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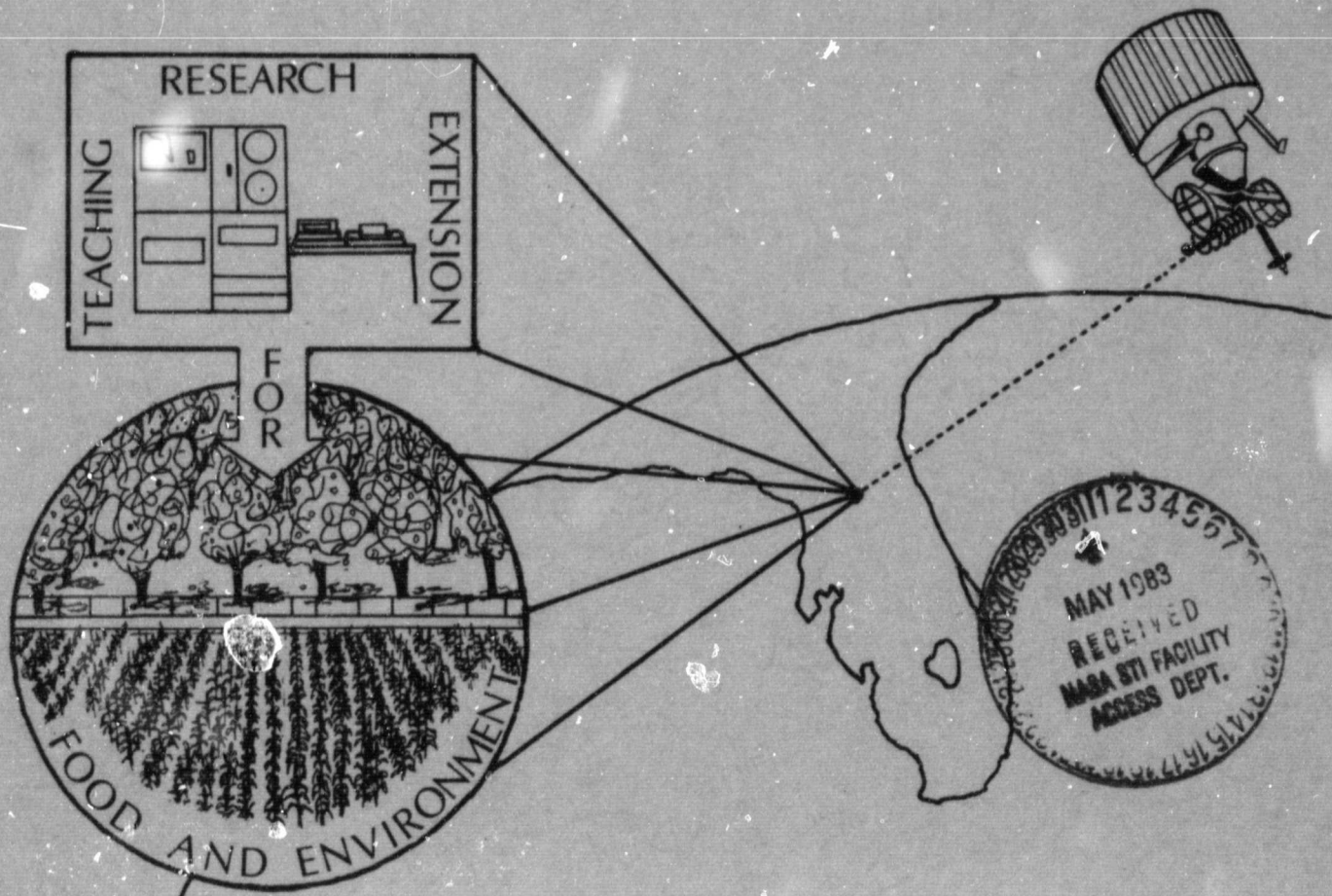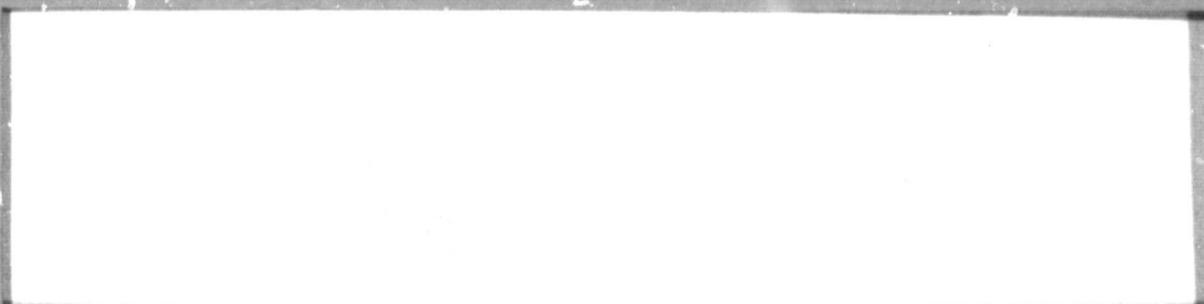
CR-166830

IFAS

E83-10369

INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES
UNIVERSITY OF FLORIDA

RESEARCH

TEACHING

EXTENSION

FOR

FOOD AND ENVIRONMENT

(E83-10369)   SATELLITE FREEZE FORECAST   N83-29779
SYSTEM Final Report (Florida Univ.) 39 p
HC A03/MF A01   CSCL 04B
                                                 Unclas
                                        G3/43 00369

REPORT BY TASK
FINAL REPORT
SATELLITE FREEZE FORECAST SYSTEM
PHASE VI

SUBMITTED TO

SI-PRO-33/WILLIAM R. HARRIS
CONTRACTING OFFICER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JOHN F. KENNEDY SPACE CENTER FLORIDA 32899

SUBMITTED BY

CLIMATOLOGY LABORATORY, FRUIT CROPS DEPARTMENT
INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES (IFAS)
2121 HS/PP, UNIVERSITY OF FLORIDA,
GAINESVILLE, FLORIDA 32611

PRINCIPAL INVESTIGATOR
J. DAVID MARTSOLF
PROFESSOR OF CLIMATOLOGY

CONTRACT NO. NAS10-9892
AMENDMENT NO. 3
DATE: APRIL 14, 1983

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Introduction

This is the second section of a two section final report under NASA Contract NAS10-9892, S/A 3, which is also accompanied by three system manuals. The first section of this report is entitled the Executive Report.

