618-CD-100-001

EOSDIS Core System Project

Replacement Parts List and Spare Parts List for the ECS Project

March 1998

Raytheon Systems Company
Upper Marlboro, Maryland

Replacement Parts List and Spare Parts List for the ECS Project

March 1998

Prepared Under Contract NAS5-60000
CDRL Item #124

RESPONSIBLE ENGINEER

Thomas W Jaeger /s/ 27 March 98

Tom Jaeger Date
EOSDIS Core System Project

RESPONSIBLE OFFICE

Thomas J. Hickey /s/ 27 March 98

Thomas J. Hickey Jr., M&O Manager Date
EOSDIS Core System Project

Raytheon Systems Company
Upper Marlboro, Maryland

618-CD-100-001

This page intentionally left blank.

Preface

This document is a contract deliverable with an approval code of 3. This document is delivered to NASA for information only, but is subject to approval as meeting contractual requirements.

Any questions should be addressed to:

Data Management Office
The ECS Project Office
Raytheon Systems Company
1616 McCormick Drive
Upper Marlboro, Maryland 20774-5372

This page intentionally left blank.

Abstract

This Replacement Parts List and Spare Parts List (CDRL 124, DID 618) identifies Release 2 equipment components that will be stocked as equipment spares at ECS sites and/or at the EDF. This document identifies spares by name, part number, and quantity to be stocked at each location.

Keywords: Spare parts, spares, sparing, repair parts, provisioning, mean time between failure (MTBF), and replacement parts.

This page intentionally left blank.

Change Information Page

List of Effective Pages	
Page Number	**Issue**
Title	Original
iii through x	Original
1-1 and 1-2	Original
2-1 and 2-2	Original
3-1 through 3-4	Original
4-1 through 4-4	Original
A-1 and A-2	Original
AB-1 and AB-2	Original

Document History			
Document Number	**Status/Issue**	**Publication Date**	**CCR Number**
618-CD-001-001	Original	September 1995	-
618-CD-100-001	Release 2.0	April 1998	-

This page intentionally left blank.

Contents

Preface

Abstract

1. Introduction

1.1 Purpose and Scope....1-1
1.1.1 Purpose....1-1
1.1.2 Scope....1-1
1.2 Spares Program Overview....1-1
1.3 Updating Process....1-1
1.4 Document Organization....1-2

2. Related Documentation

2.1 Parent Documents....2-1
2.2 Applicable Documents....2-1
2.3 Information Documents....2-1

3. Systems Supported

3.1 System Description....3-1
3.2 ECS Locations....3-1
3.3 Organizational Relationships....3-2

4. Spares Program Description

4.1 Sparing Objective....4-1
4.2 Sparing Approach....4-2
4.3 Maintenance Contractor Spares....4-4
4.4 Insurance Spares....4-4
4.5 ECS Spares Listing....4-4

Figures

3-1. Logistics Organization....3-3

Tables

4-1. ECS A_O and MDT Requirements....4-2

Appendix A: Release 2.0 Spares List

Abbreviations and Acronyms

1. Introduction

This document, Contract Data Requirements List (CDRL) Item 124, whose requirements are specified in Data Item Description (DID) 618/OP3, is a required deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS) contract NAS5-60000.

1.1 Purpose and Scope

This document provides sparing information for Release 2.0 hardware at ECS sites and at the ECS Development Facility (EDF) in Upper Marlboro, MD.

1.1.1 Purpose

The purpose of this document is to provide a spares list that identifies the replacement parts and their quantities that will be provisioned as spares at Release 2.0 locations for equipment being maintained by the ECS contractor.

1.1.2 Scope

This document identifies the initial spares the ECS contractor will purchase or lease and position at the sites to provide an immediate source of replacement parts in the event of equipment failures. Actual operations experience at the sites will determine whether the quantity and/or mix of spares need to be adjusted at a later date.

1.2 Spares Program Overview

Prior to ECS sites becoming fully operational, ECS will purchase or lease and stock a limited quantity of spares at the sites to provide a readily available source of replacement parts in which to repair equipment whose failure would render an ECS function inoperable over an extended period. The rationale for selecting the range and quantity of these spares is discussed later in this document. Such stocks will be under the control of ECS personnel at the site. As site spares are used to repair failed equipment, sites will immediately report their use to the ECS Integrated Logistics Support (ILS) Office for replenishment or repair of the failed component/part.

1.3 Updating Process

This document will not be updated after initial submission. The composition of ECS spares will be recorded in the Inventory and Logistics Management (ILM) delivered as part of Release 2. Recommendations for changes to the quantities and/or mix of spares to be positioned at ECS sites or centrally should be forwarded to the ECS ILS Office for consideration.

