



United States Climate Reference Network (USCRN)

Commissioning Plan

June 2003



Prepared by:

**U.S. Department of Commerce
National Oceanic and Atmospheric Administration (NOAA)
National Environmental Satellite, Data, and Information Service (NESDIS)**

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Preface

This document comprises the National Oceanic and Atmospheric Administration (NOAA)/ National Environmental Satellite, Data, and Information Service (NESDIS) initial baseline publication of the *United States Climate Reference Network (USCRN) Commissioning Plan* (version DCN 0, June 27, 2003, publication). The document number is NOAA-CRN/OSD-2003-0008R0UD0.

This document presents the commissioning plan for the United States Climate Reference Network (USCRN). Commissioning of the USCRN is defined as the decision point at which data collected at field sites and archived at the NOAA/NESDIS National Climatic Data Center (NCDC) can be used in an official capacity to monitor climate variability and change. The USCRN commissioning process consists of the following three activities:

- Successful completion of the Demonstration Phase Evaluation
- Commissioning each field site as it is installed and successfully transmits quality data to the USCRN archives
- Verifying the successful receipt and subsequent archival of high-quality hourly data from each field site at the Central Facility 95% of the time and/or successful entry of the data into the USCRN archives within 30 days of the observation time 97% of the time

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Future updates and revisions to this document will be produced and controlled by NOAA/NESDIS.

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Acronyms and Abbreviations

ATDD	Atmospheric Turbulence and Diffusion Division
ATS	Anomaly Tracking System
bps	bits per second
CCB	Configuration Control Board
CCR	configuration change request
CI	configuration item
CM	configuration management
CMO	Configuration Management Office
CN	change notices
CRN	United States Climate Reference Network
CSC	Computer Sciences Corporation
DCN	Document Change Notice
DCO	document change order
DCP	Data Collection Platform
DCS	Data Collection System
DOC	Department of Commerce
DocCCR	Document Configuration Change Request
FRD	Functional Requirements Document
FY	fiscal year
GCOS	Global Climate Observing System
GOES	Geostationary Operational Environmental Satellite
GPS	Global Positioning System
HDR	high data rate
ID	identifier
IMLS	integrated maintenance and logistics support
MTBF	mean time between failures
MTTR	mean time to repair
NCDC	National Climatic Data Center
NESDIS	National Environmental Satellite, Data, and Information Service

NIST	National Institute of Science and Technology
NOAA	National Oceanic and Atmospheric Administration
OSD	Office of Systems Development
PM	preventive maintenance
RCC	Regional Climate Center
S&A	Short and Associates, Inc.
SLA	Site License Agreement
US or U.S.	United States
USCRN	United States Climate Reference Network
VDR	Version Description Record
WCDAS	Wallops Command and Data Acquisition Station
WMO	World Meteorological Organization

References

1. National Oceanic and Atmospheric Administration (NOAA)/National Environmental Satellite, Data, and Information Service (NESDIS) Atmospheric Turbulence and Diffusion Division (ATDD), Brent French, *Complete Guide to Installing a USCRN Station*, September 25, 2002
2. NOAA/NESDIS, *CRN Demonstration Phase Evaluation Plan*, NOAA-CRN/OSD-2002-0003R0UD0, DCN 0, December 2002
3. NOAA/NESDIS, *CRN Demonstration Phase Evaluation Report* (in preparation; to be published in July 2003)
4. NOAA/NESDIS, *CRN Test and Evaluation Master Plan*, NOAA-CRN/OSD-2003-0006R0UD0, DCN 0, January 2003

Section 1. Introduction

The National Oceanic and Atmospheric Administration (NOAA)/National Environmental Satellite, Data, and Information Service (NESDIS) National Climatic Data Center (NCDC) is deploying and implementing the United States Climate Reference Network (USCRN), which is scheduled for completion later this decade. The USCRN is a network of climate observing stations. It is part of an initiative to provide and maintain long-term (50–100 year) high-quality observations of temperature and precipitation to meet the stringent data quality and continuity requirements of the climate science community.

The USCRN will also provide the nation with a ground-based reference network that meets the requirements of the Global Climate Observing System (GCOS). During the initial phases of the program [fiscal years 2001–2003 (FY01–03)], a number of instrument suites are being deployed in various climate regimes to test and evaluate the initial USCRN configuration and to test the network communications capabilities, quality control measures, and archival capabilities. When fully implemented, a much larger network consisting of approximately 300 sites will be strategically located nationwide to capture the representative climate regions of the United States.

The USCRN will provide the following unique features:

- Accurate data extending over 50–100 years
- Management planning and support based on longevity, continuity, and quality maintenance procedures
- Accuracy based on irrefutable standards (periodic calibration checks conforming to the National Institute of Science and Technology (NIST) standards)
- Siting and measurement standards that are defined, documented, and maintained
- Overlapping instrument upgrades in accordance with technological advances
- Rigorous maintenance and periodic instrument recalibration/replacement
- Extensive documentation and maintenance of metadata containing the site environment, including digital pictures and satellite images

1.1 Document Organization

Section 1.2 gives an overview of the USCRN commissioning, Section 1.3 outlines the assumptions, and Section 1.4 lists applicable documents (see also the Reference List given on page ix).

Section 2 presents the precommissioning evaluation criteria, and Section 3 discusses the USCRN commissioning authorities and responsibilities.

Appendix A gives the USCRN Demonstration Phase Evaluation Criteria, Metrics, and Reports; and Appendix B provides the USCRN Site Acceptance Test Plan.

1.2 Overview of Commissioning

Commissioning the USCRN is defined as the decision point at which data collected at field sites and archived at NCDC can be used in an official capacity to monitor climate variability and change. The USCRN commissioning process consists of the following three activities:

- (1) Successful completion of the Demonstration Phase Evaluation, conducted from January 1 through June 30, 2003. If evaluation criteria are successfully satisfied, the USCRN Demonstration Phase Evaluation Report will document the test results and provide verification of a stable and sustainable USCRN network. Appendix A documents evaluation subjects and criteria for evaluation.
- (2) Commissioning each field site as it is installed and successfully transmits quality data to the USCRN archives. Completion of a formal Site Acceptance Test is required. (Site Acceptance Test criteria are documented in Appendix B.)
- (3) The final commissioning decision point verifies the successful receipt and subsequent archival of high-quality hourly data from each field site at the Central Facility 95% of the time and/or successful entry of the data into the USCRN archives within 30 days of the observation time 97% of the time.