The initial statement of each task is the same as recorded in the Contract Statement of Work (SOW). Subsequent paragraphs closely follow the organization used in previous reports under this contract (see Table 1 of the Executive Report).

Task 1 - Provide back-up operations for remote monitoring and program troubleshooting of the Ruskin, Florida operations during cold nights.

a.   Back-up:

Maintenance of the operational system computer:

Software maintenance

There should be two maintenance contracts, a hardware contract and a software contract. Hewlett-Packard handles these two contracts independently, separate negotiations, separate team providing the services, often from separate locations (in this case Tampa for the hardware and Orlando for the software). As of December 1, 1982, NOAA/NWS has been paying for the hardware maintenance contract. Probably more inadvertently than intentionally, the software contract for the operational computer was not picked up by NOAA/NWS when the system was transferred from NASA to NOAA in December, 1982. NOAA/NWS has a contract under consideration but at the time this report was written the operational system was without a software contract. A penalty comes in the form of compatibility between the operational computer in Ruskin and the development system in Gainesville. The two systems must coordinate software updates or face the possibility that an update can produce an incompatibility. Sometimes these incompatibilities do not manifest themselves immediately and cause problems later when there is little time to isolate and correct them. The result is generally a rather random factor that is introduced in the overall performance of system. Consequently, the operational system must be brought back onto software maintenance before the development system can take advantage of updates arriving through its software contract.

On December 1, 1982, new hardware maintenance contracts came into effect for both the operational and the development systems.

Table 1.	Maintenance contracts and their approximate cost for the operational system at Ruskin.		
Contract	Minimum period	Cost	Penalty for lapse
Hardware	3 months	$559.75/mo.	intolerable
Software	6 months	$143.00/mo.	as noted

The Ruskin computer is a mature machine. There is a possibility that Hewlett-Packard will cease to offer maintenance agreements for the computer. A move in this direction was to have occurred in December of 1982, but pressure from customers and from maintenance teams caused the plan to be delayed indefinitely. But since HP administration favors this type of progress from old equipment toward newer models the question will come up again and probably soon. An investigation in late 1982 revealed that the Ruskin "M" could be upgraded to an "E" for approximately $18,500, which at the time seemed preferable to accepting the $9,000 upgrade that was announced as necessary to keep the "M's" power supply under maintenance. The required power supply upgrade has been delayed to 12/83. Incidently, the same mandate is on the development computer in Gainesville.

DS/1000-IV Linkage through 9600 Baud modems

The distributed system DS/1000-IV permits Florida sectors (thermal map data 220 X 122 or 26,840 pixels) to be transmitted from the development system disc to the operational system in less than one minute. This link facilitates troubleshooting by permitting the

programmers in Gainesville to interface with the system in much the same way they would if they were in Ruskin. It facilitates the use of the display screens as large chalk boards for the communication between the users in Ruskin and the programmers in Gainesville. Questions are written on the screen of the opposite system by running a program and typing the question on the terminal key board. The transmitted information remains on the screen of the terminal while the responses are displayed on the video screen.

Finally, the distributed system provides a link for the weather information that is acquired from AFOS to be communicated to the development system in Gainesville from where it is passed to the IFAS Computer System VAX.

b. Troubleshooting:

Troubleshooting has been greatly facilitated by the TEXM-TEXS program mentioned under DS/1000 above. The program permits the viewing of text typed on the terminal of the opposite system on the video display and in turn type responses to the opposite video screen. The result has permitted the users in Ruskin to ask for assistance in a way that the entire programming staff could aid in developing a response. Also the Gainesville programmers could initiate a conversation regarding messages left on the Ruskin systems console, etc., to determine the effect of a given programming change.

Two major problems developed in the Ruskin system that required extensive troubleshooting assistance from Gainesville.

1. A hardware failure in the Ruskin computer and disc system that ultimately led to a complete reconfiguration of the Ruskin system by Mr. Johnson. He described his efforts below:

November 29th, 1982, Ferris Johnson received a call from Fred Crosby of the National Weather Service office in Ruskin, Fla. indicating that they had been unable to re-boot (re-start from the master disc file) their system after several retrys. Mr. Johnson attempted to solve this problem via telephone and determined that there was a definitive hardware problem with the disc subsystem. Mr. Crosby filed a service request with the Hewlett-Packard division located in Tampa, Florida and Mr. Emmett Crenshaw of their office arrived the next day to service the HP computer system. Mr. Crenshaw determined that there had been a disc error possibly damaging the software residing on the disc and so indicated to Mr. Johnson in Gainesville.

Mr. Crenshaw spent several days isolating the problem and then indicated that the system was repaired, but he could not locate a back-up or reserve copy of the system on magnetic tape to replace the operating system on the disc that had been destroyed by the hardware failure. Mr. Crosby and members of his staff in Ruskin, also could not locate the back-up tape and after notifying Mr. Johnson in Gainesville of this problem, a new software configuration for the Ruskin System was begun. This configuration was written and run on the Gainesville HP system and finished on the 30th of November, 1982.

