

*LARS Contract Report*  
*08D177*

LACIE FIELD MEASUREMENTS  
DATA LIBRARY CATALOG  
VOLUME I  
1974-75 CROP YEAR



*National Aeronautics and Space Administration*  
**LYNDON B. JOHNSON SPACE CENTER**  
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LACIE FIELD MEASUREMENTS

DATA LIBRARY CATALOG

VOLUME I

1974-75 CROP YEAR

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## PREFACE

The LACIE Field Measurements program, under the sponsorship of the Earth Observations Division, NASA/Johnson Space Center, was initiated in the Fall of 1974 to acquire, process, and make available to researchers agricultural remote sensing data. As a result, one of the most comprehensive data sets for remote sensing research has been assembled. Information describing the test sites, sensors, data acquisition and processing procedures is contained in the project plan.

The Field Measurements Data Library Catalog provides information on what data is available from the library. The catalog is divided into separate volumes - one for each crop year during which data were collected. The Field Measurements data library facility is located at the Laboratory for Applications of Remote Sensing (LARS), Purdue University.

Volume I provides information for the 1974-75 crop and is complete. No further changes are expected on this volume.

Technical information on the data may be obtained [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

at [www.lars.purdue.edu/home/FRData/field\\_research\\_data.html](http://www.lars.purdue.edu/home/FRData/field_research_data.html).

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## 1. INTRODUCTION

The general organization of the field measurements data library is illustrated in Figure 1-1. The purpose of this document is to provide information to researchers describing by site, date, and sensor the data contained in the library.

Each volume of the data catalog consists of four levels with each level including an increasing amount of specificity describing individual items of data.

The first level is the Summary, the second level is the Record, the third is the Index, and the fourth level is the Listing.

Section 2, Summary of Field Measurements Data, summarizes the data collected by the major sensor types for the missions over each of the three test sites.

Section 3, Record of Field Measurements Data, is a record of the date that data were collected over the test site and a record of which data has been processed to the point that it is available for users. This section is organized according to test site and location of data collection. Finney County, Kansas and Williams County, North Dakota each have three data collection locations - the intensive test site (ITS), the agriculture experiment station (AES), and a modeling field. The Hand County test site has only one data collection location - the intensive test site.

Section 4, Index of Field Measurements Data, is an index of the data collected organized by sensor type, i.e. Landsat, aircraft, FSS-S191H, FSAS-VISS, Exotech 20C, Exotech 20D, and Exotech 100. The Landsat data is listed by site and date; the aircraft data by site, date, and flight line; the FSS-S191H data by site, date and flight line; the truck-mounted

spectrometer data is listed by site, data and experiment; and the tripod-mounted radiometer data is listed by site, date and time.

The fourth level of the data catalog, a computer printout, is a listing of the information (i.e., observation number, location, date, time, scene type, instrument) required to access individual spectra. It is not included in this document, but is available upon request from Purdue/LARS.

Appendix I contains information pertaining to the location of the test sites and flight lines. Appendix II describes the treatments (plots) for which data were acquired on the agriculture experiment stations. Appendix III briefly describes the supporting agronomic, meteorological, and atmospheric measurements. Appendix IV gives a summary of the LACIE Field Measurements sensor data specifications and operational characteristics.

The formats of the data are either imagery, hard copy outputs (as tables), or 9-track computer compatible tapes (CCT's). The CCT's for the Landsat and aircraft multispectral scanner data are in LARSYS format. These data are approximately linearly related to the scene radiance, i.e., the data have not been altered from the initial processing performed at the respective institutions which operated the sensors. The CCT's containing the spectrometer or interferometer data (FSS, FSAS, Exotech 20C and Exotech 20D) are in EXOSYS format. These data are calibrated in bidirectional reflectance factor. Also, each observation on the EXOSYS-CCT has a header record which contains the supporting agronomic, meteorological, and atmospheric observations.

# FIELD MEASUREMENTS DATA LIBRARY

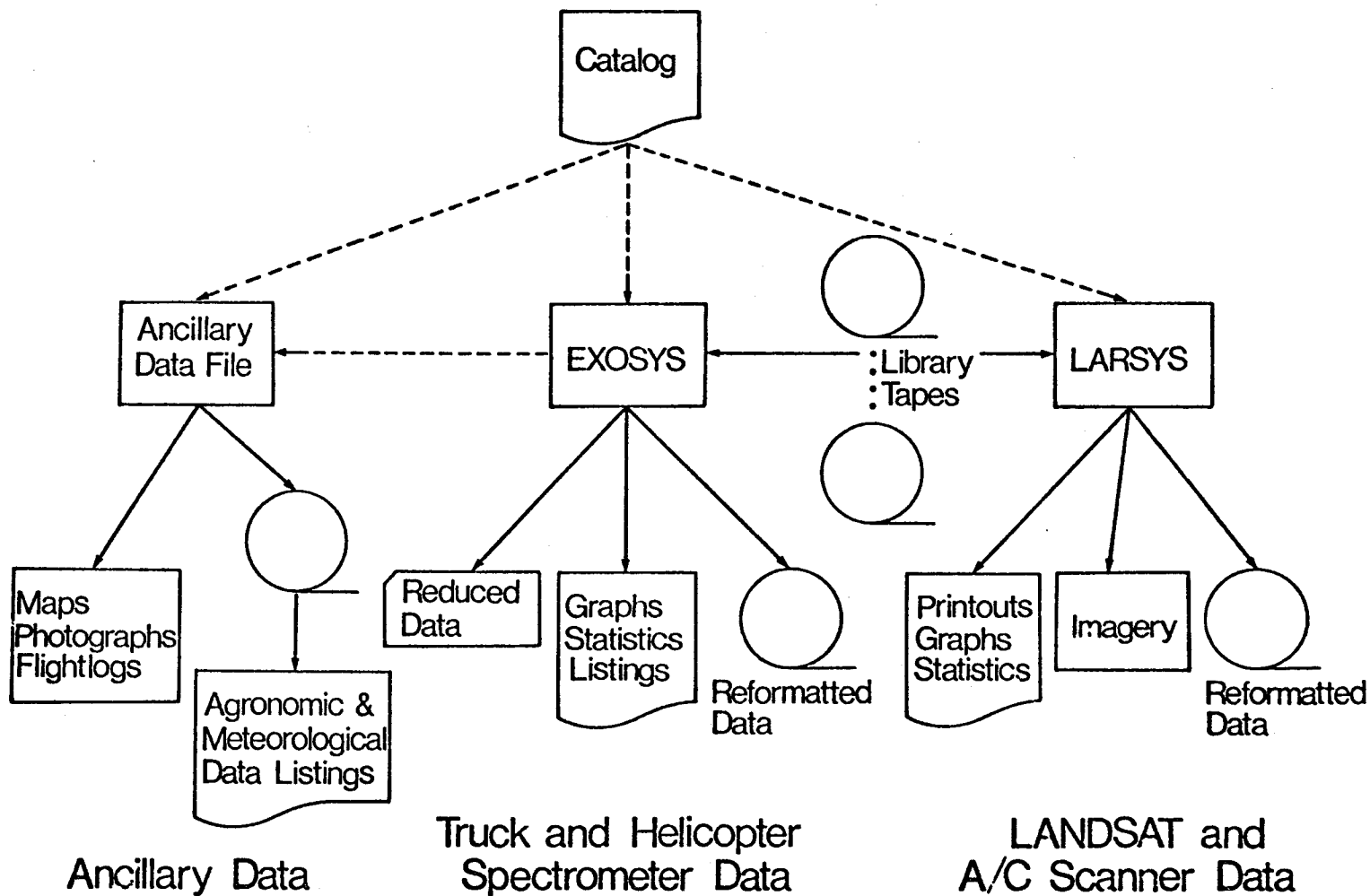


Figure 1-1. Organization of Field Measurements Data Library

## 2. Summary of Field Measurements Data

The Field Measurements Summary includes, for each of the three test sites, mission dates, wheat growth stages, and information concerning which sensor systems collected data (indicated by an X).

The locations of the test sites are given in Appendix I.

### 2.1 Summary of remote sensing data collected over the Finney County, Kansas site. (Intensive Test Site-1960, Aircraft Site-076).

#### 1974-75 Crop

Mission	Wheat Growth Stage	Sensor Type					Modeling Data
		Landsat		A/C	Truck Mounted	MSS	
		1	2	S-191			
Oct 17-20	Seedling					X	
Nov 4-7	Tillering				X	X	
Nov 23-25	Tillering	X				X	
Mar 19-22	Tillering		X		X		X
Apr 6- 9	Jointing			X*	X	X	
Apr 24-27	Jointing		X			X	X
May 13-16	Boot			X	X	X	
May 21-24	Heading			X	X	X	X
May 30-Jun 2	Milk			X	X	X	
Jun 8-11	Dough			X	X	X	
Jun 17-20	Ripening			X	X	X	X
Jun 25-28	Mature			X	X	X	
Jul 5- 8	Post Harvest		X	X	X	X	
Jul 23-25	Post Harvest		X				
Aug 11-12	Post Harvest		X				
Aug 28-29	Post Harvest		X				
Sep 15-16	Post Harvest		X				

\*X-MSS, 0-M<sup>2</sup>S



2.2 Summary of remote sensing data collected over the Williams County, North Dakota site. (Intensive Test Site-1966, Aircraft Site-118).

## 1975 Crop

Mission	Wheat Growth Stage	Sensor Type					Modeling Data
		Landsat		A/C	S-191	Truck Mounted	
		1	2	MSS			
May 25-28	Emergence			X*			
Jun 3- 7	Seedling		X	X	X	X	
Jun 12-15	Seedling	X		X			
Jun 21-24	Tillering		X	X	X	X	X
Jun 30-Jul 3	Jointing	X		X			
Jul 9-12	Boot		X	X	X	X	X
Jul 18-21	Heading	X		0	X	X	X
Jul 27-30	Headed		X		X	X	X
Aug 5- 8	Milk-dough	X		0	X		
Aug 14-17	Ripening		X	X	X	X	X
Aug 23-27	Mature			X	X	X	
Sep 1- 4	Post Harvest			0	X		
Sep 20-23	Post Harvest		X				

2.3 Summary of remote sensing data collected over the Hand County, South Dakota, site. (Intensive Test Site-1687, Aircraft Site-195).

