FOREST RESOURCE INFORMATION SYSTEM

Phase III Quarterly Report

for the period

1 April 1980 to 30 June 1980

Prepared for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Johnson Space Center
Earth Observations Division
Houston, Texas   77058

Contract: NAS 9-15325
Technical Monitor: R. E. Joosten/SF5

Submitted by:

The Laboratory for Applications of Remote Sensing
Purdue University
West Lafayette, Indiana   47906

Principal Investigator: R. P. Mroczynski

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16. Abstract

    This report covers the fifth quarter of the fifteen-month System Transfer Phase of the Forest Resource Information System Application Pilot Test. The principle activities during this quarter revolved around the documentation of software systems. Timelines and a short description of the software documentation process is given.

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Index

FRIS PROJECT OVERVIEW

The Forest Resource Information System Project (FRIS) is a cooperative effort between the National Aeronautics and Space Administration (NASA) and St. Regis Paper Co. (STR). Purdue University's Laboratory for Applications of Remote Sensing (LARS), under contract to NASA, will supply technical support to the project.

FRIS is an Application Pilot Test (APT) Project funded by NASA. The project is interdisciplinary in nature involving expertise from both the public and private sectors. FRIS also represents the first APT to involve a large broad base forest industry (STR) in a cooperative with the government and the academic communities.

Purpose

The goal of FRIS is to demonstrate the feasibility of using computer-aided analysis techniques applied of Landsat Multispectral Scanner Data to broaden and improve the existing STR forest data base, thereby creating the foundation of a dynamic information system. The successful demonstration of this technology during the first half of the project will lead to the establishment by STR of an independently controlled operational forest resource information system in which Landsat data is expected to make a significant contribution. FRIS can be viewed by the user community as a model of NASA's involvement in practical application and effective use of space technology. Additionally, FRIS will serve to demonstrate the capability of Landsat MSS data and machine-assisted analysis technology to private industry by:

> o Determining economic potentials,
>
> o Providing visibility and documentation, and

o The ability to provide timely information

and thus serve management needs.

The ultimate long term successfulness of FRIS can be measured through future development of remote sensing technology within the forest products industry.

Scope

FRIS is funded as a modular or Phase project with an anticipated duration of three years. The original project concepts were developed in 1973, and a formal project plan was submitted to NASA by STR in 1976. The project officially began in October 1977 after the signing of a cooperative agreement between NASA and STR; and after the compeltion of contractual arrangements with Purdue University.

Organization

The organization of FRIS is depicted in the chart that follows. Since FRIS is a cooperative involving three independent agencies, a steering committee consisting of a project manager from each institution was formed to provide for overall guidance and coordination. Operationally, both STR and LARS have project managers and project staff to insure for the timely completion of activities within the project. The NASA technical coordinator monitors project activities and provides a liaison between the STR and LARS staffs. The solid lines on the chart indicate the flow of management responsibility. The dash lines reflect the technical and scientific inter-changes between operating units.

