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June 27, 2003
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United States Climate Reference Network (USCRN)

Program Development Plan

June 2003

Prepared by:

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

United States Climate Reference Network (USCRN)

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COMMENTS: This DCN 0 package consists of the initial NOAA/NESDIS baseline publication of this document.

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*EXAMPLES: *"Insert change pages 6.2-6 through 6.2-9 following page 6.2-5"*
"Replace pages 3.4-1 through 3.4-10 with change pages 3.4-1 through 3.4-10b"
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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) Program Development Plan* (version DCN 0, June 27, 2003, publication). The document number is NOAA-CRN/OSD-2003-0007R0UD0.

This document presents the Program Development Plan (PDP) for the USCRN. The scope of this document is limited to the acquisition functions necessary to define, acquire, implement and establish initial capability for long-term operations and maintenance for the USCRN. Future research applications of the USCRN-generated data are not addressed here nor are future system or network evolution.

The publication of this baseline document closes the following Document Configuration Change Request:

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NOAA/NESDIS acknowledges the efforts of the NOAA/NESDIS National Climatic Data Center (NCDC) and Short and Associates, Inc., for their preparation of the material in this document.

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 (NOAA)
CONOPS	Concept of Operations
COOP	Cooperative Observer (network)
CRN	United States Climate Reference Network
FRD	Functional Requirements Document
HCN	Historical Climate Network
KDP	Key Decision Point
NCDC	National Climatic Data Center (NOAA)
NESDIS	National Environmental Satellite, Data, and Information Service (NOAA)
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
OAR	Office of Oceanic and Atmospheric Research
OSD	Office of Systems Development
PDP	Program Development Plan
RMA	Reliability, Maintainability, Availability
USCRN	United States CRN
TRB	CRN Test Review Board

References

1. *Adequacy of Climate Observing Systems,* National Research Council, 1999
2. National Oceanic and Atmospheric Administration (NOAA)/National Environmental Satellite, Data, and Information Service (NESDIS), *CRN Functional Requirements Document* (in preparation – to be published in 2003)
3. National Oceanic and Atmospheric Administration (NOAA)/National Environmental Satellite, Data, and Information Service (NESDIS), *CRN Concept of Operation Document,* (in preparation – to be published in 2003)

Executive Summary

The United States Climate Reference Network (USCRN) program is planned to provide the United States with an environmental monitoring and climate change network that meets national needs, and international commitments to monitor and document climate change. The CRN will consist of about 300 operational sites, with the goals to:

> *Ensure that future changes and variations in primary measurements at specific sites can be monitored without the need for uncertain adjustments and corrections to the data. Primary measurements at each site will include air temperatures and precipitation supplemented with other measurements (e.g., wind speed, solar radiation). The network will provide adequate spatial coverage to monitor the largest-scale, decadal-to-centennial temperature and precipitation trends across the United States.*

The CRN acquisition objectives are to develop, acquire and field the *premier* environmental climate-monitoring network of the United States. This network will provide for long-term, stable surface observations that are representative of conditions of the United States. Site selection is particularly important, as these sites must remain largely stable for 50 years or more. The actual system technology will evolve over the years but the locations should largely remain constant, with continued representative exposure for measured elements.

The CRN systems will be designed to be highly reliable, expandable and maintainable, and will automatically collect, pre-process, ensure the quality of, format, and report the climate data observation. The system is required to operate under varied and sometimes hostile weather conditions, without the need for human intervention. The system will be employed nationwide, from the arctic to the tropics. The system monitoring parameters as well as potential future expansion to be added later are listed in the table below.

System Monitoring Parameters
Primary Measurements
Air Temperature
Precipitation
Secondary Measurements
Wind Speed
Global Solar Radiation
Surface (skin) Temperature
Potential Future Expansion
Relative Humidity
Soil Moisture
Surface Temperature
Atmospheric Pressure

The network will consist of the operating field sites and the central operating facility located at the National Climatic Data Center (NCDC). The NCDC will provide the data ingest, operational quality control monitoring, archiving and user access functions. The operating concept is for hourly transmission of the primary and secondary measurements from all CRN sites to NCDC. NCDC will centrally compute summary of the day information from the hourly data.

Development and demonstration phases, presently underway, cover planning and development of system requirements, and prototype systems to reduce risk with the final system implementation. A comprehensive evaluation will be conducted to demonstrate readiness to proceed to the nationwide implementation. This evaluation will cover operational performance and support capability for the initial 40 systems fielded throughout the United States. Evaluations will include all aspects of the program (e.g., sensor performance, communications, quality control, site selection, maintenance, configuration management). Once these risk reduction activities are completed, phased limited and full implementation will be undertaken for the full nationwide program.