The USCRN commissioning authorities and responsibilities are defined in Section 3. Responsible parties are required to document the successful completion of site installation, formal site acceptance testing, central processing, documentation, and configuration management by completing the USCRN Site Acceptance Test Checklist and the USCRN Site Component Commissioning Recommendation/Approval Form given in Section 3 (Tables 1 and 2, respectively).

1.3 Assumptions

This plan assumes a knowledge of USCRN requirements, management responsibilities, and system configuration. The plan follows NOAA's *System Commissioning Policies and Procedures*.

Further governing assumptions are the following:

- Planned upgrades such as new hardware or adjunct equipment, do not require "recommissioning" of the components;
- USCRN hardware and software replacements do not require recommissioning of a retrofitted or recalibrated site.
- Site-specific configuration details for USCRN site or central processing equipment is maintained in the configuration management (CM) database by the NOAA/NESDIS Office of Systems Development (OSD) and at the NCDC.
- Long-term funding for continuing development, deployment, operation, and maintenance will be available.

1.4 Applicable Documents

The following Climate Reference Network (CRN) documents are referenced as contributing to the overall commissioning documentation:

- *Complete Guide to Installing a USCRN Station* (Reference 1)
- *CRN Demonstration Phase Evaluation Plan* (Reference 2)
- *CRN Demonstration Phase Evaluation Report* (Reference 3)
- *CRN Test and Evaluation Master Plan* (Reference 4)

Section 2. Precommissioning Evaluation Criteria

The 10 items listed below are the principal USCRN precommissioning activities, i.e., the determinants in the decision by the Director of the NCDC to commission the USCRN sites. These precommissioning criteria were initially evaluated during the USCRN Demonstration Evaluation conducted between January 1 and June 30, 2003.

The 10 precommissioning evaluation criteria are as follows:

1. The accuracy of USCRN temperature and precipitation sensors is verified.
2. The USCRN communications system reliably transmits data to the NCDC's ingest and processing center in Asheville, North Carolina.
3. The NCDC's ingest and processing activities provide verification of the accuracy and completeness of USCRN observations.
4. Achievement of USCRN product availability requirements, i.e., 95% of the hourly temperature and precipitation reports are received and processed into the USCRN archives within 1 hour and 97% within 30 days.
5. Demonstration of the USCRN archives access system to reliably acquire and store data for retention and access by the climate community.
6. Verification that site selection criteria are followed such that program requirements to reduce variance in the climate record are met.
7. Scientifically and technically acceptable USCRN site metadata are included in archives for access by the climate community.
8. USCRN technical documentation is correct and is standardized under configuration management.
9. An integrated maintenance and logistics system is in place to support sustained operations.
10. Expanded data acquisition, communications, and support functions are addressed as viable at the planned system-wide levels.

Detailed information describing the precommissioning activities is given in the USCRN Demonstration Phase Evaluation Plan (Reference 2) and in Appendix A (Demonstration Phase Evaluation Criteria, Metrics, and Reports) of this *USCRN Commissioning Plan*.

Section 3. USCRN Commissioning Authorities and Responsibilities

The authorities and responsibilities for the initiation of the USCRN commissioning process are as follows:

Director NCDC

- Approves recommendation to commission USCRN sites when precommissioning activities are completed and commissioning forms are submitted and verified. (Precommissioning activities are listed in Appendices A and B.)
- Decides the resolution of national issues not resolved by the USCRN Configuration Control Board (CCB).

USCRN Program Manager

- Makes the recommendation to the NCDC Director to commission USCRN sites when precommissioning activities are complete.
- Coordinates target commissioning dates for each USCRN site.
- Works with Atmospheric Turbulence and Diffusion Division (ATDD) representatives to resolve precommissioning issues.

USCRN Installation Manager

- Responsible for the delivery and installation of all USCRN hardware and software.
- Conducts the site acceptance testing. [see Appendix B (Site Acceptance Test Plan)]
- Initiates actions as required to correct deficiencies uncovered during acceptance testing and activation of the site equipment.
- Makes the recommendation to the USCRN Program Manager to commissioning sites

Responsible parties are required to document the successful completion of site installation, formal site acceptance testing, central processing, documentation, and configuration management by completing the forms given on the following pages (Figure 1 – USCRN Site Acceptance Test Checklist; and Figure 2 – USCRN Site Component Commissioning Recommendation/Approval Form).

Figure 1. USCRN Site Acceptance Test Checklist (1 of 2)

USCRN Site Acceptance Test Checklist	
1. USCRN Site Name/Site ID: Short Name: _____ State: _____ Long Name: _____ Alias: _____ GOES/DCS - ID _____ WBAN Number: _____ Latitude _____ Longitude _____ Elevation _____	
2. USCRN Site Host (Organization, contact name, mailing address city, state, ZIP, telephone) Organization: _____ Contact Name: _____ Mailing Address: _____ City: _____ State _____ ZIP _____ Telephone: _____	
3. Certify site preparation complete <i>Attach: Completed USCRN Site Install Issues form</i> Comments/Issues: _____	Initials _____ Date _____
4. Certify "as built" documentation is complete <i>Attach "As-built" drawing</i> Comments/Issues: _____	Initials _____ Date _____
5. Certify site metadata is complete <i>Attach: completed Site Information & Instrument Coefficient History Record form</i> <i>completed CRN Station Database - Station History form</i> Comments/Issues: _____	Initials _____ Date _____
6. Certify site metadata is placed under CM <i>Enter into CRNSITES</i> Comments/Issues: _____	Initials _____ Date _____
7. Certify NEPA documentation is complete <i>Attach Completed NOAA Environmental Checklist</i> Comments/Issues: _____	Initials _____ Date _____
8. Certify site equipment is installed in compliance with USCRN Site Installation Guide <i>Attach: USCRN Site Install Checklist</i> <i>USCRN Site Install Component Checklist</i> Comments/Issues: _____	Initials _____ Date _____

Figure 1. USCRN Site Acceptance Test Checklist (2 of 2)