1.4 Document Organization

The contents of the document are as follows:

Section 1: Introduction - Introduces the purpose, scope, program overview, updating process, and document organization.

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

Section 3: System Supported - Briefly describes Release 2.0 equipment and locations.

Section 4: Spares Program Description - Describes the relationship of the ILS spares function to other Project activities.

Section 5: Appendix A is the list of spares recommended to support Release 2.0.

Section 6: Abbreviations and Acronyms.

2. Related Documentation

2.1 Parent Documents

The following documents are the parents from which the scope and content of this document derive:

423-41-01	Goddard Space Flight Center, EOSDIS Core System (ECS) Statement of Work
423-41-02	Goddard Space Flight Center, Functional and Performance Requirements Specification for the EOSDIS Core System (ECS)
420-05-03	Goddard Space Flight Center, Earth Observing System (EOS) Performance Assurance Requirements for the EOSDIS Core System (ECS)

2.2 Applicable Documents

The following documents are referenced within this Replacement and Spare Parts List document, or are directly applicable, or contain policies or other directive matters that are binding upon the content of this volume: None

2.3 Information Documents

The following documents amplify or clarify the information presented in this document. These documents are not binding on the content of this parts list.

194-501-PA1-001	Performance Assurance Implementation Plan (PAIP) for the ECS Project
515-CD-001-003	Availability Models/Predictions for the ECS Project
516-CD-001-003	Release A Reliability Predictions for the ECS Project
518-CD-001-003	Maintainability Predictions for the ECS Project
601-CD-001-004	Maintenance and Operations Management Plan for the ECS Project
604-CD-001-004	Operations Concept for the ECS Project: Part 1-- ECS Overview
604-CD-002-003	Operations Concept for the ECS project: Part 2B -- ECS Release B,
604-CD-003-002	ECS Operations Concept for the ECS Project: Part 2A -- ECS Release 2.0
616-CD-002-001	Release B Integrated Support Plan for the ECS Project

617-CD-002-001	Logistics Support Analysis Plan for the ECS Project
MIL-HDBK-217F	Military Handbook: Reliability Prediction of Electronic Equipment
NHB 4200.1c	NASA Handbook: Equipment Management Manual
NPRD-91	Reliability Analysis Center, Rome Laboratory, Griffiss AFB; Non-Electronic Parts Reliability Data
S-530-1	Goddard Space Flight Center, Specification for Ground System Spare Parts Program
STDN 507	Goddard Space Flight Center, Spaceflight Tracking and Data Network Logistics Manual

3. Systems Supported

3.1 System Description

ECS is a geographically distributed ground system comprised of computer and communications hardware (HW) and software (SW). This system will receive, process, store, and distribute science data at four distributed active archive centers (DAACs) throughout the country. In addition, a system monitoring center (SMC) located at Goddard Space Flight Center (GSFC) will monitor the operations and performance of the systems at each of the sites. The EOS Operations Center (EOC) at GSFC is designated a mission-critical part of the ECS that will provide real-time command and control of the instruments gathering and transmitting science data from space to ECS ground systems for processing and storage of the data.

ECS Release 2.0, including its incremental releases, provides the COTS products and custom application software needed to provide initial ECS operations at AM-1 launch. Release 2.0 equipment consists entirely of COTS HW, such as workstations, servers, science processors, disk and tape storage subsystems, communications subsystems, and associated computer peripherals.

ECS has designed redundancy into most of the equipment and/or subsystems at each site to reduce the incidence of function downtime caused by equipment failure. This redundancy is shown in the ECS HW design documents for each site, which are available on the internet at "CMDM.east.hitc.com/baseline/".

System failover is another design element that will reduce the incidence of subsystem and function downtime. In the most critical subsystems (i.e. those containing the most stringent availability and downtime requirements) failure of a processor, communications link, or peripheral will not cause failure of the function because of the failover capability designed into the function. These subsystems include data ingest, archive management, data repository, and working storage and all EOC subsystems.

Equipment redundancy and failover will result in less function downtime, Where redundancy is provided, failure of a redundant component will leave the function operational, although operating at a decreased rate/capacity. Where equipment failover exists, equipment failures will result in failover to other equipment leaving the function operational. Both equipment redundancy and failover are considered in determining the component spares to be stocked at the sites.

3.2 ECS Locations

Release 2.0 equipment is installed at the following locations:

a. Goddard Space Flight Center (GSFC), Greenbelt, Maryland, (includes the GSFC DAAC, SMC, and EOC)

b. Earth Resources Observation Systems (EROS) Data Center (EDC), Sioux Falls, South Dakota

c. Langley Research Center (LaRC), Hampton, Virginia

d. National Snow and Ice Data Center (NSIDC), Boulder, Colorado

e. ECS Development Facility (EDF) in Upper Marlboro, Maryland, (includes VATC, MiniDAAC, SEO, MiniEOC, and development infrastructure).