One of the immediate problems was that a configuration must be installed in an operating system, that is, one that can communicate with a computer operator. Since the Gainesville system is operating on the HP RTE-VI/VM system, there was not available a "Grandfather

System" for RTE-IVB, the operating system used at Ruskin. Mr. Johnson made arrangements with the HP software engineering department at Orlando, specifically a Mr. Pete Simmons, who arranged to have a tape copy made of the Master Grandfather files for RTE-IVB. Mr. Johnson then drove to Orlando on December 3rd. and picked up this tape on his way to Ruskin. Upon arriving in Ruskin on December 3, 1983, Mr. Johnson found that there was a problem with the magnetic tape drive in Ruskin which did not allow the HP tape to be read into the system. HP service in Tampa was again contacted and Mr. Crenshaw came out to Ruskin on the afternoon of December 3rd to bring the magnetic tape drive back on line. Once this was accomplished, it was possible to load the Master system into the computer. By this time it was late in the day and Mr. Johnson made plans to stay over until Saturday the 4th. On the morning of December 4th, 1983 the new configuration was installed into the Ruskin computer, and all files and programs were operating again by the evening of the 4th.

There were additional problems with the computer hardware in Ruskin involving the television display system. This service problem appeared on the 29th of December, 1982 and was extremely difficult to isolate, but this problem was handled by the Tampa HP office, requiring only consulting telephone calls to Mr. Johnson in Gainesville. Even though the TV display system was inoperative, the balance of the Ruskin system was operational. Repairs were completed January 14, 1983.

2. Power supply failure in the Vadic modem chassis led to the exchange of equipment with the Gainesville system to keep the Ruskin

system in service and able to interrogate the automated weather stations. This problem took some time to resolve and the Ruskin system's Vadic power supply is still in repair at the time of this report.

When the SFFS system in Ruskin failed to collect any data from the keystations the following possible reasons for failure were considered (not necessarily in order).

1. The program called AWS had a fault.

2. The phone number file had incorrect phone numbers for the keystations being dialed from the Ruskin location.

3. The cable connecting the HP-12966A interface with the Vadic 305 modem was not connected properly.

4. The cable connecting the HP-12589 interface with the Vadic 801 dialer was not connected properly.

5. The cable connecting the Tel CO supplied DAA was not connected properly with the Vadic 801 and 305.

6. The DAA was not operating properly.

7. The Vadic 305 was not operating properly.

8. The Vadic 801 was not operating properly.

9. The Vadic chassis or power supply was not operating correctly.

10. The out-going phone line was out of order.

Since the AWS program had run successfully at the Gainesville site it was not considered to be a problem. The phone number file '=PHONE' was checked to insure that it had the correct numbers for the keystations being dialed from the Ruskin location. The cables were then checked to insure that they were connected to the proper equipment. Since these measures did not resolve the problem the Vadic

chassis was removed from the computer rack and diagnostics were run on the equipment. It was noted that when AWS was run the indicator lights on the Vadic equipment did not respond correctly. A test program was written to enable Data Terminal Ready (DTR) on the Vadic to verify that there were no problems with the connection between the Vadic modem and the HP interface card. The test was successful, but revealed a problem. When DTR was enabled the phone circuit was placed off hook. It appeared at this point to be a problem with the Vadic modem or the TEL-CO DAA. Plans were then made to ship the Vadic modem, dialer and DAA, that are used at the Climatology laboratory for AWS backup purposes, to Ruskin. The equipment was boxed up and shipped via Trailways bus. The units were installed into the Vadic ore the unit failed to operate correctly. I called Mr. Dave Pokorney at the North East Regional Data Center who is in charge of maintaining the communications equipment at that installation and asked him for possible suggestions. He indicated that based on our tests at this point the chassis or power supply were the most likely candidates. Fred Crosby had scheduled a trip the following day to Ocala Florida, so it was arranged that he should bring the Vadic chassis and modem with him and meet Mr. Gene Hannah in Ocala. When the modem arrived all modules were removed except the Vadic 305 and the unit was then turned on. It immediately became apparent that there might be a problem with the power supply because of the frequency of the sound which was emitted from it. Because the vadic has a switching power supply, when turned on it makes a high frequency sound. The sound emitted by the unit from Ruskin was not the familiar sound of a functional unit. The

modem was then removed and placed into the chassis of the Vadic equipment utilized by the Climatology computer system and tested. The test on the modem were successful. The spare power supply was then removed from the Climatology equipment and placed into the Ruskin Vadic chassis. The unit was then connected in place of the Climatology Vadic system and tested. It operated properly through several tests including calling the keystations with good results. The unit was then taken back to Fred Crosby in Ocala by Dr. Martsolf. The next day it was installed back into the S.F.F.S. computer system in Ruskin and placed in service. The modem and dialer that had been shipped down to Ruskin was shipped back to Climatology and the defective power supply was sent back to the factory. At this time the spare power supply that was sent to Ruskin is still in service waiting for Vadic to complete rapairs on Ruskin's power supply.

During the time that the Ruskin modems were inoperative most of the diagnostics were preformed by Fred Crosby under the guidance of the Climatology crew in Gainesville utilizing the Hewlett Packard DS/1000-IV facilities and program TEXM.

Ruskin's phone lines have heavy traffic and this problem grows in its disruption of the system.

A one time occurrence involved a problem with the CRT terminal at Ruskin which was repaired under maintenance contract.

c. Digitized Radar: Experiments with the acquisition of Manually Digitized Radar (MDR) maps over the one-way Automated Field Operations System (AFOS) link have been successful. A composite of the results from several radars in Florida can be displayed in preliminary form

on the development system display. An effort is in progress to pass

this map to the APPLE and display it there.