USCRN Site Acceptance Test Checklist (Page 2)	
9. Certify temperature and precipitation sensors are calibrated in compliance with USCRN Calibration Procedures <i>Attach: PRT (3) calibration sheets</i> <i>GEONOR field calibration sheet</i> <i>Wind speed sensor calibration sheet</i> <i>Solar Radiation sensor calibration sheet</i> <i>Surface IR sensor calibration sheet</i> <i>(Calibration sheets for any other sensors installed)</i> Comments/Issues: _____	Initials _____ Date _____
10. Certify GOES DCS comms interface is properly activated <i>Attach GOES DCS activation worksheet</i> Comments/Issues: _____	Initials _____ Date _____
11. Certify metadata provided to host Comments/Issues: _____	Initials _____ Date _____
12. Certify Site Technical Support Guide provided to host Comments/Issues: _____	Initials _____ Date _____
13. Certify host trained to provide support Comments/Issues: _____	Initials _____ Date _____
14. Certify "as-built" documentation is placed under CM <i>Following documentation sent to NCDC to be included on Station History CD:</i> _____ <i>USCRN Site Install Issues form</i> _____ <i>"as-built" site drawing</i> _____ <i>Site Information & Instrument Coefficient History Record</i> _____ <i>CRN Station Database- Station History form</i> _____ <i>NOAA Environmental Checklist</i> _____ <i>USCRN Site Install Checklist</i> _____ <i>USCRN Site Install Component Checklist</i> _____ <i>Calibration sheets for all installed sensors</i> Comments/Issues: _____	Initials _____ Date _____
15. Test Manager Name: _____ Test Manager Signature _____ Date _____	

Additional Comments: _____

Figure 2. USCRN Site Component Commissioning Recommendation/Approval Form

USCRN Site Component Commissioning Recommendation/Approval Form	
1. USCRN Site Name	
2. USCRN Site ID (DCS-ID)	
3. Host Name (Agency, Mailing Address, City, State, ZIP Code)	
5. Start of Evaluation (Date) _____ Completion of Evaluation (Date)_____	
6. Atmospheric Turbulence and Diffusion Division – Recommendation for Commissioning	
I the undersigned, recommend this USCRN site be commissioned for official use by the National Climate Data Center.	
Evaluation Official Name : _____	
Evaluation Official Signature:_____ Date:_____	
7. USCRN Program Manager - Recommendation for Commissioning	
I the undersigned as USCRN Program Manager (NCDC), recommend the commissioning of this site.	
Program manager Name:_____	
Program Manager Signature:_____ Date:_____	
8. National Climate Data Center - Recommendation for Commissioning	
As Director of the National Climate Data Center, I approve the commissioning of the site.	
NCDC Director Name:_____	
NCDC Director Signature:_____ Date:_____	

Appendix A. USCRN Demonstration Phase Evaluation Criteria, Metrics, and Reports

Introduction: The *CRN Demonstration Phase Evaluation Plan* (Reference 2) defines the context, scope, schedule, and purpose of the evaluation; identifies specific evaluation areas; and designates associated responsibilities. This document describes the way in the results of the Demonstration Evaluation are to be derived and structured for presentation to the Test Review Board.

Content: The *CRN Demonstration Phase Evaluation Plan* identifies seven evaluation areas, each with distinct evaluation topics. This appendix establishes evaluation criteria for each topic, identifies the metrics to be collected, and characterizes the reports to be presented to the Test Review Board.

Evaluation Areas: Table 1 presents the seven evaluation areas and evaluation teams that are identified in the *CRN Demonstration Phase Evaluation Plan*. Details on each evaluation area are given in Sections A.1 through A.7 (as noted in the Section column in Table 1).

Table 1. USCRN Evaluation Areas/Teams

Evaluation Area	Section	Team Lead	Members
USCRN Field Equipment	A.1	Jim Bradley	Bruce Baker, Tilden Myers, Mark Hall, Doug Gifford, Richard Lewis, Nolan Miller
Central Facility Equipment	A.2	Debra Braun	Jim Bradley, Ed Hiner, Grant Goodge, Ed May, Bruce Baker
Documentation and Configuration Management	A.3	Debra Braun	Tilden Meyers, Dave Easterling, Liz Smith, Wayne Taylor
Site Selection	A.4	Mike Helfert	Ed May, Mike Changery, Dave Easterling, RCCs, Hal Bogin, Bruce Baker
Site Installation	A.5	Tilden Meyers	Mark Hall, John Hughes, Grant Goodge, Nolan Miller, Mike Young, Ed May
Communications	A.6	Ed Hiner	Debra Braun, Mark Hall, Nolan Miller
Field Maintenance	A.7	Ed Hiner	John Hughes, Tilden Meyers, Nolan Miller, Mike Young, Dick Reynolds, Bruce Baker

A.1 Demonstration Evaluation Area: USCRN Field Equipment [Sensors, Data Loggers, and Site Communications Equipment]

Team Leader: Jim Bradley

Team Members: Bruce Baker, Tilden Meyers, Mark Hall, Doug Gifford, Richard Lewis,
 Nolan Miller

Evaluation Topics, Criteria, and Reports – Sensors:

Topic #1. Verify that individual sensors meet FRD* requirements. For the USCRN demonstration phase, the primary sensors required for the climate record are air temperature and precipitation quantity. Supporting measurement parameters are wind speed, solar radiation, and ground surface temperature.	
Criteria	Metric Collection Strategy
1. <i>Sensor Calibration.</i> The output of each sensor must be traceable to a known standard. Also, each sensor's output is typically converted to engineering units by a transfer algorithm; e.g., resistance to temperature, weight to precipitation amount in millimeters. Such algorithms must be validated	Examine test results of individual sensors resulting from calibration against standards in a predictable environment; e.g., field tests. The transfer algorithm can be validated by manual calculations. The data logger output can be compared against the algorithm for proper reporting of the sensor measured parameter value. Assuming this work has been done for the initial implementation of USCRN, the test team should be able to review the existing test methodologies and test results for each sensor. Otherwise, tests will have to be developed to accomplish this.
2. <i>Sensor Time Constant.</i> Sensors must be designed to respond in a timely manner to a step change in the actual value of the measurands.	If such tests have been completed for the existing implementation of USCRN, the test team can review the results. Otherwise, tests would have to be developed and executed.
3. <i>Sensor Housing.</i> Sensor housings must prevent measurement inaccuracies due to secondary effects, and not interfere with the sensor's parameter measurement. For example, temperature measurements must not be affected by solar radiation or precipitation, and precipitation measurements must not be unacceptably affected by winds. Sensor housings must not capture dirt or other foreign material to the extent that it affects the sensor readings.	Field tests need to be devised for selected installation locations to assess possible impacts due to sensor housings. Data collection may involve a manual process requiring site visits coupled with close examination of the data at NCDC.
4. <i>Sensor Environmental Requirements.</i> Sensors must be designed to operate under specified environmental conditions. These conditions are specified in the FRD.	If environmental tests have been conducted to validate sensor operation under specified environmental conditions, the test team can review these test results. If adequate testing has not been conducted, tests should be designed and executed.

