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EOSDIS Core System Project

Release B Environmental Control Plan for the ECS Project

May 1996

Hughes Information Technology Systems
Upper Marlboro, Maryland

Release B
Environmental Control Plan
for the ECS Project

May 1996

Prepared Under Contract NAS5-60000
CDRL Item 105

SUBMITTED BY

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Preface

This document is a formal contract deliverable with an approval code 1. It requires Government review and approval prior to acceptance and use. This document is under ECS contractor configuration control. Once this document is approved, Contractor approved changes are handled in accordance with Class I and Class II change control requirements described in the EOS Configuration Management Plan, and changes to this document shall be made by document change notice (DCN) or by complete revision.

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Abstract

This document is published as the Environmental Control Plan for Release B. It substantiates and is consistent with the temperature and humidity environmental requirements specified in the Facilities Plans for Release B. The plan discusses applicable environmental factors and describes the controls appropriate for Release B COTS hardware and software storage media. COTS vendor-specified operating temperature and humidity ranges are provided for those products identified and known at this time.

Keywords: Temperature, humidity, altitude, software media, monitoring, auxiliary power, hardware, equipment.

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Abbreviations and Acronyms

1. Introduction

1.1 Identification

This document, Contract Data Requirements List (CDRL) Item 105, whose requirements are specified in Data Item Description (DID) 532/PA1, is a required deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS), Contract NAS5-60000.

1.2 Scope

This document reflects the CDR-B hardware design based on the February 14, 1996 Technical Baseline. This baseline is maintained by the contractor Configuration Control Board (CCB) in accordance with ECS Technical Direction #11, dated December 6, 1994.

1.3 Purpose

This document is published as the Environmental Control Plan for Release B. It substantiates the temperature and humidity environmental requirements specified in the Facilities Plans for Release B. The plan discusses applicable environmental factors and describes the controls appropriate for Release B COTS hardware and software storage media. COTS vendor specified operating temperature and humidity ranges are provided for those products identified and known at this time.

1.4 Status and Schedule

Updates to this plan will be completed one month after the Critical Design Review (CDR) for Releases C and D. Updates may also be required for significant environmental requirements due to unplanned changes in COTS hardware or software storage media.

1.5 Organization

The contents of the document are as follows:

Section 1: Introduction - Introduces the Environmental Control Plan scope, purpose, schedule, and document organization.

Section 2: Related Documentation - Describes the parent, applicable and information documents useful in understanding the details of subjects in this document.

Section 3: Environmental Factors - Identifies and discusses in the context of Release B, environmental factors affecting COTS hardware and software storage media.

Section 4: Environmental Controls - Describes the environmental facility and operating controls appropriate to Rel B operating, storage, maintenance, repair, inspection and test areas.

Section 5: COTS Hardware and Software storage media environmental specifications - Provides vendor provided temperature and humidity operating requirements.

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2. Related Documentation

2.1 Parent Documents

The parent documents are the documents from which this Environmental Control Plan's scope and content are derived.

420-05-03	Goddard Space Flight Center, Earth Observing System (EOS) Performance Assurance Requirements for the EOSDIS Core System (ECS)
423-41-01	Goddard Space Flight Center, EOSDIS Core System (ECS) Statement of Work

2.2 Applicable Documents

The following documents are referenced within this Environmental Control Plan, or are directly applicable, or contain policies or other directive matters that are binding upon the content of this volume.

302-CD-003-001	Release B Goddard Space Flight Center (GSFC) Facilities Plan for the ECS Project
302-CD-004-001	Release B Langley Research Center (LaRC) Facilities Plan for the ECS Project
302-CD-005-001	Release B EROS Data Center (EDC) Facilities Plan for the ECS Project
302-CD-006-001	Release B National Snow and Ice Data Center (NSIDC) Facilities Plan for the ECS Project
302-CD-008-001	Release B Alaska SAR Facility (ASF) Facilities Plan for the ECS Project
302-CD-009-001	Release B Oak Ridge National Laboratory (ORNL) Facilities Plan for the ECS Project
501-CD-001-004	Performance Assurance Implementation Plan (PAIP) for the ECS Project
194-602-OP1-001	Property Management Plan for the ECS Project
613-CD-003-001	Release B COTS Maintenance Plan for the ECS Project

