4.7 Project Element - Sensor Implementation and Evaluation

4.7.3 Task 3 - Future Sensor Needs/Requirements

4.7.3.1 Description of Task

1. Objective

To define USDA needs and requirements for future sensors for crop and land cover applications.

2. Scope

This task will evaluate the results from the use of various sensor systems (Landsat MSS; Landsat RBV; TMS; aircraft acquired X, L, and C band SAR; Seasat L band SAR; Landsat TM; and Shuttle SAR and LFC) throughout the DCLC project. The assessment of these results will be made for the purpose of providing input for the design and operation of future satellite sensor systems.

4.7.3.2 Research to be Conducted

This task constitutes an ongoing assessment of all DCLC research results using various sensors for crop and land cover classification and mapping, for change detection, and for geographic information system applications. The results will be evaluated with respect to factors that are pertinent to sensor design such as the following:

1. spatial (e.g., sizes of thematic crop and land cover targets in various geographic locations and surface conditions).
2. temporal (e.g., when are the most appropriate times to acquire data and what orbit frequencies are pertinent).
3. spectral (e.g., optimum bands, band widths, and spectral regions).

4. multi-sensor (e.g., improvement of information by merging data from 2 or more different sensors).

5. data type (e.g., advantages of stereo coverage, and digital versus image).

Attention will also be given to assessing the impact of certain sensor parameters (e.g., number of bands, spatial resolution) on data processing activities.

There will be no integration and pilot testing. The thrust of this task is a documentation effort drawing on the results of other tasks within this project. It is not anticipated that the end result of this task, in itself, will provide all information needed for future sensor system design, but that it will contribute significantly to such information.

4.7.3.3. Responsibility

1. NSTL will be the task manager.

2. NSTL will be responsible for compiling and evaluating results from all DCLC crop estimation and land cover tasks.

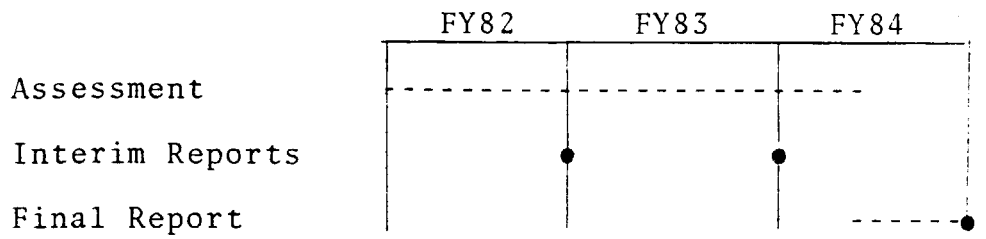
3. SRS will provide results from exploratory research pilot tests, LSAT's and other aspects of the DCLC project for which SRS has responsibility. SRS will also review all conclusions before they are finalized.

4.7.3.4 Resources

| | FY82 | | FY83 | |
|---|---|---|---|---|
| | $ | MYE | $ | MYE |
| SRS | 0 | 0 | 10 | 0.1 |
| NSTL | 25 | 0.2 | 77 | 0.8 |

NSTL civil service manpower will perform the technical assessment and limited contract management for their assigned work. Most NSTL funds will be for the in-house contractors to provide for data processing costs. SRS civil service manpower will support their assigned work.

4.7.3.5 Schedule




4.7.3.6 Interfaces

Only interfaces will be internal to DCLC project.

4.7.3.7 Data Requirements

None

## 4.8 Project Element - Preprocessing

### 4.8.1 Task 1 - Preprocessing Procedures

#### 4.8.1.1 Description of Task

Objectives

- Determine if atmospheric and sensor corrections applied to Landsat MSS data improve land cover classification in a cost-effective manner and whether or not these corrections are needed in other tasks.
- Determine usability of automated cloud masking procedures.

Scope

Select an atmospheric correction and cloud classification algorithm to test and evaluate over a limited data set to determine their usefulness in the domestic crops and land cover program. The scanner correction algorithm will not require testing.

#### 4.8.1.2 Research to be Conducted

The first step in the technical approach is to assess currently available atmospheric correction algorithms. Some candidates are the XSTAR (ERIM), ATCOR (Lockheed), and the procedures used at JSC and GSFC. The assessment will examine the type of corrections performed, testing, and evaluation reports, and run costs. Based on this assessment one algorithm will be selected for further investigation. The evaluation of the selected atmospheric correction algorithm will take into account classifier and estimator designs developed in the clustering/classification evaluation task and determine performance when used with those designs.

Major subtasks are:

1. Select best varying haze correction algorithm (detects and corrects only those areas within scene that are attenuated).

2. Build test data set of attenuated and nonattenuated MSS data:

    o consider different degrees of haze

    o use ground truth segments having similar land cover types.

3. Develop procedures to use algorithm in the following areas:

    o improving classification

    o extending training statistics.

4. Test and evaluate specific procedures, in a proof-of-concept, over an equivalent one scene or less.

5. Modify based on results.

Based on the proof-of-concept testing and modifications a preprocessing software package may be added to the front end of the current or modified Domestic Crops and Land Cover procedure.

4.8.1.3 Responsibility

JSC will provide:

a. Technical and contract management of their assigned work within the task,

b. Assessment of preprocessing technology.

c. Development of procedures.

d. Proof-of-concept test and evaluation

e. Support to pilot test accuracy assessment and performance evaluation.

f. Support design specification development for LSAT.

g. Support technology adaptation.

SRS will be overall Task Manager and will:

a. Conduct pilot test.

b. Perform pilot test accuracy assessment and performance evaluation.

c. Support the assessment, procedure development, and proof-of-concept testing.

d. Establish performance criteria.

e. Decide go/no-go for technology adaptation to on-line.

f. Perform technology adaptation.

4.8.1.4 Resources

| | FY82 | | FY83 | |
|---|---|---|---|---|
| | $ | MYE | $ | MYE |
| SRS | 10 | 0.1 | 10 | 0.1 |
| JSC | 70 | 0.5 | 70 | 0.5 |

JSC will provide the overall technical and contract management of their assigned responsibilities. They will be responsible for the overall technical integrity of their assigned work. JSC resources given here allow for procedure development, data processing, and special data acquisition requirements.

SRS will provide predominately civil service manpower for their assigned responsibilities. A majority of data acquisition and processing costs for pilot testing will be

their responsibility. The adaptation of development procedures to on-line facilities will be funded by SRS. Special ground truth acquisition for this task will also be funded by SRS, if needed.

4.8.1.5 Schedule

| Task | Desired Completion Date |
|---|---|
| Develop detailed technical plan | 11/1/81 |
| Finish FY81 atmospheric preprocessing studies | 2/1/82 |
| Decide on inclusion of sensor correction research for FY83 | 10/1/82 |
| Modify preprocessing designs as appropriate for inclusion in clustering/classification evaluation procedures | 11/1/82 |
| Deliver final report on atmospheric corrections | 2/1/83 |
| Completion of on-line adaptation of atmospheric correction procedure | 3/1/83 |

4.8.1.6 Interfaces

Successful procedures from this project element will contribute to improved classification results for other DCLC project elements and tasks. However, work on this element does not hold up development of techniques for those elements and tasks.

4.8.1.7 Data Requirements

It is expected that Landsat data obtained for other project elements will be sufficient for development and testing of procedures.



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