* FRD = Functional Requirements Document

Topic #2. Verify that data logger FRD requirements are satisfied and remain functional for 6 months. The criteria to be evaluated are the Field Site Processing Requirements specified in FRD paragraphs 3.3.2 to 3.3.9, and the Availability requirement specified in paragraph 6.1.1.

A test environment with most of a USCRN field system should suffice to validate most of the requirements. However, some field tests are required for several of the criteria. The following matches data logger specifications with metric collection strategy.

Criteria (or FRD Requirement)	Metric Collection Strategy
Local Programming Capability (3.3.2)	<ul style="list-style-type: none"> • Review design and implementation • Verify in a test environment
Automatic Recovery (3.3.3)	<ul style="list-style-type: none"> • Review design and implementation • Verify in a test environment • Monitor field site operation
Site Monitoring (3.3.4)	<ul style="list-style-type: none"> • Review design and implementation • Verify in a test environment • Monitor field site operation
Sensor Ports (3.3.5)	<ul style="list-style-type: none"> • Review design and implementation
Site Security (3.3.6)	<ul style="list-style-type: none"> • Review site design and construction • Inspect typical site
Data Storage (3.3.7)	<ul style="list-style-type: none"> • Review design and implementation • Verify in a test environment • Monitor field site operation
Retrieval of Stored Data and Information (3.3.8)	<ul style="list-style-type: none"> • Review design and implementation • Verify in a test environment
Processing and Storage Margin (3.3.9)	<ul style="list-style-type: none"> • Review design and implementation • Verify in a test environment
Reliability (6.1.1). 95% of data stored at NCDC within 1 hour and 99.9% within 1 month.	<ul style="list-style-type: none"> • Utilize site anomaly data entered into the Anomaly Tracking System (ATS) to derive MTBF* and MTTR* statistics

* MTBF = mean time between failures
 MTTR = mean time to repair

Topic #3. Verify that site communications meet the assigned functionality and reliability requirements and remain functional for 6 months. Site communications encompass that USCRN functionality required to interface with the data stream from the data logger and transmit that data to NCDC via a means that will meet the reliability specified in FRD 6.1.1. In the current USCRN demonstration phase system, the site communications configuration encompasses the Data Collection Platform (DCP) subsystem. A test environment with most of a USCRN field system should suffice to validate most of the requirements. However, some field tests are required for several of the criteria. The following matches site communications criteria with metric collection strategy.

Criteria (or FRD Requirement)	Metric Collection Strategy
Complies with high data rate (HDR) specifications	<ul style="list-style-type: none"> • Review design and implementation • Verify in a test environment
NESDIS is certified for low and high data rates, including 100, 300, and 1200 bits per second (bps)	<ul style="list-style-type: none"> • Review design and implementation • Verify in a test environment
Contains a Global Positioning System (GPS) controlled clock	<ul style="list-style-type: none"> • Review design and implementation • Verify in a test environment
Diagnostic and status information can be sampled by the data logger and transmitted as part of the data stream	<ul style="list-style-type: none"> • Review design and implementation • Verify in a test environment
Contains nonvolatile setups configured with Windows-based software	<ul style="list-style-type: none"> • Review site design and construction • Inspect typical site
Reliability. 95% of data stored at NCDC within 1 hour and 99.9% within 1 month.	<ul style="list-style-type: none"> • Utilize site anomaly data entered into the ATS to derive MTBF and MTTR statistics

A.2 Demonstration Evaluation Area: Central Facility Equipment

Team Leader: Debra Braun

Team Members: Jim Bradley, Grant Goodge, Ed May, Bruce Baker

Evaluation Topics, Criteria, and Reports:

Topic #1. Is there a process to commission a site to ensure that it is fully functional, maintainable, and documented?	
Criteria	Metric Collection Strategy
Site commissioning procedures must exist and contain commissioning criteria for documentation, support provisions, and data recovery procedures.	The team will verify that a USCRN Commissioning Plan has been prepared that contains commissioning procedures for the USCRN network infrastructure and individual sites.

Topic #2. What is the acceptable overall and sit availability? What is considered acceptable data loss?	
Criteria	Metric Collection Strategy
CRN availability requirements are stated in Section 6 of the FRD. These requirements must be acceptable to the USCRN program, or be revised accordingly.	The team will solicit input from NCDC and the USCRN Science Board regarding acceptable overall and site availability, as well as data loss. <i>Reports:</i> The team will report the status of the acceptable overall and site availability figures and make any appropriate recommendations. Using the ATS or similar tool, the team will provide central facility equipment MTBF and MTTR statistics gathered during the demonstration period.

Topic #3. Are fault recognition standards defined and documented?	
Criteria	Metric Collection Strategy
Documented standards, tolerances, and thresholds in support of central facility automated detection capabilities must exist. Section 5 of the FRD requires that the central facility (1) include a highly automated, rule-based inventory and (2) automatically identify malfunctions, engineering information approaching predetermined thresholds, and suspect observational values.	The team will solicit a copy of this documentation from NCDC staff.

Topic #4. Are quality control procedures and standards defined and documented?	
Criteria	Metric Collection Strategy
Documented procedures for conducting quality control on the incoming USCRN data must exist.	The team will solicit a copy of this documentation from NCDC staff.

Topic #5. What event tracking mechanism(s) is/are used?	
Criteria	Metric Collection Strategy
Automated and manual tools for USCRN event tracking must be identified, and policy/procedures for their use must be understood and followed. In accordance with USCRN policy, all events, both at USCRN field sites and the central facility, that relate to installation, modification, identification of anomalies, preventive maintenance, corrective maintenance, processing, archive, and web presentation are to tracked.	The team will investigate event tracking mechanisms in use by NCDC, ATDD, site hosts, and others.

Topic #6. How are faults corrected?	
Criteria	Metric Collection Strategy
Designation of responsibility and a concept for fault correction must exist and be understood by all involved parties.	The team will solicit pertinent information and identify all parties/individuals involved in USCRN fault correction, identify their responsibilities, and identify the means to initiate their actions.

Topic #7. Are fault correction procedures documented?	
Criteria	Metric Collection Strategy
Documented correction procedures must exist with sufficient scope and detail to cover all actions taken following the detection of a fault or anomaly, including tracking, documentation, and verification.	The team will solicit and review associated information from NCDC and ATDD staff.

Topic #8. Are resources sufficient to expand coverage for national deployment?	
Criteria	Metric Collection Strategy
Sufficient dedicated resources are identified to meet the requirements stated in section five of the FRD with a USCRN deployment of 300 field sites.	The team will consider the degree and schedule of planned automation, and estimate the resources necessary to meet the FRD requirements. This estimate of labor and automated systems will be compared with existing USCRN planning documents.