The Office of Systems Development (OSD), working in concert with the NCDC, will lead the CRN acquisition and implementation. NCDC will provide policy direction and provide the functional and network requirements. NCDC will also provide the central facility data management functions of ingest, archive and data access, as well as monitor network performance. OSD has established an Acquisition Office to manage, coordinate and direct the overall implementation activities, and control resources for the nationwide CRN. An Acquisition Manager provides the primary management of the CRN acquisition and implementation, leading an extended program team. The Acquisition Manager is responsible for:

- Planning, organizing and coordinating overall activities
- Budgeting and authorizing work for the CRN acquisition
- Acquiring and implementing systems
- Organizing and managing technical teams (e.g., requirements, testing)
- Developing key plans and documents (e.g., Functional Requirements, Test Plans, and Management Plans)
- Developing cost projections and developing budget initiatives

Others program partners such as NOAA's Office of Oceanic and Atmospheric Research (OAR)'s Atmospheric Turbulence and Diffusion Division (ATDD), NOAA's National Weather Service (NWS) and Regional Climate Centers (RCCs) will support key planning, analysis, or development tasks as assigned. OSD will work with NCDC and the program partners to plan a wide range of program activities. All phases of the implementation are presently scheduled for completion by fiscal year 2009, with the specific acquisition objectives to:

- Document system requirements and modes of operation
- Develop cost-effective solutions
- Develop risk mitigation approaches and manage activities accordingly
- Acquire sites with stable, long-term representative exposure characteristics
- Field the 300 site operational network by 2009
- Establish effective maintenance and configuration management support capabilities
- Meet established cost, schedule and performance targets
- Thoroughly test, evaluate and document required technical elements

Section 1. Introduction

1.1 Purpose and Scope of Document

This document provides the framework and guiding principles for development and implementation of the United States Climate Reference Network (USCRN). The purposes of this Program Development Plan (PDP) are to:

- Document the vision and objectives of the CRN program
- Provide the top-level acquisition and implementation plan describing the overall scope and management approach for the program
- Identify key decision points (KDPs) and checkpoints for effective management control

The scope of this document is limited to the acquisition functions necessary to *define, acquire, implement and establish initial capability for long-term operations and maintenance for the CRN*. Future research applications of the CRN generated data are not addressed here nor are future system or network evolution.

This PDP will be updated and reissued as changes occur in program direction or scope. Section 1 presents an overview of the mission need for the CRN, its objectives and scope. Section 2 provides a description of the system and operational concepts. Section 3 provides the implementation approach, including program phases, schedule, and KDPs, Section 4 describes the overall system acquisition management approach. Appendix A has a list of Ten Climate Monitoring Principles extracted from the Adequacy of Climate Observing Systems (Reference 1).

1.2 Program Goal and Mission Need

The 1997 Conference on the World Climate Research Programme concluded that the global capacity to observe the Earth's climate system is inadequate and is deteriorating worldwide (Reference 1):

> *Without action to reverse this decline and develop the Global Climate Observation System, the ability to characterize climate change and variations over the next 25 years will be even less than during the past quarter century.*

The CRN program is planned to provide the United States with an environmental monitoring and climate change network that meets national needs and international commitments to monitor and document climate change. The CRN will consist of about 300 operational sites located near existing meteorological observation sites such as the Historical Climate Network (HCN) and the Cooperative Observer (COOP) network. The CRN sites will be selected for long-term stability of siting characteristics, sensitivity to large-scale climate forcing, and to represent climate conditions in the United States.

The CRN will use instrumentation that automates observations of important climate monitoring parameters (i.e., air temperature and precipitation).

The goals of the CRN program are to:

> *Ensure that future changes and variations in primary measurements at specific sites can be monitored without the need for uncertain adjustments and corrections to the data. Primary measurements at each site will include air temperatures and precipitation supplemented with other measurements (e.g., wind speed, solar radiation). The network will provide adequate spatial coverage to monitor the largest-scale, decadal-to-centennial temperature and precipitation trends across the United States.*

Fundamental to this goal is the requirement to establish a network that 50 years from now can serve to answer the question: *How has the climate of the United States changed over the past 50 years?* To aid in attaining these goals, the Ten Climate Monitoring Principles in Appendix A will be followed in the implementation and subsequent operation of the CRN.

