Fortran, assembler, or EXEC routine in the system. These abstracts are intended for programmers who may need to revise and/or maintain these routines.

Note that up-to-date reference listings of LARSYS commands and control cards are available from the computer via the REFERENCE command of the LARSYS system.

3.4 IBM MANUALS

A comprehensive collection of IBM manuals describing hardware and software aspects of the system is maintained in the computer area, and an abridged collection should be maintained near each remote terminal. The more important ones are listed below:

Hardware

Form GA27-3001 "IBM 2740/2741 Communications Terminal - Operator's Guide"

Form GA27-3005 "IBM 2780 Data Transmission Terminal - Component Description"

FORTRAN Language

Form GC28-6515 "IBM System/360 and System/370 Fortran IV Language"

CP-67 OPERATING SYSTEM AND CMS OPERATING SYSTEM

Form GH20-0859 "Control Program - 67/Cambridge Monitor System - Users Guide"

(Note: This manual is updated for PURDUE/LARS Users with memoranda describing local additions

and   modifications.   These   memoranda   are
distributed with the manual.)

4.0 HOW TO USE THE COMPUTER

4.1 SIGNING UP FOR SYSTEM RESOURCES

The configuration of the computer hardware is constantly being monitored and re-evaluated, with attention given to such questions as the usage of and need for scarce resources (tape units, disk storage space, user terminals). Even with a perfect hardware mix, however, there would be times when more users want to use drives or terminals than there are drives or terminals available. The computer operations staff attempts to deal with this problem so that maximum user convenience can be served.

One such procedure is that of signing up in advance to use terminals or tape units.

Sign-up policy for terminals is set at the individual terminal locations - details and sign-up sheets are available at each location.

LARSYS automatically requests tape drives from the computer operator when needed, and releases them when done. It should not be necessary for LARSYS Version 3 users to specifically reserve tape drives, since a number of drives (currently five of the total ten) are reserved for use by LARSYS Version 3 users.

Users of LARSYS Version 2 and programmers may sign up for tape drives if desired and if reservable drives are still available to accommodate them. In practice, it is often found that this is not necessary and that a drive may be requested when needed. The operator may assign a "LARSYS 3" tape drive to a "non-LARSYS 3 user" WITH THE UNDERSTANDING THAT IT MAY BE PRE-EMPTED later if needed for a user using LARSYS Version 3.

Any user wanting to reserve magnetic tape drives may want to call the computer operator ahead of time to reserve them. This can be done by calling extension 233 (LARS users), by using the voice facility (if one exists) of a remote terminal's communications link, or by logging in at a terminal and using the CP message facility. Be prepared to give the User ID you will be using so that when you log in and need the drives attached, the operator will know that you are the person who signed up.

IMPORTANT

It should not be necessary to point out that it is very wasteful of resources as well as quite inconsiderate of the "other guy" to sign up for resources you do not use. Accordingly, if your plans change and you are not able to

use the terminal or tapes when you have reserved them, you should release them for someone else to use as early as possible. In this respect, observance of "do unto others" will reap you great dividends as, in turn, others "do unto you".

4.2 RUNNING INTERACTIVE JOBS

This section first gives the basic information necessary to operate the terminal equipment, then the basic information necessary to invoke the software system.

The first part of this section deals with procedures for use of the computer from the point of view of a user at a remote site equipped with a 2780 high speed terminal. The last part (4.2.3) deals with procedures required at the central computer site.

4.2.1. OPERATING A 2741 TYPEWRITER TERMINAL

The 2741 consists of a Selectric typewriter with additional electronics needed for communications. It has two modes of operation: communicate mode and local mode, which are set by the mode switch on the left side of the typewriter stand. When in local mode, it is disconnected from the computer and functions as a typewriter only, and no information is transmitted or received. To use the typewriter in either local or communicate mode, the power switch on the right side of the keyboard must be ON (and the terminal must be plugged in).

The steps for preparing the 2741 for use are described below. After these steps have been performed, the user may login to the system.

1. Make sure the terminal is plugged in, then press the ON portion of the power switch at the right side of the keyboard.

2. Set the margin stops (located on the typing guide just above the keyboard) to the desired positions (normally about 10 and 120). To reset a margin stop, push it in, move it to the desired position, and release it.