A.3 Demonstration Evaluation Area: Documentation and Configuration Management

Team Leader: Debra Braun

Team Members: Tilden Meyers, Dave Easterling, and Liz Smith

Evaluation Topics, Criteria, and Reports:

Topic #1. Are configuration management standards and procedures defined and documented?	
Criteria	Metric Collection Strategy
<p>The team will assess configuration management (CM) documentation to determine that the requirements that the CM process must accomplish are clearly specified in a CM Plan. Ownership and responsibility for the plan are clearly established. The USCRN CM Plan follows CM practices already established by the Department of Commerce (DOC), NOAA, NESDIS, and NCDC.</p> <p>The technical and administrative management and surveillance for configuration items (CIs) are applied using the principles of EIA Standard 649 and ISO 10007 as references, in concert with program-approved documentation and the inherent discipline in applied CM software tools.</p> <p>Supporting procedures describe how to achieve each requirement in the CRN CM Plan unless no explanation is required. Supporting procedures include an implementation approach.</p>	<p>Configuration identification, change control, audits, and status accounting responsibilities are clearly identified in the plan and meet the objectives of the USCRN program.</p> <p>Scope and authorities are designated. The plan is compliant with existing NOAA, NESDIS, and NCDC CM policy and procedure. The plan and associated procedures are benchmarked against industry's best practices.</p> <p>The integrity of data and information is assured while accommodating change. Training in the CM process and use of "specialized application tools" are made available to all affected personnel.</p> <p>Configurations are defined through documentation. Documentation items are identified by type, number, and revision level.</p> <p>The team will validate the following:</p> <ol style="list-style-type: none"> (1) The USCRN CM Plan has been authorized/signed and released to all affected components. (2) ATS Procedures/Access are documented and released. (3) USCRN sites procedures/access are documented and released. (4) U.S. Site History Record procedures/access are documented and released. (5) Other employed "CM application tools" are defined, their procedures/access are documented and released. (6) CM requirements for USCRN data and metadata are established.

Topic #2. Is there a repository for documentation under configuration management?	
Criteria	Metric Collection Strategy
<p>Documents, once released, are retained in a repository that provides an appropriate level of security as long as they remain active.</p> <p>Problem reports, configuration change requests (CCRs), document change orders (DCOs), change notices (CN) and other document revision records associated with active documents are retained in the same or similar secure repository.</p> <p>There is a repository for retaining documents that are no longer active along with their associated revision records.</p> <p>There is a repository for securing backup data that could be used to allow continuation of essential USCRN activities should a disaster occur and destroy the repositories containing primary data.</p>	<p>Documentation libraries exist for active documentation that contain policies, plans, procedures, applications, and archived data. These repositories will have the necessary security at the doors to ensure that the Government property that they contain is adequately protected.</p> <p>Where digital repositories are employed, a level of access security (logon, username, password) will be employed to ensure that the Government property that they contain is adequately protected.</p> <p>All documentation will have a level of disaster recovery capability (i.e., backup location, media, etc.).</p>

Topic #3. Does the user community have access to the documentation?	
Criteria	Metric Collection Strategy
<p>External users are able to access internally controlled databases and obtain data as needed to support the detection of present and future climate change, and to enable scientists to increase our understanding of natural and human-induced effects.</p> <p>Data management systems facilitate access, use, and interpretation of the data and data products.</p> <p>Engineers and suppliers are able to access internally controlled databases and obtain released information, as necessary, to support their efforts to provide products or services.</p>	<p>The requirements of external users/scientists and engineers and suppliers are included in the internally controlled databases. Access to these documentation are free and uninhibited.</p> <p>The access requirements of engineers and suppliers are sufficient to enable them to determine failure, replacement, and other logistic rates; and to provide for the replacement of same, or interchangeable, components when necessary.</p>

Topic #4. Are there sufficient resources available to support national deployment?	
Criteria	Metric Collection Strategy
<p>Work methodologies and workload are evaluated and projected for what is to be controlled, who is the change control authority, and how the changes are implemented and documented.</p> <p>Functional audits will determine that a configuration item (CI) has the correct characteristics and performance requirements.</p> <p>Physical audits will ensure that the CI meets the requirements specified.</p> <p>In-process audits will ensure that the CM process is being strictly followed and that each newly built or modified system complies with the established operational baseline or approved changes.</p> <p>The results and integrity of the end products are used to determine capacity.</p>	<p><i>Measure quality.</i> Obtain user evaluation of being on target with user requirements.</p> <p><i>Measure CM variability.</i> Consistent conformance while accommodating change and communicating change via released information.</p> <p>The team will identify the CIs/metadata being tracked, determine that the CIs/metadata are controlled, and audit the baselines at various sites and in various repositories to assure compliance.</p> <p>Approved changes are made correctly and in a timely manner. All affected personnel are properly trained in CM activity areas.</p> <p>The team will verify the following:</p> <ol style="list-style-type: none"> (1) OSD Configuration Management Office (CMO) will validate that ATS is recording all trouble reports and equipment change outs. (2) ATDD will validate that installed equipment has been reported via USCRN sites in a timely and accurate manner. (3) NCDC will validate that the USCRN Site History Record is maintained in a timely and accurate manner. (4) NCDC will validate that any other employed "CM application tools" used at NCDC in the capture and maintenance of CIs/metadata are maintained in a timely and accurate manner. (5) NCDC will validate that user access to USCRN data meets the requirements of the user community. (6) The team will validate that processes are in place for USCRN data and metadata that demonstrate that sufficient resources are available to support national deployment.

A.4 Demonstration Evaluation Area: Site Selection

Team Leader: Mike Helfert

Team Members: Ed May, Mike Changery, Dave Easterling, Regional Climate Centers (RCCs), Hal Bogin, Bruce Baker

Evaluation Topics, Criteria, and Reports:

Topic #1. Are site selection standards considered complete yet allow practical regional and field flexibility?	
Criteria	Metric Collection Strategy
Site selection standards must be documented and approved, and include the following: (1) Consideration of data-poor regions and regions sensitive to climate change (2) Adherence to established criteria (3) Representation of the overall area to be monitored (4) Location at or near existing sites of the U.S. Historical Climatology Network (5) Long term stability (6) Conformance with established sensor siting standards	The team will obtain the documented USCRN site selection standards, review them for compliance with the above criteria, and assess their overall completeness. The team will identify any of the documented site selection standards they consider to be impractical or unnecessary. The team will select a representative set of USCRN site locations and assess the degree to which those sites have been selected in accordance with the documented standards.

