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# AgRISTARS

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A Joint Program for  
Agriculture and  
Resources Inventory  
Surveys Through  
Aerospace  
Remote Sensing

## Yield Model Development / Soil Moisture

6. NOVEMBER 1980

### INTERFACE CONTROL DOCUMENT

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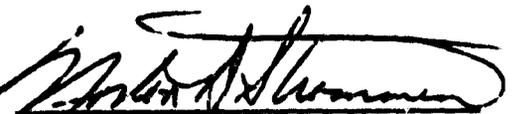
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INTERFACE CONTROL DOCUMENT

YIELD MODEL DEVELOPMENT PROJECT  
AND SOIL MOISTURE PROJECT

MAY 1980

APPROVED:



YMD PROJECT MANAGER



SM PROJECT MANAGER

# INTERFACE CONTROL DOCUMENT

## SOIL MOISTURE- YIELD MODEL DEVELOPMENT

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**INTERFACE CONTROL DOCUMENT**  
**YIELD MODEL DEVELOPMENT - SOIL MOISTURE PROJECTS**

**1.0 GENERAL**

The Agricultural and Resources Inventory Survey Through Aerospace Remote Sensing (AgRISTARS) effort is a joint endeavor of NASA-NOAA-USDA with support from the EROS Data Center (EDC) of the Department of the Interior.

The Technical Program in this joint effort is structured into eight projects:

- o Early Warning/Crop Condition Assessment (EW/CCA)
- o Foreign Commodity Production Forecasting (FCPF)
- o Yield Model Development (YMD)
- o Soil Moisture (SM)
- o Domestic Crops and Land Cover (DC/LC)
- o Renewable Resources Inventory (RRI)
- o Conservation and Pollution (C/P)
- o Supporting Research (SR)

Numerous interactions and support functions are required between the various projects to support the total AgRISTARS effort. Interface Control Documents (ICD's) are required to identify these interactions and support functions.

## 1.1 PURPOSE

This INTERface Control Document (ICD) defines the interactions and support functions required between the Yield Model Development (YMD) Project and Soil Moisture (SM) Project.

This ICD outlines and defines the requirements for YMD support of SM and vice-versa. Tasks in support of these interfaces are defined for development of support functions.

## 1.2 INTRODUCTION

The YMD Project will provide seasonal crop yield estimation capability for periodically assessing crop potential from planting to harvest. Initial efforts will be in evaluation of existing crop yield models. Additional and continuing effort will be devoted to improving existing models and developing additional models as required. This quantification will include phenological development for use in assessing the likely physiological response of the plant to the expected environmental parameters (temperature, precipitation, moisture stress) as they may impact production potential at various stages of plant maturity and under varying technological considerations.

The SM Project will develop, test, and evaluate techniques and procedures to measure or predict soil moisture in the root zone using both contact and remote sensors. The ultimate goal of the SM Project is to produce an operational soil moisture measurement system that can accurately and in near real-time provide soil moisture data in the root zone of soils over large land areas.

**1.3 POINTS OF CONTACT**

Additional information as required on tasks and data identified in this ICD may be obtained by contacting the individuals at the locations listed below:

**1.3.1 Soil Moisture - Washington, D.C.**

Mr. R. H. Gilbert  
SM Project Manager  
USDA/SCS  
P.O. Box 2890  
Washington, D.C. 20013  
FTS 447-5904

**1.3.2 Yield Model Development - Washington, D.C.**

Dr. N. D. Strommen  
YMD Project Manager  
USDA/WFAOSB  
Rm 3506  
S. Ag. Bldg.  
Washington, D.C. 20250  
FTS 447-5715

**1.3.3 Yield Model Development - Houston, Texas**

Mr. J. L. Rogers  
USDA  
1050 Bay Area Blvd.  
Houston, TX 77058  
Phone: 713-488-9780  
FTS 525-5244

**1.3.4 SEA-AR - Washington, D.C.**

Dr. J. C. Ritchie  
USDA/SEA-AR  
Bldg. 005, BARC West  
Beltsville, MD 20705  
FTS 344-3106

## 2.0 PROJECT INTERFACES

The development, testing, and evaluation of soil moisture and yield estimation techniques are very closely related. Data acquired to support these activities for soil moisture estimation will be most useful in yield estimation and vice-versa. Many yield models have soil moisture models as an integral part of the yield estimation process. Task output and related data developed as a part of either project will be furnished the other project.

Data collected by or made available to either SM or YMD will be made available to the other project. Close liaison between the two projects through day to day contacts, project reviews, formal interfaces, and progress reports will continue through the entire time-frame of AgRISTARS.

## 2.1 SOIL MOISTURE PROJECT RESPONSIBILITIES

The Soil Moisture Project will develop and test several soil moisture estimation techniques useful as independent variables or as integral components for yield model development. Soil moisture measurement and estimation techniques will be made available to YMD as they are developed. Soil moisture models will be furnished along with input requirements, documentation, and operating instructions.

### 2.1.1 In Situ Sensor Development

Results of the In Situ sensor development and evaluation is of interest to YMD crop scientists developing yield models where soil moisture is an input variable. Documented results of these tasks will be furnished the YMD manager for distribution to the

various crop scientists.