FRIS Organization

<u>Steering Committee</u>

ASVT Project Manager

NASA Technical Monitor

FRIS Project Manager

Resource and Technology Department/ STR	NASA Johnson Spacecraft Center	LARS/ Purdue University
Computer Systems	Systems Design	
Cartographic Systems	Mapping Unit	
Forest Sampling Systems	Classification Unit	
Cost Analysis	Cost Unit	
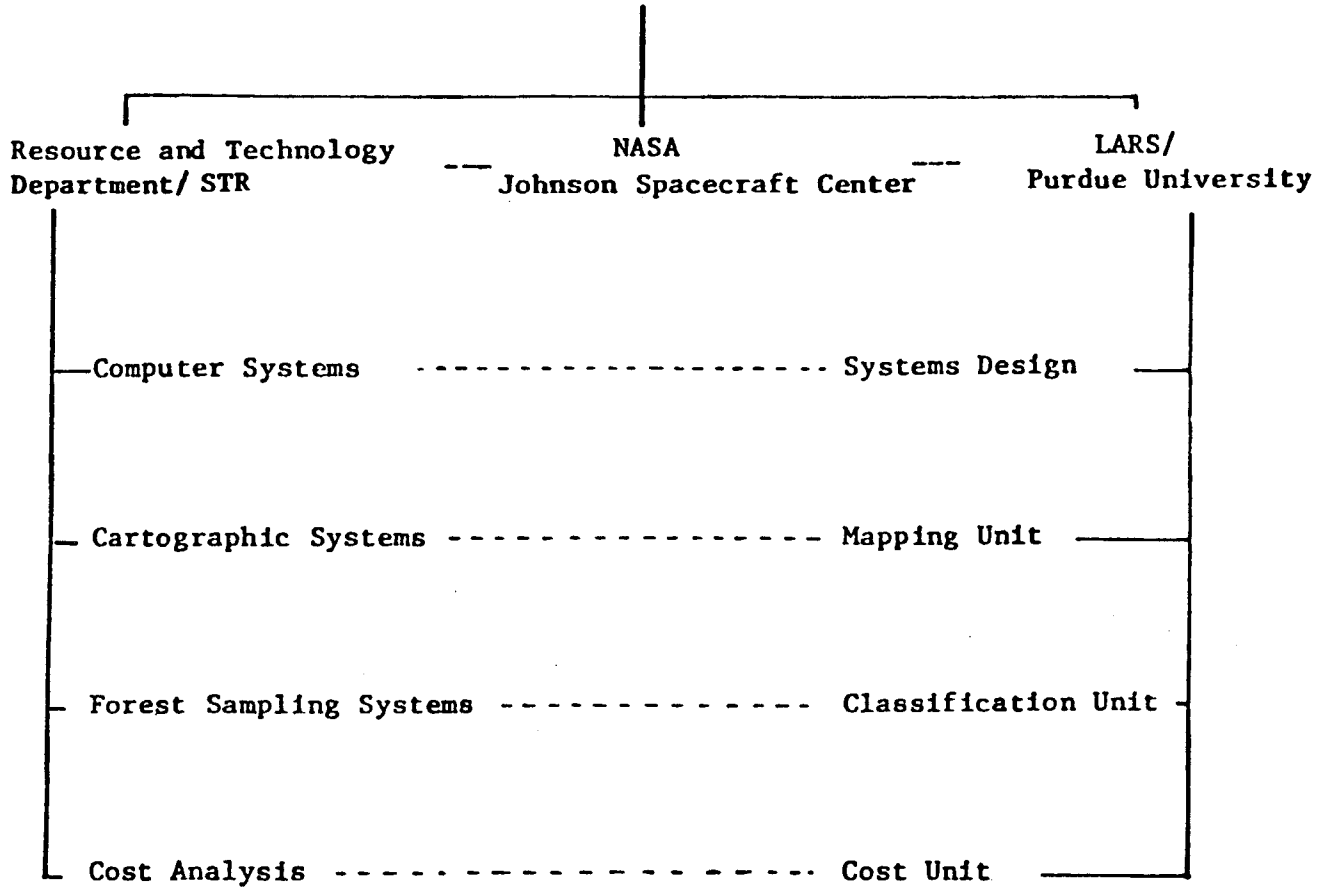
1.0 INTRODUCTION

The material which appears in this report is a reflection of the
FRIS Project Staff activities for the period 1 April 1980 to 30 June
1980. This time frame encompasses the fifth quarterly reporting
period for Phase III of the Forest Resource Information System (FRIS)
Applications Pilot Test (APT). Phase III or the System Transfer Phase
of FRIS is directed at meeting the overall Project goal:

> To document and transfer remote sensing technology
> developed throughout the project that will provide
> St. Regis with an independent operational system,
> having Landsat data as a significant and viable
> contributor.

The major staff effort during this reporting period have been directed
at software documentation. Primary emphasis has been placed on
documenting developmental LARSYS (LARSYSDV) software modules. These
are modules, subroutines, that currently do not exist in the LARSYS
ver. 3.1 software available through COSMIC.

Noteworthy project accomplishments for this last quarterly
reporting period include:

o LARSYS software installed and operational at the St. Regis
   National Computer Center.

o Decision as to the content of the LARSFRIS modules that will
   be documented for COSMIC.

o Disconnecting the ROSCOE remote terminal link to Jacksonville.

o Decision to develop the concept of and produce a FRIS color
   brochure.

o Growth of the concept to conduct a FRIS end-of-project
   symposium.

The remainder of this report will discuss the System Transfer
activities in more detail. Appendix A contains updated timeline
charts for these activities.

Z

2.0 SYSTEM TRANSFER TASKS

The System Transfer activities consist of documenting and trans-
ferring two major image processing elements; preprocessing software,
and classification software. A discussion of the status of these
activities are contained in the subsections that follow.

2.1 Preprocessing Software

Preprocessing transfer consists of four main tasks. The first
three tasks involve the completion of the major systems of preprocessing
programs known as Landsat Reformatting, Geometric Correction, and
Image Registration. The last task is creation of the Preprocessing
Cosmic Package. Documentation is an important part of all these tasks.
Both programmer and user documentation is included.

The Landsat reformatting task is designed to deliver a system of
programs which convert digital Landsat data to LARSYS format.
Specifically the input of EDIPS "P" band interleaved format to LARSYS
multispectral image tape format. Planning for this program has been
completed as has all programming efforts. Test data has been assembled
and all program abstracts have been generated. User documentation is
scheduled for completion as of September 30, 1980.