3. The paper may be released and straightened by moving the paper-release lever forward (the silver lever to the extreme upper right rear, behind the platen (roller)), and then pushing it back when finished. The paper may be manually aligned up and down (to avoid typing on the printed lines) by pressing in the left platen knob and rotating up or down.

4. Check that the mode switch (on the left side of the stand) is set to COM. The terminal is now ready for use.

A more detailed description of the 2741 can be found in the publication "IBM 2740/2741 Communications Terminal - Operator's Guide", Form GA27-3001. A copy should be located at each terminal site.

4.2.2. OPERATING THE 2780 HIGH SPEED TERMINAL
The 2780 and its associated software enable a remote user to read cards directly into the spooled reader of his virtual machine (even before he logs in, if desired). He can also receive printed and punched output from his spooled output files.

4.2.2.1. GENERAL CONSIDERATIONS

1. A more detailed description of the 2780 (including error recovery procedures) can be found in the publication "IBM 2780 Data Transmission Terminal Component Descriptions", Form GA27-3005. A copy should be located at each terminal site. In addition, at each site there is a designated hardware/software specialist who is familiar with the operation of the terminal and with recovery procedures. In case of trouble, he should be called.

2. Do not change the setting of the mode switch (the dial switch on the reader/punch console) while any printing, punching, or reading is going on. First press the appropriate STOP key. (If this rule is ignored, the printer type bar will probably jam and will need to be reset. Call your site coordinator.)

3. Whenever the OVERUN, RECORD, INCP, EQUIP CHECK, DATA CHECK, or PARITY CHECK indicator lights turn on, it is necessary to reset the 2780 before resuming operation. This can be done by turning the mode switch to another setting and then back to the original setting.

4.2.2.2. TO READ CARDS
A deck of cards can be read when there is no other activity on the terminal or by interrupting printing or punching. (In the latter case

there is a possibility of over printing or receiving duplicate print lines when printing is resumed.)

    A. There is no activity on the 2780

1. Remove blank cards from card read/punch hopper.

2. Clear the card read/punch stations by depressing the NPRO key.

3. Place your card deck in the hopper - it must be preceded by an ID card (letters ID in col 1-2 and your specific user-id beginning in col 10).

4. Turn the mode switch dial to TSM TRSP. CAUTION!! Never turn this switch while the terminal is in operation. (Depress the STOP key first!)

5. Depress the END OF FILE key.

6. Depress the START key, and keep it depressed until the READY light comes on.

7. After all cards are read, the terminal will commence beeping. You can stop it by rotating the mode switch to some ther setting.

    B. The 2780 is in active printing or punching.

0. Depress the STOP key under the mode switch dial. (It is recommended you try to do this between pages, since when printing resumes, there is a chance of receiving a duplicate line or of overprinting a line already printed. Similarly, one or two duplicate cards may be produced if punching.)

1, 2, 3. Follow the same steps as in procedure A above. (Note: if you are reading in the single CANPRT or CANPCH cards described below, do not use an ID card.)

4. Hit END OF FILE key.

5. In rapid sequence:
   (a) turn the mode switch to TSM TRSP,
   (b) depress and hold down start key until
       ready light comes on.
NOTE: You must do both within the space of about 5 seconds - before the terminal starts beeping. If you do not succeed, turn the mode switch to some other position, and repeat beginning at step 4.

6. After all cards are read, the terminal will again start beeping (signifying that it wants

to resume printing or punching the interrupted output. Rotate the mode switch to PRINT (or REC) and press START on the printer. Or load blank cards in the punch, rotate the mode switch to PUNCH, and depress the START key under the mode switch dial. Or load blank cards in the punch, rotate the mode switch to PUNCH, and depress the START key under the mode switch dial.

4.2.2.3. <u>TO RECEIVE OUTPUT</u> To ensure that the 2780 is ready to receive output whenever required, it is recommended that the following setting be maintained at times when other functions are not being performed.

1. Turn the mode switch to REC

2. Ready the printer by making sure paper is inserted, then depressing the START key on the printer control panel.

3. Ready the punch by placing blank cards in the hopper then depressing the START key on the reader/punch and holding it in until the READY light comes on.

If only printer output is expected, step 3 may be omitted, and the mode switch in step 1 may be placed either at PRINT or REC. Similarly if only punched output is expected, omit step 2 and use either the REC or PUNCH positions in step 1.