### 2.1.2 Remote Sensor Measurements

Results of microwave and radiometric measurement of surface soil moisture and the resultant inferences will be of interest and use to YMD crop scientists developing remotely sensed and spectral input requirements for yield models. The reports, tables, and plots of sensor response versus soil moisture will be made available to YMD crop scientists routinely on request. Soil moisture algorithms developed in these tasks will be exchanged between scientists in both projects upon specific request.

### 2.1.3 Modeling and Analysis

Accuracy assessment reports of algorithms using remotely sensed data to estimate soil moisture distribution in the surface layer of soils will be furnished other project scientists upon request. Reports prepared identifying types of model structure and specific models that can best use remotely sensed data and the specific limitations of each will also be made available.

Profile soil moisture model(s) using surface soil moisture to predict profile soil moisture will be documented for use by other project scientists as a component in plant stress or yield models. Computational model(s) for predicting soil moisture and crop water stress will also be documented.

Results of the comparative testing of root zone soil moisture models along with a sensitivity analysis of results to input data parameters will identify candidate models for root zone soil moisture predictions and a component for yield or plant stress estimation.

Documentation of the models and results will be made available to other AgRISTARS personnel.

Models or algorithms developed to estimate large area or large scale soil moisture will be very useful to yield model and plant stress predictions. Methods to extrapolate point data to large areas will also be useful for yield model development. Documented models or algorithms will be furnished YMD project management for development use.

Copies of the completed summary report on "Remote Sensing of Soil Moisture" will be delivered to YMD project management for researchers' use.

## 2.2 YIELD MODEL DEVELOPMENT PROJECT RESPONSIBILITIES

The Yield Model Development (YMD) Project will support the SM Project through yield model testing, evaluation, and selection of crop yield models. YMD will acquire historical meteorological and agronomic data for development, testing and evaluation of yield models. The project will identify areas of feasible research for model improvement. YMD may conduct such research as is necessary to modify existing models or request such research from other AgRISTARS projects to improve current assessment techniques or to develop new crop yield assessment methods. Specific requests for soil moisture estimation technique improvement will be directed to the SM project manager through the PMT. Data acquired through agronomic research will be made available to other AgRISTARS projects. Data acquired for development and testing of yield models

will be made available to other projects as the data base is established. Techniques developed in acquiring and estimating data from meteorological satellites will be made available as the techniques are developed. Data will be made available to other projects as requested. Requests will be cleared through the Program Support Staff to complete necessary administrative and fiscal arrangements.

#### 2.2.1 Crop Yield Model Test and Evaluation

Results of testing crop yield models will be available for other AgRISTARS projects. YMD will document results of model evaluations and performance tests. The models will be described in terms of their capabilities and limitations. Their capability for soil moisture estimation will be specifically identified for SM use.

Model deficiencies will be identified to guide research in both the YMD and SM projects.

Physiological/phenological yield models for corn, cotton, soybeans and wheat are being developed jointly by ESCS and SEA/AR crop scientists. Researchers at numerous sites are contributing to the development of these models. Research data sets and information is proprietary to the individual research scientist until publication. The information and data sets will be made available to other personnel in both YMD and SM as they are developed with the rights and responsibilities for publication remaining with each individual researcher. Physiological/phenological models documented and evaluated by YMD will be made available to SM as requested.

### **2.2.3 Data Acquisition, Processing, and Storage**

An inventory of historical meteorological data available in NOAA/EDIS will be provided to the AgRISTARS PMT in September 1980. Historical met data required by SM may be obtained from YMD through PMT. Additional daily and monthly historical met data by station, climatic region, APU, etc. will be compiled and maintained by YMD. Yearly agronomic statistics by crop, county, CRD, state, and county will be collected and maintained by YMD. These data will be in a hierarchical data base available to all AgRISTARS projects. An annual inventory of data in the data base will be provided to all projects through PMT. Current meteorological data sources for all AgRISTARS projects will be designated by joint agency management.

### **2.2.4 Yield Research Utilizing Satellite Data**

Techniques developed by NOAA/NESS/YMD for determining solar radiation incident at the surface and daily temperature extremes will be documented as they are tested and validated. These techniques and procedures will be furnished SM as they become available.

## **3.0 TASKS**

Tasks identified in this ICD are defined in the YMD and SM Project Implementation Plans (Part 5.2 and 5.3).

## **4.0 DATA AND PRODUCTS**

Products referred to in this ICD are identified and described in Part 4 of each task description of the Project Implementation Plans (Part 5.2 and 5.3). Data acquired to support individual AgRISTARS project needs are available to other projects as outlined in the AgRISTARS Data Management Plan (Part 5.4).

**5.0 REFERENCE DOCUMENTS**

**5.1 NASA, NOAA, USDA, USDI Memorandum of Understanding dated February 20, 1980.**

**5.2 Yield Model Development Project Implementation Plan**

**5.3 Soil Moisture Project Implementation Plan**

**5.4 Data Management Plan, AgRISTARS Program Management Team**