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3. Environmental Factors

3.1 Temperature

The COTS manufacturers/vendors of ECS hardware and software storage media consistently recognize the environment operating temperature as critical to the performance, reliability and customer satisfaction with their products. The COTS vendor operating temperature range is being used for hardware because it targets the operating environment, has a tighter range than non-operating storage temperatures, and it is not planned to store hardware, except possibly spares. Both non-operating storage and operating temperatures are considered for software storage media, and the tighter operating range is consistent with the Facility plan HVAC requirements. Some vendors recommend controlling and minimizing the rate of temperature change, but generally do not specify limits on rate of change. The operating temperature ranges specified in Section 5 are considered normal, and within the range for a standard computer room/office environment.

For continuous, trouble-free operation, the Release B COTS products should not be operated at maximum environmental limits for extended periods of time. The recommended operating range provides a less stressful operating environment and operating within this range ensures maximum reliability and customer satisfaction.

3.2 Humidity

Humidity is also consistently recognized by the COTS vendors and non condensing relative humidity percentage ranges are specified. The operating humidity ranges specified in Section 5 are considered normal, and within the range for a standard computer room/office environment.

For continuous, trouble-free operation, the Release B COTS products should not be operated at maximum environmental limits for extended periods of time. The recommended operating range provides a less stressful operating environment and operating within this range ensures maximum reliability and customer satisfaction.

3.3 Particle Contamination/Dust

Particle contamination will be controlled by prudent personnel cleanliness practices in operations and maintenance areas, isolation of paper distribution and printing, compartmentalization of spaces by computer room or subsystem function, controlled traffic flow and access, and positive air pressure from the down-flow air conditioners. The Release B COTS vendors do not specify contamination standards. The automated tape libraries for Release B are also self contained within their own metal envelopes.

3.4 Altitude

The maximum altitudes specified by the Release B COTS vendors for hardware operations is most frequently 10,000 feet, a few at 8,000, and some with no specified limits. For Release B sites, altitude is not an environmental factor.

3.5 Acoustic Noise

Acoustic noise is a recognized environmental factor, but the Release B COTS products do not create significant noise and are not subject to noise in the DAAC/EOC/SMC non-industrial computer room/office environment.

3.6 Vibration

Vibration is a recognized environmental factor, but the Release B COTS products do not create significant vibration and are not subject to vibration in the DAAC/EOC/SMC non-industrial computer room/office environment.

3.7 Electrical Interference/Magnetic Fields

The COTS hardware vendors control and compensate for electrical interference during the design, testing, qualification, certification processes for their product introduction into the commercial market. ECS has not applied any specific requirements on the COTS vendors.

3.8 Electrostatic Discharge (ESD)

The computer room spaces have been designed to minimize and control electrostatic buildup with appropriate non-static carpeting and grounding. Power Distribution Units (PDUs) and other electrical equipment must have grounding straps attached to the floor substructure to dissipate electrostatic buildup. These facility precautions will be supplemented with an ESD awareness program and appropriate personnel maintenance and repair practices.

4. Environmental Controls

4.1 Auxiliary Power

All sites that are in regions with a history of loss of power for more than 15-minutes per occurrence should consider furnishing an auxiliary source of power. This power would be needed for the air conditioning units which support the environment-controlled data archive areas. Fluctuation in temperature and humidity are the major causes of media breakdown. Because the ECS media will be used for many years, precautions should be taken to ensure reliability of the data and to prolong the useful life of the media. Manufacturers recommend the following environmental conditions for optimum reliability and operating life of their tape media:

	Storage	Operating
Temperature	68˚ ± 9˚ F (15-25˚C)	41˚ to 113˚ F (5-45˚C)
Relative Humidity	50% ± 20 %	20% to 80 %

If tape media are exposed to operating temperature changes greater than 30° Fahrenheit, conditioning of the tapes will be required. This conditioning requires rewinding the tape end-to-end, which would be time-consuming and costly for a large library. As the temperature and humidity rise due to the loss of the air conditioning, degradation of the media starts, shortening its useful life. The required humidity and temperature conditions should be maintained with an auxiliary power system to support the air conditioning systems during power loss. Each site should evaluate their risk of power loss to determine if an auxiliary power source is needed.

