LARS Information Note 110574

The LARSYS
Educational Package:
Instructor's Notes

BY
John C. Lindenlaub
Shirley M. Davis

The Laboratory for Applications of Remote Sensing

Purdue University, West Lafayette, Indiana

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PREFACE

The materials included in this volume have been designed
to assist LARSYS instructors as they guide students through the
LARSYS Educational Package. All of the materials have been up-
dated from the previous version to reflect the changes made in
the Educational Package which coincided with the technical
changes brought about by putting LARSYS Version 3.1 "on line."

Included in the material is "A Survey of the LARSYS Educa-
tional Package to Accompany Version 3.1," the Student Notes for
Units II through V (Units I, VI and VII have been issued as
separate LARS Information Notes) and the Instructor's Notes
for each of the seven units now in the package. Instructor's
Notes are printed on buff paper.

There are many significant changes in the nature and format
of the Educational Package as well as minor changes in the con-
tent which reflect changes brought about by LARSYS Version 3.1.
Unit I has been reduced from 83 pages to 63 pages with no sig-
nificant changes in content. Diagnostic pretests and posttests
have been added to allow the student to check his progress and
mastery of the materials presented.

Unit II also has a new format. The earlier version was a
notebook or set of slides and audio tape which the student or
students viewed rather passively. The new version incorporates
a set of student notes which contain activities to actively in-
volve the students in learning. The slides and notebook have
been replaced by a display book which makes the computer print-
outs much more readable. Three decks of computer cards allow
the student to handle the materials they will be generating
later in the sequence.

Revisions in Units III,IV, and V include those needed for
consistency with changes in LARSYS, some organizational improve-
ments to increase ease of use by both students and instructors,
and numerous smaller changes as suggested by students who had
used earlier versions of the LARSYS Educational Package. In
response to our national resource shortages, steps were also
taken to reduce the amount of computer paper needed to carry
out the activities. Notable additions to the Demonstration
(Unit III) include student follow-up activities, a conference
with the instructor, and greater emphasis on the computer sys-
tem environments and user aids. In Unit IV, students now learn
to use the system to communicate with the operator and with
other users, and look closely at the details of the typewriter,
lineprinter and punched output. In Unit V, they get experience
using the batch processor.

Unit VI, <u>Guide</u> to <u>Multispectral</u> <u>Data</u> <u>Analysis</u> <u>Using</u> <u>LARSYS</u>, has undergone the least change. Basically only typographical errors were corrected, awkward sentence structures changed and the computer printouts updated to the format generated by LARSYS 3.1.

Unit VII, <u>A</u> <u>Case</u> <u>Study</u> <u>Using</u> <u>LARSYS</u> <u>for</u> <u>Analysis</u> <u>of</u> <u>LANDSAT</u> <u>Data</u>, is a totally new addition to the Educational Package. It has been designed by Tina Cary to parallel the <u>Guide</u> (Unit VI) but uses data from LANDSAT for the analysis sequence. As in the <u>Guide</u>, the students actually complete a case study.

A Survey of the LARSYS Educational Package
to Accompany Version 3.1

The LARSYS Educational Package is a set of instructional materials developed to train people to analyze remotely sensed multispectral data using LARSYS, a computer software system developed at LARS/Purdue. A high priority was placed on designing the materials for independent study as it was felt that this would be the most likely situation in practice. Organizations just getting started in the use of multispectral data would probably have only two or three people making initial use of LARSYS. As their experience and skills improve other workers would be expected to join the effort. Students would be starting at different times and, depending on their backgrounds and other duties, would progress at different rates.

To meet these educational challenges, a series of seven units has been developed. Each unit is designed to take a student from an initial point, defined by the prerequisites, to an end point, defined by its objectives. Each unit provides informational materials, an opportunity for the student to practice and study the skills or ideas presented, and a problem or test situation to help him determine whether he has met the objectives of that unit.

A variety of media is used in the educational package, the selection dependent on the nature of the material and the defined objectives of each unit. Reinforcement of certain concepts, such as the multispectral concept and the multi-dimensional statistical approach, is interwoven throughout the package.

Essential to the effective use of the educational package is a "LARSYS expert" or "site expert." Each student should be assigned to one or two persons experienced with LARSYS who can serve as instructors. At LARS/Purdue the instructor would probably be a fellow researcher from within the same program area. At geographically remote sites, the "site expert" would be an individual who has spent anywhere from several days to several weeks at LARS learning about LARSYS. While at LARS he would have had the opportunity to go through the training materials while working with a terminal identical to his remote site terminal and to observe operations in the computer facility. As the number of experienced LARSYS users at a given remote site grows, it is expected that some of them will also assume instructional duties. Instructor notes, designed to assist those serving as instructors, accompany each unit.

The function of the instructor is not to plan and preside over formal classroom sessions, but rather to serve as a tutor helping clarify troublesome points for each student. It is intended that student/instructor sessions be brief with the instructor providing the necessary corrective feedback or encouragement to enable the student to continue on his own.

Description of the LARSYS Educational Package

The LARSYS Educational Package presently consists of seven units. A flow chart of the materials is shown on the next page. It summarizes the purpose of each unit and gives a time estimate for completing each unit.

Students begin with a background manual entitled An Introduction to Quantitative Remote Sensing. This is an introduction to remote sensing stressing the role of pattern recognition in numerically-oriented remote sensing systems. Its specific purpose is to provide a common background and orientation for the LARSYS computer software system. For newcomers to remote sensing, this manual introduces concepts and terminology which are needed later on. Remote sensing veterans will be introduced in this material to numerically-oriented remote sensing data analysis.

The second unit entitled LARSYS Software System - An Overview consists of a recorded tape which accompanies a display book and student notes. It takes the viewer through a typical remote sensing data analysis sequence and illustrates the commonly used features of the LARSYS processing functions.

An introduction to the computer terminal follows. The unit Demonstration of LARSYS on a 2780 Remote Terminal provides the student with an introduction to the data processing hardware that he will be using and introduces him to some additional aspects of the LARSYS software system. He will observe several LARSYS jobs run at the 2780 remote terminal. The demonstration requires an instructor to present the material and guide the student. Instructor's notes have been designed so that persons with only a modest amount of experience with the terminal can satisfactorily run the demonstration.

Students are instructed in the use of the terminal by means of an audio-tutorial lesson The 2780 Remote Terminal: A Hands-On Experience. The student is guided by an audio tape on how to use the terminal off-line as a card lister, login to the computer and initiate the LARSYS system, run sample LARSYS jobs and transmit data to and receive data from the main computer. The audio tape is accompanied by a set of student notes.

LARSYS Exercises, Unit V, are short problems which the student solves by using the computer terminal and LARSYS processing functions. The purpose of these problems is to increase the student's experience in the use of LARSYS for multispectral data analysis and to help him develop an appreciation for the capabilities and limitations of the LARSYS software system.

THE LARSYS EDUCATIONAL PACKAGE

UNIT I

> Title: An Introduction to Quantitative Remote Sensing
>
> Purpose: Orientation to remote sensing terminology, principles and pattern recognition.
>
> Time estimate: 4 hours

UNIT II

> Title: LARSYS Software System - An Overview
>
> Purpose: Summary of LARSYS data analysis capabilities.
>
> Time estimate: 1 hour

UNIT III

> Title: Demonstration of LARSYS on the 2780 Remote Terminal
>
> Purpose: Orientation to terminal hardware and terminal procedures.
>
> Time estimate: 1.5 hours

UNIT IV

> Title: The 2780 Remote Terminal: A "Hands-On" Experience
>
> Purpose: Experience in transmitting cards, receiving punched and printer output, and running a LARSYS program when given the control card listings.
>
> Time estimate: 4.5 hours

UNIT V

> Title: LARSYS Exercises
>
> Purpose: Practice in using the terminal, writing and executing simple LARSYS programs.
>
> Time estimate: 5 hours

UNIT VI

> Title: Guide to Multispectral Data Analysis Using LARSYS (with accompanying Example and Case Study)
>
> Purpose: Analysis of a detailed example and a case study using aircraft data.
>
> Time estimate: 40 hours

UNIT VII

> Title: A Case Study Using LARSYS for Analysis of LANDSAT Data
>
> Purpose: Analysis approach of a detailed example and a case study.
>
> Time estimate: 45 hours

At this point in learning to use LARSYS, the student has a choice between Unit VI, Guide to Multispectral Data Analysis Using LARSYS and Unit VII, A Case Study Using LARSYS for Analysis of LANDSAT Data. Both units provide a detailed breakdown of the philosophy of the analysis methods -- describing the steps in the analysis, why they are necessary and how they are carried out. A detailed example parallels the description, and the student has the opportunity to carry out an analysis of his own by means of a case study. Unit VI is geared toward a supervised analysis approach and uses aircraft data. Unit VII combines techniques from both supervised and unsupervised approaches and applies these techniques to data collected by the Earth Resources Technology Satellite, now known as LANDSAT. If the student has the time, resources and interest, a study of both units is recommended.

Other Educational Resources

A Site Library containing selected LARS Information Notes, the LARSYS User's Manual, "An Analysis of Run 71053900" (an analysis example for Unit VI), "An Analysis of Run 73033802" (an analysis example for Unit VII), and copies of Focus is included in the support materials accompaning the LARSYS Educational Package.

Two documents in particular are referenced frequently in the LARSYS Educational Package. They are the LARSYS User's Manual edited by T. L. Phillips, and Pattern Recognition: A Basis for Remote Sensing Data Analysis by P. H. Swain. The former document provides a detailed documentation of the LARSYS system from the user's viewpoint; the latter provides a theoretical framework for the algorithms used in the LARSYS processing functions.

Newcomers to the field are encouraged to do some background reading. The kind and amount of reading will vary according to the specific application of remote sensing in which they are interested. There is a large quantity of technical literature available in remote sensing. However, reading most of it requires a thorough understanding of the technology. Persons new to remote sensing find it most helpful to look at one or more of books written to provide an overview of the field. Generally they discuss the various sensor types, data characteristics, analysis procedures, and applications. We especially recommend five that are currently available.

Committee on Remote Sensing for Agricultural Purposes (1970). Remote Sensing with Special Reference to Agriculture and Forestry. National Academy of Sciences, Wash., D. C. 424 p.

Estes, J. E. and Senger, L. W. (1974). Remote Sensing: Techniques for Environmental Analysis. Hamilton Publishing Co., Santa Barbara, Calif. 340 p.

Holz, R. K. (ed.) (1973). <u>The Surveillant Science: Remote Sensing of the Environment</u>, Houghton, Mifflin Co., Boston. 390 p.

Johnson, P. L. (ed.) (1969). <u>Remote Sensing in Ecology</u>. Univ. of Georgia Press, Athens, Ga. 244 p.

Rudd, R. D. (1974). <u>Remote Sensing: A Better View</u>. Duxbury Press, North Scituate, Massachusetts. 135 p.

Readings from the remote sensing literature may be selected to emphasize the discipline orientation of the student.

Those interested may contact Technology Transfer at LARS to determine other educational materials that are available. Many different types of materials are presently in preparation including additional <u>Focus</u> items, minicourse (which include student notes, slides and audio tapes), and video tapes with viewing notes.

Many people have contributed to the development of the LARSYS Educational Package. Valuable suggestions have come from students working with earlier versions of the educational package. You, as a student, can aid in the further development and improvement of the materials by sending any comments and suggestions to:

John C. Lindenlaub
Technology Transfer
Laboratory for Applications of
    Remote Sensing
1220 Potter Drive
West Lafayette, Indiana 47906

Special Note to Instructor

Each terminal site has one or more Multispectral Image
Storage Tapes assigned to it. The person charged with the
responsibility of coordinating educational activities at the
site should dedicate one of these tapes to educational purposes.
In particular, students will need access to runs 73033802,66000600,
66005200, 71053900 and 72072302 at one or more times as they go
through the educational materials. Each site expert is respon-
sible for generating a tape with these runs on it.[1] This
may be accomplished by means of the following LARSYS run:

```
*DUPLICATERUN
FROM RUN(73033802)
TO TAPE(TTT), FILE(1)
END
*DUPLICATERUN
FROM RUN(66000600)
TO TAPE(TTT), FILE(2)
END
*DUPLICATERUN
FROM RUN(66005200)
TO TAPE(TTT), FILE(3)
END
*DUPLICATERUN
FROM RUN(71053900)
TO TAPE(TTT), FILE(4)
END
*DUPLICATERUN
FROM RUN(72072302)
TO TAPE(TTT), FILE (5)
END
```

where TTT is the tape number used for educational purposes
at your particular site.

---

[1]This particular order was chosen so as to place the run
expected to have heaviest use at the beginning of the tape.
This results in fewer file forward requirements and hence
more efficient operation. Local conditions or case study
preferences may dictate a different order at your remote
terminal site.

AN INTRODUCTION TO
QUANTITATIVE REMOTE SENSING

Materials Required: Student's personal copy of
An Introduction to Quantitative Remote Sensing
(LARS Information Note 110474)

Estimate of Instructor time required: Briefing time:
5 to 10 minutes

Important Notes:

An Introduction to Quantitative Remote Sensing is written like a programmed text. Urge your student to read the Preface first. The material is self-contained and the reader should require no external assistance. Each student should be provided with a personal copy.

The booklet is divided into three sections: I. An Introduction to Remote Sensing, II. Multispectral Analysis and III. The Role of Pattern Recognition in Remote Sensing. Each section is preceded by Objectives and a Pretest (blue page) and followed by a Posttest (yellow pages). The answers for all of the Pretest and Posttest questions are given in the Appendix (pink pages). Encourage the student to actually write out each answer in the spaces provided in the booklet. On the basis of the "correctness" of his answers to these questions, he will be directed to various parts of the text.

Instructors who have used this booklet feel that debriefing students after the Introduction is very important, especially to be sure that they understand the basic concepts such as decision rules.

If your student is a newcomer to remote sensing, you might suggest additional reading from the Site Library. Select materials that emphasize the discipline orientation of the student.

THE LARSYS SOFTWARE SYSTEM:
AN OVERVIEW

Materials Required: Audio tape and tape player
Booklet of displays
Three decks of computer cards (A,B and C)
Student Notes handout (which student will
    keep)

Estimate of Instructor time required: Briefing time:
5 to 10 minutes

    Students should be briefed on the operation of the tape
player.

    You should emphasize this is an overview and that it is
not intended that the students absorb all the details. Have
them pay close attention to the set of instructional objectives
stated at the beginning of the Student Notes.

Student Notes
for
LARSYS
software system:
An Overview

*LINEGRAPH *SEPARABILITY
*PICTUREPRINT

*HISTOGRAM **LARSYS**

*CLASSIFYPOINTS *IDPRINT *STATISTICS

*PRINTRESULTS

Developed by James D. Russell and John C. Lindenlaub

NOTE TO THE STUDENT: This set of notes is designed to accompany an audio tape, a set of display materials and three sample decks, labeled A, B and C. The presentation runs about 45 minutes and is intended as an overview or introductory treatment of the LARSYS software system.

If you have not done so already, begin this minicourse by listening to the audio tape and following the instructions given on the tape. Music on the tape will be your cue to turn off the tape and perform some activity.

PREREQUISITES: Some background in remote sensing and pattern recognition is assumed. Specifically you should be able to:

1. Define "remote sensing."

2. Identify three types of measurable electromagnetic field variations that are used in remote sensing.

3. Given a graph showing relative spectral response vs. wavelength for various ground covers, plot their associated points on the λ_1, λ_2 plane.

4. Given a plot of training samples associated with different classes of ground cover, classify an unknown point using a specified decision rule.

5. Outline and/or discuss the basic operation of an airborne multispectral scanner.

6. Given a block diagram of a pattern recognition system, discuss the following terms: receptor, feature vector, categorizer, and decision rule.

7. State two conditions a class must meet in order to be useful.

This background material is included in Unit I of the LARSYS Educational Package, entitled An Introduction to Quantitative Remote Sensing. If you do not feel you have met these prerequisites, you may want to reread sections of the Introduction or get additional suggestions from your instructor.

OBJECTIVES: When you have completed this minicourse, you should be able to:

1. List, without regard to the particular format used, the information contained on a multispectral image storage tape.

2. Name the three types of control cards used in running LARSYS programs.

3. Describe the output of at least four of the LARSYS processing functions which are described in this overview.

RETURN TO THE TAPE

WHAT IS LARSYS?

LARSYS – A GROUP OF COMPUTER PROGRAMS DESIGNED TO:

<u>Access</u>

<u>Manipulate</u>

<u>Analyze</u>

a very high volume of data.