> **Task 2 – Documentation:** Completion of necessary
> documentation, including hardware configuration
> definition, computer program documentation,
> and system operating manuals (to include any
> troubleshooting procedures). Ten (10) copies
> of the system manuals will be furnished to
> KSC at completion date of contract.

Three system manuals have been prepared as per instructions in

NAS10-9892, S/A #3, Contract, Page 3:

1. System Configuration Definition Manual,   14 pages.
2. System Software Documentation Manual,   65 pages.
3. System Operating/Troubleshooting Manual,   31 pages.

Mr. Ferris Johnson was the primary author of the Configuration Definition

Manual and supervised the development of the Operating/Troubleshooting

Manual in which he wrote two of the sections. Mr. Fred Stephens and

Mr. Robert Dillo.. each wrote two of the main sections of the

Operating/Troubleshooting Manual and these authorships are declared

in the Table of Contents. Mr. Fred Stephens was responsible for

compiling descriptions of the software documented in the System Software

Manual where the author of each of the 20 programs listed is clearly

indicated in each program documentation statement.

> **Task 3 – Data Product Dissemination:**
> Incorporation of necessary hardware, software,
> and procedural changes to enable system output
> products to be accessed by appropriate
> agricultural interests. This will include
> standard commercial and public television
> stations and the IFAS computer network, as
> well as customary NWS dissemination techniques.

Via Television

One television station, a commercial station in St. Petersburg,

FL, has accessed SFFS thermal maps by calling into the development

system in Gainesville. Mr. Jim Minard, Meteorologist with WTSP-TV, St. Petersburg, accessed SFFS maps 8 times during the 81-82 season (see Appendix 3, First Quarterly Report, SFFS VI, February 28, 1982). The 82-83 season was a much milder season and while Mr. Minard requested a similar experimental service as he had during the previous season there is no evidence that he attempted to acquire a Florida map more than one time, a trial time to verify that he had retained the capability of acquiring the maps. Several TV stations have made inquiries from time to time regarding acquisition of maps but few have followed up on plans that were discussed that would permit them free access to data.

Mr. Jan G. Rogers, Vice-President Satellite Production Services (associated with John H. Phipps Broadcasting Stations, Inc.) has visited the SFFS Development Lab for a demonstration and one of our programmers, Mr. Robert Dillon, has visited Mr. Rogers' facilities to aid in the programming of a microcomputer (IBM PC) for the purpose of experimentally acquiring SFFS maps in Tallahassee. Mr. Rogers' plan is to uplink appropriate SFFS products to a communications satellite on which his firm owns transponder time. Interested TV stations would downlink the information in the same manner that they currently downlink much of their air time. The electronics of the effort is much more straightforward than the marketing (funding). Mr. Rogers is skilled in marketing such products and if an opportunity exists to fund the effort Mr. Rogers intends to pursue that opportunity. Mr. Arthur Ward and Mr. Robert Morrison of the Division of Communiciations, Department of General Services, State of Florida, have cooperated in the feasibility study of this possibility since it has similarities to a proposal that is discussed in the next paragraph.

A proposal has been submitted to the National Telecommunications and Information Administration of the Department of Commerce by the State of Florida (Division of Communications and IFAS cooperating) entitled, "Innovative Users of Satellite Communications for Public Distribution of Agricultural Weather Information, Agricultural Education Information and Teleconferencing. This proposal involves up and downlinks of Weather data through GOES, interrogation of automated weather stations, and links between dissemination nodes by satellite. These are quite natural extensions of the work initiated in SFFS and the SFFS development system is to play a major role in the initial efforts under this grant. The grant has been reported to have received encouraging attention by reviewers and currently awaits budget decisions between OMB and DOC.

Via IFAS Computer Network

A policy decision by the IFAS Computer Committee regarding the dissemination of SFFS products through the IFAS Computer Network authorized a major change in the dissemination route (see Fig. 7 in the Executive Summary) of products from the SFFS development system to IFAS users. Essentially, the IFAS users are Cooperative Extension Specialists at the County Level. A list of the Counties and Extension Works currently actively involved in SFFS product acquisition is found in table 6 in the executive summary. Only one of these has been able to get its plan to disseminate SFFS products to growers implemented prior to the end of the frost season.

SFFS products are loaded in a queue in the VAX 11-750, the main node of the IFAS Computer Network, in a similar manner to that used by NOAA/NWS in Suitland in the provision of satellite maps from the

NOAA/NESS VISSR Data Base. The county extension workers who have APPLE II computers and one that has an APPLE III call the IFAS VAX instead of either the Gainesville or Ruskin HP. The VAX has more ports than the two SFFS HP´s collectively and thus the problem of how to handle the increasing number of users that required the SFFS products is moved outside SFFS and is grouped with the overall problem of handling the county extension traffic in general.

Mr. Boczkiewicz has made changes in the APPLE II software that permit the agents to get the maps in an automated fashion through the IFAS Computer Network. Modifications to the VAX accounts system to facilitate records of the interrogation of the SFFS products files has been delayed by a intermediate practice of having the SFFS users all sign onto the same account. This facilitated the delivery of the maps but made it impossible to tell except in a very broad fashion just who was using the products. Later modifications to the APPLE sign-on procedures have the agents coming into their accounts and then requesting the SFFS maps.

SFFS System Demonstrations

Several demonstrations of the development system were made this quarter. Also the microcomputer systems were demonstrated both in Gainesville when the development system was shown and several times at other meetings. These demonstrations are summarized in Table 2.