1.3 CRN Acquisition Goals

The CRN acquisition objectives are to develop, acquire and field the *premier* environmental climate-monitoring network of the United States. This network will provide for long-term, stable surface observations that are representative of conditions of the United States. Site selection is particularly important, as these sites must remain largely stable for 50 years or more. The actual system technology will evolve over the years but the locations should largely remain constant, with continued representative exposure of the measured elements. The CRN systems will be designed to be highly reliable, expandable, and maintainable. The network is also intended to serve as a model environmental monitoring network for the United States and the international community.

All phases of the development and implementation are presently scheduled for completion by fiscal year 2009. Specific acquisition objectives are to:

- Document system requirements and modes of operation
- Develop cost-effective solutions
- Develop risk mitigation approaches and manage activities accordingly
- Thoroughly test, evaluate and document required technical elements
- Acquire sites with stable, long-term representative exposure characteristics
- Field the 300 site operational network by 2009
- Establish effective maintenance support and configuration management capabilities
- Meet established cost, schedule and performance requirements

Section 2. System Description

2.1 Mission Purpose

The CRN is planned to provide the most accurate and reliable environmental climate data for the United States. Systems will be required at about 300 sites nationwide, some of which will have nearby "paired sites" with comparable systems as backup to ensure data continuity. A key element is locating the systems at locations where they can remain for 50 years or more without environmental degradation or obstruction to continued measurements. The system technology and equipment will evolve during this period, but stable locations are essential for long-term monitoring of climate change.

The CRN is planned to be a flexible and modular system capable of being deployed in a variety of configurations and operating without the attendance of an observer. It will automatically collect, preprocess, ensure the quality of, format, and report the environmental elements comprising the climate data observation. The system is required to operate with high reliability, continuously, under varied and sometimes hostile weather conditions, without the need for human intervention. The system will be employed nationwide, from the arctic to the tropics. It therefore must be capable of operating over a very broad range of operational environments, and operate continuously and reliably over extended periods.

2.2 Operational Description

The four major functions of fielded systems are:

1. **Data Collection—**to use a variety of sensors to measure environmental elements and provide the sensed data in a form suitable for direct reading

2. **Data Preprocessing—**to use averaging and comparison software to derive a variety of averages and maxima/minima

3. **Formatting—**to format the data output for efficient transmission

4. **Transmission—**to be able to transmit the data through a variety of communications mediums including satellite data collection system(s)

2.3 System Concept

The CRN is required to be a modular system to support future expansion and evolving needs. While the system produces environmental data used for research purposes, the system is required to *function as an operational system*. Thus it is required to operate continuously, reliably and with a high operational availability over the full range of nationwide environmental conditions. The system is required to adapt to different:

- **Parameter sets—**for expansion in response to evolving climate data requirements
- **Sensors—**to incorporate improved measurements either as new techniques/technologies are developed, or as sensors are replaced with future ones
- **Communications—**to accommodate new and evolving technologies

Figure 1 illustrates the CRN site concept of a core system with a variety of deployment options. Under this concept, specific capabilities can be added to a particular site as needed.