## 1974-75 Crop

Mission	Wheat Growth Stage	Sensor Type				Ground Observations
		Landsat		A/C	S-191	
		1	2	MSS		
Jun 18-21	Boot					X
Jul 6-10	Headed					X
Jul 25-26	Ripening					X
Aug 11-13	Harvest					X
Aug 29-Sep 2	Post Harvest					X

\*X-MSS, 0-M<sup>2</sup>S

### 3. Record of Field Measurements Data

The Field Measurements Data Record is a more detailed listing of the ancillary and major sensor system data collected at the three test sites - Finney County, Kansas; Williams County, North Dakota; and Hand County, South Dakota. The information collected at the Kansas and North Dakota sites is divided into data collection locations - Intensive Test Site, Agriculture Experiment Station, and Canopy Modeling Field. Data is collected only over the intensive test site at the Hand County, South Dakota site.

The record includes mission dates, types of data collected, dates when data were collected, and information indicating whether data is available for users.

3.1.1 Finney County, Kansas Field Measurement Intensive Test Site Data Record  
(Intensive Test Site-1960, Aircraft Site-076).

1974-75 Crop

NC - Not Collected ✓ Indicates data is available from Field Measurements library

Mission	Ancillary Data			Panel Calibration Data	Helicopter	Aircraft	Landsat	Other Data or Comments
	Periodic Ground Observations	Meteorological Optical Depth	Maps					
Oct 17-20	NC	NC	NC	NC	NC	NC	NC	
Nov 4-7	NC	11/5*✓	✓	11/5 ✓	11/5 ✓	NC	NC	
Nov 23-25	NC	NC	NC	NC	NC	NC	11/23	
Mar 19-22	3/26 ✓	3/20 ✓	✓	NC	3/20 ✓	NC	3/20 ✓	Add'tl. Agronomic Meas. + ✓
Apr 6-9	4/6-8 ✓	4/8 ✓	✓	4/8,4/9 ✓	4/8 ✓	4/9 ✓	NC	
Apr 24-27	4/25-26 ✓	NC	NC	NC	NC	NC	4/25 ✓	Add'tl. Agronomic Meas. + ✓
May 13-16	5/15 ✓	5/14 ✓	✓	5/14,15 ✓	5/14 ✓	5/15 ✓	NC	
May 21-24	5/21 ✓	5/21 ✓	✓	5/21 ✓	5/21 ✓	5/21 ✓	NC	Add'tl. Agronomic Meas. + ✓
May 30-Jun 2	6/2 ✓	6/2 ✓	✓	6/2 ✓	6/2 ✓	6/2 ✓	NC	No MSS data; film only
Jun 8-11	6/9 ✓	6/9 ✓	✓	6/9 ✓	6/9 ✓	6/9 ✓	NC	
Jun 17-20	6/18 ✓	6/17 ✓	✓	6/17 ✓	6/17 ✓	6/18 ✓	NC	Add'tl. Agronomic Meas. + ✓
Jun 25-28	6/26-28 ✓	6/26 ✓	✓	6/26 ✓	6/26 ✓	6/26-27 ✓	NC	
Jul 5-8	7/6-8 ✓	7/6 ✓	✓	7/5,6 ✓	7/6 ✓	7/6 ✓	7/6 ✓	
Jul 23-25	7/24-25 ✓	NC	NC	NC	NC	NC	7/23 ✓	
Aug 11-12	8/11-12 ✓	NC	NC	NC	NC	NC	8/11 ✓	
Aug 28-29	8/28-29 ✓	NC	NC	NC	NC	NC	8/29 ✓	
Sep 15-16	9/15-16 ✓	NC	NC	NC	NC	NC	9/16 ✓	
Sep-Aug								Ground Truth Inventory ✓
Apr-Aug								Rainfall Observations ✓
May-Aug								Crop Yield Information ✓

\* Date data was collected

+ Additional agronomic measurements including LAI for fields 367, 369, 370, 414 & 421.

3.1.2 Finney County, Kansas: Garden City Agriculture  
Experiment Station Data Record, (Site-G1).

1974-75 Crop

NC - Not Collected ✓ - Indicates data is available from Field Measurements library

Mission	Ancillary Data				Truck Mounted Spectrometer
	Plot Photos	Plant Meas.	Soil Meas.	Meteorol. Data	
Oct 17-20	10/18-19*✓	10/18,19 ✓	10/18,19 ✓	NC	10/18-20 ✓
Nov 4-12	11/5,7 ✓	11/5,7 ✓	11/5,7 ✓	NC	11/5,7,12✓
Nov 23-25	11/24,25 ✓	11/24,25 ✓	NC	11/24,25 ✓	11/24,25 ✓
Mar 30-Apr 5	3/30-4/3 ✓	3/30-4/5 + ✓	3/30-4/5 ✓	3/30-4/5 ✓	3/30-4/5 ✓
Apr 8-9	4/8-9 ✓	4/9 + ✓	4/9 ✓	4/9 ✓	4/9 ✓
Apr 14-17	4/14-17 ✓	4/16-17 + ✓	4/14-17 ✓	4/14-17 ✓	4/14-17 ✓
Apr 23	4/23 ✓	4/23 + ✓	4/23 ✓	4/23 ✓	4/23 ✓
Apr 28-30	4/28-30 ✓	4/28-30 + ✓	4/28-30 ✓	4/28-30 ✓	4/28-30 ✓
May 3-6	5/3-6 ✓	5/3-6 + ✓	5/3-6 ✓	5/3-6 ✓	5/3-6 ✓
May 14-16	5/14-16 ✓	5/15-16 + ✓	5/15-16 ✓	5/15-16 ✓	5/15-16 ✓
May 19-23	5/20-23 ✓	5/19-20 + ✓	5/19-20 ✓	5/19-20 ✓	5/19-20 ✓
May 25-26	5/25-26 ✓	5/25-26 + ✓	5/25-26 ✓	5/25-26 ✓	5/25-26 ✓
Jun 2-4	6/2-4 ✓	6/2-4 + ✓	6/2-4 ✓	6/2-4 ✓	6/2-4 ✓
Jun 9-13	6/9-13 ✓	6/11-13 + ✓	6/11-13 ✓	6/11-13 ✓	6/11-13 ✓
Jun 15-17	6/15-17 ✓	6/15-17 + ✓	6/15-17 ✓	6/15-17 ✓	6/15-17 ✓
Jun 25-26	6/25-26 ✓	6/25-26 + ✓	6/25-26 ✓	6/25-26 ✓	6/25-26 ✓
Jun 29-Jul 3	6/25-7/3 ✓	6/29-7/3+ ✓	6/29-7/3 ✓	6/29-7/3 ✓	6/29-7/3 ✓
Jul 4-9	7/4-9 ✓	7/4-9 + ✓	7/4-9 ✓	7/4-9 ✓	7/4-9 ✓

\* Date data collected

+ Limited measurements (plant heights, ground cover, a few plant counts)

3.1.3 Finney County, Kansas Field Measurements Canopy  
Modeling Data Record. (Intensive Test Site-1960,  
Field No. 416).

1974-75 Crop

NC - Not Collected / Indicates data is available from Field Measurements library

Mission	Agronomic	Photographic		Exotech 100			
		Angular	Profile	Reflectance	Transmittance		
Mar 18-20	3/18-20*/✓	3/20 ✓	NC	3/20	✓	NC	
Apr 23-24	4/23-25 ✓	4/23 ✓	4/23 ✓	4/23	✓	NC	
May 20-21	5/20-21 ✓	5/20 ✓	5/20 ✓	5/20	✓	5/20	✓
Jun 17-27	6/17-19 ✓	6/18 ✓	6/18 ✓	6/26-27	✓	6/19	✓

\*Date data was collected

3.2.1 Williams County, North Dakota Field Measurement Intensive Test Site Data Record  
(Intensive Test Site-1966, Aircraft Site-118).

1975 Crop

NC - Not Collected ✓ Indicates data is available from Field Measurements library

Mission	Ancillary Data			Panel Calibration Data	Helicopter	Aircraft	Landsat	Other Data or Comments
	Periodic Ground Observations	Meteorological Optical Depth	Maps					
May 25-28	NC	NC	NC	NC	NC	5/26	✓ NC	
Jun 3-7	6/3-5* ✓	6/5 ✓	✓	6/5 ✓	6/5 ✓	6/5	✓ 6/4 ✓	
Jun 12-15	6/11-13 ✓	NC	NC	NC	NC	6/12-13	✓ 6/13	
Jun 21-24	6/22 ✓	6/22 ✓	✓	6/22 ✓	6/22 ✓	6/22	✓ 6/22 ✓	
Jun 30-Jul 3	7/1-2 ✓	NC	NC	NC	NC	7/2	✓ 7/1	No MSS data; film only
Jul 9-12	7/9-10 ✓	7/10 ✓	✓	7/9 ✓	7/10 ✓	7/11	✓ 7/10 ✓	
Jul 18-21	7/17-18 ✓	7/18 ✓	✓	7/18 ✓	7/18 ✓	7/18-19	✓ 7/19	
Jul 27-30	7/28-29 ✓	7/27 ✓	✓	7/27 ✓	7/27 ✓	NC	7/28 ✓	
Aug 5-8	8/5-6 ✓	8/5 ✓	✓	NC	8/5 ✓	8/5	✓ 8/6	
Aug 14-17	8/14-15 ✓	8/15 ✓	✓	8/15 ✓	8/15 ✓	8/15	✓ 8/15 ✓	
Aug 23-27	8/25-26 ✓	8/23 ✓	✓	NC	8/23 ✓	8/23	✓ NC	
Sep 1-4	9/3-4 ✓	9/1 ✓	✓	NC	9/1 ✓	9/1	✓ NC	
Sep 20-23	9/22-23 ✓	9/20 ✓	NC	NC	NC	NC	9/20 ✓	
May-Sep								Ground Truth Inventory ✓
Jun-Sep								Rainfall Observations ✓
Jul-Sep								Crop Yield Information ✓

\* Date data was collected

3.2.2 Williams County, North Dakota: Williston Agriculture  
Experiment Station Data Record (Site-W1)

1975 Crop

NC - Not Collected ✓ - Indicates data is available from Field Measurements library