TABLE 2.	Demonstrations of the development system in Gainesville and of two of the microcomputer systems that display SFFS products. When a location is indicated other than Gainesville only the designated microcomputer system was demonstrated. At all others both were demonstrated.		
Date	System	Location	Description
1982 9 Dec	Dev'pment	G'ville	Dr. Bernie Dethier, NOAA National Climate Program Office, Washington, reviewed system development and discussed change in funding emphasis that provides opportunity for dissemination of climate information support.
14 Dec	Dev'pment (IBM PC featured)	G'ville	Mr. Robert Dillon brought his personal IBM/PC. He had modified the APPLE software to work on the IBM in a very similar manner. Mr. David Osterhalt and Mr. Jerry Hines of IBM viewed SFFS and discussed the possibilities of IBM funding some further software development for the IBM microcomputer known as the PC for Personal Computer.
17 Dec	Dev'pment (Antenna featured)	G'ville	Mr. Robert Morrison and Mr. Art Ward of State of Florida Depart. of General Services, Communications Div. brought Dr. Petrasko and Mr. Belkerdid of the Univ. of Central Florida Electrical Engineering & Computer Science Dept. regarding future satellite communication links.
1983 21 Jan	Dev'pment (Micros featured)	G'ville	Dr. James App, and Dr. John Gerber escorted Dr. William Blair of USDA Extension, Washington, DC to system for lengthy session regarding the dissemination of products through agricultural extension centers and the return of automatically acquired weather data from the counties.

TABLE 2. (Continued...)

Date	System	Location	Description
26 Jan	Dev´pment	G´ville	Dr. Samil brought his Sante Fe Community College class of 10 to to the lab. They showed great enthusiasm and asked more germane questions than most viewers of the development system.
1 - 3 Feb	Z-100	Wash. DC	Control Data Corp. Arranged for the loan of a Zenith Z-100 microcomputer from a firm in N. Baltimore. Dr. J. F. Gerber and the P.I. picked up the loaner and demonstrated it before participants in the Agriculture Research Institute´s Committee on Agricultural Meteorology. The top University and Industry representatives were present. The staffs of several congressmen were in attendance. Software has been developed for the Z-100 from the IBM PC software which in turn came from the APPLE software. The micro was displayed in a room next to the workshop room for a two-day period and numerous participants in the workshop had hands-on experience with the computer.
10 Feb	Dev´pment	G´ville	Two representatives of Control Data Corporation, Dr. Rafael E. Ubico Director of the Environmental Technology Center in Golden, CO and Mr. Richard A. Perry, a senior consultant in the same division of CDC viewed a demonstration with special interest in the interface with the antenna system.

TABLE 2. (Continued...)

Date	System	Location	Description
26 Feb	Dev'pment	G'ville	Approximately 100 fruit growers, department faculty, graduate and undergraduate citrus majors toured the system during the Fruit Crops Association Open House which puts the department on display. SFFS is one of the main attractions during this event.
8 Mar	Dev'pment	G'ville	Dr. J. L. App, Assistant Dean for Extension Programs brought Mr. Raiford Farrington and Mr. Mike Wagner of the Florida Farm Bureau to the lab to study SFFS operation.
23 Mar	APPLE/Z-100	Tallah.	Demonstration and paper presented to the NOAA National Climate Program Office sponsored workshop on Cooperative Climate Services. Copy of paper that will become part of the workshop proceedings is attached to the Executive Report as Appendix D. See Appendix A of the Executive Report for copy of handout to this meeting.
30 Mar	Dev'pment	G'ville	Dr. Robert Hambrick and Dr. S. Shih visited the Lab and witnessed a demonstration of the current state of acquisition and dissemination of weather information, especially the satellite and radar. Dr. Hambrick represents the South Florida Water Management Districk in the negotiation of a research grant with IFAS that Dr. Shih is coordinating.
1 Apr	Dev'pment	G'ville	Dr. Bartholic viewed a demonstration in some depth in relation to previous project direction and to current work at Michigan State University where he chairs a Department and directs several centers of environmental studies.

TABLE 2. (Continued...)

Date	System	Location	Description
6 Apr	Dev'pment	G'ville	Dr. B. J. Barfield, Ag. Engineering Dept., Univ. of Kentucky, viewed the system with an eye toward possibilities for the Kentucky fruit industry using a similar idea in their frost protection program.
9 Apr	APPLE/Z-100	G'ville	Mr. Paul Heinemann demonstrated both the APPLE and the Z-100 for President R. Q. Marston's Advisory Council (see Appendix C of the Executive Report).
14 Apr	Dev'pment	G'ville	Demonstration of SFFS status to Dr. James M. Dodge, Mr. U Reed Barnett, Mr. Richard Withrow, Mr. C. Dale Pope, of NASA and Mr. Fred Crosby, of NOAA/NWS in conjunction with a a SFFS commemorration ceremony. A demonstration of some of the products developed for FAST followed the SFFS demo.

Task 4 - Data Base Management: Hardware, software, and procedural modifications as necessary to enable system operators to store historical data of significant past freezes and retrieve it for reference as needed during operation. This also includes improved techniques for processing and manipulation of the large amount of Key Station and satellite data to facilitate real-time system operation.

The Winchester disk system (64M byte capacity) has been delivered and has been installed at the same time that the Gainesville system was upgraded from RTE IVB to RTE VI/VM. In fact the disk was

necessary to that upgrade and vise-versa. But the disk is also quite necessary to archival of satellite data. Relatively simple math results in a realization that it is virtually impossible to archive all the satellite data that is downlinked not to mention that such a task is the responsibility of NOAA and University of Wisconsin facilities. However, certain sequences of half-hour IR data are archived toward the documentation of Florida frosts and freezes and information that may be useful in the study of cloud and rainfall distribution. Archival consumes appreciable resources in terms of personnel time and magnetic tape so commitment to such a task in cooperation with other research at UF or at other Universities is rather carefully considered before it is undertaken.