Communicated By:

```
        ┌─────────────────┐
        │   Executive     │
        │    Level        │
        ├─────────────────┤
        │                 │        Terminal Commands
        │  19 Commands    │           (Typewriter)
        └────────┬────▲───┘
                 │    │
                 ▼    │
        ┌─────────────────┐
        │    Monitor      │  ┐
        │     Level       │  │
        ├─────────────────┤  │
        │ 9  Initialization│ │
        │    Functions    │  │     Input Deck
        └────────┬────▲───┘  ├    (Punched Cards)
                 │    │       │
                 ▼    │       │
        ┌─────────────────┐  │
        │   Processing    │  │
        │     Level       │  │
        ├─────────────────┤  │
        │  18 Processing  │  │
        │    Functions    │  │
        └─────────────────┘  ┘
```
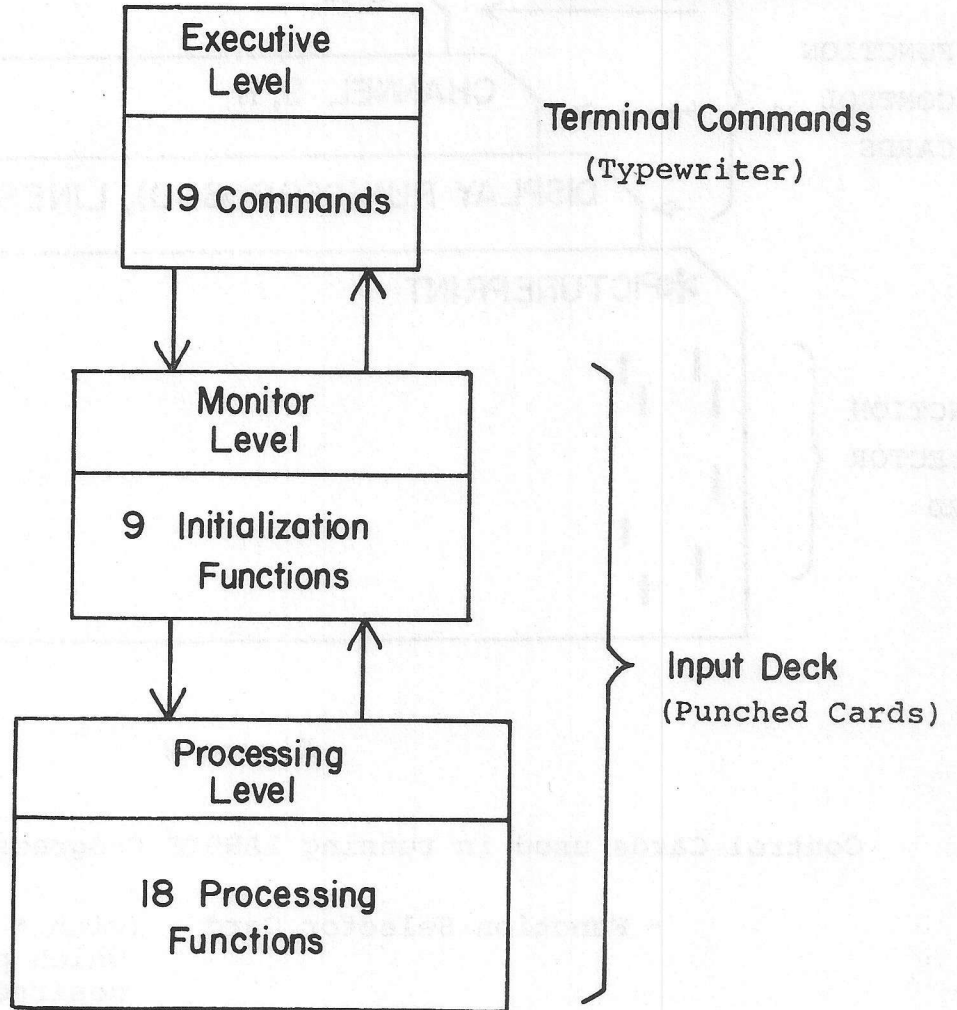
The LARSYS Organization

Figure 1

TYPES OF INFORMATION ON MULTISPECTRAL IMAGE STORAGE TAPE
- Identification Information
- Calibration Information
- Data Addresses
- Data Values for each element of the ground scene

LARSYS can be used to obtain ID Information
from a Multispectral Image Storage Tape

LARSYS can produce Alphanumeric Pictorial Printouts

FUNCTION
CONTROL
CARDS
{
END

CHANNEL 9, 11

DISPLAY RUN(66000600), LINES (587, 797, 2)

FUNCTION
SELECTOR
CARD
{
*PICTUREPRINT
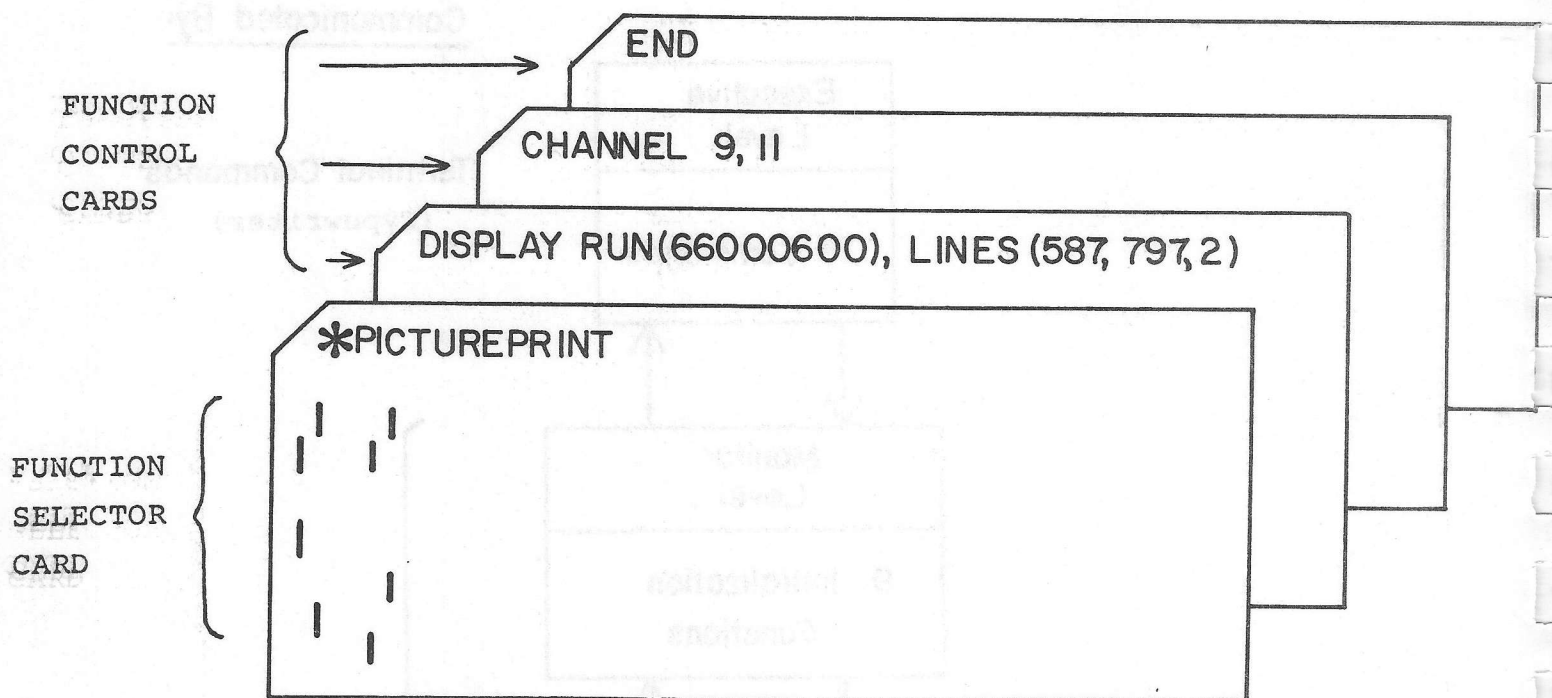
Figure 2

Control Cards used in running LARSYS Programs:

- Function Selector Card - (with * in column 1, tells which processing function is desired)

- Function Control Cards - (key word begins in column 1, card contains data addresses, computation options, type of output desired, etc.)

- Initialization Function - (with hyphen in column 1, used Cards for "housekeeping" functions such as putting identification comments on output)

THE ANALYST USES REFERENCE DATA TO -

- Locate Training Fields (typical data samples)
  and Test Fields (to evaluate accuracy of
  classification results)

- Establish Field Boundaries
  (by comparing gray scale printout with
  aerial photograph)
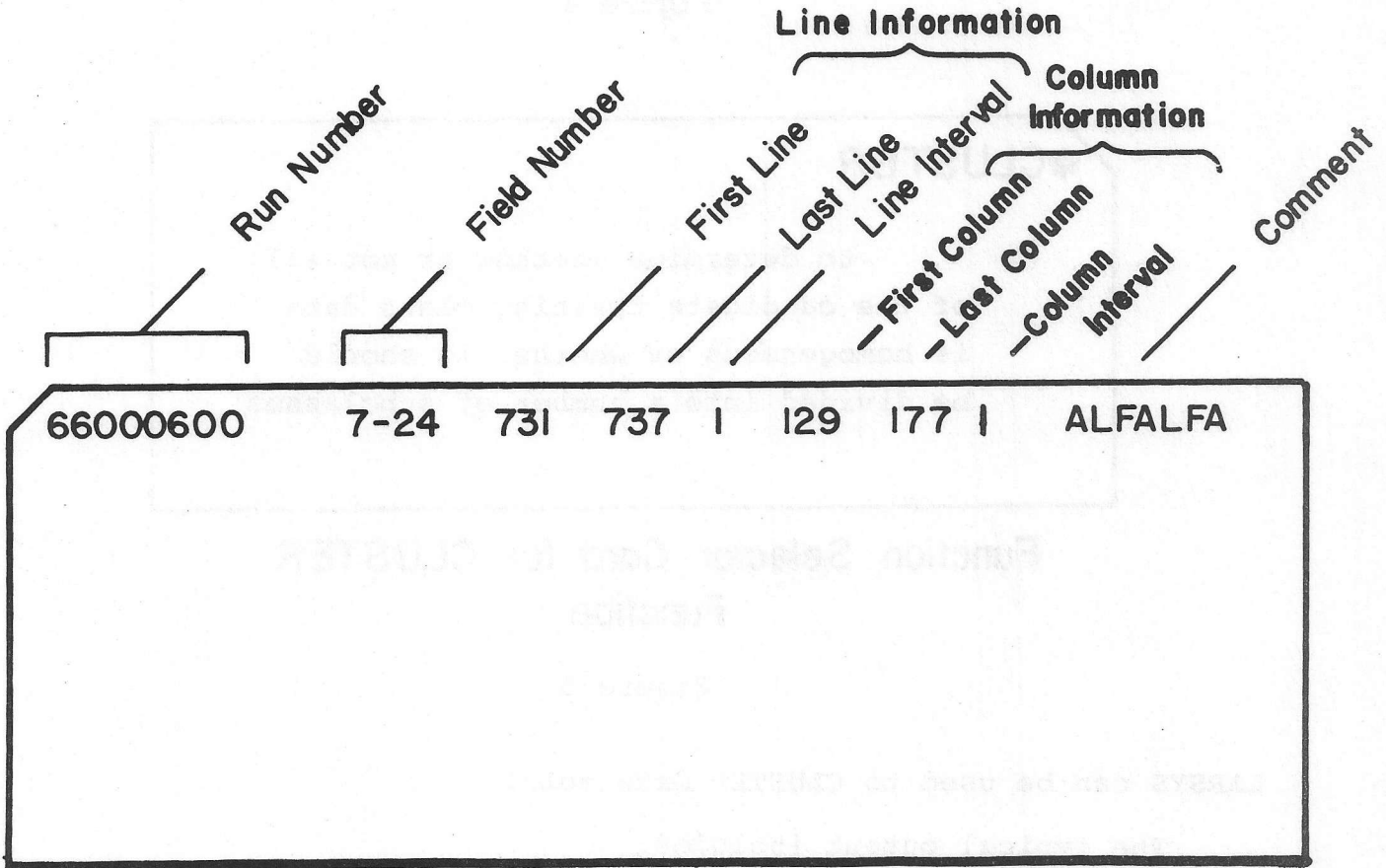
SAMPLE OF FIELD DESCRIPTION CARD

Figure 3

*LINEGRAPH

to produce graphs of
specified lines (or columns)
of data -- see Display 8

Function Selector Card for LINEGRAPH Function

Figure 4

*CLUSTER

to determine whether or not all
of the candidate training class data
is homogeneous or whether it should
be divided into a number of subclasses

Function Selector Card for CLUSTER Function

Figure 5

LARSYS can be used to CLUSTER data sets.

The typical output includes:

- Maps of candidate training fields

- Statistics for candidate training classes

- Information about separability of candidate training classes

- Histograms of data points associated with a cluster (optional)

```
┌─────────────────────────────────────────────┐
│ *STATISTICS                                   │
│                                               │
│              to calculate the statistics      │
│          for data fields and data classes     │
│          in any set of channels               │
│                                               │
└─────────────────────────────────────────────┘
```

Function Selector Card for STATISTICS Function

Figure 6

LARSYS can provide means, standard deviations, and correlation matrices of data fields and classes.

The STATISTICS processing function produces the statistics deck needed for the SEPARABILITY and CLASSIFYPOINTS processing functions.

LARSYS can provide Histograms of data from individual fields of data and from classes (groups of data fields).

The STATISTICS processing function provides:

- Mean and standard deviation vectors

- Correlation matrices

- Statistics decks

- Histograms

- Coincident spectral plots

LARSYS assists in determining the degree of SEPARABILITY of classes.
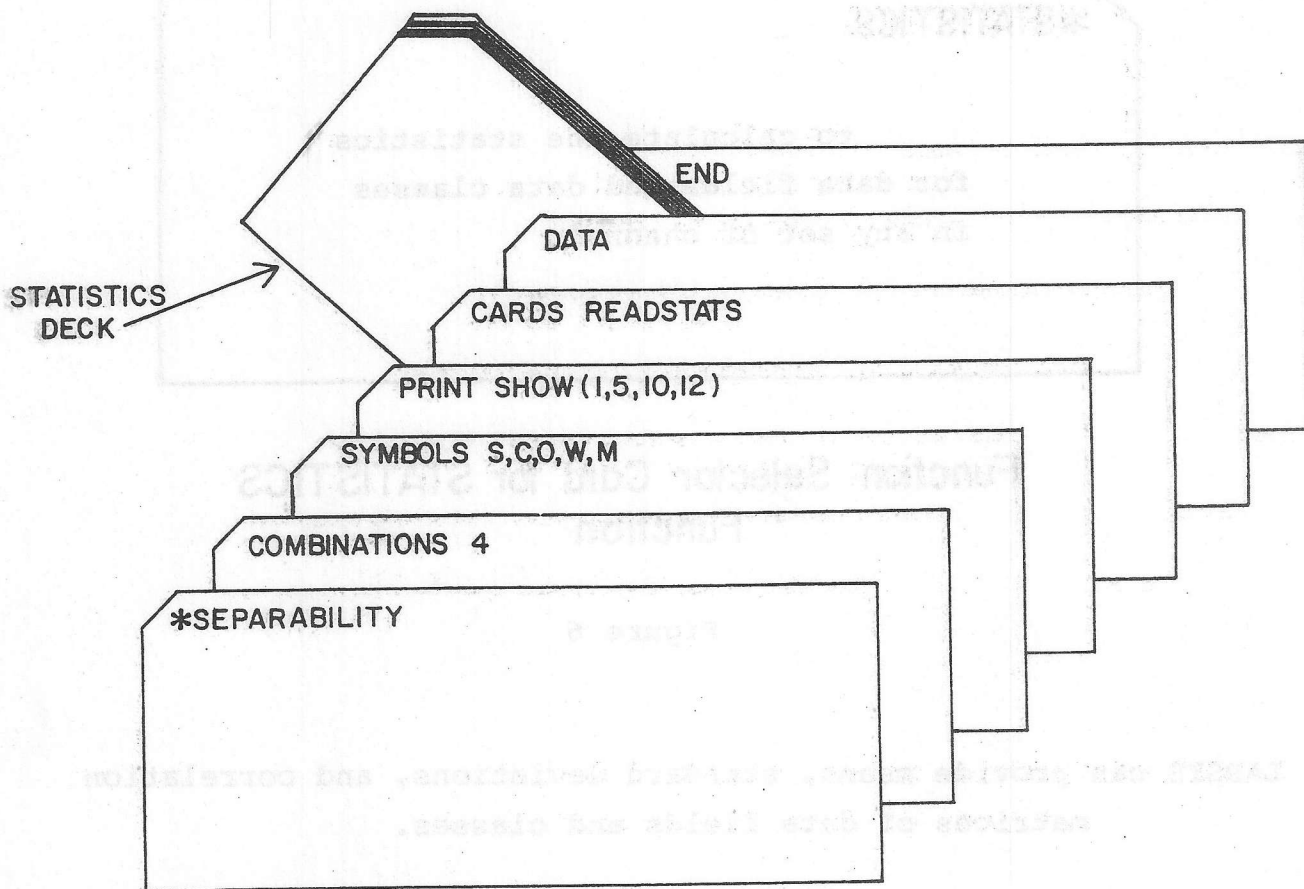
Figure 7

LARSYS helps select the best set of features.
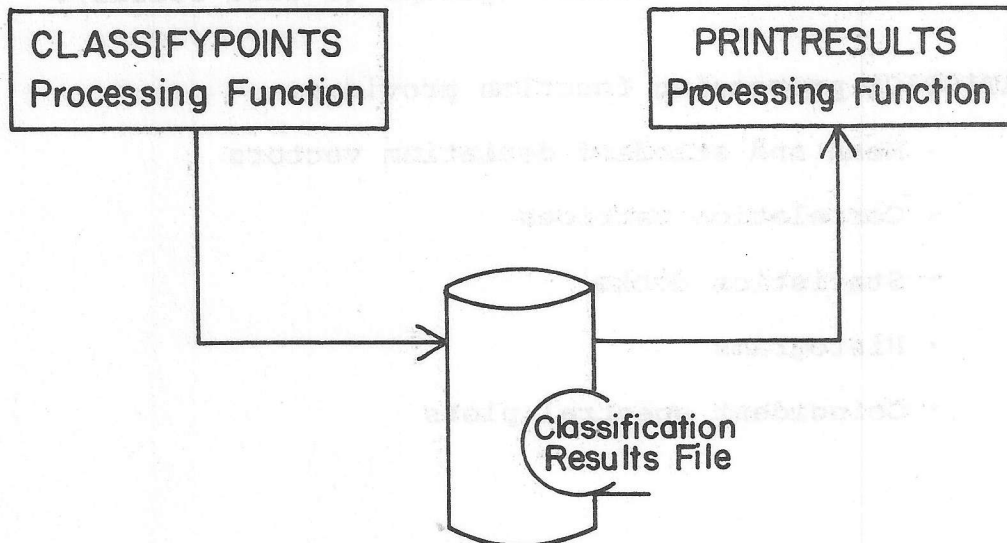
Figure 8

LARSYS can be used to classify data.