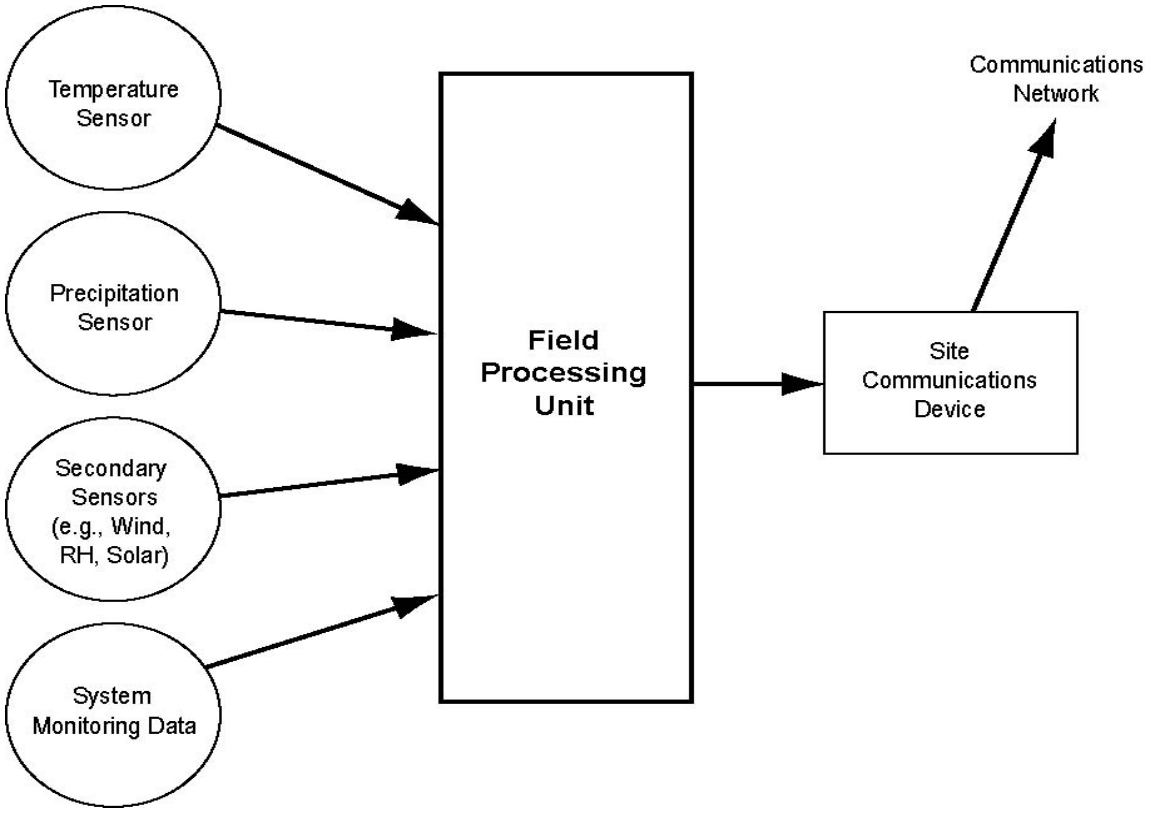

Figure 1. CRN Site Concept

The system monitoring requirements as well as other potential capabilities to be added later are listed below.

Table 1. CRN Measurements

System Monitoring Parameters
Primary Measurements
Air Temperature
Precipitation
Secondary Measurements
Wind Speed
Global Solar Radiation
Surface (skin) Temperature
Potential Future Expansion
Relative Humidity
Soil Moisture
Surface Temperature
Atmospheric Pressure

The operating concept is for hourly transmission of air temperature, precipitation, wind speed, and solar radiation, all measured by automated sensors. For some sites additional variables may be observed (e.g., soil moisture and soil temperature). The NCDC will compute summary of the day information from the hourly data separately. The specific system capabilities and modes of operation have been documented in the CRN Functional Requirements Document (FRD) (Reference 2) and the Concept of Operations Document (CONOPS) (Reference 3).

The network will consist of the operating field sites and the central operating facility located at the NCDC. The NCDC will provide the data ingest, operational quality control monitoring, archiving and user access functions. The overall system is illustrated in Figure 2 below.

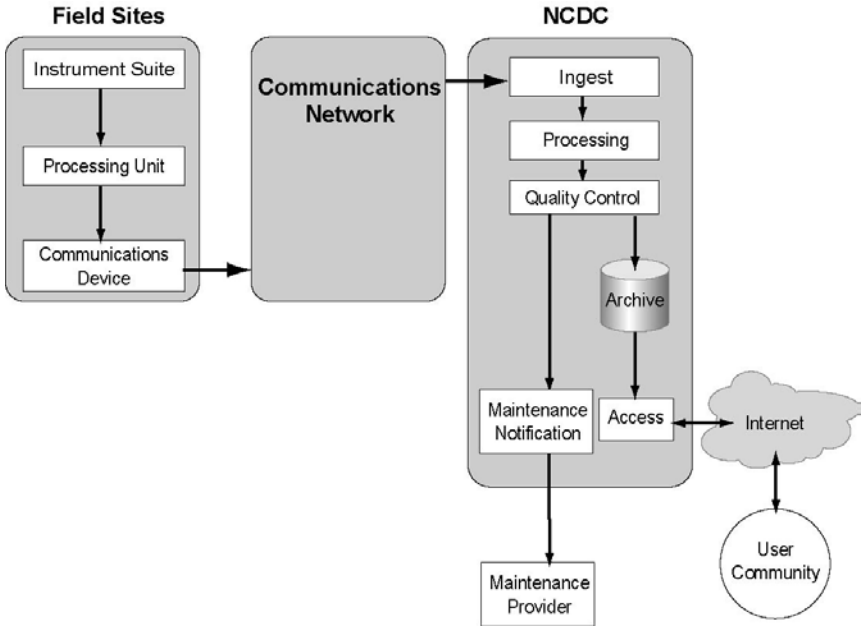

Figure 2. CRN System Concept

2.4 System Siting

Site selections will be determined through an objective screening process. This process will consider criteria such as required station distribution, long-term site stability, climate monitoring representativeness, and unique factors such as population shifts, agriculture yield, and commercial activities that may affect local conditions.