Mission	Ancillary Data				Truck Mounted Spectrometer
	Plot Photos	Plant Meas.	Soil Meas.	Met. Data	
Jun 2-7	6/2,5,7*✓	6/2-7 ✓	6/2-7 ✓	6/2,5,7 ✓	6/2,5,7 ✓
Jun 21-24	6/23 ✓	6/23 ✓	6/23 ✓	6/23 ✓	6/23 ✓
Jul 9-12	7/9,10 ✓	7/9,10 ✓	7/9,10 ✓	7/9,10 ✓	7/9,10 ✓
Jul 18-21	7/18-21 ✓	7/18-21✓	7/18-21✓	7/18-21 ✓	7/18-21 ✓
Jul 27-30	7/27-29 ✓	7/27-29✓	7/27-29✓	7/27-29 ✓	7/27-29 ✓
Aug 12-17	8/12,15 ✓	8/12-15✓	8/12-15✓	8/12-15 ✓	8/12-15 ✓
Aug 23-27	8/23 ✓	8/23 ✓	8/23 ✓	8/23 ✓	8/23 ✓

3.2.3 Williams County, North Dakota Field Measurements Canopy Modeling Data  
Record. (Field-1)

1975 Crop

NC-Not Collected ✓ Indicates data is available from Field Measurements library

Mission	Agronomic	Photographic		Exotech 100	
		Angular	Profile	Reflectance	Transmittance
Jun 24	6/24*✓	6/24 ✓	6/24 ✓	NC	NC
Jul 11	7/11 ✓	7/11 ✓	7/11 ✓	7/11 ✓	7/11 ✓
Jul 20	7/20 ✓	7/20 ✓	7/20 ✓	7/20 ✓	7/20 ✓
Jul 27-30	7/27 ✓	7/30 ✓	7/30 ✓	7/30 ✓	NC
Aug 13	8/13 ✓	8/13 ✓	8/13 ✓	8/13 ✓	8/13 ✓

\*Date data was collected

3.3 Hand County, South Dakota Field Measurement Intensive Test Site Data Record  
(Intensive Test Site-1687, Aircraft Site-195).

1974-75 Crop

NC - Not Collected ✓ Indicates data is available from Field Measurements library

Mission	Ancillary Data			Helicopter	Aircraft	Landsat	Other Data or Comments
	Periodic Ground Observations	Meteorological Optical Depth	Maps				
Jun 21	6/18-21* ✓		NC	NC	NC		
Jul 6-10	7/6-10 ✓	7/6 ✓	NC	NC	NC		
Jul 25-26	7/25-26 ✓		NC	NC	NC		
Aug 11-13	8/11-13 ✓		NC	NC	NC		
Aug 29-Sep 2	8/29-9/2 ✓		NC	NC	NC		
Jun-Jul	_____						Rainfall Observations ✓
Sep-Aug	_____						Ground Truth Inventory ✓
Jul-Sep	_____						Crop Yield Information ✓

\* Date data was collected



#### 4. Index of Field Measurements Data

The Field Measurements Data Index includes a section for each of the major sensor systems which collect LACIE Field Measurements data - Landsat, Aircraft Multispectral Scanner, Field Spectrometer System (FSS) or S191-H, Field Spectrometer Acquisition System (FSAS), Exotech Model 20C, Exotech Model 20D and Exotech Model 100. Refer to Appendix IV for a summary of the LACIE Field Measurements sensor data specifications and operational characteristics.

##### 4.1 Landsat Data Library Index

The Landsat I and II multispectral scanners collect data in four spectral bands - 0.5 to 0.6 $\mu$ m, 0.6 to 0.7 $\mu$ m, 0.7 to 0.8 $\mu$ m, and 0.8 to 1.1 $\mu$ m. The Landsat data include:

- o 9-track computer-compatible tapes (CCT's)
- o Black-and-white transparencies of each band
- o Color-composite transparency

The Landsat Data Index includes, for each of the three sites, the date data were collected, the scene ID, the cloud cover over the respective intensive test site, the cloud cover over the entire frame, and the LARSYS formatted computer compatible tape (CCT) run number. Also noted under the "Test Site Cloud Cover" are those scene ID's which do not include the entire test site. The last column indicates (with an X) whether Landsat imagery is in the Field Measurements Data Library.

4.1.1 Landsat Data Library Index for the Finney County, Kansas  
Test Site (Intensive Test Site-1960).

<u>Collected</u>	<u>Scene ID</u>	<u>Test Site*</u> <u>Cloud</u> <u>Cover</u>	<u>Frame*</u> <u>Cloud</u> <u>Cover</u>	<u>LARS</u> <u>Run</u> <u>Number</u>	<u>Imagery</u>
1/28/75	2006-16471	10	30	75011600	X
2/12/75	2021-16455	0	10	75011700	X
2/12/75	2021-16461	0	0	75010500	X
3/20/75	2057-16460	0	0	75016200	X
4/25/75	2093-16453	75	30	75011800	X
6/18/75	2147-16453	0	30	75006100	X
7/06/75	2165-16453	5	10	75004600	X
7/23/75	2182-16395	10	50	75011500	X
8/11/75	2201-16451	0	0	75012600	X
8/29/75	2219-16442	70	20	75012700	X
8/29/75	2219-16444	70	10	75012800	X
9/16/75	2237-16442	100	50	75013000	X
3/20, 6/18, 7/06, & 8/11 Precision Registration				75016202	

4.1.2 Landsat Data Library Index for the Williams County, North Dakota  
Test Site (Intensive Test Site-1966).

<u>Collected</u>	<u>Scene ID</u>	<u>Test Site*</u> <u>Cloud</u> <u>Cover</u>	<u>Frame*</u> <u>Cloud</u> <u>Cover</u>	<u>LARS</u> <u>Run</u> <u>Number</u>	<u>Imagery</u>
5/17/75	2115-17051	30	30	75011900	X
5/18/75	2116-17105	0(50)+		NR	X
6/04/75	2133-17053	25	40	75012000	X
6/22/75	2151-17053	100	30	75012200	X
7/10/75	2169-17053	0	10	75012300	X
7/28/75	2187-17051	100	30	75012400	X
7/28/75	2187-17053	(90)+	20	75012500	X
8/15/75	2205-17043	0	10	75004700	X
9/20/75	2241-17042	10	40	75011000	X
9/21/75	2242-17100	30(30)+		NR	X
7/10, and 8/15 Precision Registration				75012302	

\* Percent

+ Percent of site included

NR Not Reformatted

## 4.2 Aircraft Data Library Index

Two different aircraft systems collected data for the Field Measurements project - the NASA C-130 aircraft with the 24-channel multispectral scanner (MSS) and the NASA P-3 aircraft with the 11-channel modular multispectral scanner (MMS). The spectral bands of the two scanners are given in Table 4.2-1.

Table 4.2-1 Spectral Bands of MSS and M<sup>2</sup>S Scanners

MSS Bands (in $\mu\text{m.}$ )			M <sup>2</sup> S (in $\mu\text{m.}$ )
0.34-0.40	0.80-0.87	4.50- 4.75	0.38- 0.41
0.40-0.44	0.97-1.05	6.00- 7.00	0.44- 0.49
0.46-0.50	1.05-1.09	8.30- 8.80	0.49- 0.53
0.53-0.57	1.12-1.16	8.80- 9.30	0.54- 0.58
0.57-0.63	1.18-1.30	9.30- 9.80	0.58- 0.62
0.64-0.68	1.52-1.73	10.10-11.00	0.62- 0.66
0.71-0.75	2.10-2.36	11.00-12.00	0.66- 0.70
0.76-0.80	3.54-4.00	12.00-13.00	0.70- 0.74
			0.76- 0.86
			0.97- 1.06
			8.00-13.00

Aircraft data include:

- 9-track CCTs (proportional to scene radiance)
- 9-inch color and color-infrared photographs
- 70-millimeter, six-band airborne multispectral photographic system photographs obtained over Hand County only
- Flight logs
- Photo logs

The index includes, for each of the sites, the scanner system used, the date, the flight lines flown, the start times for the flight lines, the altitude flown and the LARS run numbers for the respective LARSYS formatted scanner data. Also, included in the last column are the NASA/JSC mission and roll film numbers for the 9 in. color (CR) and color IR (CI) underflight photography.

4.2.1 Aircraft Data Library Index for the Finney County,  
Kansas Test Site. (Intensive Test Site-1960,  
Aircraft-076).

Scanner System	Mission Date	Flight Line	Start Time (GMT)	Altitude AGL (Feet)	LARS Scanner Data Run Number	JSC Mission and Roll Film Numbers
MSS	4-9-75	4	17:33:35	10,000	750400	MX306 CR-1 CI-2
		3	17:49:10	9,800	750401	
		2	17:54:10	9,900	750402	
		1	18:00:10	10,000	750403	
		5	18:18:55	10,000	750404	
		7	18:32:20	900	750405	
		6	18:33:45	900	750406	
		7	18:39:30	15,000	750407	
		6	18:41:00	15,000	750408	
	5-15-75	5	18:51:00	10,000	750409	MX311 CR-1 CI-2
		4	16:54:30	10,400	750339	
		4	17:07:45	10,200	750340	
		3	17:30:20	10,600	750341	
		1	17:42:20	10,300	750342	
		2	17:53:40	10,700	750343	
		3	18:02:30	10,600	750344	
		5	18:19:45	10,400	750345	
		6	18:35:05	1,500	750346	
		6	18:40:50	1,500	750347	
	5-21-75	7	18:48:10	1,500	750348	MX311 CR-4 CI-5
		7	18:52:25	1,500	750361 <sup>349</sup>	
		5	16:16:10	10,700	750322	
		1	16:27:55	10,600	750323	
		2	16:34:30	10,500	750324	
		3	16:43:10	10,600	750325	
		4	16:54:40	10,500	750326	
		7	17:05:05	1,300	750327	
		6	17:06:10	1,200	750328	
		7	17:10:20	1,500	750329	
	6-02-75	6	17:11:40	1,100	750330	MX311 CR-10 CI-11
		4	16:39:15	10,100	No Scanner Data	
		3	16:49:50	10,200		
		2	16:54:35	10,200		
		1	17:00:25	10,100		
		7	17:07:55	1,400		
		7	17:13:15	1,400		
		6	17:14:40	1,500		
		6	17:19:00	1,500		
	6-09-75	5	17:30:00	9,700		MX311 CR-10 CI-11
		5	17:54:50	10,500	750043	
		1	18:05:20	10,500	750039	
		3	18:09:35	10,400	750041	
		2	18:35:35	10,500	750040	
		6	18:28:20	1,700		
		6	18:32:50	1,700		
		7	18:37:15	1,700		
		4	18:49:40	10,500	750042	