4.2.2.4. <u>TO CANCEL A PRINTER OR PUNCH FILE</u> If the 2780 is printing or punching, and it is determined that the remainder of the output is no longer wanted, it may be terminated by reading in a single card (don't use any ID card) - with CANPRT or CANPCH punched in columns 1-6 depending on whether a printer or punch file is to be cancelled. This single card is read in using the procedure B in section 4.2.2.2.. After step 6 is performed, a few more lines will be printed, followed by the message OUTPUT CANCELLED BY REQUEST.

4.2.3. <u>OPERATING THE 2501 CARD READER</u> The 2501 card reader is used by people using one of the 2741 terminals in the computer room. Its operation is somewhat simpler than that of the 2780 described above.

1. Place card deck in hopper and cover with card weight. Don't forget the ID card.

2. Hit END-OF-FILE and then START, in that sequence.

3. If the reader stops before all cards are read, check with the computer operator on duty for assistance.

4.3 RUNNING BATCH JOBS

Batch jobs run in a disconnected CMS virtual machine under CP-67. The virtual machine remains dormant until a job is read into the card reader. The batch virtual machines run at all times - a user does not need to login to the computer at all, he merely drops his job into a card reader and his output comes out as soon as the job is done.

4.3.1. LARSYS BATCH JOBS LARSYS Version 3 jobs can be run on a special batch machine and are submitted through a card reader (or they can be submitted by a user logged in at a typewriter terminal.) Details are given in Section 3.7 of the "LARSYS User's Manual."

Currently one such batch machine is available, with the ID of BTLARSYS. Jobs read in are executed in the order in which they are received. Output is returned to the site(s) specified on the BATCH OUTPUT card.

Several points about this system should be noted by users:

1. If the machine should crash (heaven forbid) while a batch job is executing, the job may or may not be restarted when the computer is brought back up. This depends on whether or not all control cards had yet been read, and how serious the crash was. If the job does not get restarted, it must be re-submitted by the user, since neither the system nor the operator has the appropriate deck available.

2. There is at present no practical way for a user to find out how many jobs there are in the queue ahead of a job just submitted, and hence how long before one might expect a job to be finished and output to be produced.

4.3.2. UTILITY BATCH JOBS A versatile capability for a utility virtual machine has been developed. This system is currently implemented to handle very short utility-type functions, such as deck listing, deck duplicating, listing or duplicating information at a remote site, tape copying and dumping, etc.

A job deck consists of the following four cards in order (followed optionally by data cards)...

1) A CP-67 ID card having the user-id of the UTILITY virtual machine. ("UTILITY" must start in column 10).

2) A "Batch ID" card, with the four fields BATCH ID 'Userid' 'username'. The words BATCH and ID appear

exactly as shown, separated by one or more spaces. A user inserts his own 'user-id' and his name or the name of the person who is to receive the output. The name can be up to 16 characters long, and may include blanks and punctuation. Note that if any tape is to be written on, the authorized ring-in ID listed on the tape's labels must match the 'user-id' given on this card.

3) A "Batch Output" card, with the four fields BATCH OUTPUT 'printloc' 'punchloc'. The words BATCH and OUTPUT appear exactly as shown, separated by one or more spaces. The 'printloc' and 'punchloc' parameters are used to control the location where output is produced. (If these are omitted, they default to Flexlab2.)

4) A job definition control card. Four formats are currently recognized. Each begins in column 1 and must be punched exactly as shown.

    DECKLIST
    DECKDUP
    EXEC filename parm1 parm2 parmetc
    EXECnn

If the "DECKLIST" control card is recognized, all remaining cards in the deck will be printed on the printer (at the location specified as 'printloc' on the BATCH OUTPUT card.)

If the "DECKDUP" control card is recognized, all remaining cards in the deck will be punched (at the location specified as 'punchloc' on the BATCH OUTPUT card).

If the "EXEC filename" control card is recognized, a search will be made for that EXEC file on the LARSLIB 1 source/text library disk. If it is found, it will be executed. One or more optional parameters may be passed.