It is currently planned that ECS HW and SW will be installed at other locations in future releases, including the Jet Propulsion Laboratory (JPL) in Pasadena, CA and the Alaska SAR Facility (ASF) in Fairbanks, AK.

3.3 Organizational Relationships

The Integrated Logistics Support (ILS) office within the Maintenance and Operations (M&O) organization plans and manages the spares program. The ILS Office budgets, procures, distributes, repairs and replenishes, and accounts for the spares supporting the ECS Project. Spares distributed to the operations sites (i.e. DAACs, SMC, and EOC) for their use are controlled by the local maintenance coordinator (LMC) supporting each site. Figure 3-1 reflects the relationship of the ILS office and LMCs to operations sites and other organizations within the ECS Project. LMC functions for the EOC and the SMC are performed by the same individual.

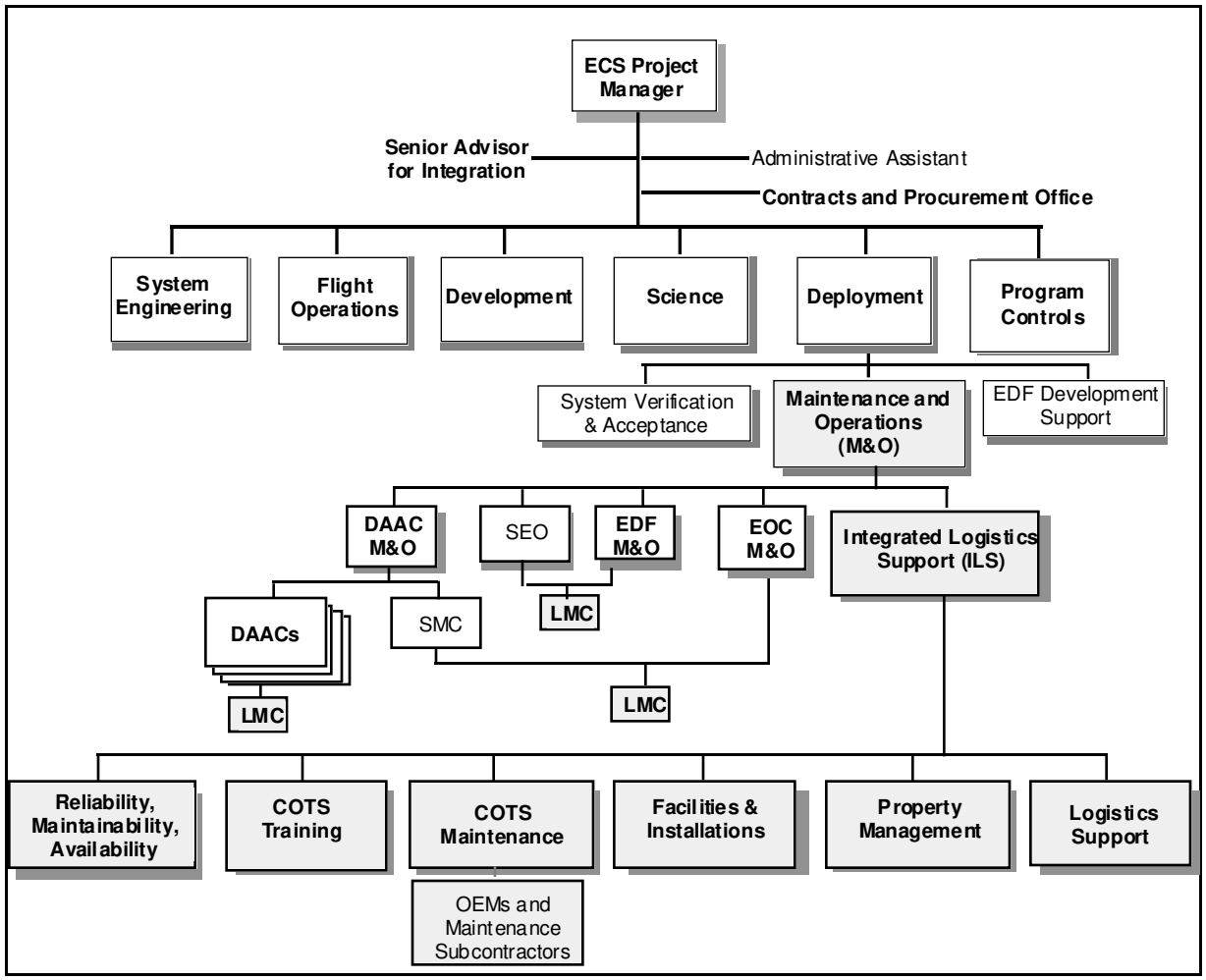

Figure 3-1. Logistics Organization

The ILS Office operates out of the EDF in Upper Marlboro, MD.