## Aircraft Data Library Index for the Finney County, Kansas Test Site (cont'd)

Scanner System	Mission Date	Flight Line	Start Time (GMT)	Altitude AGL (feet)	LARS Scanner Data Run Number	JSC Mission and Roll Film Numbers	
MSS	6-18-75	1	17:48:10	10,400	750349 ?	MX311 CR-14 CI-15	0% clouds
		2	17:59:10	10,500	750350		
		3	18:07:15	10,500	750351		
		3	18:15:00	10,500	750352		
		3	18:21:35	10,500	750353 No		
		5	18:33:40	10,500	750354		
		7	18:44:00	1,900	750355 No		
	6-26-75	6	18:47:00	1,900	750356	MX311 CR-18 CI-19	0% clouds
		4	18:59:45	10,400	750357		
		1	16:57:35	10,600	750200		
		2	17:08:45	10,600	750193		
		3	17:15:20	10,700	750196 No		
		7	17:25:50	2,000	750201 No		
		6	17:31:50	2,200	750198 No		
	6-27-75	4	17:46:05	10,500	750194	MX311 CR-20 CI-21	50% clouds
		5	18:01:50	10,500	750199		
		1	16:21:25	10,000	750331		
		2	16:27:20	10,000	750332		
		3	16:33:30	10,000	750333		
		7	16:46:00	2,000	750334		
		6	16:49:45	1,800	750335 No		
	7-06-75	7	16:53:20	1,900	750336 No	MX311 CR-24 CI-25	
		5	17:04:35	10,100	750337		
		4	17:31:25	3,300	750338		
		1	15:47:20	10,700	750038		
		3	15:52:45	10,800	750036		
		2	15:59:00	10,800	750037		
		4	16:08:20	10,700	750029		
	5	16:24:25	10,800	750031			
	6	16:37:55	1,900	750033			
	7	16:39:35	1,900	750035			

4.2.2 Aircraft Data Library Index for the Williams County, North Dakota  
Test Site. (Intensive Test Site-1966, Aircraft Site-118).

<u>Scanner System</u>	<u>Mission Date</u>	<u>Flight Line</u>	<u>Start Time (GMT)</u>	<u>Altitude AGL (feet)</u>	<u>LARS Scanner Data Run Number</u>	<u>JSC Mission and Roll Film Numbers</u>
MSS	5-26-75	6	16:19:25	1,500	750260	MX311
		6	16:23:30	1,500	750259	CR-6
		6	16:27:50	1,400	750258	CI-7
		7	16:35:50	1,400	750257	
		7	16:41:20	1,500	750268	
		3	16:58:10	10,200	750256	
		2	17:04:15	10,000	750255	
		1	17:09:25	10,000	750267	
		4	17:20:25	10,000	750266	
		3	17:29:10	10,000	750263	
		5	17:34:10	9,800	750262	
		2	17:42:50	10,000	750261	
		1	17:47:55	10,000	750265	
		5	17:53:50	9,900	750264	
	6-5-75	3	19:36:30	10,100	750420	MX311
		1	19:40:40	10,100	750417	CR-10
		2	19:46:20	10,000	750418	CI-11
		4	19:56:35	10,000	750419	
		6	20:14:20	1,600	750421	
		7	20:33:20	1,200	750422	
		5	20:45:25	10,100	750423	
	6-12-75	1	14:55:00	9,600	750439	MX311
		2	15:02:10	9,500	750440	CR-12
		3	15:08:45	9,700	750441	CI-13
		5	15:13:40	9,600	750443	
		4	15:27:05	9,600	750442	
		7	15:44:20	1,800	750432	
		6	15:55:40	1,800	750431	
6-13-75	5	16:06:30	10,000	750433	MX311	
	5	16:53:45	9,400	750166	CR-12	
	3	16:59:40	9,500	750169	CI-13	
	4	17:07:25	9,500	750173		
6-22-75	2	17:23:25	9,500	750175		
	1	17:30:45	9,500	750179		
	6	17:45:00	2,000			
	7	17:52:35	2,200			
	5	16:47:15	10,100	750030	MX311	
	4	16:58:35	10,300	750028	CR-16	
	7	17:13:35	1,070	750034	CI-17	
	6	17:45:05	2,000	750032		
	3	17:53:50	10,200	750027		
	2	18:02:05	10,300	750025		
1	18:07:35	10,200	750024			

## Aircraft Data Library Index for the Williams County, North Dakota Test Site (cont'd)

Scanner System	Mission Date	Flight Line	Start Time (GMT)	Altitude AGL (feet)	LARS Scanner Data Run Number	JSC Mission and Roll Film Numbers	
MSS	7-02-75	6	21:17:15	1,900	No Scanner Data	MX311 CR-22 CI-23	
		7	21:27:45	2,000			
		3	21:40:40	10,000			
		1	21:46:35	10,200			
		2	21:52:10	10,000			
	7-11-75	4	22:00:05	10,100			
		5	22:12:15	10,100			
		6	16:15:20	2,000		750231	MX311 CR-26 CI-27
		7	16:22:35	2,000		750250	
		1	16:34:10	10,200		750247	
3	16:38:30	10,300	750252				
2	16:43:55	10,200	750227				
MMS	7-18-75	4	16:52:05	10,300	750234	MX316 CR-2* CI-3	
		5	17:05:45	9,700	750233		
		5	18:34:55	10,800	750184		
		3	18:39:55	10,900	750186		
		2	18:46:30	11,000	750188		
	8-05-75	1	18:52:45	10,900	750190	MX316 CR-5* CI-4	
		6	19:00:00	2,000	750192		
		7	19:07:05	1,800	750164		
		1	17:07:45	10,200	<del>750362</del>		
		3	17:12:30	10,400	<del>750363</del>		
MSS	8-15-75	2	17:18:30	10,200	<del>750364</del>	MX318 CR-1 CI-2	
		5	17:28:40	10,200	<del>750365</del>		
		4	17:40:45	10,300	<del>750366</del>		
		6	17:54:10	1,800	<del>750367</del>		
		6	17:56:55	2,000	<del>750368</del>		
	8-23-75	7	18:02:40	2,000	<del>750369</del>	MX318 CR-3 CI-4	
		5	17:00:55	10,000	750021		
		3	17:05:50	10,000	750019		
		2	17:11:20	10,050	750018		
		1	17:15:55	10,050	750017		
MMS	9-01-75	4	17:24:00	10,100	750020	MX317 CR-13 CI-14	
		7	17:39:55	1,800	750023		
		6	17:52:25	2,000	750022		
		5	16:38:25	10,300	750393		
		4	16:48:45	10,200	750394		
	7	7	17:48:20	2,100	750395		
		6	18:15:25	2,100	750296		
		1	18:25:50	10,100	750397		
		2	18:31:40	10,100	750398		
		3	18:37:10	10,000	750399		
7	5	16:02:10	10,100	750410			
	3	16:07:30	10,100	750411			
	1	16:14:15	10,400	750412			
	2	16:22:15	10,100	750413			
	4	16:30:25	10,100	750414			
7	6	16:46:20	2,000	750415			
	7	16:52:50	2,000	750416			

\* 70mm photography

### 4.3 Field Spectrometer System (FSS) S191-H Data Library Index

The Field Spectrometer System (FSS) or S191-H system collected two types of data in general, spectral data and 70mm color photography, over the flight lines. The FSS spectral data consists of .02 $\mu$ m wide bands from 0.4 to 1.1 $\mu$ m, .05 $\mu$ m wide bands from 1.1 to 2.4 $\mu$ m, and 0.5 $\mu$ m wide bands from 8.0 to 14.0 $\mu$ m. The FSS data include:

- 9-track CCTs (bidirectional reflectance factor)
- Microfilm tabulation of data on CCTs
- 70-millimeter boresight color photographs
- Flight logs
- Supporting agronomic, meteorological, and atmospheric observations

The index for the FSS data includes the mission date, flight line start time (GMT) for the flight line, and helicopter data flight number. The Index also includes the JSC 70mm color photography roll identification - mission and roll film numbers.



4.3.1 FSS (S191-H) Data Library Index for the Finney County, Kansas Test Site. (Intensive Test Site-1960, Aircraft Site-076).

<u>Mission Date</u>	<u>Flight Line</u>	<u>Start Time (GMT)</u>	<u>Data Flight</u>	<u>JSC Roll Film ID (Mission, Roll #)</u>
11/05/74	1	16:17:40	1	H-11, 1
	2	16:39:33		2
	3	17:01:24		3
	4	19:00:12		4
	5	20:17:27		5
3/20/75	1	High Altitude Photography 16:02:30	2A	H-13, 6
	2	16:26:30		7
	3	16:48:29		8
	4	17:39:10		9
	5	19:12:50		5
4/08/75	1	High Altitude Photography 15:41:50	3	H-13, 10
	2	16:04:03		11
	3	16:31:33		12
	4	17:16:13		13
5/14/75	1	High Altitude Photography 15:55:50	5	H-13, 15
	2	16:16:30		16
	3	16:41:07		17
	4	17:28:15		18
	5	19:01:45		19
5/21/75	1	High Altitude Photography 15:58:48	6	H-13, 19
	2	16:18:45		20
	3	16:41:38		21
	4	17:27:22		22
	5	18:43:44		23
6/02/75	1	15:41:15	7	H-13, 23
	2	16:00:18		24
	3	16:23:30		25
	4	17:05:07		26
	5	18:41:28		27
6/09/75	1	17:07:28	9	H-13, 33
	2	17:29:01		34
	3	17:50:44		35
	4	18:43:27		36
6/17/75	1	14:02:58	10	H-13, 37
	2	14:23:20		38
	3	14:45:16		39
	4	15:29:35		40
	5	16:59:15		41
6/26/75	1	15:57:08	12	H-13, 46
	2	16:17:50		47
	3	16:40:12		48
	4	17:27:24		49
	5	18:59:25		50

FSS (S191H) Data Library Index for the Finney County, Kansas  
Test Site (cont'd)

<u>Mission Date</u>	<u>Flight Line</u>	<u>Start Time (GMT)</u>	<u>Data Flight</u>	<u>JSC Roll Film ID (Mission, Roll #)</u>
7/06/75	1	14:15:20	13A	H-13, 58
↓	2	14:35:31	↓	59
	3	14:56:50		60
	4	15:44:47		61
	5	16:56:40		↓

4.3.2 FSS (S191H) Data Library Index for the Williams County, North Dakota Test Site. (Intensive Test Site-1966, Aircraft Site-118).

