Date: January 2, 1973

To: ERTS Contracting Officer
Code 245, GSFC
Greenbelt, Maryland 20771

ERTS Technical Officer
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Greenbelt, Maryland 20771

ERTS Project Scientist
Code 650, GSFC
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NASA Scientific and Technical
Information Facility
Attn - ERTS Resources
Post Office Box 33
College Park, Maryland 20740

From: Dr. John P. Mahlstede, Principal Investigator (UN-611)
Iowa Agriculture Experiment Station
104 Curtiss Hall
Iowa State University
Ames, Iowa 50010

Re: Progress Report (Type I)

The following progress report summarizes work accomplished for the 4-month period ending December 31, 1972 with reference to Article II, Item 3 of the contract schedule outlined in #NAS5-21839.

a. Remote Sensing in Iowa Agriculture (MMC #249).

b. GSFC Identification Number of the Principal Investigator (UN-611).

c. Any problems that are impeding the progress of the investigation: ERTS-1 and the imagery provided by the Earth Observations Aircraft Program, Manned Space Center, Houston, Texas (flown August 12, 1972) were not received until October, 1972. This delay slowed the progress of this investigation. Since the receipt of the underflight imagery and selected ERTS-1 imagery, the major problems impeding progress have been cloud cover over the ground truth areas and other atmospheric hinderances to the ERTS-1 imagery resolution. This contract was not finalized until September 1, 1972, therefore, August - 1972 ERTS-1 imagery was not delivered. The Iowa imagery for the 13th and 30th of August is basically cloud free for major portions of Iowa. This imagery has been ordered and will greatly aid this investigation when received.

One objective of this proposal was to examine the possibility of monitoring soil moisture stress. This objective was deleted as the 1972 growing season was provided with ample and timely rainfall so that no significant moisture stress developed in Iowa.

The ERTS-1 imagery received to date has been of reasonable quality with the exception that wavelength bands #4 and #6 have occasionally contained serious scanning lines.

(E72-10335) REMOTE SENSING IN IOWA AGRICULTURE Progress Report, period ending 31 Dec. 1972 J.P. Mahlstede (Iowa State Univ. of Science and Technology) 2 Jan. 1973 4 p CSCL 02C G3/13

N73-14323

Unclas 00335

d. Accomplishments during this reporting period and those planned for the next reporting period: Ground truth (crop identification) has been established for four different test sites in Iowa. To date analysis of the underflight imagery of August 12 has proceeded toward development of either a single-band or multi-band pattern recognition technique for crop identification in these areas during this time frame. The underflight imagery is of excellent quality and essentially cloud-free for all areas. This imagery and the ground truth collected to date are being used to correlate crop identification with the ERTS-1 imagery.

Analysis of the 70 mm positive transparencies has proceeded using three approaches: 1) direct enlargements of the 70 mm positive transparencies, 2) analysis procedures utilizing additive color and density slicing instrumentation provided by the Iowa Geologic Survey - Remote Sensing Center, and 3) utilization of multiple 2½" filtered lantern projectors to simulate the color additive process and to attain additional enlargement of the 70 mm positive transparencies.

Enlargements (15" × 15") of the initial ERTS imagery were examined for soil landscape differences. Major drainage systems can be outlined and identified. An indistinct density pattern may differentiate the Des Moines lobe (late Wisconsin glaciation) from the surrounding loess covered landscape. Detailed soil patterms can not be identified probably because of the vegetative cover.

The ERTS-1 imagery for August in Iowa is essentially cloud free for major areas. When this imagery is received, analysis will proceed using the procedures previously described. Portions of this imagery correspond within a day of the acquired underflights during August, 1972. This will increase the degree of correspondence between ground truth and ERTS-1 imagery. In addition a zoom stereo viewing system is being acquired through the Iowa State Agricultural Experiment Station. This equipment will greatly improve the analysis of the underflight imagery.

e. Discussion of significant results and their relationship to practical applications or operational problems: Acquisition of the August 12th underflight imagery was a big step for our program. Analysis of this imagery is just beginning; however, the following observations were noted: 1) For crop classification, the color IR photography appears to be the best single product. Many field irregularities can be noted on this photography. Preliminary analysis of the thermal scanner (RS-14) black and white imagery combined with the black and white multiband photography appears to have potential for classification of Iowa's major crops during the August time frame. Discrimination between corn and soybean fields from other fields is quite good on the thermal imagery. Using the multiband imagery to classify the remaining corn and soybean fields remains to be shown. Imagery filtered with a #89B filter appears to be the most likely prospect. This aspect is being examined by standard photo-interpretive methods and, also, by applying density slicing-color coding techniques. The latter would provide a more automatic classification method. 2) The high-altitude color IR imagery provided by the Ames Center underflights flown on June 6, 1972 clearly show the usefulness of timing as a crop classification tool. Discrimination between fields which will be either corn or soybeans from oats, pasture and hay fields appears very likely.

This will allow the interpreter to classify major crop types at a time when maximum differences in the spectral response occur. 3) With respect to disease detection in corn and soybeans, the August 12th time frame appears to be too early as the disease plots did not show differences until later in the growing season. This investigation continues.

After receiving the ERTS-1 imagery in late October, three methods of analysis of this imagery have been used as stated in part d of this report. No significant conclusions can be stated at this time; however, noted observations are as follows: 1) Use of color additive and density slicing-color coding appears potentially useful for crop identification and automatic classification in Iowa for this time frame. The influence of soil association differences on the spectral response of the imagery will probably have to be taken into account for any automatic crop identification procedure to be successful. Small fields and the diversity of Iowa's cropping patterns also will cause significant problems for crop classification. 2) The presence of high clouds and associated hazy atmospheric conditions markedly reduces the resolution of the ERTS-1 imagery. 3) Utilization of filtered 2¼" projectors is quite difficult because of multiple image registration problems. This procedure does, however, allow the interpreter to achieve image enlargement and the enhancement of response differences using two image projections.

f. There are no published articles, and/or papers, pre-prints, etc. at this time.

g. No recommendations concerning practical changes in operations are suggested at this time.

h. Changes in the standing order form are requested as follows: (see attached standing order form).

j. No data request forms have been submitted during this reporting period.

ERTS 1 STANDING ORDER FORM

(See Instructions on Back)

DATE January 2, 1973

GSFC ID NUMBER _____

PRINCIPAL INVESTIGATOR Mahlstede, John P.

TELEPHONE NO. 515-294-4762 ☐ NEW

SHIP TO: Dr. John P. Mahlstede
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☐ ADDITION
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MICROFILM ☒ U.S. ☐ NON-U.S.

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AREA NUMBER	GEOGRAPHIC POINTS		CLOUD COVER %	QUALITY	COVERAGE PERIOD		PROD		TICK MARK	QUANTITY	RBV BANDS			MSS BANDS				DELETE
	LATITUDE	LONGITUDE			START DATE	STOP DATE	TYPE	FORMAT			1	2	3	1	2	3	4	
	4317 N	09611 W	7	F	04 01 73	10 31 73		S		1				X	X	X	X	
	4204 N	09345 W	7	F	04 01 73	10 31 73		S		1				X	X	X	X	
	4227 N	09155 W	7	F	04 01 73	10 31 73		S		1				X	X	X	X	
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GSFC 37-3 (7/72)

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