Results are displayed in map or tabular form.


```
                                    ┌──────────────┐
                                    │ END          │
                                    ├──────────────────────────────────────┐
                                    │ RUN(66000600), LINES(587,797,2),COLS(I,222,2) │
                            ┌───────┤                                       │
                            │ DATA  │                                       │
                    ┌───────┤                                               │
                    │ DATA  │                                               │
            ┌───────┤       │                                               │
            │ CHANNELS I,6,IO,II                                            │
    ┌───────┤                                                               │
    │ CARDS READSTATS                                                       │
  ┌─┤                                                                       │
  │ RESULTS TAPE(OOO), FILE(OI), INIT                                       │
┌─┤                                                                         │
│ *CLASSIFYPOINTS                                                           │
│                                                                          │
└──────────────────────────────────────────────────────────────────────────┘
```

Statistics Deck

Function Control Cards

← Function Selector Card
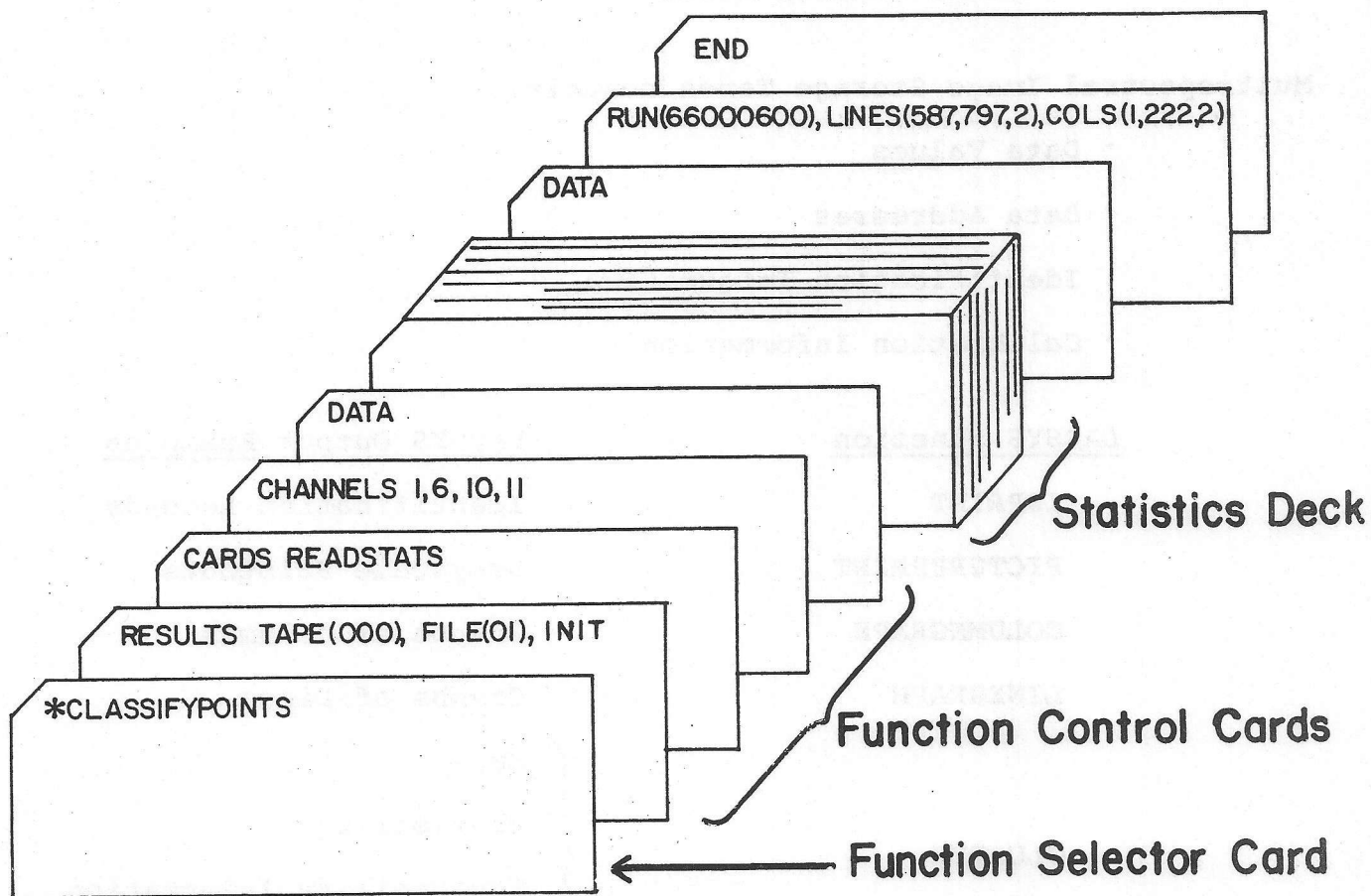
Figure 9

S U M M A R Y

LARSYS uses three types of control cards

- Initialization cards
- Function Selector cards
- Function Control cards

Multispectral Image Storage Tapes contain:

- Data Values
- Data Addresses
- Identification Information
- Calibration Information

LARSYS Function	LARSYS Output Examples
IDPRINT	Identification Records
PICTUREPRINT	Grayscale Printouts
COLUMNGRAPH	Graphs of Columns
LINEGRAPH	Graphs of Lines
CLUSTER	Maps
	Statistics
	Separability Information
	Histograms (optional)
STATISTICS	Histograms
	Spectral Plots
	Mean and Correlation Matrices
	Statistics Deck
SEPARABILITY	Statistical Distances between class pairs
CLASSIFYPOINTS	Classification File
PRINTRESULTS	Classification Maps and Performance Tables

Remember, this is an "overview." You are not expected to learn
the details of the data processing procedure at this stage in
your study.

Self-Check

A. The data source for the LARSYS processing functions is the
    Multispectral Image Storage Tape. It contains the following
    information:

    1.

    2.

    3.

    4.

B. What are the three types of control cards used in running
    LARSYS programs?

    1.

    2.

    3.

C. Briefly describe the output of at least four of these
    Processing Functions.

    *IDPRINT

    *PICTUREPRINT

    *COLUMNGRAPH, *LINEGRAPH

    *CLUSTER

    *STATISTICS

    *SEPARABILITY

    *CLASSIFYPOINTS

    *PRINTRESULTS

                    (Check you answer with DISPLAY 25)

Preface to the Instructor

This instructor's guide is designed to help you give a "first time" demonstration of the 2780 remote terminal. We have assumed that you are already familiar with the terminal and use the terminal in your daily activities. If you are a knowledgeable but infrequent user of the terminal, go through a "dry run" of the demonstration before presenting it to your students. For your convenience, the three decks used in the demonstration are listed in the Appendices to these notes.

Materials required: Student Notes
                       Control card decks (3)
                       Instructor's Notes

Time Estimate: The demonstration can be completed in one hour if the demonstrator doesn't talk too much. One and a half hours is typical.

Terminal sign-up and tape drive requirements: Insure your access to the terminal; reserve the terminal according to local procedures. Observe current LARS procedures for reserving tape drives.

LARSYS Demo
Instructor's Notes

STEPS IN CARRYING OUT THE DEMONSTRATION

I. Before you meet the student

1. Read the Instructor's Notes and Student Notes; locate the required control card decks.

2. Check to see that one of the Multispectral Image Storage Tapes assigned to your terminal site has a copy of run 66000600 on it. If it does, enter the tape number and file number below for easy reference:

    Tape TTT = _____; File F = _____.

    If it does not, see page 6 of "A Survey of the LARSYS Educational Package" at the front of these Instructor Notes.

3. Check the control card decks used with this demonstration. Make sure each deck includes a RUNTABLE initialization function to call into use your tape with run 66000600 on it. The deck setup should be:

    ```
    -RUNTABLE
    DATA
    RUN(66000600), TAPE(TTT), FILE(F)
    END
    ```

    where TTT and F are the tape and file number determined in step 2 above.

II. Preliminary Talk with Student

1. Talk to the student and determine what he knows about remote sensing, pattern recognition and LARSYS. See if he has any questions as a result of going through the LARSYS Software System - An Overview. (Unit II)

2. If the student is already somewhat familiar with the hardware, he may find this unit more interesting if you let him do as much of the demonstration himself as he can; as you tell him each step that needs to be demonstrated, he can carry out the demonstration for you.

3. If the student is unfamiliar with the hardware, assure him that he is not expected to run LARSYS unaided at the conclusion of this demonstration. The "Hands-On" experience in the next unit will teach him one-by-one the steps he needs to know.

LARSYS Demo
Instructor's Notes

III. The Demonstration

Step

1

```
┌─────────────────────┐
│   Orientation to    │
│   physical setup    │
└─────────────────────┘
```

2

```
┌─────────────────────┐
│ Use 2780 off-line to│
│  list control cards │
└─────────────────────┘
```

3

```
┌─────────────────────┐
│   Login, type name  │
│    initiate LARSYS  │
└─────────────────────┘

┌──────────────────────────┐
│ Request NEWS, REFERENCE ALL │
│  send message to operator │
└──────────────────────────┘
```

4

```
┌─────────────────────┐
│      Read cards     │
└─────────────────────┘
```

5

```
┌─────────────────────┐
│  Run STATISTICS job │
└─────────────────────┘
```

6,7

```
┌──────────────────────────┐
│  Run CLASSIFYPOINTS job  │
└──────────────────────────┘

┌──────────────────────────────────────────────┐
│ Run PRINTRESULTS job; when requested type:   │
│              threshold 6*0.1                  │
└──────────────────────────────────────────────┘
```

8

```
┌─────────────────────┐
│       Logout        │
└─────────────────────┘
```
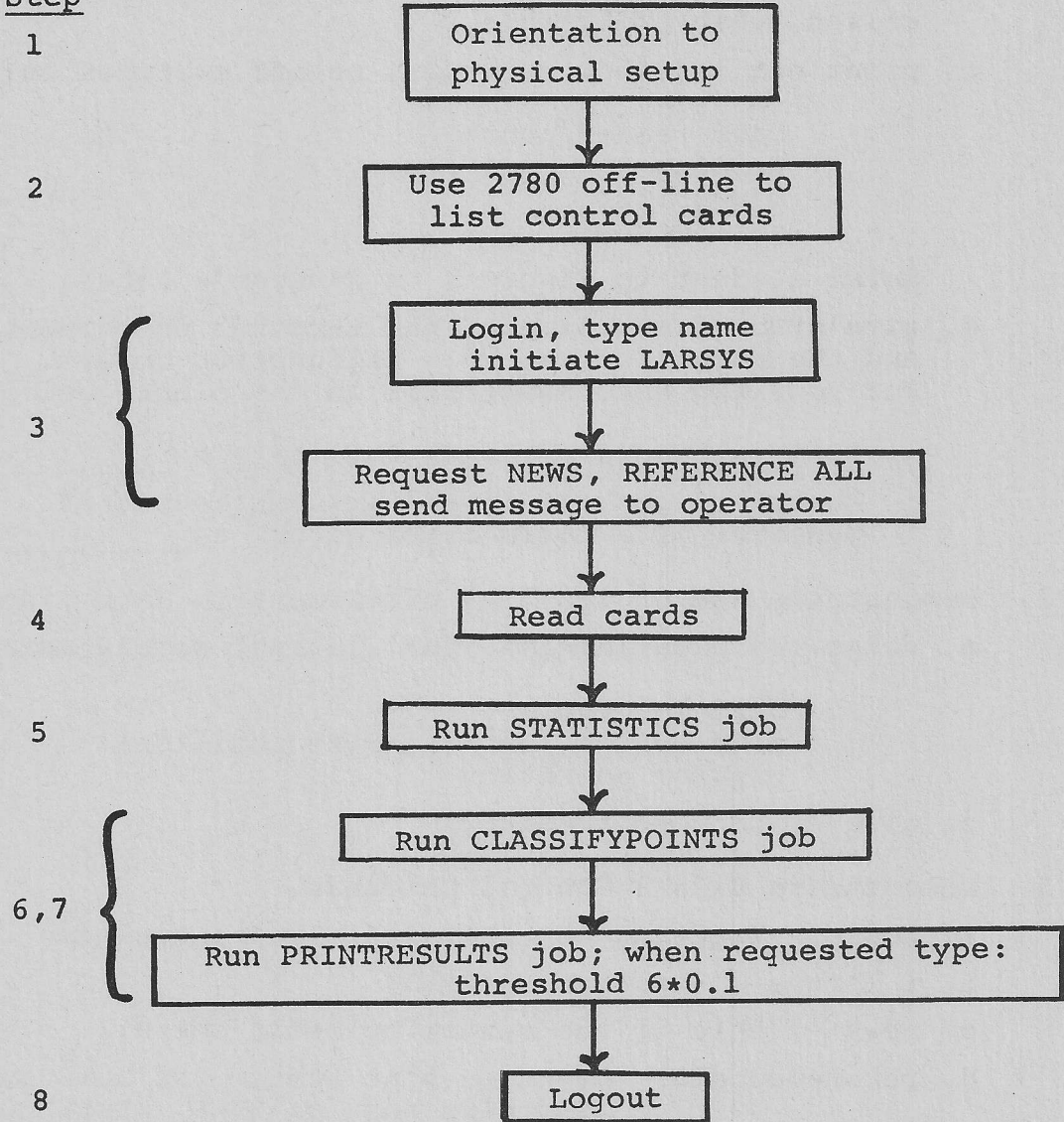
Details of each step are on pages 4 and 5.

LARSYS Demo
Instructor's Notes

Step 1. Orient student to the physical setup.

   a. point out terminal documentation, <u>LARSYS User's Manual</u>, bulletin board, etc.

   b. describe sign-up procedures for terminal and tape drives, when applicable.

   c. point out and show controls, on/off switches on:

           card reader/punch
           printer
           typewriter
           data modem

   Refer student to Figure 1 in Student's Notes.

   d. give student the name of the terminal coordinator and the person to see if a malfunction occurs. For your own reference, fill in the blanks below:

       Terminal coordinator at this site is_____.

       Person to contact if the printer is out of paper or if a malfunction occurs is_____.

Step 2. Demonstrate use of the 2780 off-line as a card lister.

   a. using the deck labeled "for listing" demonstrate:

           card loading
           mode switch (use off-line position)
           printer operation

   b. give listing to student

Step 3. Demonstrate LARSYS Control Commands.

   a. login - (getting "on the air"); and enter name

   b. i larsys - (initiate LARSYS)

   c. news - (this is the system bulletin board)

   d. reference all - (mention that system has numerous user aids such as NEWS, REFERENCE, and LIST control commands. Student will need the LARSYS control card listing to do his future assignments. Point out how easily control card listings are obtained.)

   e. msg operator - I'm demonstrating system; if you get this message, please respond.

LARSYS Demo
Instructor's Notes

Step 4. Demonstrate how cards are read. Use deck labeled
STATISTICS.

a. point out need for ID card and what happens if you
forget the ID card (cards won't read).

b. point out need to hit End-of-File before last card
is read and how to recover if forgotten (load a
blank card, hit EOF and read blank card).

c. point out computer response to a successful transfer
of cards (typewriter message).

Step 5. Run the STATISTICS job read in above (type 'run larsys').

a. While STATISTICS is running, read in all the remain-
ing control cards (CLASSIFYPOINTS and PRINTRESULTS).
Point out that you can read in cards for another job
while running one job.

b. Demonstrate receiving printer output.

c. Demonstrate receiving punched output. Point out
why you should use plenty of cards (if you run out
of cards you can load more and START again but you
may get some duplicate cards).

Step 6. Run the CLASSIFYPOINTS AND PRINTRESULTS jobs (type
'run larsys').

a. Point out progress messages; they let one know that
the program is running.

b. Point out how you can receive output from one job
while running a second job.

Step 7. Correct (intentional) control card error in PRINT-
RESULTS deck.

a. An error was deliberately made on a control card in
the PRINTRESULTS program. When asked to type the
correct card type:

threshold 6*0.1

b. If you have not already done so, this is a good time
to demonstrate how to recover from a typing error.
(@ to delete a single character, ¢ to delete a whole
line.)

c. You might also point out that by using the initiali-
zation card -TYPE in the card deck, you can enter
control cards from the typewriter.

Step 8. Logout(type 'quit'). Obtain printer and punched
output.

LARSYS Demo
Instructor's Notes

Points to emphasize during the demonstration:

    LARSYS progress messages
    LARSYS error messages and diagnostics
    The three environments: Control Program (CP) Command Environment
                              LARSYS Command Environment
                              LARSYS Processor Environment
                              (See Figure 2 in Student Notes)
    How to send messages to the computer operator

At the end of the demonstration:

  -If more than one student is witnessing the demonstration,
   supply each student with a copy (either original or Xerox)
   of the following:

          1)   listing of control cards used
          2)   the typewriter output
          3)   the printer output

  Note: it would be reasonable for students to share the same
        output deck

  -Be sure the student understands what he is to do with the
  output. Schedule a follow-up conference with him.

IV. Follow-up Conference

    Go through the objectives with the student to:
    - help him find answers to questions he has
    - reinforce the material presented in the unit

    Be certain that the student feels satisfied with the work
    he did with the output from the demonstration.

    Make plans for doing the next unit, the "Hands-On Experience."