<u>Mission Date</u>	<u>Flight Line</u>	<u>Start Time (GMT)</u>	<u>Data Flight</u>	<u>JSC Roll Film ID (Mission, Roll #)</u>
6/05/75	3	19:16:50	8	29
	4	19:57:39		30
	1	21:22:42		31
	2	21:46:50		32
6/22/75	1	16:36:08	11	H-13, 41
	2	16:56:46		42
	3	18:08:52		43
	4	18:47:12		44
	5	20:13:30		44, 45
7/10/75	1	14:36:30	14A	H-13, 66
	2	14:56:00		67
	3	15:16:05		68
	4	17:31:30		69
	5	18:57:35		↓
7/18/75	1	18:39:30	15	H-13, 70
	2	18:57:16		71
	3	19:18:50		72
	4	20:46:45		73
	5	22:03:15		↓
7/27/75	1	18:54:58	16	H-13, 74
	2	19:13:05		75
	3	19:32:28		76
	4	20:49:50		77
	5	21:31:45		↓
8/05/75	1	15:41:42	17	H-13, 82
	2	16:01:45		83
	3	16:24:44		84
8/15/75	1	15:33:54	18	H-13, 85
	2	15:52:12		86
	3	16:12:37		87
	4	17:48:20		88
	5	19:19:25		↓
8/23/75	1	18:22:29	19	H-13, 89
	2	18:40:22		90
	3	19:05:56		91
	4	19:40:52		92
9/01/75	1	15:35:24	20	H-13, 93
	2	15:57:47		94
	3	16:19:10		95
	4	18:02:45		96
	5	19:23:28		↓

## 4.4 FSAS Data Library Index

The NASA/JSC truck-mounted interferometer system, the Field Signature Acquisition System (FSAS), acquired spectral data in the range of 0.4 to 2.4 $\mu$ m. The data were processed into .01 $\mu$ m bands. The FSAS data include:

- o 9-track CCT's (bidirectional reflectance factor)
- o 35-millimeter color transparencies (vertical and oblique)
- o Supporting agronomic, meteorological, and atmospheric observations

The index for the FSAS data includes the location where the data were collected, the mission date, the experiment for which data were collected, and the number of observations collected.

## Location Legend:

AES(G1) - Garden City Agriculture Experiment Station, Site-1

Finney County, Kansas

<u>Location</u>	<u>Mission Date</u>	<u>Experiment Name</u>	<u>Number of Observations</u>
AES(G1) ↓	10/19/74	Irr. Fertility	1
	↓	Irr. Variety	1
	10/20/74	Other Crops	2
	11/05/74	Other Crops	4
	11/07/74	Sun Angle	28
	↓	Residue Management	2
	↓	Irr. Variety	3
	↓	Irr. Fertility	1
	11/12/74	Other Crops	6
	↓	Irr. Variety	4
	↓	Residue Management	2
	11/24/74	Irr. Variety	3
	↓	Irr. Fertility	1
	↓	Other Crops	5
	11/25/74	Irr. Variety	2

## 4.5 Exotech Model 20C Data Library Index

The Purdue/LARS truck-mounted system, an Exotech Model 20C circular variable filterwheel spectrometer, acquired spectral data in the ranges of 0.4 to 2.4 $\mu$ m and in certain situations from 2.8 to 13.4 $\mu$ m. The reflective data is processed into .01 $\mu$ m wide bands and the thermal data is processed into .05 $\mu$ m wide bands. The Exotech 20C data include:

- o 9-track CCT's (bidirectional reflectance factor)
- o 35-millimeter color prints (vertical and obliques)
- o Supporting agronomic and meteorological observations

The index for the Exotech 20C data includes the location where the data were collected, the mission date, the experiment for which the data were collected, and the number of observations collected.

## Location Legend:

AES(G1) - Garden City Agriculture Experiment Station, Site-1  
 AES(W1) - Williston Agriculture Experiment Station, Site-1  
 ITS(1960) - Calibration Panel Location at Intensive Test Site - 1960  
 ITS(1966) - Calibration Panel Location at Intensive Test Site - 1966

<u>Location</u>	<u>Mission Date</u>	<u>Experiment Name</u>	<u>Number of Observations</u>
Finney County, Kansas			
AES(G1)	10/18/74	Residue Management	6
		Other Crops	29
		Irr. Fertility	3
		Irr. Variety	3
		Calibration	7
	10/19/74	Sun Angle	24
		Calibration	11
ITS(1960)	11/05/74	Calibration Panels	7
		Helicopter Field	13
		Calibration	2
AES(G1)	11/07/74	Other Crops	24
		Irr. Fertility	3
		Irr. Variety	3
		Residue Management	6
		Calibration	3

## Exotech Model 20C Data Library Index (Cont.)

<u>Location</u>	<u>Mission Date</u>	<u>Experiment Name</u>	<u>Number of Observations</u>
Williams County, North Dakota			
AES (W1)	6/02/75	Small Grain	4
↓	6/05/75	Small Grain	8
↓	↓	Spring Wheat	16
ITS (1966)	↓	Calibration	6
		Calibration Panels	8
AES (W1)	6/07/75	Small Grain	8
↓	↓	Spring Wheat	16
↓	↓	Seeding Rate	6
↓	↓	Other Crops	6
↓	↓	Calibration	7
ITS (1966)	6/22/75	Calibration	3
↓	↓	Calibration Panels	8
AES (W1)	6/23/75	Small Grain	16
↓	↓	Spring Wheat	36
↓	↓	Seeding Rate	12
↓	↓	Other Crops	24
↓	↓	Calibration	24
↓	7/09/75	Small Grain	9
↓	↓	Spring Wheat	14
↓	↓	Calibration	3
ITS (1966)	↓	Calibration Panels	6
AES (W1)	7/10/75	Small Grain	32
↓	↓	Spring Wheat	70
↓	↓	Seeding Rate	24
↓	↓	Other Crops	17
↓	↓	Calibration	50
ITS (1966)	7/18/75	Calibration	8
↓	↓	Other Crops	2
↓	↓	Calibration Panels	10
AES (W1)	7/19/75	Small Grain	16
↓	↓	Spring Wheat	32
↓	↓	Seeding Rate	12
↓	↓	Other Crops	2
↓	↓	Calibration	8
↓	7/21/75	Small Grain	8
↓	↓	Spring Wheat	6
↓	↓	Other Crops	19
↓	↓	Calibration	11

## Exotech Model 20C Data Library Index (Cont.)

<u>Location</u>	<u>Mission Date</u>	<u>Experiment Name</u>	<u>Number of Observations</u>
AES(W1)	7/27/75	Small Grain	24
	↓	Spring Wheat	37
		Seeding Rate	12
ITS(1966)	↓	Calibration	24
		Calibration Panels	3
AES(W1)	7/28/75	Other Crops	5
	7/29/75	Small Grain	24
	↓	Spring Wheat	38
		Seeding Rate	12
		Other Crops	11
	↓	Calibration	31
	8/12/75	Small Grain	24
	↓	Spring Wheat	48
		Seeding Rate	12
		Other Crops	2
	↓	Calibration	15
	8/15/75	Small Grain	8
	↓	Spring Wheat	22
		Seeding Rate	12
		Other Crops	14
	↓	Calibration	16
ITS(1966)	↓	Calibration Panels	10
AES(W1)	8/23/75	Spring Wheat	12
↓	↓	Calibration	1

## 4.6 Exotech Model 20D Data Library Index

The NASA/ERL truck-mounted system, an Exotech Model 20D circular variable filterwheel spectrometer, acquired spectral data in the range of .35 to 2.40 $\mu$ m. The data were processed into .01 $\mu$ m wide bands. The Exotech 20D data include:

- o 9-track CCT's (bidirectional reflectance factor)
- o 70-millimeter color prints (vertical and oblique)
- o Supporting agronomic and meteorological observations

The index for the Exotech 20D data includes the location where the data were collected, the mission date, the experiment for which the data were collected, and the number of observations collected.

## Location Legend:

AES(G1) - Garden City Agriculture Experiment Station, Site-1  
 ITS(1960) - Calibration Panel Location at Intensive Test Site - 1960

## Finney County, Kansas

<u>Location</u>	<u>Mission Date</u>	<u>Experiment Name</u>	<u>Number of Observations</u>
AES(G1)	3/30/75	Small Grain	7
	↓	Other Crops	1
	3/31/75	Small Grain	13
	↓	Irr. Fertility	2
	↓	Other Crops	1
↓	4/3/75	Irr. Fertility	6
	↓	Irr. Variety	13
	↓	Other Crops	1
↓	4/5/75	Irr. Variety	5
	↓	Residue Management	2
ITS(1960)	4/8/75	Calibration Panels	2
↓	↓	Other Crops	7
↓	4/9/75	Calibration Panels	5
	↓	Other Crops	1
	↓	Small Grain	10
AES(G1)			



## Exotech Model 20D Data Library Index (Cont.)

<u>Location</u>	<u>Mission Date</u>	<u>Experiment Name</u>	<u>Number of Observations</u>
AES (G1)	4/14/75	Small Grain	9
	↓	Other Crops	1
	4/15/75	Small Grain	10
	↓	Irr. Fertility	8
	↓	Other Crops	1
	4/16/75	Irr. Variety	18
	↓	Other Crops	1
	4/17/75	Residue Management	16
	4/23/75	Small Grain	20
	4/28/75	Small Grain	19
	↓	Irr. Fertility	8
	4/29/75	Irr. Variety	18
	4/30/75	Residue Management	16
	↓	Other Crops	1
	5/3/75	Small Grain	4
↓	Residue Management	16	
5/4/75	Small Grain	5	
↓	Irr. Fertility	4	
↓	Irr. Variety	8	
↓	Other Crops	1	
5/6/75	Irr. Fertility	4	
ITS (1960)	5/14/75	Calibration Panels	2
↓	↓	Other Crops	5
AES (G1)	5/15/75	Small Grain	9
ITS (1960)	↓	Calibration Panels	4
AES (G1)	↓	Other Crops	2
↓	5/16/75	Irr. Fertility	8
↓	↓	Other Crops	1
AES (G1)	5/19/75	Small Grain	9
↓	5/20/75	Irr. Variety	9
↓	↓	Residue Management	11
ITS (1960)	5/21/75	Calibration Panels	6
↓	↓	Other Crops	8