Geometric correction is a modified system of programs designed to
rotate EDIPS "P" format Landsat data to true north or other orientation
as required. Actual inputs and outputs to and from the processor are
in LARSYS format. Planning for this series of programs was completed
in May with implementation of programs scheduled for completion at the
end of August, 1980. Test data will be generated during program
implementation. Abstracts and user documentation will be completed in
parallel by the end of September, 1980.

Image registration is the third preprocessing software task. This
processor provides the tool to register two coincident scenes of Landsat
or other image data. Input images are assumed to be in LARSYS format.
Planning for this processor will be completed in August, 1980. The
main image registration programmed have been functionally specified
and three-fourths of the units have passed the design stage. Over one-
third have been implemented at this time. The second major section,

the coincident cross-correlation and the third multifit least squares
analysis will be modifications of current program implementations.
Program abstracts and user documentation for all sections are
scheduled for completion as of October 31, 1980.

The final task is the creation and submission of a package of the
above processors to COSMIC. Compiled listings of computer tapes con-
taining all programs will be put together as of late October, 1980.
All documentation for the package will be gathered and the package
will be created and sent to COSMIC by mid-November, 1980. Detailed
timeline charts for these activities appear in Appendix A.

2.2 Image Classification Software

The image processing software that St. Regis will use for classi-
fying Landsat data will be called LARSFRIS. The modules that comprise
this software currently exist as LARSYS ver. 3.1 and LARSYSDV, see
Table 2.2.1 . LARSYS ver. 3.1 currently exists as a completely
documented software package available through COSMIC. LARSYSDV con-
tains experimental modules that represent a logical development of new
software capability. LARSYSDV is not available through COSMIC.

The principle project activity during this past quarter has been
completing the documentation of LARSYSDV software. A secondary activity
involves updating the software elements of LARSYS ver. 3.1 that are
transferred to St. Regis. The end result of these activities will be
a completely documented software package called LARSFRIS. This soft-
ware will be available to interested users through COSMIC. Timeline
charts for the various image processing components of LARSFRIS appear
in Appendix A.

2.2.1 Software Modifications

LARSYS software that would support the FRIS image processing
requirements was identified early during the preliminary system design
task in Phase II. A re-evaluation of these software modules as the
documentation process began indicated that some software was in-
appropriate to transfer to St. Regis. The GDATA, GRESULTS, and BROWSE
modules are specific software unique to the LARS computer configuration
and, therefore, have been deleted from the software listed in Table 2.2.1.

Table 2.2.1. Software modules that comprise LARSFRIS and their
origin, either LARSYS ver. 3.1 or LARSYSDV.

LARSYS ver. 3.1 Modules	LARSYSDV Modules
PICTUREPRINT	SEPARABILITY
STATISTICS	PRINTRESULTS
IDPRINT	CHANNELTRANSFORM*
LISTRESULTS	SECHO*
PUNCHSTATISTICS	MERGESTATISTICS
LINEGRAPH	RATIOMEANS*
COLUMNGRAPH	BIPLOT
HISTOGRAM	COMPARERESULTS*
GRAPHHISTOGRAM	SMOOTHRESULTS
COPYRESULTS	
EXCOMAND	

*Indicates a module name change, refer to sec. 2.2.2 of text.

In addition to deleting the three modules, four modules were renamed. Renaming was deemed appropriate because the new module name better represented the functions that the software performed. The following module names were changed:

New Name	Old Name
CHANNELTRANSFORM	DUPLICATERUN
SECHO	ECHO
RATIOMEANS	RATIO
COMPARERESULTS	CHANGE

3.0 MANAGEMENT

During the quarterly reporting period both the LARS/NCC and LARS/JAX remote terminals were disconnected. The FRIS terminal network was intended to augment the technology transfer activities and assist with the system transfer. The LARS/JAX proved valuable during on-site training sessions at Jacksonville. The LARS/NCC terminal link was not extensively used because StR staff involved in software implementation had fewer problems than anticipated.

The FRIS Steering committee has developed a concept to produce a color brochure, and conduct an end-of-project symposium. Planning for both these activities began during this quarter.

Appendix A

Timelines

I.   Preprocessing Software

I.a. Preprocessing COSMIC Package

II.   FRIS Software Development

III. FRIS LARSYSDV Documentation

IV.   FRIS "LARSYS Documentation"

V.   St. Regis COSMIC Package

FRIS PREPROCESSING Software Documentation Task

	Apr	May	June	July	Aug	Sept	Oct	Nov					
I. Preprocessing Software													
A. Landsat Reformatting (EDIPS)													
1. Plan Processor	▼												
2. Implementation	━━━━━━━━▼												
3. Test Deck	━━━━━━━━━━▽												
4. Program Abstracts	━━━━━━━━━━━━▽												
5. User Documentation	━━━━━━━━━━━━━━━▽												
B. Geometric Correction													
1. Plan Processor	━━━━━▼												
2. Implementation	━━━━━━━━━━━━▽												
3. Test Deck	━━━━━━━━━━━━━━▽												
4. Program Abstracts	━━━━━━━━━━━━━━━▽												
5. User Documentation	━━━━━━━━━━━━━━━▽												
C. Image Registration													
1. Plan	━━━━━━━━━▽--▽												
2. Implementation	━━━━━━━━━━▽---▽												
3. Test Deck	━━━━━━━━━▽----▽												
4. Program Abstracts	━━━━━━━━━▽---▽												
5. User Documentation	━━━━━━━━━▽---▽												