> **Task 5 - Predictive Models:** Preliminary evaluation system performance during the 1980-81 season indicates areas where minor adjustments to the P-model may be possible to improve Key Station forecast accuracy and reliability. Further improvements in S-model coefficients will be investigated.

a. P-Model:

Mr. Paul Heinemann, graduate student working toward Ph.D. in the Climatology Lab, has modeling skills which he has applied to the P-model. 1. He has incorporated the ability to transfer dew point temperature information from AFOS into P-model and evaluated the effect that it has on the predictions (See Appendix). In summary, the effect of inputting the current dew point temperature observations from around the state (done by solving for the dew point temperature

gradient down the pennisula and picking off the appropriate value for each of the automated weather station sites) was disappointing. The dew point temperature puts a floor under the temperature forecasts and tends to keep them higher than if the dew points are defaulted to a low value. This is quite predictable from knowledge of how the model operates. It seems to work much better if the forecasters input their forecasts of what they expect the dew point to be at the time the minimum temperatures are expected to occur (usually this is sunrise). However, the requirement to input dew point temperature forecasts manually has not been crystalized with the forecasters.

Mr. Barnett of NASA/KSC has raised a question as to the meaning of the observation that the P-model seems to operate better with forecasted dew-point than with observed dew-point data from AFOS. Since the dew point temperature in a sense provides a floor below which the forecasted AWS temperatures are not permitted to go except in rather severe situations the observed dew points are often high enough to retard the cooling trend in the forecasts making the forecasts two high in some cases. If the forecaster recognizes that the advection of dry air onto the peninsula is likely to be quite effective during the freeze night his forecasts provide this insight to P-model when it has not other way of acquiring such information. It remains a matter for debate, as to the desirability of providing ways that man may interface with machine to increase the reliability of the machine's forecast. The philosophy of the SFFS developers

is to provide the mechanism and permit the user to exercise the option if possible.

The P-model has been relatively insensitive to the success of the interrogation of the automated weather stations since its conception to keep failure in that acquisition from stopping the system's prediction capability. An estimate was made back in 1979 when the AWS were automated that predictions were possible with as little as 90% of the AWS data acquired. Mr. Paul Heinemann analyzed AWS data acquisition records for the last two frost seasons and the results of these analyses are reported in Table 3.

In the 81-82 analysis of the AWS data acquisition success no attempt was made to differentiate between the data as to the system acquiring the data for two reasons. One was that the development system phone links permitted use of regular service lines in 81-82, i.e. non-Suncom lines which is a higher quality service. Secondly, the acquiring system is not indicated in the summary files of data for that year and this information must be retrieved manually from the rolls of system printer records, a very time consuming task. Also, less than 10 stations were operating due to failures of the Darcom units during the season. No attempt to repair these units by exchange or special trips was made by Mr. Hannah during the 81-82 season to develop some experience with how well the AWS could be expected to operate without repair support for the season. The result: approximately 70%. Recommendation: when possible replace Darcoms with microcomputers, upgrade AWS to year-around service by

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-------------------------------------------------------------------
Table 3.          AWS DATA AQUISITION SUCCESS
-------------------------------------------------------------------
 1982-1983

 DATE          START    FINISH     TOTAL     SUCCESS      %
               HOUR     HOUR       HOURS
-------------------------------------------------------------------


Interrogated by the development system
(From Gainesville via Suncom):


 JAN 14-15      23       12         14       60/140      43
 JAN 16-17      23       12         14       42/140      30
 JAN 18         00       12         13       40/130      31

          Average success rate Suncom:     142/410      35

Interrogated by operating system (from Ruskin):

 FEB 3-4        17       08         16       154/160     96
 FEB 9-10       20       06         10       85/100      85
 FEB 15         02       12         11       63/110      57
 FEB 15-16      23       11         13       113/130     87

          Average success rate, RUSKIN:    415/410      81


 1981-1982

 JAN 10         18       23         07       40/40  *    100
 JAN 11-12      18       07         14       111/112 *   99
 JAN 14-15      18       07         14       93/112  *   83
 JAN 16-17      18       07         14       109/112 *   97
 JAN 27-28      18       07         14       111/112 *   99
 JAN 28-29      18       00         06       45/48  *    94
 FEB 7-8        18       07         14       95/98  **   97
 FEB 8-9        18       07         14       96/98  **   98