Appendix I: For Listing

DEMONSTRATION OF REMOTE TERMINAL

```
-COMMENT DEMONSTRATION OF THE 2780 REMOTE TERMINAL
-RUNTABLE
DATA
RUN(66000600),TAPE(TTT),FILE(F)
END
*STATISTICS
PRINT HIST(C),CORRE(C)
PUNCH CHARACTERS
CHANNELS 1,2,3,4,5,6,7,8,9,10,11,12
OPTION HIST(1,8,12)
DATA
CLASS SOYBEANS
66000600   31-13      237  253  1     141  167  1     SOYBN
66000600   36-7       307  327  1      59   81  1     SOYBN
CLASS CORN
66000600   36-9       267  283  1      45   61  1     CORN
66000600   36-8       319  341  1      21   31  1     CORN
CLASS OATS
66000600   6-2        365  373  1     145  185  1     OATS
66000600   1-11       421  455  1      63   83  1     OATS
CLASS WHEAT
66000600   31-12      295  303  1     134  175  1     WHEAT
66000600   6-14       471  495  1     177  201  1     WHEAT
CLASS RED CLVR
66000600   6-10       439  447  1     139  183  1     RED CLVR
66000600   1-1        539  565  1     175  195  1     RED CLVR
CLASS ALFALFA
66000600   7-24       731  737  1     129  177  1     ALFALFA
END
            *
            *
        END OF FIRST DEMONSTRATION JOB.
            *
            *
-COMMENT DEMONSTRATION OF THE 2780 REMOTE TERMINAL
-RUNTABLE
DATA
RUN(66000600),TAPE(TTT),FILE(F)
END
*CLASSIFYPOINTS
RESULTS DISK
CHANNELS 1,6,10,11
CARDS READSTAT
DATA
            *
            *
            *
        STATISTICS DECK IN THIS LOCATION
            *
            *
            *
DATA
RUN(66000600),LINES(271,711,2),CCL(1,222,2)
END
```

> Note: TTT and F should be replaced by the appropriate tape and file numbers for your location.

```
*PRINTRESULTS
RESULTS DISK
PRINT OUTLINE(TRAIN,TEST), TRAIN(F,C), TEST(F,C,P)
SYMBOLS S,C,O,W,R,A
BHRESHOLD6*.01
                    *
                    *
                    *
            ERROR IN THRESHOLD CARD. CORRECTION ENTERED FROM TYPEWRITER.
                    *
                    *
                    *
TEST 1
66000600    12-3        705   797    2    69   111    2    SOYBN E PRT PR SOYBN
66000600    36-7        291   341    2    43    97    2    SOYBN VOLUNTR CORN
66000600    6-9         489   519    2   115   161    2    SOYBEANS
66000600    7-27        643   663    2   125   197    2    SOYBEANS
66000600    12-7        647   699    2    51    87    2    SOYBEANS
66000600    12-2        647   675    2    93   111    2    SOYBEANS
66000600    12-3        705   797    2    33    63    2    SOYBN W. PRT PLT ERL
TEST 2
66000600    36-9        261   287    2    39    65    2    CORN

66000600    36-8        307   349    2    19    35    2    CORN
66000600    6-11        401   421    2   111   199    2    CORN
66000600    12-9        589   643    2     3    43    2    CORN DIFF VARIETIES
TEST 3
66000600    31-11       327   335    2   109   197    2    OATS
66000600    6-2         365   377    2   131   183    2    OATS DITCH W END
66000600    1-11        413   467    2    45    93    2    OATS
66000600    7-1         583   605    2   121   193    2    OATS
TEST 4
66000600    31-12       285   317    2   109   199    2    WHEAT
66000600    6-1         347   353    2   107   205    2    WHEAT
66000600    6-1         385   393    2   109   203    2    WHEAT
66000600    6-14        459   509    2   167   211    2    WHT 2 VARIETIES
66000600    7-2         581   689    2   203   211    2    WHEAT
66000600    12-10       649   699    2     3    43    2    WHEAT 2 VAR LODGING
TEST 5
66000600    1-1         357   399    2    61    95    2    RED CL HAY
66000600    6-10        433   453    2   113   197    2    RED CL HAY
66000600    6-7         521   561    2   173   215    2    RED CL PASTURE
66000600    1-6         559   581    2    49   109    2    RED CL PASTURE
66000600    12-8        589   633    2    49   109    2    RED CL PASTURE
66000600    7-29        613   619    2   121   183    2    RD CL DIVERTED ACRES
66000600    7-28        629   637    2   123   191    2    RED CL HAY
END
```

*****END OF DEMO LISTING DECK*****

Appendix II: Statistics

```
-RUNTABLE
DATA
RUN(66000600),TAPE(TTT),FILE(F)        ←      See note in Appendix I
END
-COMMENT DEMONSTRATION OF THE 2780 REMOTE TERMINAL
*STATISTICS
PRINT HIST(C),CORRE(C)
PUNCH CHARACTERS
CHANNELS 1,2,3,4,5,6,7,8,9,10,11,12
OPTIONS HIST(1,8,12)
DATA
CLASS SOYBEANS
66000600    31-13        237   253   1     141   167   1     SOYBN
66000600    36-7         307   327   1     59    81    1     SOYBN
CLASS CORN
66000600    36-9         267   283   1     45    61    1     CORN
66000600    36-8         319   341   1     21    31    1     CORN
CLASS OATS
66000600    6-2          365   373   1     145   185   1     OATS
66000600    1-11         421   455   1     63    83    1     OATS
CLASS WHEAT
66000600    31-12        295   303   1     134   175   1     WHEAT
66000600    6-14         471   495   1     177   201   1     WHEAT
CLASS RED CLVR
66000600    6-10         439   447   1     139   183   1     RED CLVR
66000600    1-1          539   565   1     175   195   1     RED CLVR
CLASS ALFALFA
66000600    7-24         731   737   1     129   177   1     ALFALFA
END
```

Appendix III: Classifypoints;Printresults

```
-COMMENT DEMONSTRATION OF THE 2780 REMOTE TERMINAL
-RUNTABLE
DATA
RUN(66000600),TAPE(TTT),FILE(F)        ← [ See note in Appendix I ]
END
*CLASSIFYPOINTS
RESULTS DISK
CHANNELS 1,6,10,11
CARDS READSTATS
DATA
```

LARSYS VERSION 3 STATISTICS FILE					0				1
CLASS SOYBEANS									2
66000600	31-13	237	253	1	141	167	1	SOYBN	3
66000600	36-7	307	327	1	59	81	1	SOYBN	4
CLASS CORN									5
66000600	36-9	267	283	1	45	61	1	CORN	6
66000600	36-8	319	341	1	21	31	1	CORN	7
CLASS OATS									8
66000600	6-2	365	373	1	145	185	1	OATS	9
66000600	1-11	421	455	1	63	83	1	OATS	10
CLASS WHEAT									11
66000600	31-12	295	303	1	134	175	1	WHEAT	12
66000600	6-14	471	495	1	177	201	1	WHEAT	13
CLASS RED CLVR									14
66000600	6-10	439	447	1	139	183	1	RED CLVR	15
66000600	1-1	539	565	1	175	195	1	RED CLVR	16
CLASS ALFALFA									17
66000600	7-24	731	737	1	129	177	1	ALFALFA	18

```
     6 CLASS    11 FIELD    12 CHANNELS                                      19
CHAN  1 WAVELENGTH 0.40- 0.44 CODE  1 C0  31.00 C1  41.05 C2  63.05          20
CHAN  2 WAVELENGTH 0.44- 0.46 CODE  1 C0  31.00 C1  42.45 C2  67.30          21
CHAN  3 WAVELENGTH 0.46- 0.48 CODE  1 C0  31.00 C1  41.85 C2  63.05          22
CHAN  4 WAVELENGTH 0.48- 0.50 CODE  1 C0  31.00 C1  44.90 C2  72.05          23
CHAN  5 WAVELENGTH 0.50- 0.52 CODE  1 C0  31.00 C1  59.10 C2 128.40          24
CHAN  6 WAVELENGTH 0.52- 0.55 CODE  1 C0  31.00 C1  66.25 C2 139.35          25
CHAN  7 WAVELENGTH 0.55- 0.58 CODE  1 C0  31.00 C1  59.45 C2 119.65          26
CHAN  8 WAVELENGTH 0.58- 0.62 CODE  1 C0  31.00 C1  94.80 C2 229.40          27
CHAN  9 WAVELENGTH 0.62- 0.66 CODE  1 C0  31.00 C1  96.90 C2 232.30          28
CHAN 10 WAVELENGTH 0.66- 0.72 CODE  1 C0  31.00 C1 126.40 C2 248.70          29
CHAN 11 WAVELENGTH 0.72- 0.80 CODE  1 C0  31.00 C1 100.50 C2 221.40          30
CHAN 12 WAVELENGTH 0.80- 1.00 CODE  1 C0  31.00 C1  85.30 C2 214.50          31
NO. PTS.        942        542       1104       1003        972       343    32
MN 0.8442569E 02 0.7915286E 02 0.6117197E 02 0.6182059E 02 0.8450848E 02     33
MN 0.8660721E 02 0.6356262E 02 0.8212631E 02 0.6880997E 02 0.8021231E 02     34
MN 0.9208810E 02 0.7259978E 02                                              35
MN 0.8367711E 02 0.7751291E 02 0.5952532E 02 0.5969740E 02 0.8178966E 02     36
MN 0.8610147E 02 0.6190221E 02 0.7562915E 02 0.6091144E 02 0.7201476E 02     37
MN 0.1105018E 03 0.8375461E 02                                              38
MN 0.7725090E 02 0.7427083E 02 0.5837680E 02 0.5916666E 02 0.8139764E 02     39
MN 0.8583694E 02 0.6454980E 02 0.8686322E 02 0.7283694E 02 0.8925452E 02     40
MN 0.1059438E 03 0.8336230E 02                                              41
MN 0.7105383E 02 0.6998404E 02 0.5720239E 02 0.5884346E 02 0.7857527E 02     42
MN 0.7931406E 02 0.6205782E 02 0.9016550E 02 0.8157127E 02 0.9231604E 02     43
MN 0.7802393E 02 0.6581256E 02                                              44
MN 0.7226749E 02 0.6888271E 02 0.5415123E 02 0.5394341E 02 0.7136830E 02     45
MN 0.7828703E 02 0.5731172E 02 0.6816151E 02 0.5501337E 02 0.7507304E 02     46
MN 0.1346913E 03 0.1046533E 03                                              47
MN 0.7714577E 02 0.7186005E 02 0.5570845E 02 0.5583382E 02 0.7608162E 02     48
MN 0.8580466E 02 0.6116034E 02 0.7060349E 02 0.5524197E 02 0.7898833E 02     49
MN 0.1491545E 03 0.1100408E 03                                              50
CV 0.7787777E 01 0.6143146E 01 0.7870337E 01 0.4498446E 01 0.4144777E 01     51
CV 0.3949139E 01 0.4292180E 01 0.4311194E 01 0.2889546E 01 0.3726546E 01     52
CV 0.8451747E 01 0.8343015E 01 0.5540514E 01 0.5869219E 01 0.1330864E 02     53
CV 0.7542513E 01 0.7656281E 01 0.5028300E 01 0.5331158E 01 0.1049431E 02     54
CV 0.1084025E 02 0.4912204E 01 0.4861828E 01 0.3458930E 01 0.3472991E 01     55
CV 0.6583952E 01 0.6122395E 01 0.4813820E 01 0.6971671E 01 0.7015737E 01     56
CV 0.4731706E 01 0.5086450E 01 0.9735908E 01 0.8813752E 01 0.5685491E 01     57
CV 0.1017850E 02 0.4773855E 01 0.5040768E 01 0.3364275E 01 0.3693821E 01     58
CV 0.6905440E 01 0.6169704E 01 0.4284496E 01 0.6644647E 01 0.6402748E 01     59
CV 0.4924401E 01 0.5011080E 01 0.3585127E 01 0.3597110E 01 0.6988630E 01     60
CV 0.6338529E 01 0.4429833E 01 0.6509813E 01 0.5146657E 01 0.6751899E 01     61
CV 0.5351399E 01 0.4914252E 01 0.3793545E 01 0.3449405E 01 0.7187880E 01     62
CV 0.7697769E 01 0.4917429E 01 0.4818825E 01 0.2722392E 01 0.4363844E 01     63
CV 0.2207405E 01 0.1829420E 01 0.1618098E 01 0.9445636E 00 0.1148102E 01     64
CV 0.2380129E 01 0.2795877E 01 0.1498525E 01 0.1736052E 01 0.9578767E 00     65
CV 0.1482510E 01 0.4599593E 01 0.5908735E 01                                66
CV 0.1460720E 01 0.1175187E 02 0.1294161E 02 0.7160851E 01 0.6315746E 01     67
CV 0.4992862E 01 0.6748702E 01 0.6591715E 01 0.3695445E 01 0.4669827E 01     68
CV 0.1330350E 02 0.1241492E 02 0.7375128E 01 0.7193171E 01 0.1565623E 02     69
```

```
CV  0.9859072E  01  0.9555987E  01  0.5288501E  01  0.5703589E  01  0.1052970E  02    70
CV  0.9555303E  01  0.5853765E  01  0.5667624E  01  0.3504378E  01  0.3652427E  01    71
CV  0.6191963E  01  0.5307538E  01  0.4443285E  01  0.1000204E  02  0.1034029E  02    72
CV  0.5862646E  01  0.6229539E  01  0.1161317E  02  0.9547868E  01  0.6161450E  01    73
CV  0.1346111E  02  0.7413127E  01  0.8307984E  01  0.4390461E  01  0.5152451E  01    74
CV  0.8948066E  01  0.7655953E  01  0.5327738E  01  0.1039963E  02  0.1042837E  02    75
CV  0.6677602E  01  0.7500732E  01  0.4278730E  01  0.4616303E  01  0.8369099E  01    76
CV  0.7166706E  01  0.5252831E  01  0.9901972E  01  0.8838648E  01  0.1019941E  02    77
CV  0.4088397E  01  0.1119200E  01  0.1556329E  01  0.1521304E  00  0.2200019E  01    78
CV  0.2265061E  01  0.2617334E  00-0.2987299E  01-0.4962867E  01-0.2748640E  01    79
CV  0.3581422E  02  0.1244098E  01  0.8543015E-01-0.1405999E  00-0.1390823E  00    80
CV  0.4418222E  00  0.1341028E  01-0.2569418E  00-0.2056049E  01-0.2676115E  01    81
CV -0.2114671E  01  0.1245979E  02  0.1379734E  02                                   82
CV  0.9325022E  01  0.6099709E  01  0.7200381E  01  0.4475633E  01  0.3480809E  01    83
CV  0.3547820E  01  0.3382442E  01  0.3358265E  01  0.2105772E  01  0.2936838E  01    84
CV  0.9063329E  01  0.7623847E  01  0.5202701E  01  0.4494862E  01  0.1285987E  02    85
CV  0.9918551E  01  0.8320716E  01  0.4999842E  01  0.4726201E  01  0.1181648E  02    86
CV  0.1520458E  02  0.5644333E  01  0.4701364E  01  0.3293087E  01  0.2972650E  01    87
CV  0.6575366E  01  0.7584739E  01  0.5426346E  01  0.5290921E  01  0.6001719E  01    88
CV  0.4059744E  01  0.4247658E  01  0.8296504E  01  0.7450027E  01  0.5398932E  01    89
CV  0.1250983E  02  0.1183284E  01  0.3369673E  01  0.2137648E  01  0.3094288E  01    90
CV  0.3845490E  01  0.2089439E  01  0.3082472E  01  0.1026780E  02  0.1299968E  02    91
CV  0.2881681E  01  0.4245599E  01  0.3048156E  01  0.3555001E  01  0.5575939E  01    92
CV  0.4074175E  01  0.4314143E  01  0.1110465E  02  0.1163719E  02  0.1383271E  02    93
CV  0.9420268E  01  0.4778596E  01  0.3420093E  01  0.1517075E  01  0.7311563E  01    94
CV  0.1197996E  02  0.5201349E  01-0.3815485E  01-0.1140808E  02-0.7376445E  01    95
CV  0.4225975E  02  0.2920795E  01  0.1111212E  01  0.4481190E  00  0.1943185E  00    96
CV  0.1883900E  01  0.4274902E  01  0.1359993E  01-0.2926826E  01-0.5876502E  01    97
CV -0.4009802E  01  0.1487077E  02  0.1347695E  02                                   98
CV  0.4396299E  01  0.3504851E  01  0.5973797E  01  0.2952166E  01  0.3375486E  01    99
CV  0.3686541E  01  0.2641170E  01  0.3601293E  01  0.2694386E  01  0.3609206E  01   100
CV  0.5046841E  01  0.6558087E  01  0.4997225E  01  0.5238840E  01  0.1152801E  02   101
CV  0.4224591E  01  0.5740543E  01  0.4391463E  01  0.4854597E  01  0.8869050E  01   102
CV  0.9331409E  01  0.30368C3E  01  0.3840244E  01  0.3233793E  01  0.3386306E  01   103
CV  0.6253127E  01  0.6117549E  01  0.5343958E  01  0.6021020E  01  0.8113420E  01   104
CV  0.6179044E  01  0.6894196E  01  0.1321707E  02  0.1250486E  02  0.9112176E  01   105
CV  0.2071309E  02  0.6016118E  01  0.8088963E  01  0.6152723E  01  0.6954782E  01   106
CV  0.1295546E  02  0.1243316E  02  0.9316233E  01  0.1970175E  02  0.2126711E  02   107
CV  0.8069793E  01  0.1050305E  02  0.8300241E  01  0.9256107E  01  0.1740881E  02   108
CV  0.1665013E  02  0.1265236E  02  0.2668616E  02  0.2738612E  02  0.3924631E  02   109
CV  0.4693321E  01  0.5768845E  01  0.4816509E  01  0.5247262E  01  0.1004111E  02   110
CV  0.1063918E  02  0.8282047E  01  0.1628545E  02  0.1613800E  02  0.2354033E  02   111
CV  0.2632877E  02  0.4055011E  01  0.5197605E  01  0.3951147E  01  0.4265041E  01   112
CV  0.8392366E  01  0.8403236E  01  0.5869133E  01  0.1300011E  02  0.1244751E  02   113
CV  0.1770001E  02  0.1295060E  02  0.1342990E  02                                   114
CV  0.5417562E  01  0.3579293E  01  0.4849257E  01  0.2640245E  01  0.2197982E  01   115
CV  0.2583695E  01  0.2520815E  01  0.2467094E  01  0.1646053E  01  0.2498340E  01   116
CV  0.5005395E  01  0.4760028E  01  0.3161542E  01  0.3286567E  01  0.8199942E  01   117
CV  0.4289773E  01  0.4190239E  01  0.2550777E  01  0.2850450E  01  0.5941545E  01   118
CV  0.6705372E  01  0.3019516E  01  0.2803848E  01  0.2113466E  01  0.2180375E  01   119
CV  0.3995263E  01  0.3789935E  01  0.3586555E  01  0.5159633E  01  0.5186831E  01   120
CV  0.3489450E  01  0.3899982E  01  0.7824073E  01  0.6356266E  01  0.4563396E  01   121
CV  0.1041364E  02  0.3557695E  01  0.3968614E  01  0.2466564E  01  0.3067698E  01   122
CV  0.5598570E  01  0.4410163E  01  0.3386146E  01  0.7301647E  01  0.7059553E  01   123
CV  0.4258505E  01  0.3878812E  01  0.2538890E  01  0.2619997E  01  0.5683676E  01   124
CV  0.5826591E  01  0.3785650E  01  0.5790455E  01  0.3853810E  01  0.7723804E  01   125
CV  0.8365055E  00-0.3128923E  01-0.1717435E  01-0.4925824E  01-0.5267256E  01   126
CV  0.3791051E  01-0.1267231E  01-0.1561539E  02-0.1749741E  02-0.1047159E  02   127
CV  0.1803907E  03  0.2110344E  01-0.1838565E  00-0.8218681E  00-0.1809546E  01   128
CV -0.1692974E  01  0.4662957E  01  0.3172528E  00-0.7263199E  01-0.9063329E  01   129
CV  0.8078904E  01  0.1010772E  03  0.7568707E  02                                   130
CV  0.2218453E  01  0.1152038E  01  0.3103166E  01  0.7765417E  00  0.9766252E  00   131
CV  0.1850425E  01  0.8634767E  00  0.1307085E  01  0.8783097E  00  0.1881660E  01   132
CV  0.1186895E  01  0.1640112E  01  0.1120360E  01  0.1209512E  01  0.3876357E  01   133
CV  0.2712478E  00  0.5047482E  00  0.2791417E  00  0.5200757E  00  0.9926005E  00   134
CV  0.2186878E  01  0.6169079E  00  0.7739672E  00  0.7574122E  00  0.8659062E  00   135
CV  0.7997374E  00  0.8238112E  00  0.1731523E  01  0.1362062E  01  0.2704584E  01   136
CV  0.1211549E  01  0.2027483E  01  0.3038310E  01  0.1472030E  01  0.1186571E  01   137
CV  0.5544081E  01  0.1145908E  01  0.2501799E  01  0.1298825E  01  0.2057874E  01   138
CV  0.2524048E  01  0.1170213E  01  0.1221318E  01  0.4429560E  01  0.5610864E  01   139
CV  0.5748043E  00  0.1089006E  01  0.9030228E  00  0.9074131E  01  0.1702708E  01   140
CV  0.1395375E  01  0.1209477E  01  0.2249748E  01  0.2017449E  01  0.3637290E  01   141
CV -0.2569374E  01-0.7191763E  01-0.2495754E  01-0.5149685E  01-0.4369375E  01   142
CV  0.1477639E  01-0.1150580E  01-0.9543817E  01-0.1178604E  02-0.6970232E  00   143
CV  0.6157545E  02-0.1874388E  01-0.3798365E  01-0.2432509E  01-0.2969805E  01   144
CV -0.3099833E  01  0.1180511E  01-0.5416517E  00-0.4334645E  01-0.5509905E  01   145
CV -0.5215419E-01  0.2269835E  02  0.2168253E  02                                   146
EOS          *****  LAST CARD OF STATISTICS DECK  *****                          147
```