4.2 Heating, Ventilation, and Air Conditioning (HVAC)

Based on the class of processors planned for Release B, chilled water lines will not be required to cool these systems. Conditioned air should be supplied under the floor with the raised computer room floor acting as the plenum. The conditioned air should be at positive pressure; equipment and console cooling should be supplied directly from the plenum or from louvered vents built into the raised floor panels. Ambient room temperatures in the range of 72˚ + or - 2˚(F) or 21-23˚ (C) and relative humidity in the range of 50% + or - 5% non condensing, are required to be maintained by the facilities. Cooling requirements for each site's equipment are shown in Appendix A of the Facilities Plans, and will meet the COTS vendor operating requirements provided in Section 5. These requirements are based solely upon Release B COTS equipment, and do not include the heating or cooling required for personnel, GFE, and physical space.

4.3 Environmental Monitoring

Environmental monitoring of the computer facility is necessary, and recommended, to provide early warning of humidity or temperature problems that could affect computer hardware operations. This is especially applicable in the automated tape library robotics tape archive areas, where constant humidity, temperature, and dust control is required to extend the useful life of the storage media.

The monitoring system should act as a central control point and provide monitoring capability of all mechanical and electrical components of the facility. These monitoring systems should be connected to the environmental systems, such as smoke and fire detection and suppression, power systems, and CPU alarms. Water detection and security systems should also be tied into these monitoring and control systems.

Regardless of the type of detection system used, sensors should be placed to detect leaks from the most likely sources, such as air conditioners, chillers, manifolds, cooled water pipes and floor drains. Because of the large amount of cabling and electrical conductors under the raised floor, all leaks must be detected quickly, and the locations of the activated sensor must show on a centrally located control panel.

DAAC/EOC/SMC operations personnel will be working in and monitoring this environment, and will report any environmental problems to the appropriate Government facility/engineering personnel.

4.4 ESD Program

An awareness program on ESD and operations and maintenance practices will be followed to eliminate ESD hazards to HW, SW, or people. Procedures for the program will be developed using DOD-HDBK-263 and DOD-STD-1686 as guides. Included in the program will be policies and procedures for prevention and safe dissipation of static electricity; workplace common grounding requirements; and parts handling and protection when in storage, outside the manufacturer's protective packaging, and being readied for installation or removal. ESD hazard awareness and prevention will be an appropriate part of the training and certification process of ECS operations and maintenance personnel. All ESD hazard awareness and prevention requirements will be passed through as requirements to all operations or maintenance subcontractors.

4.5 Facility Planning

The ability to compartmentalize space and have dedicated functional areas at the DAACs/EOC/SMC will enhance environmental control, and minimize contamination from personnel traffic. The ECS Facility plan describes the dedicated functional planning for Release B.

4.6 Cleanliness/Contamination Control

Particle contamination will be controlled by prudent personnel cleanliness practices in operations and maintenance areas, isolation of paper distribution and printing, compartmentalization of dedicated functional spaces by computer room or subsystem function, controlled traffic flow and access, positive air pressure from the down-flow air conditioners, and air filtration. The automated tape libraries for Release B are also self contained within their own metal envelopes.

It is our recommendation that the DAACs/EOC/SMC provide 24-hour, seven-day-a-week controlled access to the ECS facility. In addition, it is recommended that a card key security system be installed for access to the computer room, operations control room, data storage, archive and data ingest distribution areas.

5. Release B COTS Environmental Specifications

The temperature and humidity requirements stated in the Facilities Plans meet the Release B COTS vendor specifications for all hardware and software storage media.

For continuous, trouble-free operation, the Release B COTS products should not be operated at maximum environmental limits for extended periods of time. The recommended operating range provides a less stressful operating environment and ensures maximum reliability and customer satisfaction.

DAAC/EOC/SMC operations personnel will be working in and monitoring this environment, and will report any environmental problems to the appropriate Government facility/engineering personnel.