Topic #2. Do hosts understand their responsibilities over the duration of the USCRN activity?	
Criteria	Metric Collection Strategy
For each USCRN site, a Site License Agreement (SLA) is on file, signed by an authorized representative of that site's host. Any responsibilities, considerations, or understandings beyond those stated in the SLA are separately documented, on file, and signed by an authorized representative of that site's host.	The team will review the SLA file and verify that a signed SLA is present for each USCRN site. The team will make a record of any additional documented site host responsibilities, considerations, or understandings.

Topic #3. Is there a repository for documentation of site surveys, acquisition material, and environmental assessments?	
Criteria	Metric Collection Strategy
A complete, accessible, organized repository for documentation of site surveys, acquisition material, and environmental assessments exists; and responsibilities for the security and maintenance of this repository are sufficient and documented.	The team will identify the location of the repository, review its contents, and document its completeness. The team will review documented responsibility designations, and assess their adequacy for long-term USCRN site record retention.

Topic #4. Do site locations conform to the spatial density study contained in the USCRN Network Plan?	
Criteria	Metric Collection Strategy
USCRN site locations do conform to the spatial density study.	Based on their intimate familiarity with the goals and objectives of the USCRN program, the team will assess the continued validity of the spatial density study and investigate the degree to which current and future USCRN site locations conform.

Topic #5. Do we have sufficient resources (people and funding) to proceed with deployment of remaining systems?	
Criteria	Metric Collection Strategy
Sufficient resources have been identified and, as appropriate, committed on, selection, and SLA activities of the remaining USCRN field sites.	The team will review actual cost and labor information from previous USCRN installations, for all activities that led to a signed SLA. These activities include determination of candidate site locations, selection and approval of the chosen location, and efforts associated with obtaining a signed SLA. The team will then (a) review the deployment schedule and locations for the remaining sites, (b) review the current status of site selection activities for the remaining sites, (c) assess the likelihood and impact of deployment delays and other factors, and (d) construct an itemized fiscal year resource estimate to complete all remaining site selection activities. The team will then compare their estimate of labor, materials, travel, and other costs to existing USCRN budget documents.

A.5 Demonstration Evaluation Area: Site Installation

Team Leader: Tilden Meyers

Team Members: Mark Hall, Grant Goodge, Nolan Miller, Mike Young, Ed May

Evaluation Topics, Criteria, and Reports:

Topic #1. Are site installation standards/documentation defined and considered complete?	
Criteria	Metric Collection Strategy
<p>Complete site installation standards and documentation are available, and adherence can be demonstrated for each USCRN site. Installation standards and documentation sufficiently address the following items:</p> <ol style="list-style-type: none"> (1) Site preparation (adherence to policies, procedures, and practices of the host organization; building permits and compliance with local ordinances; facility specifications including concrete, fencing and power; and preinstallation inspection records) (2) Predelivery equipment calibration and test records (3) Specifications for equipment installation and workmanship standards (4) Installation and activation procedures, checklists, and inspection records (5) Postinstall field calibration procedures and records (6) Complete "as-built" site drawings, inventory, and photographs (7) All appropriate provisions of the corresponding SLA, including identification of a local contact and support of a local connection for access to the site's data (8) Itemized checklist for all site metadata to be placed in station history file (9) Procedures for delivering complete installation records to a permanent repository. 	<p>The team will review USCRN installation standards, documentation, and site installation records.</p> <p>As part of the review, the team will assess compliance with the above criteria.</p> <p>The team will also assess compliance with any additional criteria they consider appropriate.</p>

Topic #2. Are site acceptance testing standards and procedures defined?	
Criteria	Metric Collection Strategy
Adequate standards and procedures are documented and employed to insure proper installation and operation of a newly installed USCRN site, including any site-unique provisions for host access to USCRN data and/or metadata.	The team will review documented site acceptance standards and procedures and assess their completeness. For each installed USCRN site, the team will determine if a site inspection and acceptance record exists and if the record verifies adherence to the documented site acceptance standards and procedures.

Topic #3. Are site IDs registered with the World Meteorological Organization (WMO) or Data Collection Platform (DCP) system?	
Criteria	Metric Collection Strategy
Site IDs are appropriately registered.	The team will make an objective determination of the organizations with which USCRN site IDs should be registered, based on potential data users, supporting networks, retention systems, and other factors. The team will determine if USCRN site IDs are in conformance with and registered with the appropriate organizations. <i>Reports:</i> The team will identify the organizations with which USCRN site IDs should comply and be registered and provide accompanying rationale. Should the team conclude that USCRN site IDs are not appropriately registered, the team will recommend specific steps to accomplish the appropriate registrations.

Topic #4. Are documentation (Metadata) standards defined and complete?	
Criteria	Metric Collection Strategy
The following documentation is readily available and complete: (1) An approved itemized list of all currently required USCRN site metadata parameters (2) A list of approved standards that apply to each parameter (3) As appropriate, procedures for collecting, updating, and retaining each metadata item	The team will review existing USCRN metadata documentation and determine if these criteria are met. The team will review and assess the completeness of current station history files.

Topic #5. Are copies of metadata documentation provided to host organizations?	
Criteria	Metric Collection Strategy
<p>Procedures are in place to insure that appropriate metadata documentation is provided to host organizations.</p> <p>Procedures are in place to document any agreements with each site host regarding the provision of any USCRN metadata beyond that included in the station history file.</p>	<p>The team will verify that each site host has been provided, or has access to, the host site's station history file in accordance with the Site Information Handbook.</p> <p>The team will verify compliance with any other documented agreements regarding USCRN metadata documentation.</p>

Topic #6. Do we have sufficient resources (people and funding) to support national deployment?	
Criteria	Metric Collection Strategy
<p>Sufficient resources have been identified and, as appropriate, committed to the installation of the remaining USCRN field sites.</p>	<p>The team will present their installation resource estimate, the content of existing USCRN budget documents, and identify any periods of potential funding shortages. If appropriate, the team will make associated recommendations.</p>

A.6 Demonstration Evaluation Area: Communications

Team Leader: Ed Hiner

Team Members: Debra Braun, Mark Hall, Nolan Miller

Evaluation Topics, Criteria, and Reports:

Topic #1. Is communications design sufficient to support each site and all 40 sites?	
Criteria	Metric Collection Strategy
<p>Sufficiency requires appropriate timeliness, reliability, and capacity. This element addresses timeliness. Reliability is addressed in Topic 4, and capacity is addressed in Topics 2 and 3.</p> <p>Timeliness Criteria: There is no established criteria for message timeliness, although there is a clear intent that all USCRN reports be delivered to NCDC within 1 hour. The team will establish a message timeliness "target"; in the meantime, a somewhat arbitrary target of 10 minutes will be used as a placeholder.</p>	<p>Throughout the demonstration, message timeliness will be recorded for each hourly report from each of the demonstration sites, using the message time stamps and the time of error-free receipt at NCDC.</p> <p>If a practical target is established for message timeliness, the report will show the percentage of messages received within the target duration.</p> <p>In addition, the team will provide a plot of message receipt times, including the mean and standard deviation.</p> <p>The team will also characterize communications timeliness as acceptable or not acceptable, and provide any appropriate recommendations for improvement.</p>

Topic #2. Are there sufficient DCP reservations available for USCRN use?	
Criteria	Metric Collection Strategy
<p>DCS system managers currently have reserved 40 20-second time slots within each hour at 1200 baud for USCRN site messages.</p>	<p>The team will obtain documentation from DCS system managers clearly indicating the number of reservations that are in place for USCRN. If less than 40, the team will request the additional number required and request a documented response.</p>

Topic #3. Can we expand capacity to support full national deployment?	
Criteria	Metric Collection Strategy
<p>DCS system managers document a guarantee for 300 20-second time slots at 1200 baud, within each hour, for USCRN site messages. This criterion is based on the following requirement from Section 4.1 of the Functional Requirements Document: <i>The USCRN communications network shall have sufficient capacity to provide NCDC with the required data and information from 300 field sites within 1 hour.</i></p>	<p>The team will request that DCS system managers document this guarantee.</p> <p>The team will describe the number of DCS time slots guaranteed available for USCRN messages.</p>

Topic #4. Are communications sufficiently direct, redundant, robust, and reliable?	
Criteria	Metric Collection Strategy
<p>Evaluation criteria are based on the following requirements from the FRD:</p> <p>(4.2) The communications network shall retain each collected observation until successful receipt at NCDC is acknowledged or for 24 hours, whichever is smaller.</p> <p>(6.2) The USCRN network transmission medium, infrastructure, and central facility interface shall provide the capability to provide all required data and information as specified from all field sites to the customer interface at the Central Facility, error free, with an operational availability of 97%.</p> <p>(6.2) The network communications intermediate storage capability shall operate with an availability of 97%.</p> <p>(6.2) Each field site's network interface device shall operate with an availability of 95%.</p>	<p>The team will investigate and document the current message retention capability of the DCS. The associated information will be solicited from DCS system managers and/or staff at Wallops Island.</p> <p>For the availability criteria, the team will establish/identify a method at NCDC to track and record each instance of message loss due to the communications system. Using this data, the team will calculate the experienced network availability.</p> <p>In addition, the team will investigate additional sources of DCS 1200 baud channels.</p>

A.7 Demonstration Evaluation Area: Field Maintenance

Team Leader: Ed Hiner

Team Members: Tilden Meyers, Nolan Miller, Mike Young, Bruce Baker

Evaluation Topics, Criteria, and Reports:

Topic #1. How, how often, and by whom is periodic preventive maintenance performed?	
Criteria	Metric Collection Strategy
A documented USCRN site preventive maintenance (PM) plan, including a schedule, designation of responsibility, procedures, and tracking mechanism, must exist. Evidence must indicate that the plan is being followed.	The team will request both a PM plan and PM records from NCDC and/or ATDD and make appropriate recommendations.

Topic #2. How, how often, and by whom is periodic sensor calibration performed? Are calibration standards documented?	
Criteria	Metric Collection Strategy
A documented USCRN site sensor calibration plan, including a schedule, designation of responsibility, procedures, standards, and tracking mechanism, must exist. Evidence must indicate that the plan is being followed.	The team will request both a sensor calibration plan and calibration records from NCDC and/or ATDD. The team will report the status of the sensor calibration plan and make appropriate recommendations.

Topic #3. Are unit spares necessary to support real-time maintenance? If yes, where will they be stored?	
Criteria	Metric Collection Strategy
Unit spares must be available to support repair of USCRN equipment. A spares depot must be identified.	The team will verify that sufficient spares have been identified and stored at a central location.

Topic #4. Who provides and installs spare installations?	
Criteria	Metric Collection Strategy
Unit spares must be acquired and installation documentation must be complete. A responsible Government or Government-authorized organization must be identified.	The team will verify that a mechanism exists to purchase and store sufficient spare parts to service repairs to USCRN field equipment and that an authorized organization is responsible for installation.

Topic #5. What are the per site average costs?	
Criteria	Metric Collection Strategy
Cost information for equipment acquisition, installation, and maintenance must be identifiable.	The team will solicit cost information regarding site equipment, installation, and maintenance costs from program staff. The team will report cost information in each of the three categories.

Topic #6. How do we know logistics will be sufficient?	
Criteria	Metric Collection Strategy
An integrated maintenance and logistics support (IMLS) plan must exist, with evidence that it is being followed. The plan must include a sparing analysis, logistics strategy, and designation of responsibility.	The team will request an IMLS plan and records from NCDC and/or ATDD. The team will report the status of the integrated maintenance and logistics plan and make appropriate recommendations.

Additional USCRN Field Maintenance Products To Be Provided

To the extent practical, the team will provide a draft of the following information:

- USCRN field site maintenance requirements (preventive and corrective)
- Failure modes and rates for representative equipment
- Failure modes and rates for USCRN equipment during the demonstration, using information from the Anomaly Tracking System (ATS)
- USCRN availability experienced during the demonstration period
- Identification and characterization of potential maintenance providers

Appendix B. Site Acceptance Test Plan

B.1 Overview of Site Acceptance

Site Acceptance is the process of verifying that the installation of a USCRN site has been done in accordance with plans and specifications; that all the equipment at the site is functioning correctly; and that all the necessary metadata have been collected and properly archived. Site Acceptance is an intermediate step between installation of a site and the commissioning of the site. The installation-to-commissioning process will normally be as follows:

1. Install the site
2. If the site passes the USCRN Site Acceptance Test Checklist, accept the site
3. Activate the site and begin to receive data from the site at NCDC
4. Following a period of data receipt that meets the criteria set forth in this *USCRN Commissioning Plan*, the site will be recommended for commissioning
5. Formal commissioning of the site

B.2 Responsibility for Site Acceptance

The USCRN installation activity is the responsibility of the NOAA Atmospheric Turbulence and Diffusion Division (ATDD) laboratory in Oak Ridge, Tennessee. As one of the final steps during a USCRN site installation, the ATDD installation team will complete the USCRN Site Acceptance Test Checklist (see Figure 1) and verify (1) that the site was installed according to accepted plans and specifications and (2) that the equipment at the site is operating correctly.