(Continued)

```
DATA
RUN(66000600), LINES(271,711,2), COL(1,222,2)
END
*PRINTRESULTS
RESULTS DISK
PRINT OUTLINE(TRAIN,TEST), TRAIN(F,C), TEST(F,C,P)
SYMBOLS S,C,O,W,R,A
BHRESHOLD6*.01
DATA
TEST 1
66000600    12-3        705   797    2    69   111    2    SOYBN E PRT PR SOYBN
66000600    36-7        291   341    2    43    97    2    SOYBN VOLUNTR CORN
66000600    6-9         489   519    2   115   161    2    SOYBEANS
66000600    7-27        643   663    2   125   197    2    SOYBEANS
66000600    12-7        647   699    2    51    87    2    SOYBEANS
66000600    12-2        647   675    2    93   111    2    SOYBEANS
66000600    12-3        705   797    2    33    63    2    SOYBN W. PRT PLT ERL
TEST 2
66000600    36-9        261   287    2    39    65    2    CORN
66000600    36-8        307   349    2    19    35    2    CORN
66000600    6-11        401   421    2   111   199    2    CORN
66000600    12-9        589   643    2     3    43    2    CORN DIFF VARIETIES
TEST 3
66000600    31-11       327   335    2   109   197    2    OATS
66000600    6-2         365   377    2   131   183    2    OATS DITCH W END
66000600    1-11        413   467    2    45    93    2    OATS
66000600    7-1         583   605    2   121   193    2    OATS
TEST 4
66000600    31-12       285   317    2   109   199    2    WHEAT
66000600    6-1         347   353    2   107   205    2    WHEAT
66000600    6-1         385   393    2   109   203    2    WHEAT
66000600    6-14        459   509    2   167   211    2    WHT 2 VARIETIES
66000600    7-2         581   689    2   203   211    2    WHEAT
66000600    12-10       649   699    2     3    43    2    WHEAT 2 VAR LODGING
TEST 5
66000600    1-1         357   399    2    61    95    2    RED CL HAY
66000600    6-10        433   453    2   113   197    2    RED CL HAY
66000600    6-7         521   561    2   173   215    2    RED CL PASTURE
66000600    1-6         559   581    2    49   109    2    RED CL PASTURE
66000600    12-8        589   633    2    49   109    2    RED CL PASTURE
66000600    7-29        613   619    2   121   183    2    RD CL DIVERTED ACRES
66000600    7-28        629   637    2   123   191    2    RED CL HAY
END
```

Student Notes

for

DEMONSTRATION of LARSYS

on a 2780 REMOTE TERMINAL

DEMONSTRATION OF LARSYS
ON A 2780 REMOTE TERMINAL

Prerequisites:

    a) List the four kinds of information (without regard
       to format) contained on a multispectral image
       storage tape.

    b) Name the three types of cards used in running LARSYS
       programs.

    c) Describe the output of at least four of the LARSYS
       processing functions discussed in the LARSYS Soft-
       ware System: An Overview

General Description: This demonstration introduces you to the
computer hardware and provides an opportunity to increase
your familiarity with the LARSYS system of programs. You
will witness the running of several LARSYS jobs from a 2780
terminal. During the demonstration you will see:

    the 2780 used off-line as a card lister
    login procedure
    user information obtained from LARSYS control commands
    messages sent to the computer operator from the typewriter
    card information transmitted from the 2780 to the computer
    line-printer output being received
    card-punch output being received
    logout procedure

The demonstration takes about 1 to 1½ hours. You will have
ample opportunity to discuss the operations with your instruc-
tor during the demonstration. At the end of the demonstration
you will be given a listing of the control cards used, the
typewriter output and the printer and card-punch output.
Examine these materials in some detail to reinforce the basic
concepts presented. After you have completed this step,
arrange a conference with your instructor.

LARSYS Demo
Student's Notes

Objectives: Upon completion of the demonstration you should
be able to:

1. Explain the local sign-up procedures.

2. Name the person who acts as terminal coordinator and
    the person to be contacted if the printer is out of
    paper or if another malfunction occurs.

3. While standing in the remote terminal area, point to:

    the printer (and the printer control panel)
    the card reader/punch (and the mode switch)
    the typewriter terminal
    the LARSYS User's Manual

4. Describe in a few words:

    the use of the 2780 as an off-line card lister
    the use of the typewriter for input and output
    the use of the card reader/punch for input and output
    the use of the line printer for receiving output

5. Explain in general terms the use of LARSYS Control
    Commands to:

    log in, log out
    initialize LARSYS control system
    start processing LARSYS control cards
    obtain user assistance information (e.g., latest
        system news, listings of control commands).

6. Using the typewriter output, point out when the system
    was in CP command environment, LARSYS command environ-
    ment, or LARSYS processor environment.

7. Using the typewriter output, name two kinds of user
    assistance information provided by LARSYS without
    being requested by the user.

8. With the listing of the control cards used in the
    demonstration:

    - correctly identify each control card as an
       Initialization Function Card, a Function
       Selector Card or a Function Control Card.

    - compare the listing against the REFERENCE ALL
       output to verify the completeness of the
       control card decks.

9. Locate typical information in the line-printer output.

10. Locate the ID card in the card-punch output.

Note: It is not intended that you be able to run LARSYS
       jobs unaided at the completion of this demonstration.
       The next unit in the LARSYS Educational Package,
       the "Hands-on" exercise, will help you learn the
       necessary steps for doing that.

LARSYS Demo
Student's Notes

During your preliminary talk with your instructor, fill in
the following information for future reference.

    1.   Describe the local sign-up procedures:

    2.   Terminal coordinator at this site is_____.

    3.   Person to contact if the printer is out of paper or
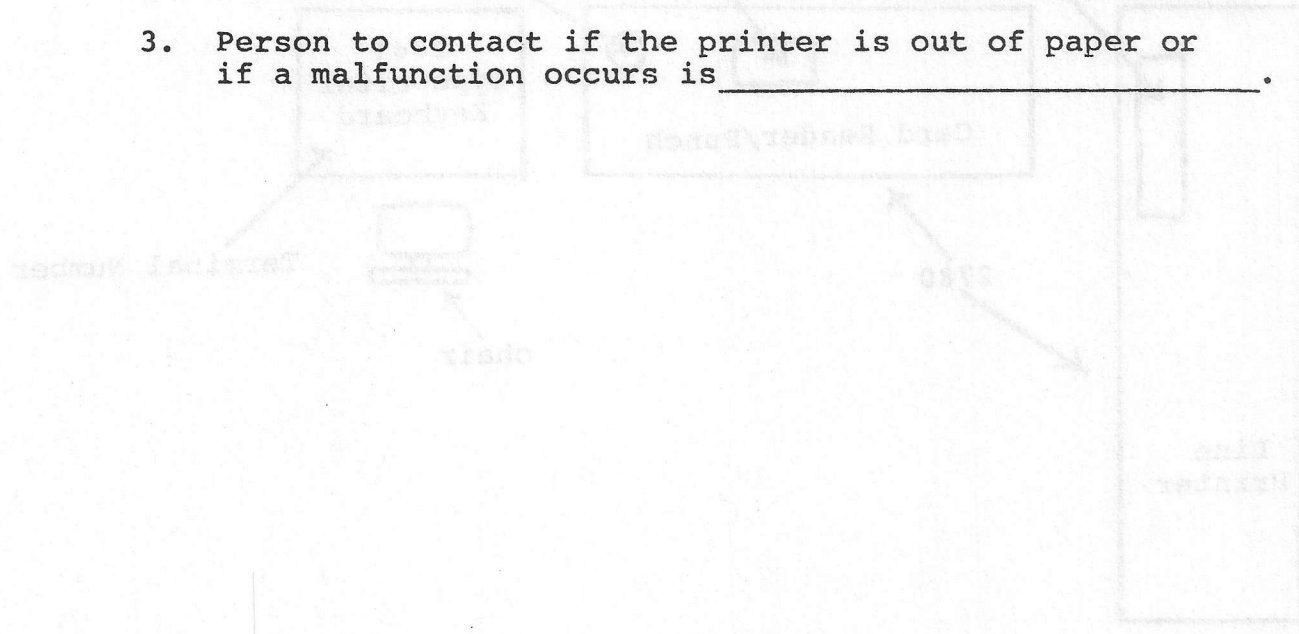   if a malfunction occurs is_____.

LARSYS Demo
Student's Notes

Figure 1

Typical Layout of the Terminal Area

Figure 2. LARS Computer System Environment Diagram

SOLID LINES SHOW NORMAL TRANSITION PATHS
DOTTED LINES SHOW ALTERNATE TRANSITION PATHS

LOGGED OFF THE COMPUTER

'QUIT'

'LOGOUT'

LARSYS
COMMAND ENVIRONMENT

ATTN
'BEGIN' OR ATTN
'I LARSYS'

CP
COMMAND ENVIRONMENT

'RUN LARSYS'
(END OF JOB)

'BEGIN' OR ATTN

'LOGIN'

LARSYS PROCESSOR ENVIRONMENT
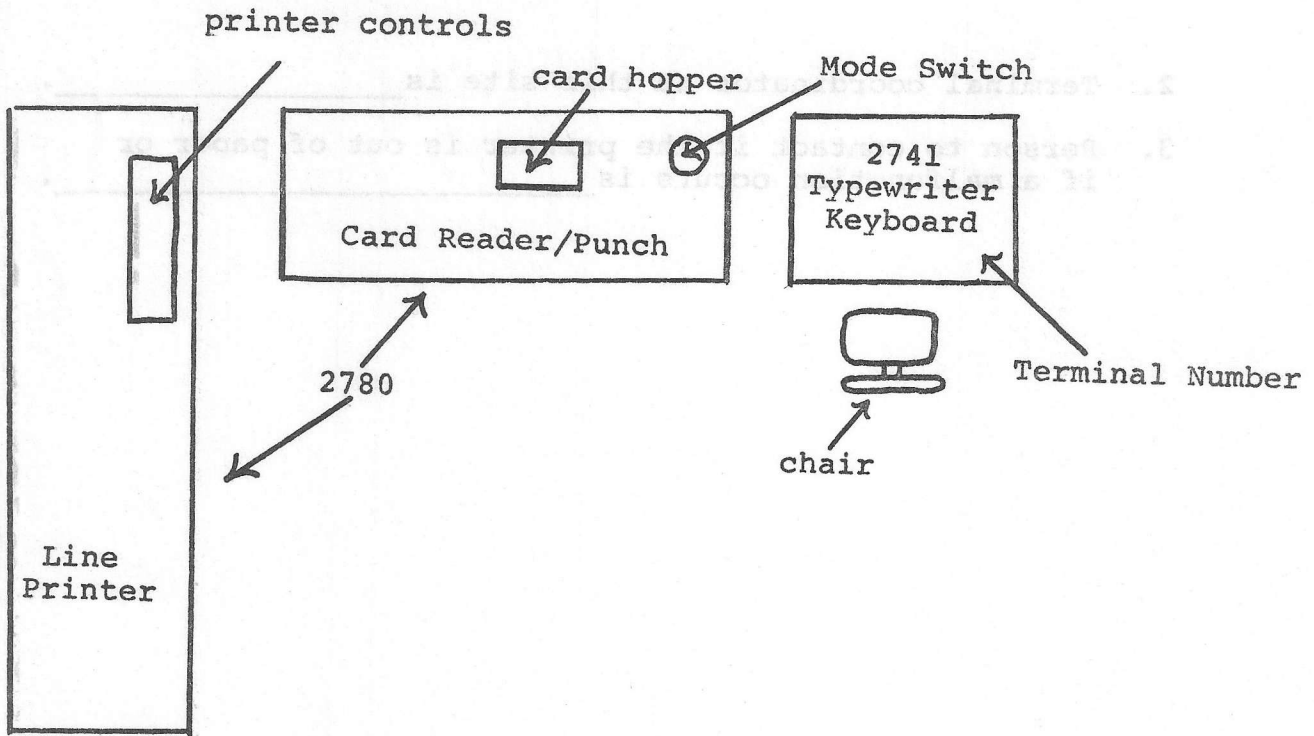
LARSYS Demo
Student's Notes

After the demonstration . . . . .

Go over the output that you have received:

1. Using the typewriter output:

    a) mark on the output when the system was in CP
       (Control Program) command environment, LARSYS
       command environment, or LARSYS processor environ-
       ment.

    b) locate each of these six steps

          Step 1: log in
          Step 2: enter password
          Step 3: enter your name
          Step 4: initiate LARSYS
          Step 5: run LARSYS
          Step 6: log out

    c) point out an example of a progress message

    d) point out an example of an error message

2. Using the line-printer output:

    a) Identify each control card on the card listing as an
       Initialization Function Card, a Function Selector
       Card or a Function Control Card.

    b) Compare the listing for STATISTICS, CLASSIFYPOINTS,
       and PRINTRESULTS with the deck specifications in
       your REFERENCE ALL output. (You might find it use-
       ful to trim the REFERENCE ALL output, separate the
       pages, and staple them together for future use.)

    c) Locate in the output from STATISTICS where the
       training fields are identified, the mean and standard
       deviation vectors and correlation matrices, and the
       histograms for soybeans, for corn, for oats, for
       wheat, and for red clover.

    d) Locate in the output from CLASSIFYPOINTS and PRINT-
       RESULTS the classification map with training and
       test fields outlined; locate performance percentages
       for training and for test fields.

3. Using the card-punch output:

    a) Identify the ID card, which appears with all LARSYS
       punched output. It can be recognized by the solid
       punching in columns 69-80. It is not considered
       part of the deck and must be removed before the
       deck is used as input to other processing functions.

> When you have completed the above steps, make
> an appointment to meet with your instructor.

THE 2780 REMOTE TERMINAL:
A "HANDS-ON" EXPERIENCE

Materials required: Student's Notes
                       Instructor's Notes
                       Audio tape, cassette tape recorder
                       Punched cards for listing
                       LARSYS User's Manual

Estimate of Instructor Time Required:

    Briefing student on the preparation of his control cards:
    5 min.
    Checking control cards: 5 to 10 min.
    Getting the student set up, explaining the use of the
    tape recorder and general procedure to be followed:
    10 Min.
    You will need to be available for help during the time the
    student is at the terminal.

Terminal Sign-up and Tape Drive Requirements:

    Have student sign up for two hours of terminal time. One
    tape drive is needed; follow current policy for reserving
    it.

Instructional Objectives:

    The student will obtain a copy of the instructional objectives
for this unit when he lists the punched cards provided. For your
information, this listing is included on page 3 of these Instruc-
tor's Notes.

Before going to the terminal:

1. Check to see that one of the Multispectral Image Storage Tapes
    assigned to your terminal site has a copy of run 66000600 on
    it. If it does, enter the tape number and file number below
    for easy reference:

        Tape TTT = _____;   FILE F = _____.

    If it does not, see page 6 of A Survey of the LARSYS Educa-
    tional Package.

2. Give student the notes which accompany this unit and check to
    see that he meets the prerequisites.

3. See if your student has a user ID and password assigned to
    him. If not, assist him in getting them assigned.

4. Tell him where he can find the LARSYS User's Manual.

5. Give student the computer tape number and file number used at
    your remote site for run 66000600, and suggest he record them
    on page 1 of his notes. Have him punch the control card decks
    shown on pages 2-3 of the student's notes. (Show student how
    to punch and duplicate cards on the key punch if he is not
    familiar with it).

6. Check over the student's control card decks for errors.

At the terminal

1. Make sure the terminal is powered up.

2. Explain to the student the general procedure for using
    the audio tape and notes at the terminal and help him
    get set up. The student will be more comfortable doing
    the exercise if his tape recorder has earphones and bat-
    teries so that he can move around in the terminal area
    and not bother others working there.

3. Reassure student that malfunctions caused by the hardware
    may occur; he should not feel that when things go wrong
    it is necessarily his fault.

4. Start student on his way; answer questions as they arise.
    Watch long enough to see that he can load cards into the
    hopper, 9-edge down, using card weight. (See Figure 2
    in Student's Notes)

5. If others are using the terminal, explain to them that
    your student is using the terminal for the first time
    and that, while it is nice to "help out," the student
    should be allowed to push all the buttons and retrieve
    all the output himself.