2.5 Critical Technical Areas

To ensure that the CRN performs as the *premier* observational network there are ten areas that require thorough testing and evaluation. These are:

- System siting
- Sensors
- Site processing
- Communications
- Timely failure detection/reporting
- Archiving
- User access
- Quality Control Monitoring
- Reliability, Maintainability, and Availability (RMA)
- Documentation and Training

These elements will be addressed as part of comprehensive program test and evaluation activities.

Section 3. Program Implementation

3.1 Program Phases

The CRN program has been organized into the broad program phases of

- Development
- Demonstration
- Limited Implementation
- Full Implementation

Figure 3 depicts the program structure and general schedule. Because of the duration of the program and the normal uncertainties of development and implementation, the schedule depicted is for planning purposes only. The full implementation is presently planned for completion by fiscal year 2009.

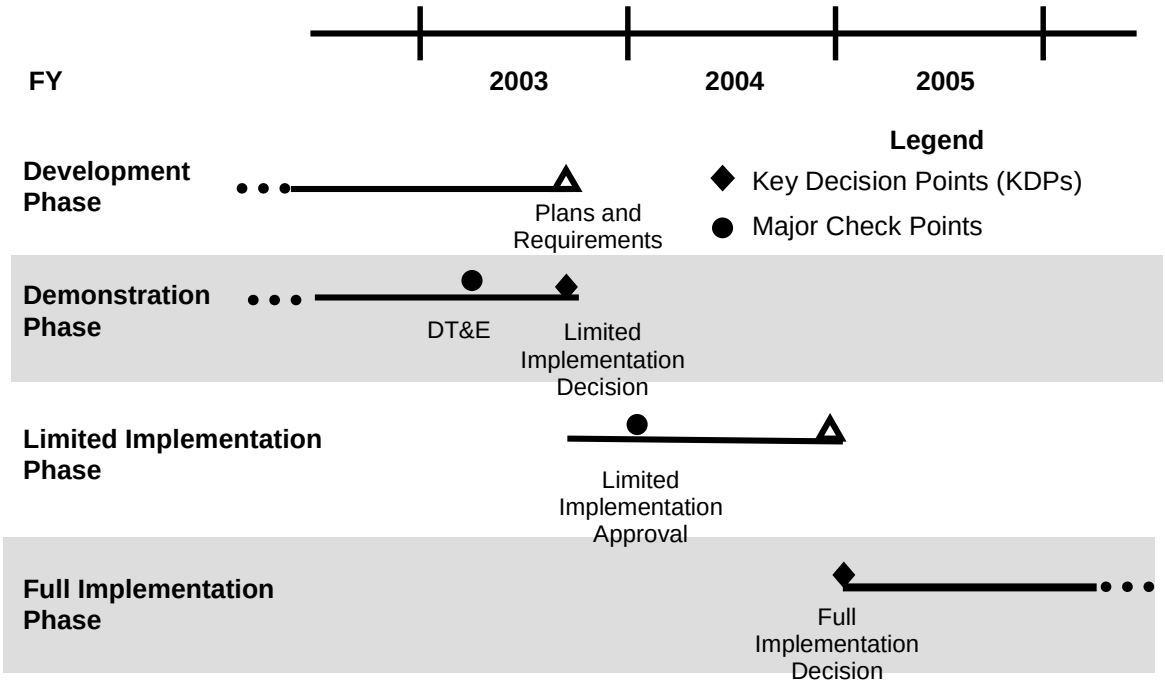

Figure 3. Climate Reference Network Program Phases

3.2 Development Phase

This phase presently underway, consists of organizing and documenting plans and system requirements for the CRN program. Basic technical, cost, and schedule tradeoff analyses will be

conducted during this phase, as well as early planning and analysis to optimize capability, reduce risk and define costs for the development and acquisition. Developing basic program strategies (e.g., site survey, system acquisition, maintenance) are part of this phase. Planning and organizing cooperative interagency activities have already been started. During this phase the following will be addressed:

- Program planning and organizing
- Requirements definition, validation and approval
- Systems engineering and design activities
- Prototype development and risk reduction activities
- Key sensor testing
- Network planning
- Site survey of sites nationwide

3.3 Demonstration Phase

This phase, which is also currently underway, will demonstrate prototype capability and reduce risk with the final system implementation by providing:

- Early exposure of prototype systems
- Quasi-operational use of prototype systems in different climatic regimes

A demonstration evaluation will be conducted to ensure the readiness to proceed to the Limited Implementation Phase. The evaluation, leading to KDP 1, will assess technical and operational performance characteristics of the initial 40 systems fielded throughout the United States. Evaluations will include all aspects of the CRN program (e.g., sensor performance, communications, quality control, site selection, maintenance, configuration management). The intent is to demonstrate readiness for cost-effective deployment and supportability of the Limited Implementation Phase. KDP 1 is scheduled prior to proceeding into the Limited Implementation Phase.