B.3 Applicable Documents

The following documents are referenced as contributing to the overall site acceptance *documentation*.

- *Complete Guide to Installing a USCRN Station* (Reference 1)
- *CRN Test and Evaluation Master Plan* (Reference 4)
- *USCRN Site Acceptance Test Checklist* (Figure 1 in this USCRN Commissioning Plan)
- *USCRN Commissioning Plan* (present document)

B.4 Site Acceptance Procedure

ATDD has developed extensive documentation on the site installation process, including instructions and standards for installation, checklists to verify that the proper activities are carried out through the installation process, and forms on which collected information can be recorded. The ATDD installation documentation is included in the *Complete Guide to Installing a USCRN Station* (Reference 1).

The site acceptance procedure will, through the use of the USCRN Site Acceptance Test Checklist, verify the following activities:

- The site installation activities adhered to the instructions, standards, and procedures included in the Installation Guide
- Deviations from accepted procedures are properly documented
- Collection of site metadata is completed
- Site metadata are entered into, or sent to, the proper repository
- Site host is provided the site metadata
- Site host is trained to conduct the agreed-upon maintenance
- Site host has been provided the Technical Support Guides
- Sensors at the site have been calibrated properly, and calibration documentation is available
- All of the installed sensors are working properly and providing realistic data
- Communications at the site [normally the Geostationary Operational Environmental Satellite (GOES) transmitter] is working properly and data are being received at the appropriate data collection site [in the case of GOES, this would be the DCS system at the Wallops Command and Data Acquisition Station (WCDAS), Wallops Island, Virginia].

B.5 Site Acceptance Checklist

The USCRN Site Acceptance Test Checklist (Figure 1) will be used by the manager of the site installation team to record and certify compliance with the items indicated on the checklist. Any deviations or changes from the accepted procedures, specifications, and standards must be noted, as appropriate, on the checklist. The completion and certification of the USCRN Site Acceptance Test Checklist will signify the USCRN site system has been accepted and activated, and the 30-day testing leading to the site commissioning can begin.

B.6 Disposition of the USCRN Site Acceptance Test Checklist

Following completion and signing of the USCRN Site Acceptance Test Checklist, the checklist and the supporting documentation indicated on the checklist will be sent to the USCRN Program Manager at NCDC. The USCRN Program Manager will assure that the proper archival procedures are followed to include the documentation in the Station History Archive.

Distribution List

Loc. No.	Organization	Name	Address	Copies	
				Paper	Elec.
National Oceanic and Atmospheric Administration (NOAA)					
Library and Floor Locations					
001	NOAA OSD Library	c/o Verna Cauley	FB 4, Room 3307	1	1
344	NOAA NCDC Library	c/o Debra Braun	FED, Room 514, Asheville, NC	2	2
OSD					
010	NOAA/OSD3	Richard G. Reynolds	FB 4, Room 3308C		1
345	NOAA/OSD3	Richard Brooks	FB 4, Room 3301D	1	
NCDC					
346	NOAA/CC11	Bruce Baker	FED, Room 420, Asheville, NC		1
347	NOAA/CC21	Debra Braun	FED, Room 514, Asheville, NC		1
348	NOAA/CC2	David Easterling	FED, Room 516, Asheville, NC		1
349	NOAA/CC3	Michael Helfert	FED, Room 468, Asheville, NC		1
351	NOAA/CC	Thomas Karl	FED, Room 557C, Asheville, NC	1	1
352	NOAA/CC	Sharon LeDuc	FED, Room 557A, Asheville, NC	1	1
OAR					
353	NOAA/ARL1	Ray Hosker	P.O. Box 2456, Oak Ridge, TN	1	1
354	NOAA/ARL1	Tilden Meyers	P.O. Box 2456, Oak Ridge, TN		1
390	NOAA/ARL1	Mark E. Hall	P.O. Box 2456, Oak Ridge, TN		1
NWS					
355	NOAA/OST32	Doug Gifford	SSMC2, Room 12110	1	
NOAA NOAA / Computer Sciences Corporation (CSC)					
094	NOAA/CSC – CMO Copy	Kelly Giglio	FB 4, Room 3317	1	
096	NOAA/CSC	Linwood Hegele	FB 4, Room 3313		1
097	NOAA/CSC	Wayne Taylor	FB 4, Room 3311		1
098	NOAA/CSC – DCO Copy	c/o Elizabeth Smith	FB 4, Room 2326	2	1
101	NOAA/CSC	Pong Yu	FB 4, Room 3315		1
205	NOAA/CSC	Forrest Gray	FB 4, Room 3315A		1
NOAA / Short and Associates (S&A)					
356	S&A	Harold Bogin	FB 4, Room 3010E		1
357	S&A	James Bradley	FB 4, Room 3010E		1
359	S&A	Edwin Hiner	FB 4, Room 3010E		1
360	S&A	Edwin May	FB 4, Room 3010E		1
363	S&A	Steve Short	FB 4, Room 3010E		1
364	S&A	Michael Young	FB 4, Room 3010E	1	1
375	S&A (at NCDC)	Marjorie McGuirk	Asheville, NC	1	1

Loc. No.	Organization	Name	Address	Copies	
				Paper	Elec.
<i>Regional Climate Centers (RCCs)</i>					
365	Southeastern RCC	Mike Janis	Columbia, SC		1
366	High Plains RCC	Ken Hubbard	Lincoln, NB		1
367	Western RCC	Kelly Redmond	Reno, NV		1
368	Western RCC	Dick Reinhardt	Reno, NV		1
<i>USCRN Science Panel</i>					
391	USCRN Science Panel	Chris Firbrich	University of Oklahoma		1
392	USCRN Science Panel	Claude Duchon	University of Oklahoma		1
393	USCRN Science Panel	Dave Robinson	Rutgers University, Piscataway, NJ		1
394	USCRN Science Panel	Greg Johnson	National Water and Climate Center, Portland, OR		1
395	USCRN Science Panel	John Christy	University of Alabama, Huntsville, AL		1
396	USCRN Science Panel	Ken Kunkel	Illinois State Water Survey, Champaign, IL		1
397	USCRN Science Panel	Nolan Doeskin	Colorado State University, Fort Collins, CO		1
398	USCRN Science Panel – NOAA/NWS	Rainer Dombrowsky	NWS, W/OS7 SSMC2, Room 4210		1
TOTAL				13	37