## Exotech Model 20D Data Library Index (Cont.)

<u>Location</u>	<u>Mission Date</u>	<u>Experiment Name</u>	<u>Number of Observations</u>
AES(G1) ↓	5/25/75	Small Grain	10
	↓	Irr. Fertility	6
	5/26/75	Irr. Variety	8
↓	↓	Residue Management	15
	↓	Other Crops	1
	6/2/75	Residue Management	12
ITS(1960) ↓	↓	Calibration Panels	7
	↓	Other Crops	4
	6/3/75	Small Grain	10
AES(G1) ↓	↓	Irr. Fertility	8
	6/4/75	Irr. Variety	8
ITS(1960) ↓	6/9/75	Calibration Panels	6
	↓	Other Crops	4
AES(G1) ↓	6/11/75	Irr. Variety	3
	↓	Residue Management	16
	6/12/75	Small Grain	10
	↓	Irr. Fertility	3
	6/13/75	Irr. Fertility	5
	6/15/75	Small Grain	9
	6/16/75	Irr. Variety	3
ITS(1960) ↓	6/17/75	Calibration Panels	4
	↓	Other Crops	6
AES(G1) ↓	6/25/75	Small Grain	10
	↓	Irr. Fertility	2
ITS(1960) ↓	6/26/75	Calibration Panels	3
	↓	Other Crops	6
AES(G1) ↓	6/29/75	Small Grain	10
	↓	Irr. Fertility	1
	7/1/75	Irr. Fertility	7
	↓	Irr. Variety	2
	7/2/75	Irr. Variety	7
	↓	Residue Management	3
	7/3/75	Residue Management	13

## Exotech Model 20D Data Library Index (Cont.)

<u>Location</u>	<u>Mission Date</u>	<u>Experiment Name</u>	<u>Number of Observations</u>
AES(G1)	7/4/75	Small Grain	10
↓	↓	Irr. Fertility	7
		Irr. Variety	8
		Other Crops	6
ITS(1960)	7/5/75	Calibration Panels	3
↓	↓	Other Crops	6
	7/6/75	Calibration Panels	8
	↓	Other Crops	8
AES(G1)	7/9/75	Small Grain	9
↓	↓	Residue Management	8
		Other Crops	5

#### 4.7 Exotech Model 100 Data Library Index

The Exotech Model 100 is a Landsat band radiometer; in other words it has four spectral bands: .5-.6 $\mu$ m, .6-.7 $\mu$ m, .7-.8 $\mu$ m, .8-1.1 $\mu$ m. The data is recorded on paper. The Exotech 100 data include:

- o Hard copy record (bidirectional reflectance factor)
- o 35-millimeter color transparencies (angular and profile)
- o Supporting agronomic and atmospheric observations

The index for the Exotech Model 100 data includes for each of the two test sites the mission date, the locations or plots within the field, the type of radiometer data collected, the start time for the observations, the number of observations and the Purdue/LARS roll film ID's for the photography. Under the Location Number(s) column, B.S. indicates bare soil measurements. Under the Data Type column, reflectance refers to plot or scene reflectance measurements; Leaf Trans. refers to transmittance measurements of individual leaves.

4.7.1 Exotech Model 100 Data Library Index for the Finney County,  
Kansas Canopy Modeling Field - 416

<u>Mission Date</u>	<u>Location Number(s)</u>	<u>Data Type</u>	<u>Start Time(GMT)</u>	<u>Number of Observations</u>	<u>Purdue/LARS Roll Film ID</u>
3/20/75	1-3	Reflectance	15:33	12	35FS75-017
↓	↓	↓	16:14	12	35FS75-020 <sup>to</sup>
↓	1-3 & B.S.	↓	17:36	12	↓
↓	1-3	↓	18:26	15	↓
↓	1-3	↓	20:15	12	↓
4/23/75	1-3 & B.S.	↓	15:09	14	35FS75-009
↓	1-3	↓	16:28	12	35FS75-010 <sup>to</sup>
↓	1-3 & B.S.	↓	18:20	14	↓
↓	1-3	↓	22:21	12	↓
5/20/75	1-3	↓	14:45	12	35FS75-011
↓	↓	↓	16:00	12	↓
↓	1-3 & B.S.	↓	17:00	12	↓
↓	1,3	Leaf Trans.	18:07	14	↓
↓	↓	↓	?	14	↓
6/19/75	1	Leaf Trans.	15:50	2	35FS75-021
↓	↓	↓	↓	↓	to
6/26/75	2	Reflectance	16:10	4	35FS75-022
↓	↓	↓	16:54	4	↓
↓	↓	↓	17:40	4	↓
↓	↓	↓	18:25	4	↓
6/27/75	3	↓	15:06	4	↓
↓	↓	↓	16:19	4	↓

4.7.2 Exotech Model 100 Data Library Index for the Williams County,  
North Dakota Canopy Modeling Field - 1

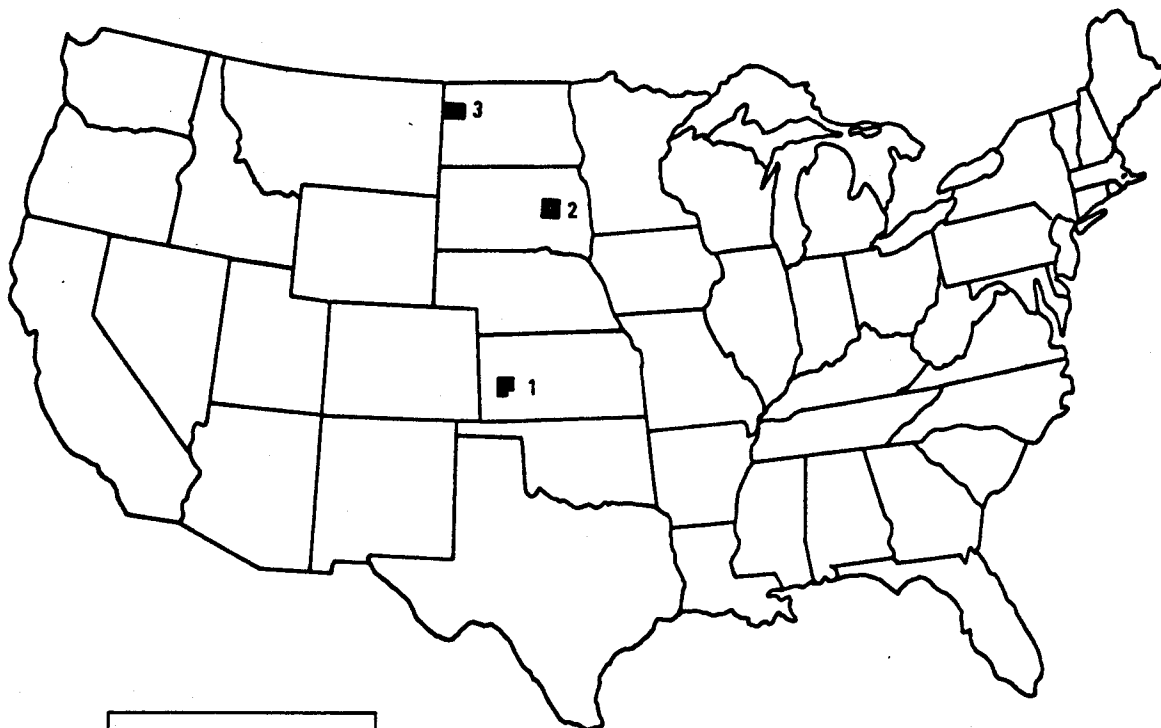
<u>Mission Date</u>	<u>Location Number(s)</u>	<u>Data Type</u>	<u>Start Time(GMT)</u>	<u>Number of Observations</u>	<u>Purdue/LARS Roll Film ID</u>
6/24/75	1-3	No Spectral Data Collected			35FS75-001 35FS75-002 <sup>to</sup>
7/11/75	1-3	Reflectance	19:13	3*	35FS75-003
			20:07	3*	35FS75-023
			21:02	3*	
		Leaf Trans.	?	8	
7/20/75	1-4 & B.S.	Reflectance	15:55	5	35FS75-004 <sup>to</sup>
	1-4		17:40	4	35FS75-005 <sup>to</sup>
	1-4 & B.S.		18:35	5	
	1-4		20:02	4	
	1-4 & B.S.		21:03	5	
	1-4		23:17	4	
	1-4 & B.S.		24:03	5	
	1-4	Leaf Trans.	?	8	
7/30/75	1-4	Reflectance	16:17	4	35FS75-006 <sup>to</sup> 35FS75-008 <sup>to</sup>
8/13/75	1-4 & B.S.		15:37	5	35FS75-024
			16:35	5	35FS75-025 <sup>to</sup>
			17:30	5	
			18:35	5	
			20:18	5	
			21:14	5	
	1-4	Leaf Trans.	?	4	

\* Only the data for the 0.8-1.1 $\mu$ m band is good.