3.4 Limited Implementation Phase

The limited implementation further serves to reduce risk by incorporating fixes from the demonstration evaluation, followed by a phased implementation of production systems. The purpose is to manage risk by validating a higher rate production, implementation, and maintenance activities before proceeding with the highest rate production and implementation activities required for full implementation. Key aspects to assess during this phase are comprehensive system production, and implementation approaches, end-to-end system performance, system maintenance effectiveness, and larger scale centralized quality control

performance. Transfer to contract maintenance support is also expected during this phase. Once the objectives of the limited implementation phase have been fully proven, the key decision (KDP 2) can be made for the full nationwide implementation.

3.5 Full Implementation Phase

The full implementation phase covers all activities necessary to complete the CRN network and its operational and support capabilities.

3.6 Program Check Points and Key Decision Points

Figure 3 illustrates the current program schedule with identified, checkpoints, and KDPs. The checkpoints and KDPs are as follows:

- Completion of the Demonstration prototype evaluations
- KDP 1—Limited Deployment Decision, constituting the commitment to limited nationwide implementation
- Limited Implementation Approval to proceed with implementation based on follow-on evaluations (as necessary)
- KDP 2—Full Implementation Decision, constituting the commitment to the full program implementation

The CRN Executive Board will receive recommendations from an independent CRN Test Review Board (TRB) that assesses readiness. The TRB will review the test and evaluation findings and methodology, identified risks, proposed corrective actions, and provide recommendations to the Executive Board relative to the key decisions.

Section 4. Acquisition Management

4.1 Management Approach

NCDC will provide policy level direction and the system functional and network requirements for the CRN. NCDC will also provide the central facility data management functions of ingest, archive and data access, as well as monitor the network performance. NCDC is transitioning the current acquisition and implementation functions lead to OSD.

The OSD, working in concert with the NCDC, will lead the acquisition and implementation of the CRN. OSD has established an Acquisition Office to manage, coordinate and direct the overall acquisition and implementation activities, and control resources for the nationwide CRN. Lastly, there is an extended program team and other program partners (e.g., Atmospheric Turbulence and Diffusion Division, Regional Climate Centers) that will provide specialized support to the program.

4.2 Executive Board

A policy level Executive Board has been established to oversee the program. This board is chaired by the NCDC Director (as the Executive Director), and includes one member each from OSD and NCDC. The board will review progress on a regular basis and determine readiness at the major program checkpoints and KDPs. The Executive Director will approve final decisions and policies as required. Budget planning will be led by OSD with NCDC assisting; the final budget plan and initiatives are to be approved by the Executive Director.

4.3 OSD Acquisition Manager

An Acquisition Manager located in OSD provides the primary management of the CRN acquisition and implementation. The Acquisition Manager is responsible for:

- Planning, organizing and coordinating overall activities
- Budgeting and authorizing work for the CRN acquisition
- Acquiring and implementing systems in coordination with the NCDC Program Manager
- Organizing and managing technical teams (e.g., requirements, testing)
- Developing key plans and documents (e.g., Functional Requirements, Test Plans, and Management Plans)
- Developing cost projections and developing budget initiatives

OSD, NCDC and the program partners will work together to plan and organize activities (e.g., demonstration evaluations, site acquisition strategy development).

4.4 NCDC Activity Management

NCDC will provide the CRN data management functions of ingest, archive and data access, as well as monitoring the network performance. Some of these functions are unique to CRN and some are common functions of NCDC. Figure 4 illustrates these functions.