          Average success rate, 81-82:     700/732      96
-------------------------------------------------------------------
      * 8 STATIONS OPERATING
     ** 7 STATIONS OPERATING
-------------------------------------------------------------------
```

hardening AWS to lightning, move AWS that cannot be upgraded easily

at present location to one where such computer facilities are more

likely to develop (there is nothing very sacred about the present

locations). The move from Arcadia to Bartow this past season is an

experiment with this recommendation. Both Bartow and Tavares are

likely to operate through the locally available APPLE this next year.

b. S-Model:

Attempts to remove the need for the automated weather stations and the P-model have not been fruitful. The S-model is quite dependent on the type of input that the P-model provides, i.e. an array of predicted temperatures for the remainder of the night. An attempt to extrapolate such an array for numerous areas of the pennisula revealed that the temperature data is not smooth with respect to time -- it jumps up and down. A possibility remains that has not been completely explored because the number of assumptions that have to be made is large, is to use the P-model to make predictions for several hundred locations using parameters derived from satellite data only.

An experiment was run to determine if the S-model could be run without the use of automated weather station data. A program was set up to read the satellite maps as they are accessed. The average temperature of nine pixels surrounding each automated weather station location was supplied to the P-model to represent the 1.5 m air temperatures. Since the P-model is set up to fill in data for missing values, no other parameter inputs were necessary. The predicted temperatures decreased at a smooth rate, so they could be used as S-model inputs. Table 4 shows examples of S-model predictions without automated weather station data. The model gave good predictions at the sites that had no cloud cover, but when there was clouds in the early hours, the cloud temperatures caused S-model to predict too low. In conclusion, S-model can be run without

automated weather station data, using satellite temperatures as input, for stations that have no cloud cover.

Table 4 lists the results of a statistical analysis of the differences between S-model temperature forecasts and observed map values. The temperature of nine pixels surrounding each automated weather station location were averaged for the predicted and observed maps, the difference was taken, and that difference (predicted minus observed) was averaged.

Table 4. Results of error analyses of two frost nights using S-model and a P-model modified to use satellite temperatures in place of temperatures from AWS.

DATE (1983)	3 HOUR PREDICTION	6 HOUR PREDICTION	9 HOUR PREDICTION
Jan. 15-16	1.5 ± 3.3 F	3.9 ± 4.4 F	5.7 ± 4.8 F
Feb. 9	-0.1 ± 2.8 F	0.5 ± 2.0 F	-2.3 ± 5.3 F

Task 6 - Key Stations: Investigate improvements in Key Station concept including configuration update and the feasibility of modifying SFFS concept to eliminate the need for Key Stations.

A. Installation

The remaining 6 automated weather stations were installed by Mr. Eugene Hannah between the dates of November 29 and December 1, 1982. Mr. Hannah has supplied information with which Table 5 has been developed.

B. Progress Toward Operational Status

The current disposition of the AWS has been discussed earlier in the report under status of the AWS. In summary, the AWS are to

be retrieved and re-installed in the Fall by the local cooperators
to conserve funds. Repairs are to be made through an exchange of
information about the malfunction by phone and through an exchange
of parts by mail or with an extension specialist who is found to be
going by the location as a part of other duties and responsibilities.
In other words, the AWS are in a survival mode.

Some discussion of the recommendations regarding modification
of the AWS network for the future occurs under Task 5a, P-model.

TABLE 5

LOCATIONS OF KEY STATION TOWERS

NAME & LOCATION	TOWER SITUATION
TLH Tallahassee Airport National Weather Service	On a grassy strip behind Airport Fire Department and 100 yards northwest of control tower and NWS building.
JAX Jacksonville Airport National Weather Service	On northside behind NWS Building and 300 yards Southwest of the control tower.
GNV Gainesville: Univ. of Fla. Horticultural Unit Data Acquisition Lab off county road 232.	100 yards northeast of lab.
TAV Tavares Lake Extension Office: state road 19.	50 yards north of office.
TBA Ruskin: Main Office of National Weather Service	100 yards east of office.
BOW Bartow: Polk County Extension Office, 1702 Highway 17-98 S.	100 yards south of office.
PBI Palm Beach International Airport NWS	30 yards east of office.
BLG Belle Glade: State Road 80 at Univ. of Fla. Agricultural Research and Education Center	1 mile south of office of research center.
IMK Immokalee: State Road 29 at Univ. of Fla. Agricultural Research Center	200 yards southeast of the main office.
HST Homestead: Off State Road 27 at Univ. of Fla. Agricultural Research and Education Center, 18905 SW 280 Street	due north of administration building 150 yards in the weather station.

Task 7 - Digital Data Acquisition: Investigate
techniques to improve timeliness and
reliability of techniques for acquiring
satellite digital data, including incorporation
of a direct satellite communications system.

Appendix 1 of the First Quarterly Report (SFFS VI, Feb. 28,
1982) is a 20 page description of the Antenna System. The Second
Quarterly Report (SFFS VI, May 31, 1982) contains a description of
the system's development on pages 36 through 44 and in Appendix 3
of that report (16 pages by Michael P. Baker). The same author
updated that Appendix with E-1 through E-10 of the August 31, 1982
Report and with Appendix E of the November 30, 1982 report. He
supplied the following statement in regard to the current status of
the antenna system:

The EMR 822 Frame-Sync/Sectorizer still exibits occasional
minor data stoppages of an intermittent nature. The problem appears
to be temperature related. Difficulties have occurred in bringing
the unit back on line following a power outage. At this point, no
solution short of returning the unit to the factory for service has
been discovered. In spite of the continuing occurrences of small
"bugs" which visit the down-link antenna system hardware, its service
record is admirable: 98.33% on line. At this point, not a single
outage has occurred during a critical period.

On two occasions, troubleshooting the antenna system has been
greatly facilitated by the presence and use of a facsimile recorder
loaned to the development lab by the operational team in Ruskin for
this purpose and another of mutual interest, i.e. the downlink of

WEFAX. Information regarding the scheduling of format changes in the stretch VISSR from GOES comes down through WEFAX. Experiments are under way to acquire the WEFAX through the antenna system in Gainesville in addition to the GOES IR or VIS and display this information via the facsimile recorder.