After the exercise

1. Talk with the student to determine how he did and his
    reaction to his "Hands-On" experience.

2. Make plans for working on the next unit in the sequence,
    the LARSYS Exercises.

***** LISTING DECK FOR 2780 HANDS-ON EXPERIENCE *****

OBJECTIVES FOR 2780 HANDS-ON EXPERIENCE

BY THE TIME YOU FINISH WITH THE TERMINAL TODAY YOU SHOULD BE ABLE TO

USE THE 2780 OFFLINE AS A CARD LISTER

LOGIN

USE THE LARSYS CONTROL COMMANDS TO

A) OBTAIN THE LATEST NEWS FILES FOR ANY OF THE FOLLOWING

SYSTEM
LARSYS
SCHEDULE

B) OBTAIN THE LATEST CONTROL CARD LISTINGS FOR THE LARSYS FUNCTIONS

RECEIVE PRINTER OUTPUT

TRANSMIT A DECK OF CARDS

RECEIVE PUNCHED OUTPUT

COMMUNICATE WITH THE COMPUTER OPERATOR OR A USER VIA
THE REMOTE TERMINAL NETWORK

*****END OF HANDS-ON LISTING DECK*****

Student Notes
for
THE 2780 REMOTE TERMINAL
-- A "Hands-on" Experience--
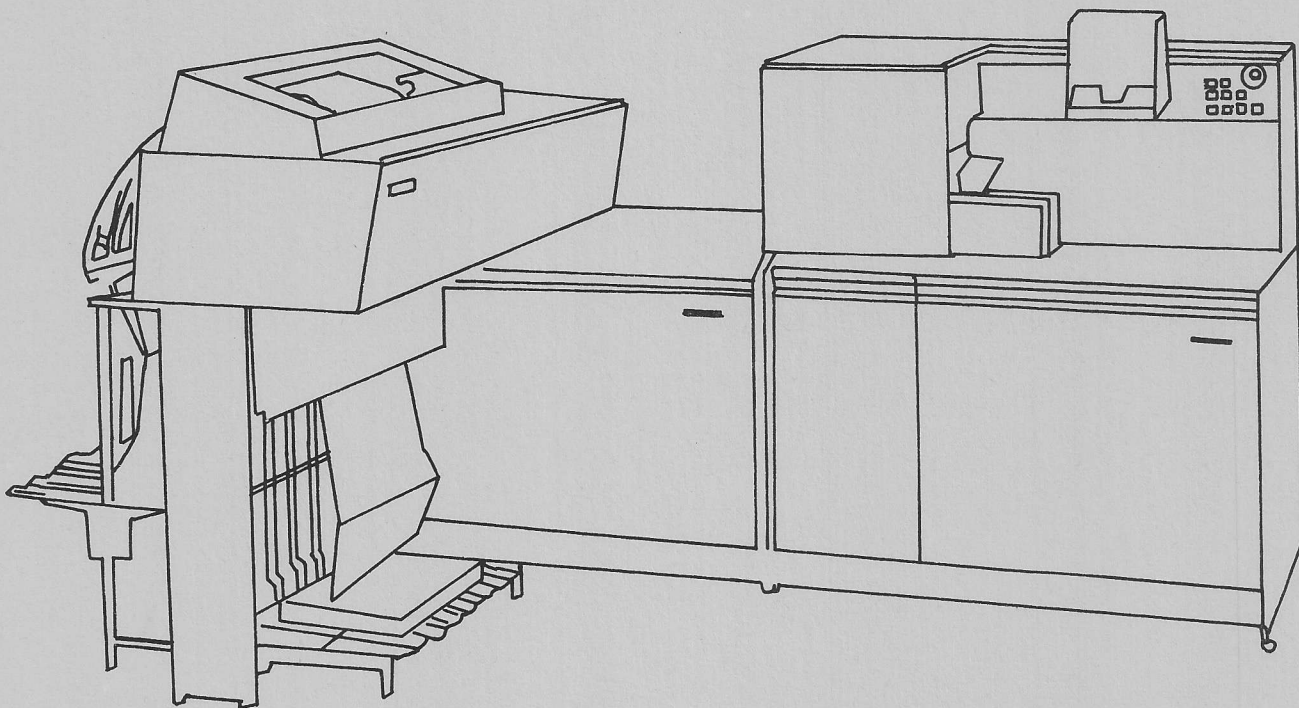
Developed by:

Technology Transfer Staff

Laboratory for Applications of Remote Sensing
Purdue University, West Lafayette, Indiana 47907

THE 2780 REMOTE TERMINAL:
A "HANDS-ON" EXPERIENCE
_____

Prerequisites:

    a) Satisfactory completion of Units 1, 2 and 3 of the LARSYS
        Educational Package.

    b) Access to the terminal through the assignment of a user
        ID and a password.

    c) Basic ability to punch and duplicate control cards on a
        key punch.

Objectives: You will obtain a copy of the objectives of this
               minicourse early in your work at the terminal.

Estimated time: Including preparation time, time at the terminal
                  and follow up, most students spend about 4½ hours
                  on this unit.

Before going to the terminal:

    a) Find out from your instructor what tape and file
        numbers to use for data run 66000600:

            Tape TTT = _____; File F = _____

    b) In order to survey the system capabilities from a
        "user" point of view, skim Section 2 of the LARSYS
        User's Manual, Volume I.

    c) Punch the 2 decks of cards described on pages 2 and 3
        and let your instructor check them for accuracy. The
        annotations on the right briefly explain the purpose
        of the cards. Details may be found in the LARSYS
        User's Manual.

    d) Sign up for 2 hours of terminal time at a time when
        your instructor will be available; reserve one tape
        drive according to current policy.

Control Cards for First LARSYS Run

Punched on Card	Comment

①   ⑩

ID   *your ID*

①, ⑩ indicate columns 1 and 10 on the ID card. All LARSYS control cards begin in column 1.

-COMMENT DEMONSTRATION OF STATISTICS FUNCTION

This comment will appear at the top of your printer output.

-RUNTABLE

DATA

RUN(66000600), TAPE(TTT), FILE(F)

END

These four cards create a special runtable which allows you to access the Multispectral Image Storage Tape assigned to your remote terminal site. See your instructor for tape and file numbers.

*STATISTICS

Tells LARSYS monitor you will run a job using the STATISTICS processing function.

PRINT HIST(C), CORRE(C)

Indicates that histograms and correlation matrices are desired for each class (C).

PUNCH CHARACTERS

Requests punched statistics file in character (not binary) format.

CHANNELS 1,2,3,4,5,6,7,8,9,10,11,12

Designates channels for which statistics are to be computed.

OPTIONS HIST(1,8,12)

Designates channels for which histograms are desired.

DATA

Signals that a data deck will follow next.

CLASS SOYBEANS

Indicates that cards following define soybean training fields.

①	⑪	㉑	㉖	㉛	㊱	㊶	㊻	�50
66000600	31-13	237	253	1	141	167	1	SOYBN
66000600	36-7	307	327	1	59	81	1	SOYBN

Punch these field description cards using the columns indicated. The following cards define the corn training fields; use the same columns.

CLASS CORN

66000600	36-9	267	283	1	45	61	1	CORN
66000600	36-8	319	341	1	21	31	1	CORN

END   Signifies end of function

Put a rubber band around the above deck of cards. They will be used in your first LARSYS job.

Control Cards for Second LARSYS Run

①   ⑩

ID   *your ID*

-COMMENT DEMONSTRATION OF IDPRINT AND PICTUREPRINT FUNCTIONS

-RUNTABLE

DATA

RUN(66000600), TAPE(TTT), FILE(F)   Use same tape and file number
                                      you used before.

END

*IDPRINT

PRINT RUN(66000600)   } Requests ID record of run 66000600.

END

*PICTUREPRINT   Requests gray scale map of area
                               defined on next card.

DISPLAY RUN(66000600), LINE(1,199,2), COL(1,222,2)

HISTOGRAM COMPUTE   Requests that histograms be
                              computed.

PUNCH HISTOGRAM   Punch histogram file in binary
                              format.

BLOCK RUN(66000600), LINE(1,1001,2), COL(1,222,4)

                              Gives area for histogram.

CHANNEL 6   Signifies channel desired.

END   Signifies end of function.

Put a rubber band around this deck. It will be used to run your
second set of LARSYS functions.

Materials required at the terminal:

      2 decks of punched cards you prepared as specified on
          pages 2 and 3.

      1 deck of punched cards supplied in the unit box.

      1 audio tape "The 2780 Remote Terminal - a 'Hands-On'
          Experience."

      1 cassette tape recorder, preferably equipped with
          earphones and batteries.

      1 experienced instructor to start you off and to be
          available if you run into difficulties

      1 copy of LARSYS User's Manual - there should be one
          near the terminal.

Outline of Terminal Session

    Part 1.   Introduction and Orientation to terminal layout

    Part 2.   Using the 2780 off-line as a card lister

    Part 3.   "Login," enter name, and initiate the LARSYS
             system.

    Part 4.   Run sample LARSYS jobs

Normally students can complete their work at the
terminal in an hour, although that time may be
doubled during the "heavy use" hours.

+---+
| Begin the exercise by having your instructor explain the use |
| of the tape recorder and general procedure to be followed |
| during the unit. He should let you know where he can be |
| reached while you are at the terminal, and you should not |
| hesitate to ask him for help. |
| Stand in the remote terminal area and start the tape recorder |
+---+

Part 1 - Introduction and Orientation to hardware layout
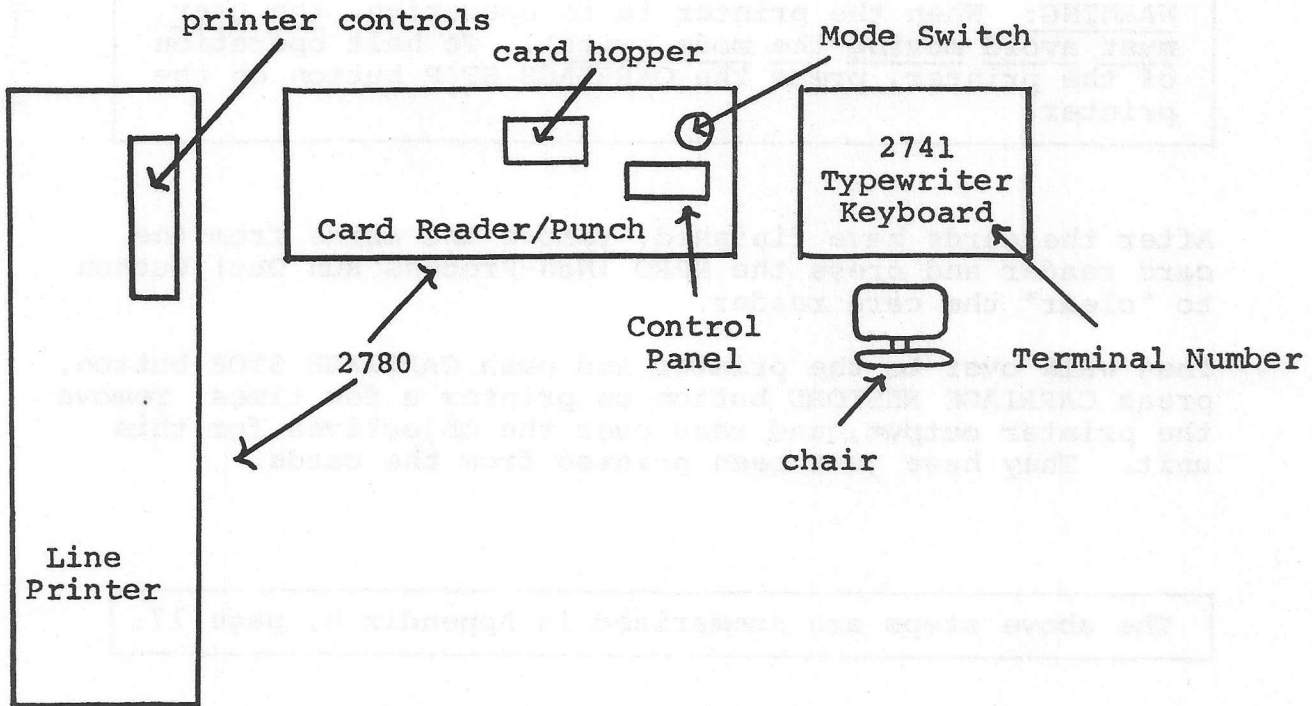
Figure 1

Typical Layout of the Terminal Area

Part 2 - Using the 2780 off-line as a card lister

Standing in front of the card reader/punch unit:
    push STOP button on card reader/punch control panel
    set mode switch to "off-line"
    load "listing deck" cards as directed on tape (see Figure 2).

Heed the warning on tape: if you get a card reader mal-
function, try the procedure given in Appendix A. If that
doesn't work, get your instructor to help.

Go to the printer controls and press the START button.

Go back to card reader unit; press and hold the START
button until the green light comes on.

WARNING: When the printer is in operation, the user
must avoid moving the mode switch. To halt operation
of the printer, press the CARRIAGE STOP button on the
printer.

After the cards have finished, remove the cards from the
card reader and press the NPRO (Non-Process Run Out) button
to "clear" the card reader.

Then walk over to the printer and push CARRIAGE STOP button,
press CARRIAGE RESTORE button on printer a few times, remove
the printer output, and read over the Objectives for this
unit. They have just been printed from the cards.

The above steps are summarized in Appendix B, page 17.

Mode Switch

STOP button

START button

NPRO button

card hopper

weight

9-edge
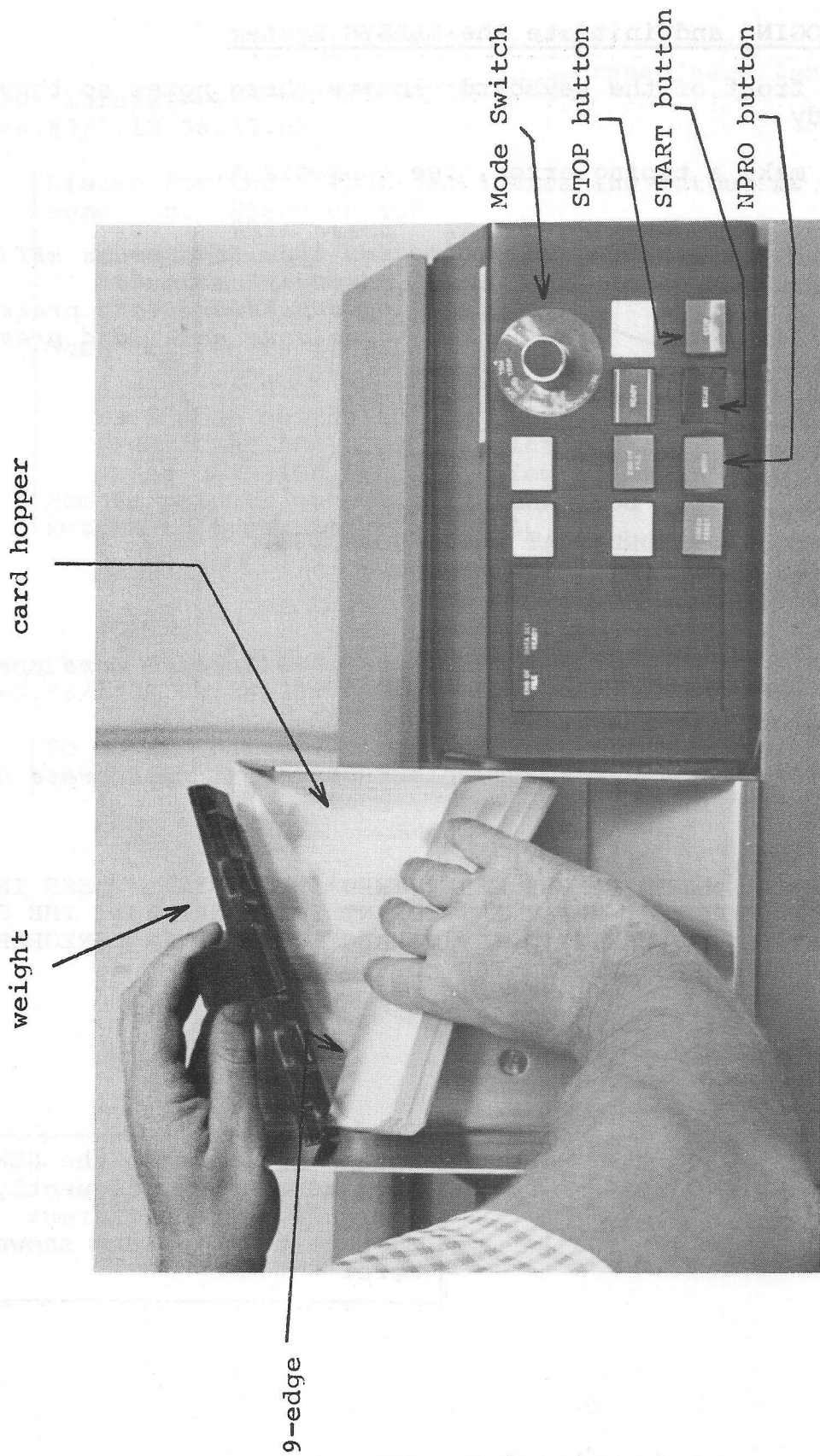
Figure 2

Loading Cards into the Card Hopper

Part 3 - "LOGIN" and initiate the LARSYS System

Sit in front of the keyboard; locate these notes so they will
be handy

If you make a typing error, see Appendix A.

press ATTN
you type (and press RETURN)
computer responds
type password (and press RETURN)
type your name (and press RETURN)

login *userid*
ENTER PASSWORD:
▮▮▮▮▮▮▮▮
ENTER NAME: *your name*
OPERATORS ARE: MIKE, BOB, AND WAYNE.

NEXT SHUTDOWN: SATURDAY AT 15.00 HOURS

READY AT 08.26.47 ON 12/05/74
CP

type 'i larsys' (and press RETURN)

i larsys
LARSYS (Version 3.1) READY;

T=1.55/2.32 08.27.15   *type 'news' (and press RETURN)*
news

REVISED 09/11/74
     A NUMBER OF MINOR ERRORS WERE FIXED IN LARSYS. THESE INCLUDE
PROBLEMS WITH -COMMENT, A FIX IN IDPRINT TO VERIFY THAT THE CORRECT
TAPE IS MOUNTED, AND CHECKING FOR CORRECT COLUMNS IN LINEGRAPH.
USE THE COMMAND 'NEWS LARSYS' FOR MORE DETAILS.

T=0.81/1.08 08.27.57

> Note: response to the NEWS
> command changes frequently.
> You will get a different
> message than the one shown
> here.

_____ *type 'news larsys'* (RET URN)

news larsys←
T=0.83/1.13 08.33.08

> Listen for the beep tone, indicating output is ready to
> come out. Stand up and:
>
>> press the STOP button on the card reader/punch control panel
>> set mode switch to REC
>> press START button on printer.
>
> When printer is finished:
>
>> press the STOP button on the card reader/punch
>> move mode switch to OFF LINE
>> Press CARRIAGE STOP on printer
>> press CARRIAGE RESTORE a few times.
>
> Remove printer output.
> Return to typewriter terminal.

_____ *type 'reference statistics'*
                                          (RET URN)

reference statistics←
T=0.93/1.39 08.34.20

> To obtain printer output, repeat the same steps you used
> to obtain "news LARSYS" output.

Part 4 - Sample LARSYS jobs

        Review the objectives of this unit.
        Locate your first LARSYS control deck (*STATISTICS) and
            move to the card reader.
        Press the STOP button and set mode switch to TSM/TRSP
            (transmit/transparent)
        Load cards into hopper
        Press END OF FILE
        Press START, holding it until the READY light comes on,
            cards should read in.