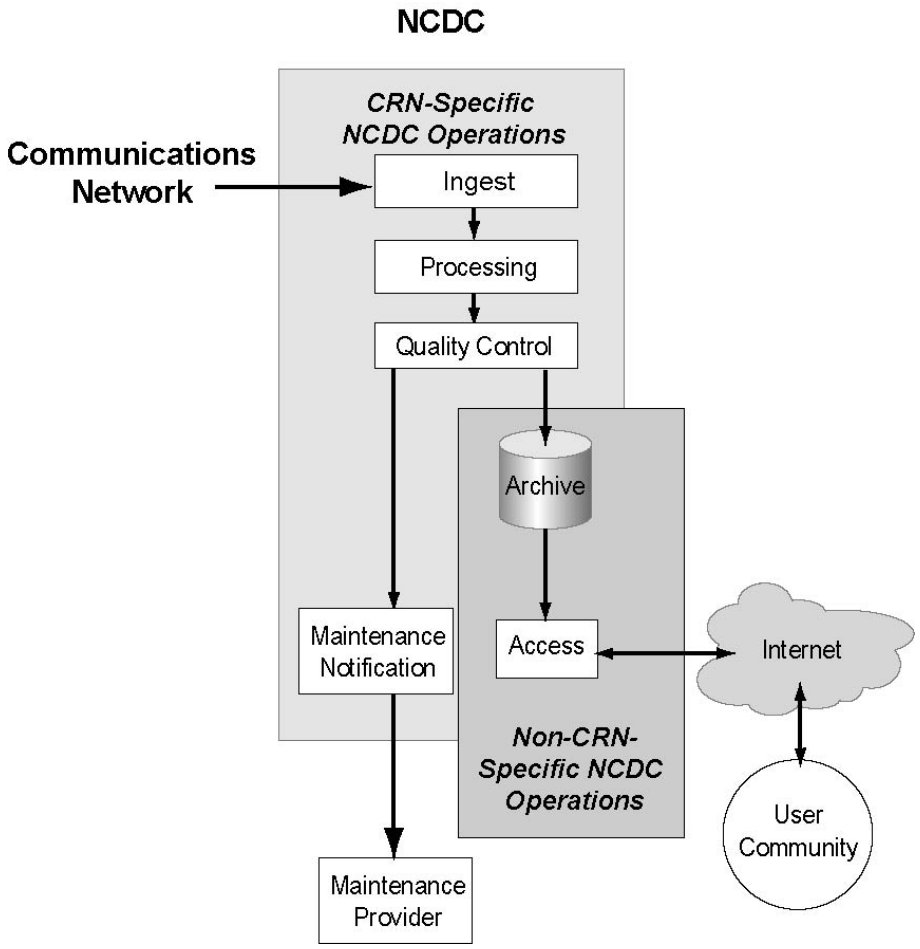

Figure 4. NCDC CRN Functions

NCDC and OSD will work together to develop processes for network performance and maintenance monitoring, site acquisition, and other CRN activities. NCDC, serving as the principal science advisor, will review and coordinate applied science and climate research activities, and provide system functional requirements. At a minimum these activities consist of

- Network Plan and network requirements (density study)
- Transfer functions
- Future requirements
- Evaluation and analysis
- Performance measures

4.5 Extended Program Team

The program organization includes an extended NOAA program team bringing to bear expertise and support from NCDC, OSD, ATDD, the RCCs and others where appropriate. Functional managers will be assigned responsibility for specified program activities, and will report periodically to the Acquisition Manager on progress and issues.

4.6 Program Plans

Thorough program planning and evaluation are required for a successful CRN implementation. This PDP documents overall program objectives, approach, and scope. Other top-level documents describing requirements, concepts, implementation and support plans are required.

The top-level set of plans required for defining, acquiring, implementing and establishing initial operations and maintenance capability for the CRN are identified in Figure 5. This document tree identifies the top-level set of *program or policy level* plans and documents for subsequent flow down to other *working level* documents. All final documents will be under Change Control.