Appendix I

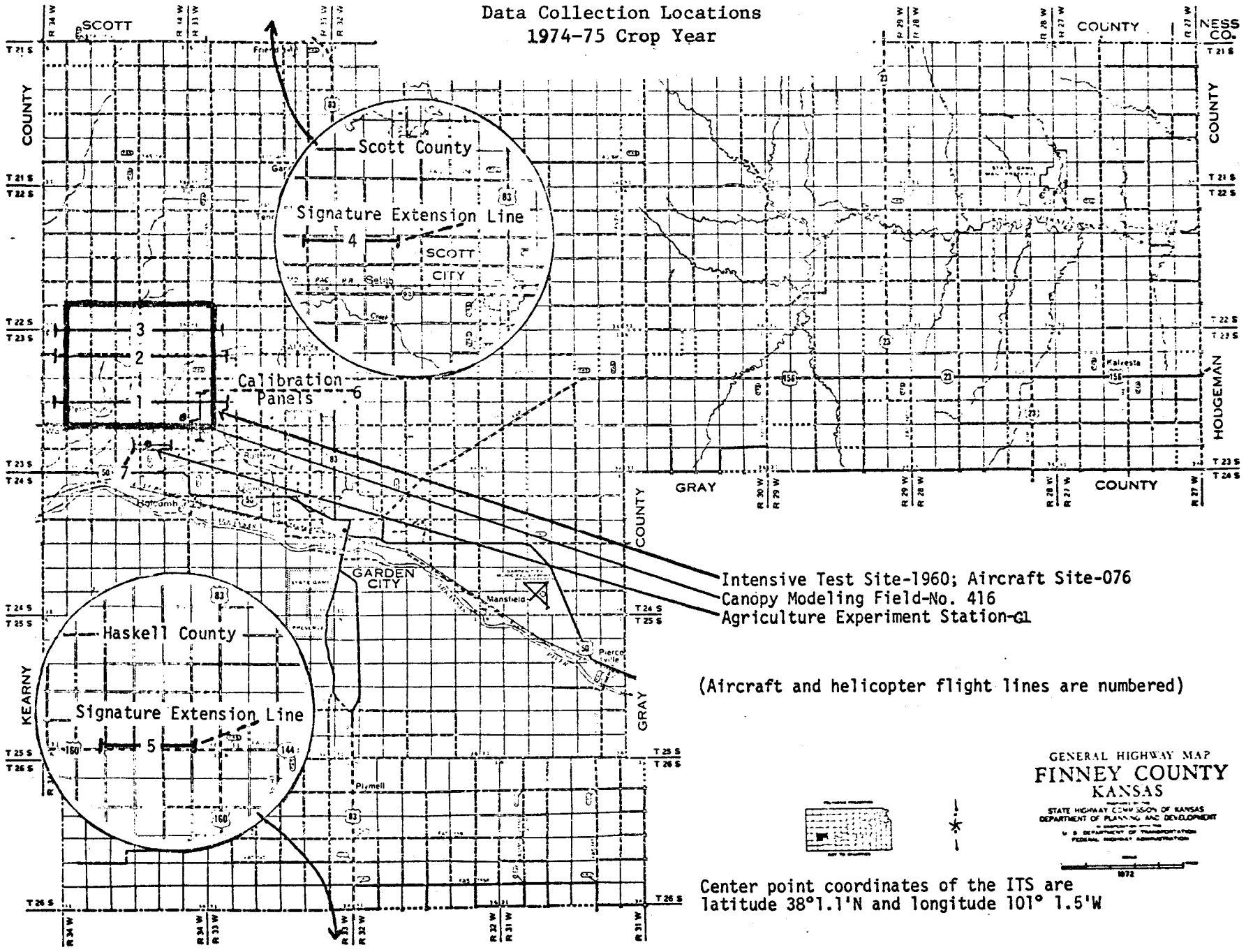
Location of LACIE Field Measurements Test Sites  
and Flight Lines

Location of the Three Test Sites



LEGEND	
1	FINNEY COUNTY, KANSAS
2	HAND COUNTY, SOUTH DAKOTA
3	WILLIAMS COUNTY, NORTH DAKOTA

Finney County, Kansas  
Data Collection Locations  
1974-75 Crop Year

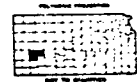


- Intensive Test Site-1960; Aircraft Site-076
- Canopy Modeling Field-No. 416
- Agriculture Experiment Station-G1

(Aircraft and helicopter flight lines are numbered)

GENERAL HIGHWAY MAP  
FINNEY COUNTY  
KANSAS

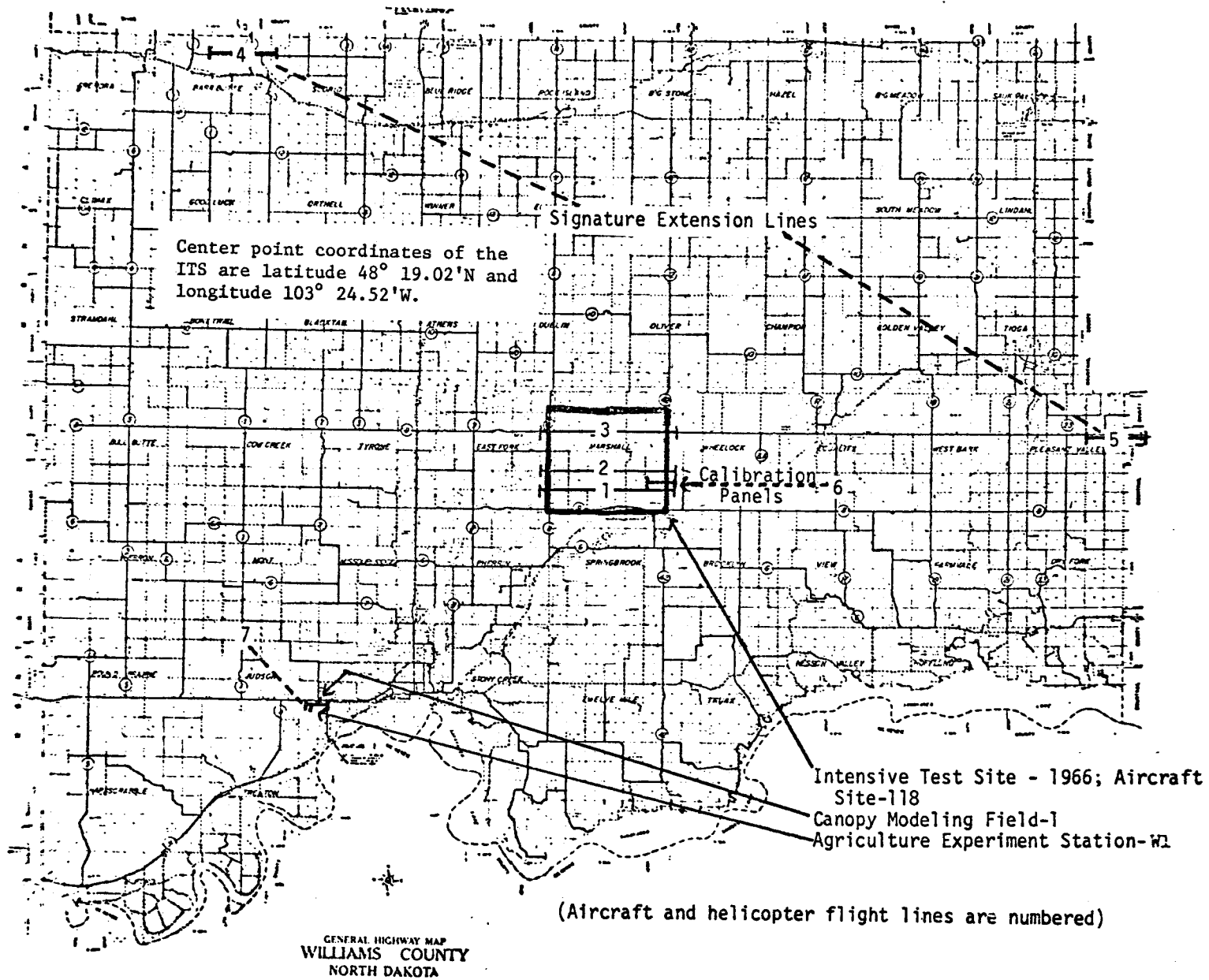
STATE HIGHWAY COMMISSION OF KANSAS  
DEPARTMENT OF PLANNING AND DEVELOPMENT  
A DIVISION OF THE  
U. S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION



Center point coordinates of the ITS are  
latitude 38°1.1'N and longitude 101° 1.5'W



Williams County, North Dakota, Data Collection Locations  
for 1975 Crop Year



1974-1975 Garden City, Kansas, Agriculture Experiment Station

Remote Sensing Experiments (Site-G1)

110	111
109	112
108	113
107	114
106	115
105	116
104	117
103	118
102	119
101	120

Small Grain Experiment

206	N <sub>2</sub>	I <sub>1</sub>
205	N <sub>2</sub>	I <sub>0</sub>
216	N <sub>2</sub>	I <sub>2</sub>
215	N <sub>2</sub>	I <sub>2</sub>
214	N <sub>2</sub>	I <sub>2</sub>
213	N <sub>0</sub>	I <sub>2</sub>
212	N <sub>0</sub>	I <sub>0</sub>
211	N <sub>0</sub>	I <sub>0</sub>
210	N <sub>0</sub>	I <sub>1</sub>
209	N <sub>0</sub>	I <sub>1</sub>
204	N <sub>0</sub>	I <sub>1</sub>
203	N <sub>1</sub>	I <sub>1</sub>
202	N <sub>1</sub>	I <sub>1</sub>
201	N <sub>1</sub>	I <sub>1</sub>

Irrigated Winter Wheat-Fertility Experiment

Nitrogen Fertilization

- N<sub>0</sub> None
- N<sub>1</sub> 40 lbs./acre
- N<sub>2</sub> 80 lbs./acre

Irrigation Treatment  
Pre-irrigation +

- I<sub>0</sub> None
- I<sub>1</sub> Boot
- I<sub>2</sub> Joint + Boot

Sage Variety

Pre-Plant Irrigation - Sept. 26, 1974

318	V <sub>1</sub>	I <sub>2</sub>
317	V <sub>2</sub>	I <sub>2</sub>
316	V <sub>3</sub>	I <sub>2</sub>
315	V <sub>3</sub>	I <sub>3</sub>
314	V <sub>2</sub>	I <sub>3</sub>
313	V <sub>1</sub>	I <sub>3</sub>
312	V <sub>1</sub>	I <sub>3</sub>
311	V <sub>3</sub>	I <sub>3</sub>
310	V <sub>3</sub>	I <sub>3</sub>
309	V <sub>3</sub>	I <sub>1</sub>
308	V <sub>3</sub>	I <sub>1</sub>
307	V <sub>3</sub>	I <sub>1</sub>
306	V <sub>1</sub>	I <sub>1</sub>
305	V <sub>1</sub>	I <sub>1</sub>
304	V <sub>2</sub>	I <sub>1</sub>
303	V <sub>2</sub>	I <sub>1</sub>
302	V <sub>2</sub>	I <sub>1</sub>
301	V <sub>2</sub>	I <sub>1</sub>