        After cards have been read:
            press the STOP button to stop the beep
            clear reader by pressing NPRO
            remove cards from the reader

(RETURN)
type 'run larsys' (RETURN)

CARDS XFERED BY FLEXLAB1
T=1.90/3.76 08.38.31
run larsys
EXECUTION BEGINS...

  I0198   STATISTICS FUNCTION REQUESTED   (STASUP)
  I0034   ALL CONTROL AND DATA CARDS HAVE BEEN READ   (STAINT)
  I0200   TRAINING FIELDS NOW BEING PROCESSED.   (STAINT)
  I0201   STATISTICS BEING CALCULATED FOR CLASS SOYBEANS   (LEARN)
  I0002   TAPE   0445 HAS BEEN REQUESTED ON UNIT 0181   (MOUNT)
DEV 181 ATTACHED
  I0003   TAPE READY...EXECUTION CONTINUING   (MOUNT)
  I0036   DESIRED RUN FOUND...66000600   (GADRUN)

                                    ———— *press ATTN*
CP ←

                                    type on one line - - -
                                    'msg operator I am learning
                                    to use the terminal. Please
                                    respond when you get this
                                    message.' (RETURN)

msg operator I am learning to use the terminal. Please respond
when you get this message.
                            ———— *type 'sleep' (RETURN)*
sleep ←

(operator will respond)

press ATTN

CP ←

type 'begin' (RETURN)

begin ←

```
I0201   STATISTICS BEING CALCULATED FOR CLASS CORN     (LEARN)
I0209   COINCIDENT SPECTRAL PLOT(S) PRINTED,      (MULSPC)
I0208   STATISTICS BEING PUNCHED   (PCHSTA)
I0199   STATISTICS FUNCTION COMPLETED      (STASUP)
I0004   END OF INPUT DECK - RUN COMPLETED     (LARSNN)
T=13.19/16.81 08.45.57
```

Get your printer output by:
    pressing STOP button and setting mode switch to REC
    press START on line printer.

    After output stops:
       press CARRIAGE STOP
       press CARRIAGE RESTORE several times
       remove printer output from printer.

Get your punched output by:
    loading blank cards into hopper
    press and hold START until cards start through the punch
    after punching stops, press STOP to stop beep
    remove and store excess blank cards
    press and hold NPRO to clear reader punch unit
    remove punched cards.

> There is one more function to be run

type 'run larsys' (RETURN)

run larsys ←

Notice appearance of "beep tone." Secure your printer output.
Discussion - why the error occurred.
    For E-messages (error messages) and I-messages
    (information messages) refer to Appendix III
    in Volume 3 of <u>LARSYS User's Manual</u>

To correct the error -
    Locate your second deck (*IDPRINT and *PICTUREPRINT),
    load into the card reader, and read in.

(RETURN)

CARDS XFERED BY FLEXLAB1
T=14.50/18.31 08.50.31

type 'run larsys' (RETURN)

run larsys
EXECUTION BEGINS...

```
 I0065   IDPRINT FUNCTION HAS BEEN REQUESTED.     (RUNSUP)
 I0002   TAPE     0445 HAS BEEN REQUESTED ON UNIT 0181    (MOUNT)
DEV  181 ATTACHED
 I0003   TAPE READY...EXECUTION CONTINUING    (MOUNT)
 I0114   IDPRINT FUNCTION COMPLETED.    (RUNSUP)

 I0092   PICTUREPRINT FUNCTION REQUESTED     (PICSUP)
 I0237   ALL CONTROL CARDS FOR PICTUREPRINT HAVE BEEN READ   (PICRDR)
 I0082      100 LINES HISTOGRAMMED.      (HISTD)
 I0082      200 LINES HISTOGRAMMED.      (HISTD)
 I0082      300 LINES HISTOGRAMMED.      (HISTD)
 I0082      400 LINES HISTOGRAMMED.      (HISTD)
 I0091   END OF FILE REACHED ON MULTISPECTRAL IMAGE STORAGE TAPE.(LINEPR)
 I0084   HISTOGRAM(S) READY TO BE PUNCHED.    (HISTD)
```

press ATTN

CP

type 'msg yourid this is a
test message' (RETURN)

msg *yourid* this is a test message

FROM YOURID: THIS IS A TEST MESSAGE

type 'begin' (RETURN)

begin

```
 I0098      100 LINES DISPLAYED FOR CHANNEL  6    (PIC1)
 I0093   PICTUREPRINT FUNCTION COMPLETED    (PICSUP)
T=31.83/46.17 09.14.56
```

(continued on next page)

type 'quit' (RETURN)

quit

CONNECT= 00:51:40   VIRTCPU= 000:32.26   TOTCPU= 000:46.74
LOGOUT AT 09.18.23 ON 12/05/74

cp-67 online   xd.65 qsyosu

   Obtain your printer output. See Appendix D if you need
      more detailed instructions.

   Obtain your punched output. See Appendix D if you need
      more detailed instructions.

After the session at the terminal

1. Save these notes, your typewriter output and your printer
    output for future reference.

2. There are some features of the <u>punched output decks</u> you
    received that you should be familiar with:

    <u>First</u> take the ID card off the front of each deck; it is
        not considered part of the deck. Duplicate it on
        the keypunch and check that your ID and name are on
        the card.

    <u>Next</u> duplicate (using the key punch) the first and last
        card of each deck; now you will be able to "read"
        the punches. Write down what you find there.

    Statistics Deck:
        1st card _____

        last card _____

    Histogram Deck:
        1st card _____

        last card _____

●The two punched decks serve as examples of two types of
deck format: character and binary. The first card in the
Statistics deck identifies the format chosen by the user.
    If column 44 contains a 0, the deck is a character deck.
    If column 44 contains a 1, the deck is a binary deck.

        This Statistics Deck is in _____ format.

    The Histogram Decks are in binary format.

●The decks are numbered so that they can be reassembled if
they are dropped.

        -The cards in the Statistics Deck have sequence
         numbers in columns 73 - 80 beginning with number 1.

        -The cards in the Histogram Deck are also numbered
         in ascending order, but they are not numbered
         consecutively.

3. After examining your typewriter, printer, and punched out-
    put, let your instructor know how you did on the unit and
    make plans for doing the LARSYS Exercises, Unit 5.

Appendix A: MALFUNCTION RECOVERY PROCEDURES

Cards Won't Read

Condition	Probable Cause	Recovery
A few cards read then reader stops; no additional lights come on and there are no beeps	No ID Card	Remove cards from hopper Press NPRO* button and hold for a few seconds Gather any cards that have come out of the reader Reassemble your deck with your ID card on the front, reload the hopper, and try again
Cards start reading and the "hopper" light comes on	Cards bent, torn or uneven	Remove cards from the hopper Press the NPRO* button and hold for a few seconds Put a blank card in hopper, press EOF** button, read in blank card Go to typewriter, push RETURN (you should receive a message that cards have been transfered) Type 'clear reader' RETURN (these steps remove the partial deck that had already been read in) Check original deck for bent or torn cards and make new cards where needed Read deck in again. If you still can't get the cards to read after three attempts, check with your instructor

In all other cases, see your instructor

System Error Messages

?CP-system is in the CP command environment; you have just
typed an invalid CP command.
E116-'COMMAND' IS NOT A VALID CONTROL COMMAND (EXCOMD)
System is in the LARSYS command environment; you have just
typed an invalid command.

All system error messages are identified in Appendix III
(Vol. 3) of the LARSYS User's Manual.

---

*NPRO stands for non-process run out.

**EOF stands for end-of-file.

Typing Errors

One (or up to several) letter(s) in error.
type an @ symbol for each letter in error,
then continue with your message.

Example:

run larty@@sys would be interpreted as:

run larsys

Deletion of a whole line.
type ¢, then the desired line.

Example:

news larys¢ reference larsys would be interpreted as:

reference larsys

No EOF sent when Transmitting Cards

If you neglect to press the EOF button before the last
card is read, you can recover in the following way:

put a blank card in the hopper
press EOF, START

To verify successful transmission, press RETURN

Appendix B: USING 2780 AS A CARD LISTER

```
press STOP on reader/punch unit
turn mode switch to OFF LINE
load cards
press START on printer
press START on card reader and hold until READY light comes on
    .
    .
    .
cards will be listed
    .
    .
    .
clear card reader (NPRO)
remove cards
press CARRIAGE STOP on printer
press CARRIAGE RESTORE on printer
remove listing
```


Appendix C: SENDING MESSAGES

Send message to operator

```
press ATTN
type 'msg cp' and your message
press RETURN
```

Send message to another user

```
press ATTN
type:  'msg'
       id of user being addressed
       the message you are sending
press RETURN
```

Note: messages sent as described above are limited
to one line on the typewriter.

Appendix D: TRANSMITTING DATA TO AND RECEIVING DATA FROM THE
              MAIN COMPUTER

<u>To transmit cards</u>

    load cards in hopper; ID card must be first card
    press STOP; turn mode switch to TSM/TRSP
    press END OF FILE
    press and hold START until READY light comes on

        .
        .
        .

    wait until all cards are read

        .
        .
        .

    press STOP; move mode switch to OFF LINE
    press NPRO
    pickup your cards
    press RETURN to get message verifying transfer of cards

<u>To receive printer output</u>

    press STOP; turn mode switch to REC or PRINT
    press START on printer

        .
        .
        .

    wait for output to finish

        .
        .
        .

    press CARRIAGE STOP
    hit CARRIAGE RESTORE a few times
    remove printer output from back of printer
    press STOP; put mode switch in OFF LINE position

<u>To receive punched output</u>

    press STOP; turn mode switch to REC or PUNCH
    load blank cards in hopper
    press START

        .
        .
        .

    wait for punching to stop, pick up your cards

        .
        .
        .

    press STOP; turn mode switch to OFF LINE
    remove extra cards
    clear punch by pressing NPRO
    pick up your cards
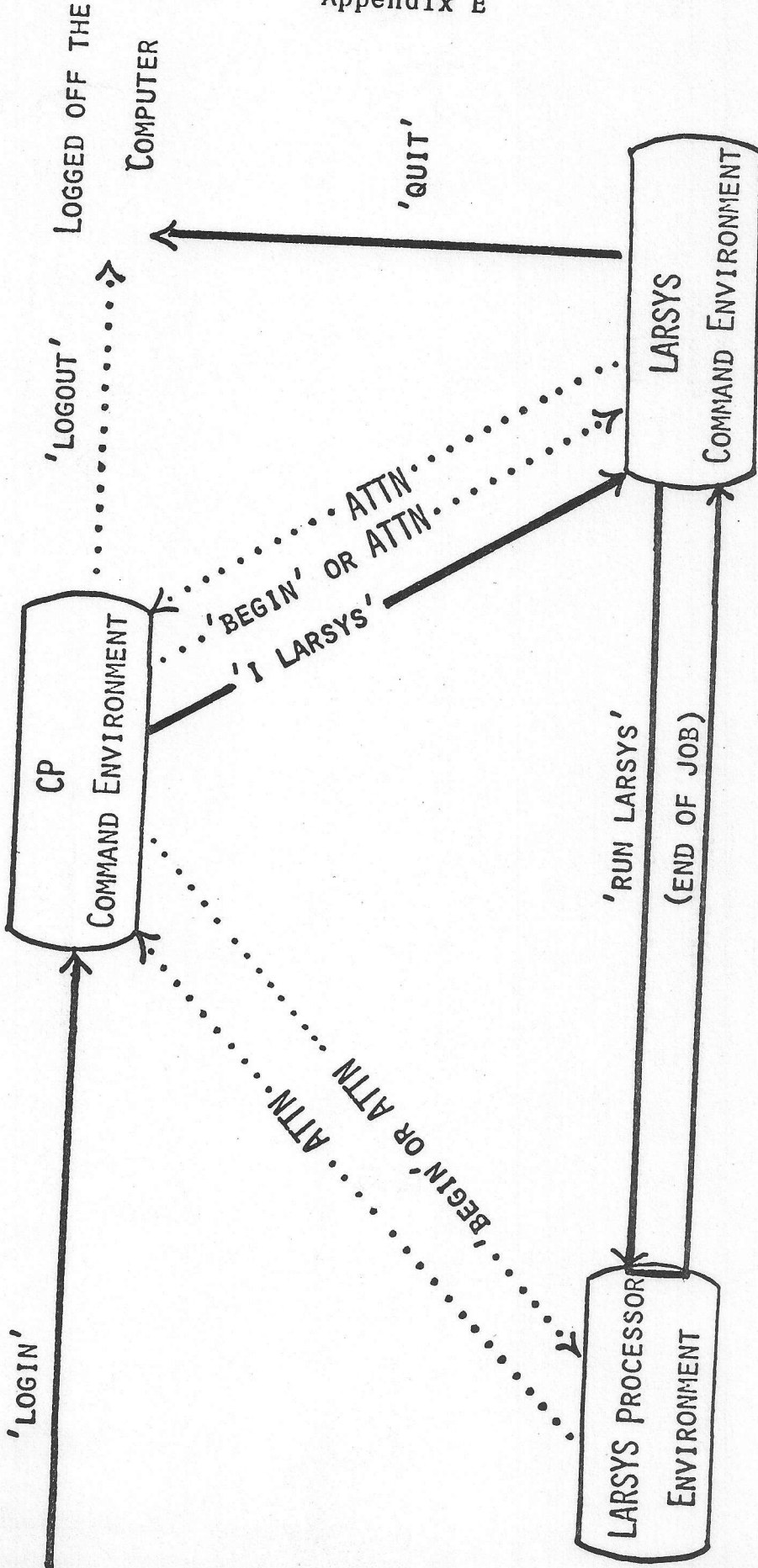
LARS Computer System Environment Diagram

LOGGED OFF THE COMPUTER

'QUIT'

LARSYS COMMAND ENVIRONMENT

'LOGOUT'

ATTN
'BEGIN' OR ATTN
'I LARSYS'

CP COMMAND ENVIRONMENT

'RUN LARSYS'
(END OF JOB)

'BEGIN' OR ATTN
ATTN

'LOGIN'

LARSYS PROCESSOR ENVIRONMENT

SOLID LINES SHOW NORMAL TRANSITION PATHS
DOTTED LINES SHOW ALTERNATE TRANSITION PATHS

Materials Required

Problem statements for students
Instructor's Notes

General Instructional Procedure

It is suggested that you assign these problems one at a time and interact with the student between problems.

For each problem the recommended approach is to:

a) Go over the problem statement with the student.
Discuss which processing function he will be using.
b) Have student punch the control cards.
c) Check over the control cards, point out errors or alternative approaches if you wish.
d) Have student run program.
e) Discuss results.

Encourage your students to use the LARSYS User's Manual and the LARSYS system features themselves as references. The student may find it helpful if you instruct him how to cancel a job and how to cancel output.

Instructor Time Estimate

Interaction with students before and after each exercise:
10 to 15 minutes per exercise.

Data Source

In all exercises requiring access to a Multispectral Image Storage Tape, the student should be encouraged to use a personal runtable using the card sequence:

```
-RUNTABLE
DATA
RUN(XXXXXXX), TAPE(TTT), FILE(F)
END
```

See "Special Note to Instructor" on page 6 of A Survey of the LARSYS Educational Package at the beginning of this volume for instructions on how to create the data tape for your site.

Exercise 1: Reference All

This **exercise is intended for all students who did not** previously get a complete listing of LARSYS Control Commands, Initialization Function Control Cards, and Processing Function Selector and Control Cards.

Log in to the computer, and, after taking care of your ID, password and name and initiating LARSYS, type the command:

reference all

Keep the printer listing for future reference.

Instructor's Notes

1. *Check with your student to see that he has a 'Reference All' listing. If he already has one, skip this problem.*

2. *No control cards are required. Student merely has to review how to login, get his listing and quit.*

Exercise 2: LARSYS Control Commands

The purpose of this exercise is to reinforce the login procedure, to give you practice in getting printer output, and to illustrate use of some of the LARSYS Control Commands.

Login and:

a) obtain the NEWS file pertaining to the system
b) obtain the SCHEDULE for computer operation
c) type the command LIST
d) obtain the RUNTABLE entry for run 72050700

(use your "Reference All" listing to find out which LARSYS Control Command you need to use)

Instructor's Notes

1. *No control cards are required for this exercise. It is designed to give the student practice in the login procedure, issuing control commands and obtaining printer output.*

Exercise 3: <u>Gray Scale Printouts</u>

The purpose of this exercise is to provide experience building an input deck and running a LARSYS job in order to acquire specific output. (See page 2-29 in Volume 1 of the <u>LARSYS User's Manual</u> for general information about card format.) This LARSYS output also illustrates the informational value of multispectral data.

Set up the control card deck needed to obtain a single-width gray scale printout of lines 750-949, run 66000600, showing channels 1 through 12. Use a COMMENT card so that the output will be labeled.

List your deck off-line and check the listing for errors in card preparation. Correct any such errors.

Run the job.

Instructor's Notes

1. *Your student will probably need help in deciding which processing function to use. Try to get him to discover the answer himself, direct him to his REFERENCE ALL output and the* <u>*LARSYS User's Manual.*</u>

2. *If you have two students doing the exercise at the same time, the output could be reduced by having one run the even channels and the other the odd ones.*

3. *Explain the set-up for a user runtable so that your student will use the tape that has been reserved for instructional purposes at your remote terminal location.*

    *For easy reference run 66000600 is stored on Tape TTT = _____;
File F = _____.*

4. *After your student has completed this exercise, you can use his output to illustrate the value of multispectral data. Show how some field boundaries are more easily detected in certain channels.*

5. Point out how you might want to use the PUNCH control card if
you expect to make additional gray scale printouts of the
same area. (Saves computing the histograms again.)

6. Ask your student if he used the BLOCK card and find out why or
why not. Discuss the BLOCK card's function.

7. This exercise creates a lot of output. Discuss with your student
the need for restricting output requests so that they call for
only what is needed.

Exercise 4: Graph Columns

This exercise and the next are designed to give you more experience with LARSYS and added familiarity with the power of LARSYS for utilizing the multispectral characteristics of the data.

Graph columns 49, 59, 69, lines 408 to 503, of run 66000600. Show data from the .44-.46, .62-.66 and .80-1.00 micrometer channels.

Punch the control card deck and run the job.

Instructor's Notes

1. *The problem statement emphasizes the wavelength bands of the channels. Student will have to refer to IDPRINT output to find the corresponding channel numbers.*

2. *Let the student set up the control card deck. As long as it will work, let it run. Afterwards you may want to point out various ways of setting up the control cards so as to get desired types of graphs (not too many plots on one set of axes, etc.)*

For easy reference, run 66000600 is stored on Tape TTT = _____.
File F = _____.