The Release B COTS operating temperature and humidity specifications are summarized in Tables 5-1 and 5-2 below:

Table 5-1 Media Temperature and Humidity Specifications

COTS Software Storage Medium	Operating Temp.	Operating Humidity	Storage Temp.	Storage Humidity
3 M 3480 tape cartridge	16 - 32˚ C (60 - 90˚ F)	20 - 80 %	04 - 32˚ C (40 - 90˚ F)	05 - 80 %
3M 3490E tape cartridge	16 - 32˚ C (60 - 90˚ F)	20 - 80 %	04 - 32˚ C (40 - 90˚ F)	05 - 80 %
3M 3590 tape cartridge	16 - 32˚ C (60 - 90˚ F)	20 - 80 %	04 - 32˚ C (40 - 90˚ F)	05 - 80 %
3M SD3 tape cartridge	16 - 32˚ C (60 - 90˚ F)	20 - 80 %	04 - 32˚ C (40 - 90˚ F)	05 - 80 %
3M 6250 reel tape	16 - 32˚ C (60 - 90˚ F)	20 - 80 %	04 - 32˚ C (40 - 90˚ F)	05 - 80 %
8 mm Exatape	05 - 40˚ C (41 - 113˚ F)	20 - 80%	05 - 32˚ C (40 - 90˚ F)	20 - 60 %
3M 4mm & 8mm	05 - 40˚ C (41 - 113˚ F)	20 - 80 %	05 - 32˚ C (40 - 90˚ F)	20 - 60 %

Table 5-2. COTS Hardware Temperature and Humidity Specifications (1 of 2)

COTS Hardware	Operating Temperature	Operating Humidity
DEC storage devices	10 - 35˚ C (50 - 95˚ F)	10 - 90 %
SGI Challenge RAID	10 - 38˚ C (50 - 100˚ F)	20 - 80 %
HP Mass Storage System	05 - 50˚ C (41 - 122˚ F)	08 - 80 %
HP High Avail Disk Arrays	10 - 38˚ C (50 - 100˚ F)	20 - 80 %
SUN SPARCstorage Array Series	10 - 40˚ C (50 - 104˚ F)	20 - 80 %
SGI DLT mass storage	10 - 40˚ C (50 - 104˚ F)	20 - 80 %
HP DAT drive	05 - 40˚ C (41 - 104˚ F)	20 - 80 %
HP CD-ROM drive	05 - 50˚ C (41- 113˚ F)	08 - 80 %
SEAGATE Elite 9gb drive	10 - 45˚ C (50 - 113˚ F)	05 - 95 %
SUN Multi-disk Pack	00- 40˚ C (32 - 104˚ F)	05 - 95 %

Table 5-2. COTS Hardware Temperature and Humidity Specifications (2 of 2)