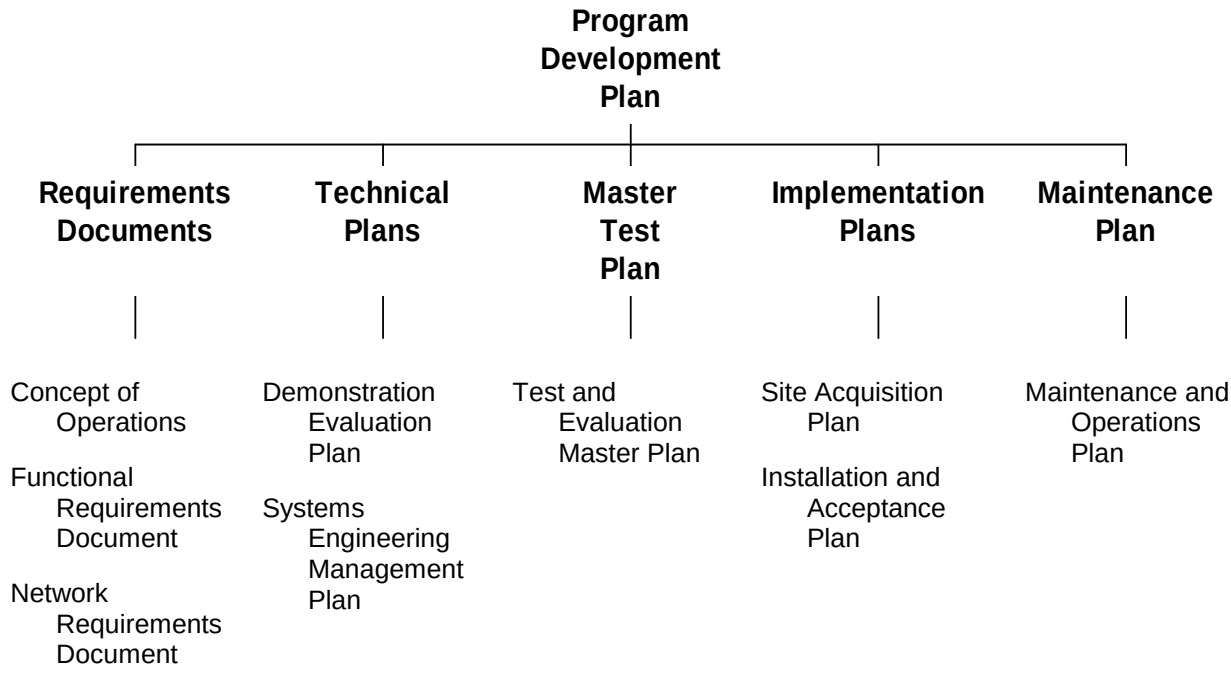

Figure 5. Top-Level CRN Document Tree

Appendix A – Ten Climate Principles

1. Management of Network Change: Assess how and the extent to which a proposed change could influence the existing and future climatology obtainable from the system, particularly with respect to climate variability and change. Changes in observing times will adversely affect time series. Without adequate transfer functions, spatial changes and spatially dependent changes will adversely affect the mapping of climate elements.

2. Parallel Testing: Operate the old system simultaneously with the replacement system over a sufficiently long time period to observe the behavior of the two systems over the full range of variation of the climate variable observed. This testing should allow the derivation of a transfer function to convert between climatic data taken before and after the change. When the observing system is of sufficient scope and importance, the results of parallel testing should be documented in peer-reviewed literature.

3. Metadata: Fully document each observing system and its operating procedures. This is particularly important immediately prior to and following any contemplated change. Relevant information includes: instruments, instrument sampling time, calibration, validation, station location, exposure, local environmental conditions, and other platform specifics that could influence the data history. The recording should be a mandatory part of the observing routine and should be archived with the original data. Algorithms used to process observations need proper documentation. Documentation of changes and improvements in the algorithms should be carried along with the data throughout the archiving process.

4. Data Quality and Continuity: Assess data quality and homogeneity as a part of routine operating procedures. This assessment should focus on the requirements for measuring climate variability and change, including routine evaluation of the long-term, high-resolution data capable of revealing and documenting important extreme weather events.

5. Integrated Environmental Assessment: Anticipate the use of the data in the development of environmental assessments, particularly those pertaining to climate variability and change, as part of a climate observing system's strategic plan. National climate assessments and international assessments (e.g., international ozone or IPCC) are critical to evaluating and maintaining overall consistency of climate data sets. A system's participation in an integrated environmental monitoring program can also be quite beneficial for maintaining climate relevancy. Time series of data achieve value only with regular scientific analysis.

6. Historical Significance: Maintain operation of observing systems that have provided homogeneous data sets over a period of many decades to a century or more. Alist of protected sites within each major observing system should be developed, based on their prioritized contribution to documenting the long-term record.

7. Complementary Data: Give the highest priority in the design and implementation of new sites or instruments within an observing system to data-poor regions, poorly observed variables,

regions sensitive to change, and key measurements with inadequate temporal resolution. Data sets archived in non-electronic format should be converted for efficient electronic access.

8. Climate Requirements: Give network designers, operators, and instrument engineers climate monitoring requirements, at the outset of network design. Instruments must have adequate with biases sufficiently small to resolve climate variations and changes of primary interest. Modeling and theoretical studies must identify spatial and temporal resolution requirements.

9. Continuity of Purpose: Maintain a stable, long-term commitment to these observations, and develop a clear transition plan from serving research needs to serving operational purposes.

10. Data and Metadata Access: Develop data management systems that facilitate access, use, and interpretation of the data and data products by users. Freedom of access, low cost mechanisms that facilitate use (directories, catalogs, browse capabilities, availability of metadata on station histories, algorithm accessibility and documentation, etc.), and quality control should be an integral part of data management. International cooperation is critical for successful data management.

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					
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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
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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

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396	USCRN Science Panel	Ken Kunkel	Illinois State Water Survey, Champaign, IL		1
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398	USCRN Science Panel, NOAA, NWS	Rainer Dombrowsky	NWS, W/OS7 SSMC2, Room 4210		1
			TOTAL	13	37