If the "EXECnn" control card is recognized (nn are two digits between 01 and 99), a new temporary EXEC file is created using the next nn cards into the file. That temporary file is then executed. (This procedure is useful for initial checkout and testing of procedures that are intended to go later on the LARSLIB 1 disk).

EXAMPLE 1 - DUPLICATE A CARD DECK

This example shows a user named John Doe duplicating a

card deck at Flexlab1. His user-id is MYID.

```
ID         UTILITY
BATCH      ID    MYID     JOHN DOE
BATCH      OUTPUT  FLEXLAB1    FLEXLAB1
DECKDUP
  .
  .   }  Cards to be duplicated
  .
```

EXAMPLE 2 - PRINT A LISTING OF A CARD DECK

This example shows a user named Jim Dane producing a listing of a card deck. For the purpose of this example, assume that he is located at the Houston remote terminal. He has used his own user-id MSCQJK, but has specified the output to be printed at Flexlab2 instead of Houston and to be labelled with the name of Jeanne Etheridge instead of his own name. In this way Jim Dane can send a copy of a listing of his card deck to be examined by Jeanne Etheridge (say he is having a problem with a job deck and needs to have someone look at his control cards).

```
ID         UTILITY
BATCH      ID    MSCQJK    JEANNE ETHERIDGE
BATCH      OUTPUT  FLEXLAB2    FLEXLAB2
DECKLIST
  .
  .   }  A few cards punched with information
  .      describing the rest of the cards.
  .
  .   }  Cards to be listed.
  .
```

EXAMPLE 3 - COPY TAPES

Any tape copy job can be done, including straight copy, 7 track to 9 track conversion, 1600 bpi to 800 bpi conversion, etc. It is not necessary to know the number of bytes in a physical record (block), and any blocksize up to 32767 bytes is acceptable. (This program - TAPCPY - can also be used from a terminal and full details are given in PURDUE/LARS Abstracts 0610 and 0611. It is more versatile than the CMS command TPCOPY, since the latter has a maximum blocksize of 4096 bytes.)

In this example, John Doe is converting from 1600 bpi to 800 bpi.

```
        ID        UTILITY
        BATCH ID  QJCK5 JOHN DOE
        BATCH OUTPUT FLEXLAB2  FLEXLAB2
        EXEC TAPUTL RDCOPY
        TAPIN(1052),MODIN(16),TAPOUT(828),MODOUT(17)
```

Notes on Tape copying:

CARD 4 - Contains the letters 'EXEC TAPUTL RDCOPY' in columns 1-18.

CARD 5 - Contains options (in any order) from the following list:

Option	Purpose	Default
TAPIN(XXX)	Tape to be copied from	(None)
MODIN(XX)	Mode of input tape (see below)	MODIN(16)
START(XX)	Start copying at this file on input tape	START(1)
TAPOUT(XXX)	Tape to be copied to	TAPOUT(SCRATCH)
MODOUT(XX)	Mode of output tape (see below)	MODOUT(16)
SKIP(XX)	How many files to skip on output tape	SKIP(0)
COPY(XX)	How many files to copy	Copy until two consecutive EOF marks

CODES FOR MODIN AND MODOUT

CODE	TRACKS	DENSITY	PARITY	CONVERTER	TRANSLATOR
17	9	800 bpi	(not applicable)		
16	9	1600 bpi	(not applicable)		
15	7	200 bpi	Even	off	off
14	7	200 bpi	Even	off	on
13	7	200 bpi	Odd	off	off
12	7	200 bpi	Odd	off	on
11	7	200 bpi	Odd	on	off
10	7	556 bpi	Even	off	off
9	7	556 bpi	Even	off	on
8	7	556 bpi	Odd	off	off
7	7	556 bpi	Odd	off	on
6	7	556 bpi	Odd	on	off
5	7	800 bpi	Even	off	off
4	7	800 bpi	Even	off	on
3	7	800 bpi	Odd	off	off
2	7	800 bpi	Odd	off	on
1	7	800 bpi	Odd	on	off

A printer file will be created containing a log detailing what was requested and copied, and any error messages if errors occurred. (The error codes are discussed in the documentation of the TAPOP module.)