COTS Hardware	Operating Temperature	Operating Humidity
KODAK CD disc transporter	15 - 40˚ C (59 - 104˚ F)	20 - 85 %
EXABYTE 4&8mm tape drive	05 - 40˚ C (41 - 104˚ F)	20 - 80 %
EXABYTE 4&8mm library	05 - 35˚ C (41 - 95˚ F)	20 - 80 %
EMASS AML Model 2 archive- range	16 - 32˚ C (60 - 90˚ F)	15 - 80 %
EMASS AML model 2 archive recmd	21 - 24˚ C (70 - 75 F)	40 - 60 %
STK Powderhorn/Wolfcreek	16 - 32˚ C (60 - 90˚ F)	20 - 80 %
EMASS 8590 tape drive	16 - 32˚ C (60 - 90˚ F)	08 - 80 %
IBM 3490E tape drive	16 - 32˚ C (60 - 90˚ F)	20 - 80 %
IBM 3590 NTP tape drive	16 - 32˚ C (60 - 90˚ F)	08 - 80 %
STK Redwood SD-3 tape drive	15 - 27˚ C (59 - 81˚ F)	30 - 60 %
CABLETRON Ethernet Hubs	05 - 50˚ C (41 - 122˚ F)	05 - 95 %
CABLETRON MicroMMAC 22E	05 - 50˚ C (41 - 122˚ F)	05 - 95 %
ALANTEC FDDI Switch	00 - 40˚ C (32 - 104˚ F)	10 - 90 %
DEC GIGA Switch	10 - 24˚ C (50 - 75˚ F)	10 -50 %
SYNOPTICS 2914 FDDI Concentrator	05 - 40˚ C (41 - 104˚ F)	xx - 85 %
HiPPI Switch Network Systems	00 - 40˚ C (32 - 104˚ F)	05 - 95 %
CISCO 7000 Series Routers	00 - 40˚ C (32 - 104˚ F)	05 - 95 %
TYMSERVE 2000 LAN Time Server	00 - 55˚ C (32 - 131˚ F)	10 - 80 %
SGI Challenge (DM, XL, L) series	05 - 35˚ C (41 - 95˚ F)	10 - 80 %
SGI Power Challenge series	05 - 35˚ C (41 - 95˚ F)	10 - 80 %
HP 755 server	05 - 45˚ C (41 - 113˚ F)	15 - 85 %
HP K class server	05 - 40˚ C (41 - 104˚ F)	15 - 80 %
HP J class server	05 - 40˚ C (41 - 104˚ F)	xx - 95 %
HP C class server	05 - 40˚ C (41 - 104˚ F)	15 - 80 %
DEC Alpha server 1000	10 - 40˚ C (50 - 104˚ F)	20 - 80 %
SGI Indy/Indigo workstations	13 - 35˚ C (55 - 95˚ F)	10 - 80 %
SUN SPARC 20 series	00 - 40˚ C (32 - 104˚ F)	05 - 95 %
SUN ULTRA SPARC series	05 - 40˚ C (41 - 104˚ F)	20 - 80 %
HP 715	05 - 40˚ C (41 - 104˚ F)	15 - 80 %
NCD X terminals	10 - 40˚ C (50 - 104 F)	10 - 90 %
HP Color Laser Jet printers	10 - 28˚ C (50 - 83˚ F)	20 - 70 %
HP Laser Jet printers	10 - 33˚ C (50 - 91˚ F)	20 - 80 %
Genicom Impact printer 3480	10 - 40˚ C (50 - 104 F)	10 - 90 %
Genicom Impact printer 4490	04 - 40˚ C (39 - 104˚ F)	15 - 90 %
HP Scanner	05 - 40˚ C (41 - 104˚ F)	10 - 90 %

Abbreviations and Acronyms

ASF	University of Alaska Synthetic Aperture Radar (SAR) Facility
CCB	Configuration Control Board
CDR	Critical Design Review
CDRD	Contract Data Requirement Document
CDRL	Contract Data Requirements List
COTS	Commercial Off-the-Shelf
DAACs	Distributed Active Archive Centers
DID	Data Item Description
DM	Data Management
ECS	EOSDIS Core System
EDC	Earth Resources Observation Systems (EROS) Data Center
EDF	ECS Development Facility
EOC	EOS Operations Center
EOS	Earth Observing System
EOSDIS	Earth Observing System (EOS) Data and Information System (DIS)
EROS	Earth Resources Observation Systems
ESD	Electrostatic Discharge
ESDIS	Earth Science Data and Information System
FMEA	Failure Modes and Effects Analyses
FOS	Flight Operations Segment
GSFC	Goddard Space Flight Center
HW	Hardware
ILS	Integrated Logistics Support
ILSO	ILS Office
JPL	Jet Propulsion Laboratory
LaRC	Langley Research Center

M&O	Maintenance and Operations
MDT	Mean Down Time
MR	Malfunction Report
NASA	National Aeronautics and Space Administration
NSIDC	University of Colorado, National Snow and Ice Data Center
OEM	Original Equipment Manufacturer
OPPM	Outside PPM Hours
ORNL	Oak Ridge National Laboratory
PAIP	Performance Assurance Implementation Plan
PHS&T	Packaging, Handling, Storage, and Transportation
PM	Preventive Maintenance
PPM	Principal Period of Maintenance
RMA	Reliability, Maintainability, and Availability
SA	System Administrator
SAR	University of Alaska Synthetic Aperture Radar
SDPS	Science Data Processing Segment
SMC	System Monitoring and Coordination Center
SOW	Statement of Work
SW	Software
TOO	Target of Opportunity
UPS	Uninterruptable Power Supply