Irrigation Winter Wheat-Variety Experiment

Winter Wheat Variety

- V<sub>1</sub> Centurk
- V<sub>2</sub> Sage
- V<sub>3</sub> Sturdy

Irrigation Treatment  
Pre-irrigation +

- I<sub>1</sub> 3" Boot Stage
- I<sub>2</sub> 6" Milk Stage
- I<sub>3</sub> 3" Boot + 3" Milk Stages

Planting Date - Sept. 30, 1974

401, 402	M <sub>2</sub>	N <sub>1</sub>	R <sub>1</sub>
403, 404	M <sub>2</sub>	N <sub>2</sub>	R <sub>1</sub>
405, 406	M <sub>1</sub>	N <sub>2</sub>	R <sub>1</sub>
407, 408	M <sub>1</sub>	N <sub>1</sub>	R <sub>1</sub>
409, 410	M <sub>3</sub>	N <sub>2</sub>	R <sub>1</sub>
411, 412	M <sub>3</sub>	N <sub>1</sub>	R <sub>2</sub>
413, 414	M <sub>4</sub>	N <sub>1</sub>	R <sub>2</sub>
415, 416	M <sub>4</sub>	N <sub>2</sub>	R <sub>2</sub>

Winter Wheat Residue Management Experiment

Residue Management

- M<sub>1</sub> Shredding
- M<sub>2</sub> Complete Removal
- M<sub>3</sub> Heavy Residue
- M<sub>4</sub> Burning

Nitrogen Fertilization

- N<sub>1</sub> 50 lbs./acre
- N<sub>2</sub> 100 lbs./acre

Seeding Rate

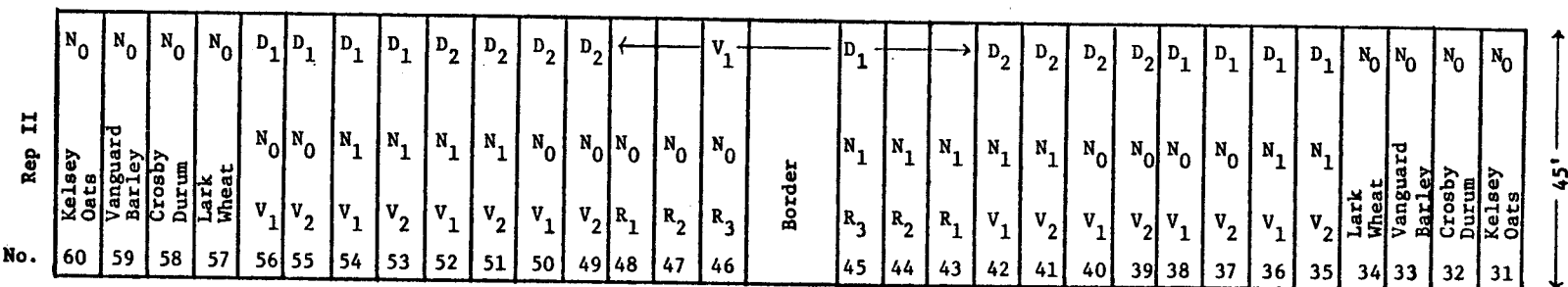
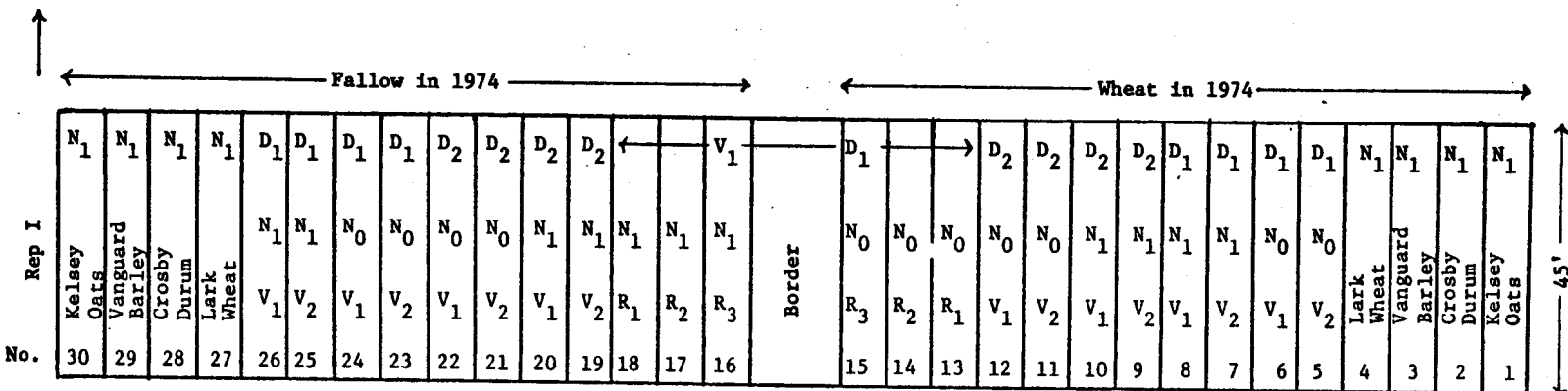
- R<sub>1</sub> Normal
- R<sub>2</sub> Double

Fallow
Grain Sorghum
Sugar Beets
Soybeans
Alfalfa
Corn

Other Crops Experiment

1975 Williston, North Dakota Agriculture Experiment Station  
Remote Sensing Experiments (Site-W1)

North



Winter Wheat
Fallow
Alfalfa
Native Grass

124

Treatment Descriptions

Soil Moisture	Planting Date	Variety	Nitrogen	Seeding Rate
M <sub>1</sub> Wheat in 1974	D <sub>1</sub> May 20	V <sub>1</sub> Ellar	N <sub>0</sub> None	R <sub>1</sub> 30 lbs/acre
M <sub>2</sub> Fallow in 1974	D <sub>2</sub> May 30	V <sub>2</sub> Olaf (Semi dwarf)	N <sub>1</sub> 25 lbs/acre	R <sub>2</sub> 60
				R <sub>3</sub> 90

## Appendix III

## Brief Description of Supporting or Ancillary Measurements

Intensive Test Site

An inventory of all fields including crop species, crop variety, field acreage, and planting date was obtained, once in the spring and once in the fall. Rainfall amounts were noted at selected places in the site during the crop year.

Periodic observations of large fields under helicopter flight lines include:

- o Crop species
- o Cultural practices: fertilization, planting date, etc.
- o Crop Maturity
- o Plant height
- o Ground cover
- o Stresses: disease, insects, moisture deficits, etc.
- o Field operations: cultivation, harvesting, etc.
- o Vertical and oblique photographs
- o Grain yield

At selected fields under the helicopter flight lines for the Finney County, Kansas test site, the following additional observations were made:

- o Leaf area
- o Vertical and oblique photographs
- o Soil moisture samples
- o Yield measurements

Meteorological and atmospheric measurements collected at the base station for each site during the helicopter and aircraft flights include:

- o Percent cloud cover and type
- o Temperature
- o Relative humidity
- o Wind speed and direction
- o Barometric pressure
- o Total irradiance
- o Optical depth
- o Sky brightness

Agriculture Experiment Station

Supporting measurements collected at the plots on the agriculture experiment stations include:

- o Crop species and variety
- o Cultural practices: fertilization, planting date, etc.
- o Crop maturity
- o Plant height
- o Plant counts
- o Ground cover
- o Stresses: disease, insects, moisture deficits, etc.
- o Leaf area
- o Fresh and dry biomass
- o Soil moisture measurements
- o Yield measurements
- o Vertical and oblique photographs

Meteorological and atmospheric measurements include a daily record of the temperature variation and precipitation amounts recorded at the experiment station for the crop year. The measurements also include during the time that spectral data were collected:

- o Percent cloud cover and type
- o Temperature
- o Relative humidity
- o Wind speed and direction
- o Barometric pressure
- o Total irradiance

Crop Canopy Modeling Field

Supporting measurements on the crop canopy modeling field include:

- o Crop species and variety
- o Crop maturity
- o Plant height
- o Plant counts
- o Stresses: disease, insects, moisture deficits, etc.
- o Leaf area
- o Head area
- o Fresh and dry biomass
- o Canopy modeling photographs
- o Skylight: shaded vs non-shaded field reflectance standard  
(Exotech Model 100 measurements)

Appendix IV

LACIE Field Measurements Sensor Data Specifications and Operational Characteristics

SPECIFICATIONS

OPERATIONAL CHARACTERISTICS

Sensor	Type	Spectral Bands	Spectral range, micrometer	Spot size IFOV, m	Swath width, m	Altitude of Operation, m	Site of Operation
Landsat	Imagery	4	0.5 to 1.1	79 x 57	1.9 x 10 <sup>5</sup>	9.3 x 10 <sup>5</sup>	ITS
Aircraft MSS	Imagery	15 9	0.34 to 2.36 3.54 to 13.00	12 6 0.9	10 230 5 115 760	6 100 3 050 460	ITS ITS ITS; experiment station
Aircraft M <sup>2</sup> S	Imagery	10 1	0.4 to 1.1 8.0 to 13.0	15 8 1.2	14 520 7 265 1 090	6 100 3 050 460	ITS ITS ITS; experiment station
Helicopter FSS	Non-imagery	61 12	0.4 to 2.4 8.0 to 14.0	24	(a)	60	ITS
FSAS	Non-imagery	201	0.4 to 2.4	1.2 to 1.8	(a)	6 to 9	Experiment station
Exotech 20C	Non-imagery	201 188	0.4 to 2.4 2.8 to 13.4	1.7	(a)	6	Experiment station ITS calibration panels
Exotech 20D	Non-imagery	206	0.35 to 2.40	1.7	(a)	6	Experiment Station ITS calibration panels
Exotech 100	Non-imagery	4	0.5 to 1.1	0.4 to 0.5	(a)	1.5 to 2.0	Canopy modeling field

(a) Not applicable.