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APPLICATION OF LANDSAT-2 DATA TO THE IMPLEMENTATION AND ENFORCEMENT OF
THE PENNSYLVANIA SURFACE MINING CONSERVATION AND RECLAMATION ACT

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Principal Investigator:

DANIEL J. DEELY
EARTH SATELLITE CORPORATION
7222 47th STREET
WASHINGTON, D.C. 20015

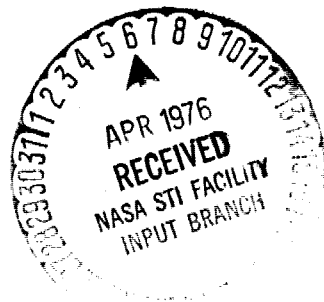
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TYPE II PROGRESS REPORT

FOR PERIOD DECEMBER 19, 1975 - MARCH 19, 1976

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APPLICATION OF LANDSAT-2 DATA TO THE IMPLEMENTATION
AND ENFORCEMENT OF THE PENNSYLVANIA
SURFACE MINING CONSERVATION AND RECLAMATION ACT

TYPE II - Progress Report

For Period December 19, 1975 - March 19, 1976

Introduction to Project Objectives

The central objectives of the Pennsylvania LANDSAT Investigation are:

- To prepare information products from analysis of LANDSAT and aircraft imagery to rapidly and effectively implement the regulatory provisions of Pennsylvania's Surface Mining Conservation and Reclamation Act.
- To develop and operationally implement a monitoring system, within one or more detailed study sites, which will include surface mine disturbance change detection, reclamation status monitoring and mined lands inventory updating.
- To provide utilitarian regulatory information products to line agencies within the Pennsylvania Department of Environmental Resources.

Problems

Natural color imagery over the South Clarion County detailed study area from NASA Ames underflight mission number 75-183 was somewhat degraded by the presence of atmospheric haze, but was judged to be of adequate quality for interpretation of required mining-environmental information.

Accomplishments

Fourth quarter activities: The most significant accomplishments which were made during the fourth quarterly performance period include:

- Completion of an unsupervised digital classification analysis for the central portion of the South Clarion detailed study area.

The unsupervised digital classification included a total of nine categories. Those categories represented strip mines, five categories represented forest and agricultural vegetation, and the last poorly differentiated category included water, shaded forest slopes and very dark exposed rock and bituminous coal within strip mine sites. Very dark surface materials may be spectrally distinguished from water within this test area only with some considerable difficulty.

- Evaluation of the significance of unsupervised classification results through detailed comparisons with natural color and color infrared underflight imagery.

- Selection of gray value ranges on bands 5 and 7 for use in digital density slicing to represent four major classes of strip mined lands. Strip mine categories recognized include:
 1. Barren spoils of medium (visible) color consisting of both exposed rock fragments and soil.
 2. Barren spoils of very dark (visible) color consisting mostly of dark organic shales and coal.
 3. Partially revegetated spoils of light (visible) color consisting of mostly exposed soil and light rock fragments.
 4. Partially revegetated (more vegetation than class 3) spoils of darker (visible) color.

- Completion of production of digitally enhanced color composite prints of two seasons of imagery over the South Clarion detailed study area. Digital color composites were compared with photographic color composites, and the change detection information potential from June to October was evaluated.

- Production of a digital ratio of bands 5 and 6 in Litton print form for later use in preparation of a color composite print for comparison with other photographic and digital data products.

The 5/6 ratio has shown some promise for eliminating difficulties in interpretation related to the presence of light cloud cover and jet contrails.

- Preliminary review of multi-stage sampling techniques reported previously by other NASA LANDSAT investigators.

Other lesser accomplishments made during the fourth quarterly performance period have included:

- Purchase and receipt of northwestern Pennsylvania county highway maps for later use in display of LANDSAT derived data.
- Review and evaluation of NASA Ames underflight data mission number 75-183 which was flown on 23 October 1975.

Planned fifth quarter activities: Investigative effort during the next quarterly reporting period from March 19, 1976 to June 19, 1976 is expected to be directed toward accomplishment of the following tasks:

- Production and delivery to the Pennsylvania Bureau of Surface Mine Reclamation of a barren to partially revegetated surface mined lands inventory of a multi-county area in northwestern Pennsylvania. Disturbance inventory data derived from digital density slicing is expected to be utilized by regulatory personnel as an aid to achievement of full implementation of regulatory control over all forms of surface mining within counties presently without assigned mining inspectors as required by specific provisions of the Surface Mining Conservation and Reclamation Act.

- Completion of a digital band 5/band 6 ratio color composite for comparison with other photographic and digitally derived LANDSAT data products.
- Further evaluation of photographic multi-date change detection mined lands information delivery potential.
- Further work toward development of a multi-stage sampling design for generation of periodic digitally-derived LANDSAT surface mining activity and reclamation status monitoring reports. The multi-stage system is expected to include supervised on unsupervised digital classification in the first LANDSAT stage, with manually interpreted underflight imagery information in the second stage.

Significant Results

None.

Publications

None.

Recommendations

None.

Funds Expended

Total fund expenditures incurred through February 29, 1976 amount to \$25,556.15.

Data Use

| <u>Type of Data</u> | <u>Value of Data Allowed</u> | <u>Value of Data Ordered</u> | <u>Value of Data Received</u> ^{1/} |
|---------------------|------------------------------|------------------------------|---|
| LANDSAT | \$3,200 | \$1,253 | \$1,225 |
| CCT | 3,000 | 1,000 | 1,000 |
| Aircraft | 8,532 | 3,900 | 3,900 |

Aircraft Data

Natural color and color infrared imagery from NASA Ames underflight mission number 75-183 (flown on 23 October, 1975) was utilized for ground truth comparison with digitally-derived unsupervised classification results within the central portion of the South Clarion Mining Inspection District detailed study area. Imagery was interpreted manually in color positive transparency form. Image quality was judged satisfactory for derivation of the required mining-environmental information in spite of some measure of degradation due to atmospheric haze on natural color imagery.

^{1/}

Based on EROS Data Center account statements of March 1, 1976.