The following is an update of the procurement of equipment for the antenna system:

GOES DOWNLINK SYSTEM STATUS

List of backup equipment selected for purchase:

1. GaAsFET LNA, Type SCF-169-40B28. Sci-Com Inc.
   (1,7 Ghz. CF, 1.5dB. NF, 40dB. min. G.)

   STATUS--Received. Stand-by replacement.

2. Phase-Lock Multiplier assy., Type MO-111XB-11
   Frequency Sources, Inc. 28V, Low noise, Low
   FM residual, Co-axial cavity resonator.

   STATUS--Received. Standby replacement.

3. Microwave Oscillator Assy, Type MO-11F-xx.
   1.68 Ghz. CF, +20 dBm. Frequency Sources, Inc.

   STATUS--Received. Standby.

4. Low Noise I.F. Bandpass Amplifier, 30 dB. min. gain,
   5 Mhz. BW. 1.5 dB. NF max. Trontech Inc.

   STATUS--Received. Stand-by replacement.

5. Amplifier, Bandpass, Low Noise Telemetry. Type 3157.
   30 dB. min. gain. 1 dB. gain flatness. Dexter
   Microwave Inc.

   STATUS--Received. In service.

6. Polarizer & Mount Assy. Ins. Loss .15 dB. max. 1.7 Ghz.
   CF. S-Band feed with mount for S.A. Feed-horn.

   STATUS--Received. In service.

7. Mixer, Microwave, 1.691 Ghz. CF. Low Noise Model
   MPA-8796 Western Microwave Inc.

   STATUS--Received. Proformance problem in resolution.

It might be added as a point of explanation that the procurement
of redundant equipment to make the antenna system more reliable was
delayed to obtain as much experience with the antenna as possible.
Toward this end the antenna has been purposely kept in continuous
operation since installation in November of 1981.

APPENDIX

Addition of Dewpoint Temperature Data

to P-Model

This report describes the inclusion of dew point temperatures into the P-model. It outlines two methods used to incorporate the dew point temperatures into the model and the effects of each method on the P-model predictions.

The change in air temperature with time (dT/dt) decreases as the dew point temperature is approached during radiative frost conditions. This is due to the addition of heat from the condensation of water vapor near the surface. The P-model program incorporates and computes this principle in the subroutine MODLX. However, because of the absence of dew point sensors at each key station, the dewpoint temperature has been initialized to 0 F within the program. This can result in predicted key station temperature falling below actual dewpoint temperature.

A subroutine, DEWFX, has been added to the P-model (version PMODH) to provide the dew point temperature for each key station. The dew point temperature was inputted into DEWFX by two methods to determine which method would

improve predictions.

In the first method, air temperature and relative humidity (RH) are supplied hourly through AFOS data. The dew point temperature is calculated for each available station by the use of the simple empirical relationship,

$$T_d = T_a - 35(\log_{10}(RH/100)).$$

If the relative humidity and/or air temperature is not available for a certain key station during a particular hour, the subroutine DEWFX sets up a linear temperature gradient to fill in the missing dew point temperatures. This gradient is calculated by using data from selected stations in the following relationship:

$$T_d)_y = \nabla T_d)_y \simeq \frac{\Delta T_d}{\Delta y} \quad ,$$

$$= \left(\frac{T_{d10} - T_{d1}}{y_{10} - y_1} + \frac{T_{d5} - T_{d1}}{y_5 - y_1} + \frac{T_{d4} - T_{d1}}{y_4 - y_1} \right)/3 \quad ,$$

where T_{d10} = dew point temperature for Miami,

T_{d5} = dew point temperature for Ruskin,

T_{d4} = dew point temperature for Orlando,

T_{d1} = dew point temperature for Tallahassee,

Y_s = latitudinal distance of each station from Tallahassee.

Dew point values are linearly interpolated by multiplying the gradient times the latitudinal distance from the northernmost station (Jacksonville or Tallahassee):

$$T_{ds} = \Delta T_d)_y \times (Y_s - Y_1) + T_{d1} .$$

DEWFX is programmed to screen missing data. For example, if data are missing from Tallahassee, Jacksonville is substituted as station number 1. The gradient is calculated from the data of three stations instead of four if any one station is missing.

In the second method, lowest predicted dew point temperatures are inputted into DEWFX before the frost episode begins. The same dewpoint values are accessed for each station every hour.

The variable from DEWFX containing the dewpoint temperature is reassigned to the variable DATA(8,J) where J is the keystation number. This change occurs in the subroutine DAFIX, which is the program that checks key station data integrity.

RESULTS

The first method was run on one frost night, February 3, 1983. As shown in Table 1, using the dew point temperatures as they came in caused PMODH to predict

minimum temperatures with considerably less accuracy than observed values. PMODH improved predictions over PMOD3 in two out of 71 cases, while predicting less accurately than PMOD3 in 21 out of 71 cases.

An analysis run was made using the second method on data from the nights of January 12, 1981 and January 16, 1983 (KEY STATION Files K81012 and K83016). Dew point temperatures were included in the analysis and the results were compared to PMOD3 runs (dew point set at 0 C) for predictions of 3 to 10 hours in advance.

The results show that addition of the forecasted dew point temperatures improved results. For the nights of January 12, 1981 and January 16, 1983, PMODH improved the predictions over PMOD3 in 16 out of 160 cases, and worsened the predictions over PMOD3 in 2 out of 160 cases (Table 2).

CONCLUSIONS

PMODH tended to predict better than PMOD3 when good predicted dew point temperatures were incorporated into the model. This addition prevented P-model from predicting too low temperature values. For the cases when the actual air temperature comes close to the dew point, the lowest predicted value would be close to the observed value. However, The actual observed air temperature does not always drop to the dew point temperature. The hourly AFOS dew

point temperatures caused PMODH to predict too high because the dew point temperatures were too high, especially in the early hours. A possible solution to this is the addition of some kind of correction factor. The major drawback of using predicted dew point temperatures is that the values have to be manually inputted before PMODH is scheduled to begin operation.

Table 1.   Summary of results comparing performance of PMOD3
           and PMODH using inputted AFOS hourly dew point
           temperatures (PMOD3 sets dew point temperature
           to 0 F).

February 3, 1983

Predictive Base Hour	# Cases PMODH decreased accuracy	No Change	# Cases PMODH increased accuracy
3	3	4	1
4	6	3	0
5	2	7	0
6	2	7	0
7	2	7	0
8	2	6	1
9	2	7	0
10	2	7	0
Totals:	21	48	2

Table 2. Comparison of performance between PMODH and PMOD3
          using lowest predicted dew point temperature.
          (PMOD3 sets dew point to 0 F).

Night	#cases PMODH decreased accuracy	#cases no change	#cases PMODH improved accuracy
1/12/82	0	77	3
1/16/83	2	65	13
Totals	2	142	16