Exercise 5: Graph Lines

The purpose of this exercise parallels that of the previous
one with added experience in using a LARSYS diagnostic feature.

Graph line 708 of run 66000600.

Punch the control card deck.
Use the -CHECKOUT procedure to check for control card
errors. See pages 5-15 through 5-18 (Volume 1) of the
LARSYS User's Manual for a description of this initiali-
zation function and pages 3-14 through 3-19 for a step-by-
step description of how to use it.

Run the job.

Instructor's Notes

1. *Students will have to decide which channels they want.*

2. *A common blunder is to plot all 12 channels on the same
    graph. This results in a mass of symbols. Three or four
    channels per graph works out better.*

*For easy reference run 66000600 is stored on Tape TTT = _____;
File F = _____.*

Exercise 6: Color Panels

The purpose of this exercise is to acquaint you with the batch processing mode and to further your understanding of the nature of multispectral data.

Run 66005200 is a low-level flight over a set of color panels on the ground. These panels are used to obtain data which help in calibrating the aircraft scanner data. The panels, located between lines 400 and 1000 and columns 315 and 425, are arranged in two strips. The strip on the left is made up of three colored rectangular panels; the right-hand one is a series of gray panels.

Using the batch processing mode, obtain some representative gray scale printouts of this area and determine the row and column boundaries of the color panels. See pages 2-45 through 2-46 and pages 3-38 through 3-39 of the LARSYS User's Manual (Volume 1) for information on how to submit a batch run from the terminal.

After you get your gray scale printouts, select a particular panel and obtain lineprinter output of the data values for all points within the panel boundaries. Show the data for a representative set of channels.

Can you tell from the multispectral data the color of each of the three colored panels?

Instructor's Notes

1. Before starting student on this problem be sure a copy of run 66005200 is on the tape dedicated to instructional use at your remote terminal location. If a copy is not available you can make one by running

        *DUPLICATERUN
        FROM RUN(66005200)
        TO TAPE(TTT), FILE(F)
        END

    For your future reference:

        TTT = _____, F = _____

    at this location for run 66005200.

    Student should be encouraged to use a personal runtable when running this exercise.

2. This run has only 6 channels. I suggest you let the student
    stumble into this himself; then point out the value of the
    ID record (IDPRINT) when working with a new run.

3. Student must decide for himself what a "representative" set of
    channels is. Channel 5 shows the panels quite well.

4. The data for line 431 does not exist and, if the parameters
    selected by the student call for this line, a message to this
    effect will appear on the gray scale printout. Let the
    student discover this for himself and use the opportunity to
    point out the many diagnostic features built into LARSYS.

5. Panels are in the vicinity of lines 687-726, columns 340-378.
    The degree to which the panels show up on the gray scale
    printouts depends on the size of the area histogrammed.

6. The color panels are red, green, and blue in that order.

Instructor's Notes

At this point in learning to use LARSYS, the student
has available two case study units. One case study is
geared toward a supervised analysis approach, analyzing
aircraft data. The other case study combines techniques
from both supervised and unsupervised approaches and applies
these techniques to data collected by the Earth Resources
Technology Satellite, now known as LANDSAT.

If a student has the time, resources, and interest, a
study of both units is recommended. If not, you should
help the student decide which one will be more useful. The
philosophy taken in preparing these case studies is described
in the "Preface to the Student" section of each document.
Please read this material.

In working through either case study, it is important
that the students state clearly the objectives of their
analyses. Discuss the chosen objectives with the student.
A number of readings are suggested from the site library.
Make sure that your student knows the local procedures
for gaining access to the materials.

We recommend that you monitor the progress of your
students frequently. Try to arrange frequent student/
instructor conferences of short duration, since experience
has shown they are more beneficial than lecture sessions
of longer duration. These conferences are particularly
important in the case study analyzing LANDSAT data.

Included in the site library is one solution to each
case study. "An Analysis of Run 71053900" is the aircraft
data analysis, and "An Analysis of Run 73033802" is the
satellite data analysis. These solutions are NOT presented
as "the correct solutions" but rather as example solutions.
Since the analysis of remotely sensed multispectral data
is a developing science, you should not expect your
student's analysis to match the results of the solution
we have provided.

Also provided as part of your "instructor's kit" are
decks of Field Description Cards for the test fields used
in the solutions provided. The test deck for the aircraft
data analysis is not intended to replace student-selected
test fields, but rather to serve as an additional evaluation
tool if, for instance, several students are going through
at once and you want a comparison test deck. The test
deck for the satellite data analysis is provided for use
by all students, to save them the time they would spend
selecting their own test fields.

Materials Required

1. Student copy of Guide to Multispectral Data Analysis using LARSYS by J.C. Lindenlaub (LARS Information Note 062873)
2. Student copy of Pattern Recognition Notes by P.H. Swain (LARS Information Note 111572)
3. Reference copy of LARSYS User's Manual
4. Reference copies of LARS Information Notes:
   - 120371 - The Importance of Ground Truth Data in Remote Sensing by R.M. Hoffer
   - 102670 - Random Noise in Multispectral Classification by S. Whitsitt
   - 062273 - Analysis Research for Earth Resource Information Systems: Where Do We Stand? by D.A. Landgrebe
   - 020871 - Comparison of the Divergence and β-Distance in Feature Selection by P.H. Swain, T.B. Robertson and A. Wacker
5. "An Analysis of Run 71053900" with Field Description Cards for test fields.
6. Multispectral Image Storage Tape: Check to see that one of the data tapes assigned to your terminal site has a copy of run 71053900 on it. If it does, enter the tape number and file number below for easy reference:
   Tape TTT = _____ ; File F = _____
   If it does not, see page 6 of A Survey of the LARSYS Educational Package.

Additional References

Examples of results analysis and the extraction of useful information from multispectral data classifications may be found in journals such as:

Remote Sensing of the Environment
IEEE Transactions on Geoscience Electronics
Remote Sensing in Ecology
Journal of Soil and Water Conservation
Photogrammetric Engineering and Remote Sensing
Agronomy Journal
Applied Optics

as well as in a number of LARS Information Notes, and published proceedings of remote sensing conferences.

Instructor's Notes

The philosophy taken in preparing this part of the LARSYS Educational Package is described in the "Preface to the Student" section of the document. Please read this section.

It is suggested that you monitor the progress of your student frequently - you should plan on talking to him at least once during each step of the analysis sequence. Experience indicates that frequent student/instructor conferences of short duration are more beneficial than longer duration lecture sessions.

Students need to state their objectives clearly for the case study.

Each remote terminal site has been provided with a copy of "An Analysis of Run 71053900." The analysis of remotely sensed multispectral data is a developing science and you should not expect your student's analysis to match the results of the "school solution" we have provided. There is no single "correct" analysis. In particular, it is doubtful that a person analyzing a flightline for the first time would obtain as high a degree of correct classification as has been achieved on the analysis provided to you. Consider our solution a "crutch" but not an "authority."

A CASE STUDY USING LARSYS FOR
ANALYSIS OF LANDSAT DATA

Instructor's Notes

Materials Required

1. Student copy of A Case Study Using LARSYS for
   LANDSAT Data by Tina K. Cary and John C. Lindenlaub
   (LARS Information Nore 050575)
2. Student copy of Pattern Recognition: A Basis for
   Remote Sensing Data by Philip H. Swain
3. (LARS Information Note 111572)
3. Reference copy of LARSYS User's Manual
4. Reference copies of LARS Information Notes:
   120371 - The Importance of Ground Truth Data
            in Remote Sensing by R.M. Hoffer
   011069 - Ecological Potentials in Spectral
            Signature Analysis by R.M. Hoffer
            and C.J. Johannsen
   042673 - Two Effective Feature Selection Criteria
            for Multispectral Remote Sensing by
            P.H. Swain and R.C. King
   062873 - Guide to Multispectral Data Analysis
            Using LARSYS by J.C. Lindenlaub
   110474 - An Introduction to Quantitative
            Remote Sensing by J. Lindenlaub and
            J. Russell
   072473 - Emission and Reflectance from Natural
            Targets by R. Kumar and L. Silva
   100771 - The Minimum Distance Approach to
            Classification by A.G. Wacker and
            D.A. Landgrebe
5. "An Analysis of Run 73033802" with field description
   cards for test fields.
6. Reference Data: Three kinds of reference material
   are needed for the case study:
   a) Six U.S. Geological Survey 7.5 minute
      quadrangle maps covering the area analyzed
      in the case study. These are not provided
      as part of the site library. The site
      techniques specialist should be responsible
      for ordering these maps. Three or more
      sets of maps per site are recommended.
      The maps may be ordered from Distribution
      Section, U.S. Geological Survey,
      1200 South Eads Street, Arlington, Virginia,
      22202. The names of the sheets required are:
         Oolitic, Indiana
         Bartlettsville, Indiana
         Clear Creek, Indiana
         Allen's Creek, Indiana
         Bloomington, Indiana
         Unionville, Indiana
      A set of the USGS maps should be loaned
      to the students during their study and
      collected from them afterward.

    b)   Monroe County, Indiana highway maps. Ten
         of these are provided per site. They are
         to be lent to the students during their
         study and collected from them afterward.

    c)   Color infrared aerial photograph in 35 mm
         slide format. Ten slides are provided
         for each site. Again, they are intended
         to be loaned to the students and collected
         from them upon completion of the case study.

7. Multispectral Image Storage Tape: Check to see
    that one of the data tapes assigned to your terminal
    has a copy of runs 73033802 and 72072302 on it.
    If it does, enter the tape number and file number
    below for easy reference:
    73033803 Tape TTT = _____; File F = _____
    72072302 Tape TTT = _____; File F = _____
    If it does not, see page 6 of A Survey of the LARSYS
    Educational Package.

Additional References

Examples of results analysis and the extraction of
useful information from multispectral data classifications
may be found in journals such as:

    Remote Sensing of the Environment
    IEEE Transactions on Geoscience Electronics
    Remote Sensing in Ecology
    Journal of Soil and Water
    Photogrammetric Engineering and Remote Sensing
    Agronomy Journal
    Applied Optics

as well as in a number of LARS Information Notes and
published proceedings of remote sensing conferences.

Instructor's Notes

As mentioned earlier, student/instructor interaction
is an important part of this case study. It is recommended
that you meet with your students after each step in the
analysis. At the beginning of the case study you will want
to make sure that each student knows about the various
reference materials and their availability.
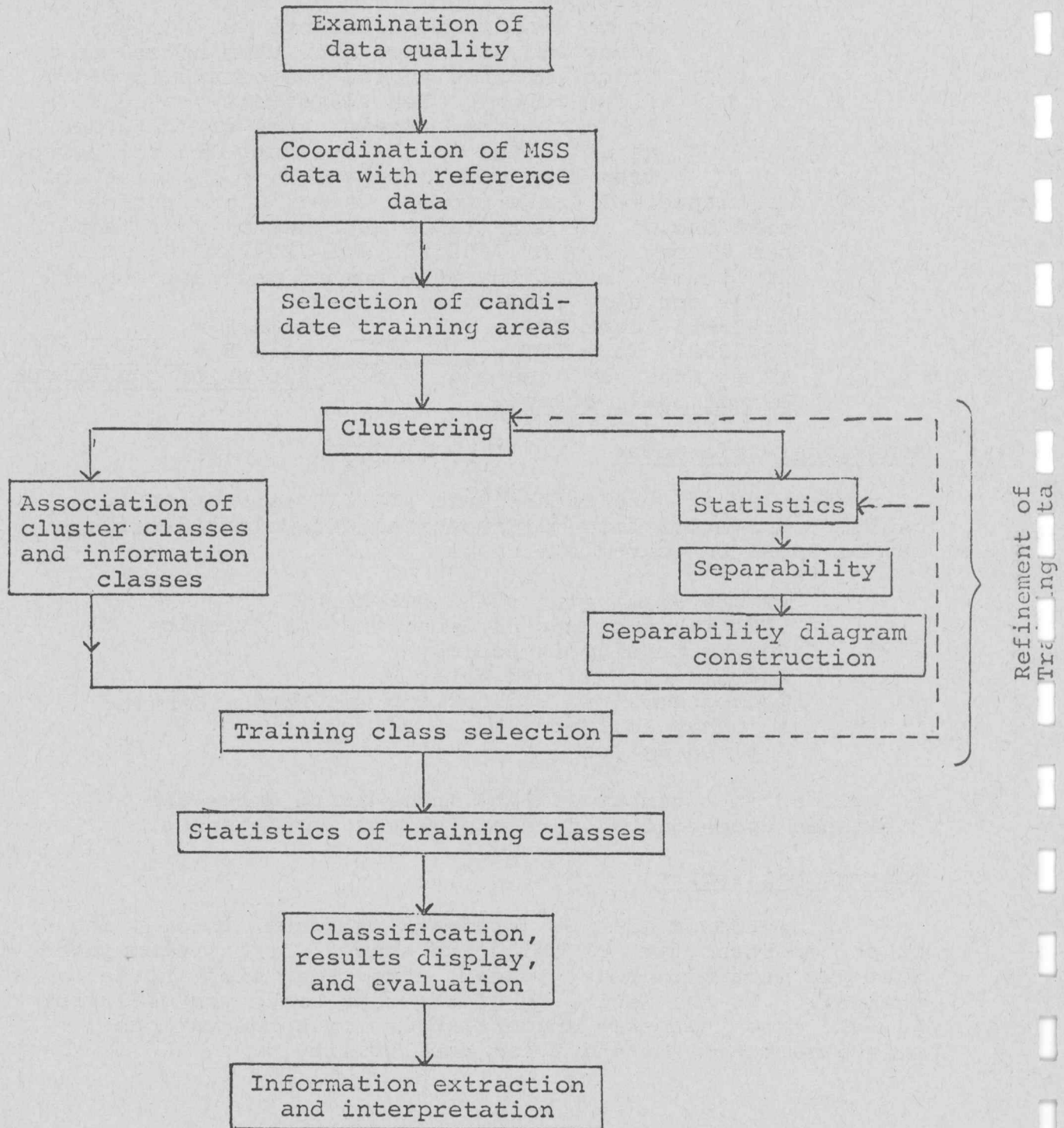
ANALYSIS FLOWCHART

Figure 2. Flowchart indicating the sequence of steps undertaken
          in the analysis procedure described in this manual.

The following comments relate to the analysis flowchart
for the case study which is reprinted on page three for
your convenience.

In the examination of data quality and coordination of
the multispectral scanner data with reference data, the student
is told in the case study that the data tape he will be
working with has been geometrically corrected and scaled
to match the scale of the USGS 7.5 minute quadrangle maps.
However, no mention has been made of the fact that in
order to get proper matching a double printout employing
every line and column should be used. It might also be
helpful for you to know that if every other line and column
is used, the scale approximates the scale of the Monroe County
highway map.

The case study material suggests in the section on
selecting training areas that each training area should
contain more than one cover type. Some students will perhaps
inquire why you can't select areas that are "pure" in the
sense that they contain only one cover type. An obvious
example here is to select an area from the middle of the
reservoir which is certain to contain only the water cover
type. Although this procedure can be used to carry out the
case study, it is suggested that you encourage students to
include more than one cover type. The reason for doing this
is: when the clustering algorithm uses all four channels of
data, the cluster map which is produced may be thought of
as an enhanced image. That is, a map obtained by using data
from all four bands might be expected to do a better job
of delineating boundaries between cover types than any
single-channel gray scale map. An area which includes a
fairly large portion of the reservoir along with some shoreline
area should illustrate this point.

It is suggested that you place the burden of decision
upon your students in selecting candidate training areas.
There are a number of approaches, and some work better than
others, but we have found that students gain by their mistakes
and seldom make the same mistake twice. Examples of typical
blunders in selecting candidate training areas are the following:

a)   Selecting areas on gray scale printouts and then
discovering later on that the areas that they selected
happened to fall in the cloud shadow area of the aerial
photograph, thus making it impossible to establish
cluster-class/information-class associations.

b)   Not selecting areas with distinctive
geometric features, such as a bend in the river or a
penninsula jutting out into the reservoir, thereby
making the process of overlaying the aerial photograph
and the cluster maps more difficult.

Here again, it is suggested that you let students discover
these errors for themselves. If they don't use the best

techniques the first time, you can point out some of
their weaknesses and suggest improved techniques for use in
future analyses.

It would be a good idea to discuss with your students
the analysis flowchart after they have completed the clustering
operation. As the case study is written, students are
encouraged to make cluster-class/information-class associations
working from the output of the cluster maps and reference
data before running the STATISTICS and SEPARABILITY
processors. You might want to point out that it would be
possible to proceed on the right-hand branch of the analysis
flowchart, that is the statistics, separability diagram
construction prior to the time that they make the spectral
class/information class associations. Experience with pilot
groups of students has indicated that until the students
have actually pursued both paths they don't have a full
appreciation of the interdependency of these operations.

Although the case study points out that the students
should take care in keeping track of the symbols used in
SEPARABILITY and being able to relate them to the original
cluster symbols, it would not hurt to emphasize this point
with them before the SEPARABILITY processor is run.

Interpretation of the separability diagram and final
training sample selection will be one of the most frustating
experiences for the students. Your encouragement at this
point would be helpful. It must be realized however, that
there are no clear-cut, crisp rules that can be used in this
part of the analysis. Also, take this opportunity to state
that part of the purpose of the case study is to develop
experience. If there were strict rules available, it
would not be necessary to have highly trained analysts.

In discussing the classification and results display
operations with your students, point out that the case study
suggests storing the classification results on disk and
hence, it is suggested that the students chain several
PRINTRESULTS runs immediately after the CLASSIFYPOINTS
algorithm has been run. One possibility is to do a
PRINTRESULTS which does not group any of the subclasses
which they may have defined. This allows students to see
the interdependency between the various subclasses. Then
follow this with a second PRINTRESULTS operation which groups
subclasses into the major cover types so that the test deck
which has been provided as part of the case study materials
may be used.

Out of seven groups of students that have field-tested
this study most of them achieved training data performance
results in the low to mid 90% range. Most of the groups
achieved test results percentages in the low to mid 80's
with considerable confusion between the urban and agricultural
classes and to a lesser extent confusion between the forest
and agricultural classes. These numbers are given simply

as guidelines. It is certainly possible that a student who achieved only 60% accuracy could learn as much about the case study as a student who achieved an 87% accuracy.

The interpretation of classification results should be discussed with your students. When low accuracies and confusion between certain cover types are evident in the results, this could also arise because the training sets that were finally chosen were not representative of the area being classified. If the situation warrants it and time permits you may wish to have your students iterate through portions of the analysis again.