EXAMPLE 4 - DUMP A TAPE

User John Doe, at Flexlab2, wants to dump the first two files of his tape number 1234. He is using the TAPUTL program (described in more detail in PURDUE/LARS Abstract 612). Note that at present seven-track tapes cannot be dumped using TAPUTL.

```
     ID        UTILITY
     BATCH     ID    MYID    JOHN R. DOE
     BATCH     OUTPUT  FLEXLAB2    FLEXLAB2
     EXEC      TAPUTL  RDDUMP
     TAPE(1234),HEX,LREC(10),LFILE(2)
```

Notes on tape dumping:

CARD 4 - Contains the letters 'EXEC TAPUTL RDDUMP' in columns 1-18.

CARD 5 - Contains options (in any order) from the following list:

Option	Function	Default
TAPE(XXX)	TAPE XXX is requested to be dumped	(None)
BCD	Tape is dumped in BCD format	HEX
HEX	Tape is dumped in HEX format	HEX
IREC(XXX)	XXX is the first record in each file to be dumped	IREC(1)
LREC(XXX)	XXX is the last record in each file to be dumped	LREC(99999)
IFILE(XXX)	XXX is the first file to be dumped	IFILE(1)
LFILE(XXX)	XXX is the last file to be dumped	LFILE(1)

EXAMPLE 5 - USING THE EXECnn OPTION

John needs to produce a listing of a deck of cards that has been punched with carriage control characters in column 1 of each card. This can be done using the CMS command OFFLINE PRINTCC. He creates a 3 card temporary EXEC file using the EXEC03 control card. This file reads the rest of his deck into a disk file named INPUT CARDS, then OFFLINE

PRINTCC's it and ERASE's it.

```
ID        UTILITY
BATCH     ID      MYID      JOHN DOE
BATCH     OUTPUT  FLEXLAB2  FLEXLAB2
EXEC03
OFFLINE   READ    INPUT   CARDS
OFFLINE   PRINTCC INPUT   CARDS
ERASE     INPUT   CARDS
     .
     .  }
     .  }
     .  }   Input card deck to be listed.
        )
```

Note in connection with this example that the UTILITY virtual machine is only configured with a 1-cylinder P-disk. Thus the deck of cards that is read into the file INPUT CARDS should not be larger than about 1300 cards, or the file INPUT CARDS will be too big to be contained on the P-disk. This will cause the UTILITY virtual machine to abnormally terminate and log itself out.

5.0 NOTES FOR PROGRAMMERS

5.1 CMS

Most usage of the computer for program development is through the use of CMS (Cambridge Monitor System) -- See Section 2.2.2. The PURDUE/LARS Technical Support Group periodically conducts a short introductory course in the use of CMS, and it is expected that each person who wants to use CMS will have first attended the course.

5.1.1. DISK SPACE FOR CMS USERS When authorization to use CMS is approved and an ID is set up, the user will have private disk space defined for his virtual machine (his P-disk) that may be used to store programs, procedures, and data from one terminal session to the next. The amount of such disk space actually available on the real computer is limited, and it is expected of each user that he develop and practice procedures for making the most efficient use of his quota of space. This includes, for example, keeping files not being used at the moment on back-up storage (tape or cards).

5.1.2. BACKUP PROCEDURES It should be emphasized that each CMS user should frequently backup his entire disk to tape for safety purposes. The computer staff does not backup any user disk areas, and although it seldom occurs, a hardware crash could cause loss of all files on any disk. Far more likely is the occurrence of an inadvertent user error that wipes out his disk, or makes it unreadable. A convenient method of backing up user CMS disks is provided by the CMS command BACKUP - it is described in an addendum to the CP/CMS Users Guide, and its regular use is highly encouraged.

5.1.3. PRINTER AND PUNCH OUTPUT All printer and punch output is normally produced at the main computer site. A special CP command ("REMOTE") exists that is used to cause output to be produced at a remote terminal site, and it must be issued by any user (including a CMS user) who wants his output produced on his 2780 at his remote terminal site. LARSYS (both Version 2 and Version 3) contain programming that issues the REMOTE command automatically by sensing which 2741 terminal is being used and then REMOTEing printer and punch output to the same physical location.

The CMS user can utilize the same automatic sensing of location and issuing REMOTE command by using the CMS command WHERE - it is described in an addendum to the CP/CMS Users Guide. The recommended method of use is to include the WHERE command within the user's PROFILE EXEC, so that it is automatically issued whenever he logs in and ipl's CMS.