7

	Apr	May	June	July	Aug	Sept	Oct	Nov				
I.A. Preprocessing COSMIC Package												
A. 1. Compile module sizes, lines of codes						▽ – – – – ▽						
2. Create tape (Document format)						▽ – – – ▽						
3. Duplicate "LARSYS Preprocessor" documentation						▽ – – – ▽						
4. Create new listing + abstract books						▽ – – – – ▽						
B. Send Package to COSMIC						▽ – – – – ▽						

FRIS LARSYS Software Documentation Task

II. FRIS Software Development	Apr	May	June	Jul	Aug	Sept	Oct	Nov				
A. COMPARERESULTS												
1. Programming (completed 6/79)	▼											
2. User Documentation		▽		---▽								
3. Program Abstracts	▽			-▽								
4. System Manual Flowchart		▽		-▽								
5. Test Procedures		▽		-▽								
B. CLASSIFYPOINTS (MiniDistance)												
1. Programming (completed 3/79)	▼											
2. User Documentation			▽	-▽								
3. Program Abstracts			▽	---	▽							
4. System Manual Flowchart			▽	----	▽							
5. Test Procedures			▽	----▽								
C. SMOOTHRESULTS												
1. Programming		▼										
2. User Documentation			▽	--▽								
3. Program Abstracts	▽			▽								
4. System Manual Flowchart			▽	▽								
5. Test Procedures			▽	▽								
D. PRINTRESULTS (Combine versions)												
1. Programming			▼									
2. Program Abstracts				▽								
3. User Documentation				▽-	▽							
4. System Manual Flowchart				▽-	▽							
5. Test Procedures				▽-▽								

	Apr	May	June	July	Aug	Sept						
F. CLUSTER												
1. Program Abstracts			▽	- - -▽								
2. User Documentation			▽	- - -	- - -▽							
3. System Flowchart			▽	- - -	- - -▽							
4. Test Deck			▽	- - -	- - -▽							
G. SEPARABILITY												
1. Program Abstracts			▽	- - -▽								
2. User Documentation			▽	- -▽								
3. System Flowchart			▽	- -▽								
4. Test Deck			▽	- -								
H. CHANNELTRANSFORM												
1. Program Abstracts			▽	- -								
2. User Documentation			▽	- -								
3. System Flowchart			▽	- - ▽								
4. Test Deck			▽	- -▽								

10

NASA-JSC

III. FRIS LARSYSDV Documentation	Apr	May	June	July	Aug	Sept							
A. MERGESTATISTICS													
1. Program Abstracts													
2. User Documentation													
3. System Flowchart													
4. Test Procedures													
B. BIPLOT													
1. Program Abstracts													
2. User Documentation													
3. System Flowchart													
4. Test Procedures													
C. RATIOMEANS													
1. Program Abstracts													
2. User Documentation													
3. System Flowchart													
4. Test Procedures													
D. SECHO													
1. Program Abstracts													
2. User Documentation													
3. System Flowchart													
4. Test Procedures													

	Apr	May	June	July	Aug	Sept								
IV. FRIS "LARSYS Documentation"														
A. Remaining LARSYS Processors														
*PIC, *STAT, *IDP, *LIST, *PUNCH,														
*LINEGR, *COLUMNGR, *HIST, *GRAPH														
1. Review User Manual (e.g. examples)				▽										
2. Review System Manual				▽										
3. Check Program Abstracts				▽										
4. Review Test Procedures				▽										
B. EXCOMD EXEC (+ related EXECs)														
1. Abstracts		▽			▽									
2. User Documentation		▽			▽									
3. Flowchart		▽			▽									
4. Test Procedures		▽			▽									
C. System Manual (Section 2)				▽										
D. User Manual														
1. Volume 1					▽									
2. Volume 3 - assign new error msg					▽									
#s and compile new list														

12

	Apr	May	June	July	Aug	Sept							
V. St. Regis COSMIC Package													
A. Compile module sizes, lines of code						▽							
B. Create tape (document format)						▽							
C. Duplicate "LARSYS" documentation						▽							
D. Create New listing + Abstract books						▽							
E. Send package to COSMIC						▽							

13