This page intentionally left blank.

4. Spares Program Description

4.1 Sparing Objective

The objective of procuring and stocking spares at ECS sites is to support the achievement of the operational availability (A_O) and mean down time (MDT) requirements described in the Functional and Performance Requirements Specification for the EOSDIS Core System (ECS). Those requirements are shown in Table 4-1.

Table 4-1. ECS A_O and MDT Requirements

Function Number	Function Description	A_O Minimum	MDT Maximum
	Flight Operations Segment (FOS)		
3800	Critical real time functions	0.9998	1 Min.
3810	Non critical real time functions	0.99925	5 Min.
3820	Targets of opportunity	0.992	1 Hr
3710	ECS shall have no single point of failure for functions associated with real time operations of the spacecraft and instruments		
	Science Data Processing Segment (SDPS)		
3900	Science data receiving	0.999	2 Hrs
3910	Switchover to backup	NA	15 Min.
3920	Archiving & distributing data	0.98	2 Hrs
3930	User interface to IMS at DAACs	0.993	2 Hrs
3940	Information searches on the ECS directory	0.993	2 Hrs
3950	Data acquisition request submittals	0.993	2 Hrs
3960	Metadata ingest and update	0.96	4 Hrs
3970	Info searches on local holdings	0.96	4 Hrs
3980	Local data order submission	0.96	4 Hrs
3990	Data order submission across DAACs	0.96	4 Hrs
4000	IMS data base management and maintenance interface	0.96	4 Hrs
4010	Product generation computers	0.95	NA
4020	Product generation computers shall provide a "failsoft" environment	NA	NA
	Communications and System Monitoring Segment (CSMS)		
4030	SMC functions of gathering and disseminating system management information	0.998	20 Min.
4035	ESN shall have no single point of failure for functions associated with network databases and configuration data	NA	NA
4036	The A_O of individual ESN segments shall be consistent with the A_O of the supported ECS functions.	NA	NA
3630	Maximum down time shall not exceed twice the required MDT in 99 percent of failure occurrences	NA	NA

Ao = Operational Availability
MDT= Mean Down Time

4.2 Sparing Approach

The spares program provides a limited stock of replacement parts and end items at ECS sites in which to provide an immediate source to repair ECS equipment. Spares purchased/leased for Release 2 represent an initial projection of the parts needed to support operations. These stocks may be adjusted, as needed, once operations Ao and MDT performance statistics are gathered and analyzed. Specifically, the breadth, depth, and/or mix of spares may change based upon whether Ao and MDT objectives are reached. Because of the high costs associated with stocking spares at the sites, spares will be stocked at the minimum levels necessary to achieve ECS performance objectives.

Appendix A contains a listing of the initial spares to be stocked in support of Release 2. This list was selected after consideration of the following factors:

a. Hardware redundancy and failover capabilities designed into the system. HW redundancy and failover capabilities reduce the risk of a failure to the function or subsystem. This will increase availability, reduce downtime, and thereby reduce the need for having spares on site.

b. Inherent reliability of equipment components. Equipment with a high reliability, i.e. mean time between failure (MTBF), has a lower probability of failing and therefore less need to spare its components.

c. Criticality of equipment components. Equipment having a lesser role in the operation of a subsystem function (e.g. server mouse, keyboard, monitor, printer, etc.) decreases the need to have a spare on site because the function is not dependent upon the component being operational. In many cases of non-critical components, a like component from another system can be shared temporarily until the failed component is repaired or replaced.

d. Response and coverage of maintenance support contracts. Some equipment has extended contract maintenance coverage (e.g. SGI 16x7, DEC & SGI 24x7), others have 5x8 coverage (e.g. Sun, HP, and limited others), and the remainder have depot maintenance coverage. Maintenance coverage decisions were determined based upon operations requirements, availability of coverage, and cost considerations. Generally, equipment having extended contract maintenance support was not spared because the extended support should be adequate to meet requirements. Furthermore, maintenance contracts prohibit site personnel from self-maintaining the equipment (see paragraph below). For some equipment (e.g. communications equipment), although the equipment may be highly reliable, the manufacturer does not provide on-site maintenance coverage or it is not available at an acceptable cost. In such cases, the equipment or its components may be spared.

e. Availability of parts on or near the ECS site. Where the maintenance contractor stocks substantial breadth and depth of spares on or near the site, it lessens the need for ECS to purchase or lease spares (e.g. DEC depot in Lanham, MD).

f. Replacement parts replenishment/repair time. For equipment under depot maintenance contracts, the less time it takes the contractor to replace or repair a failed component, the less the need to stock spares on site. Further, for stocked spares, the longer it takes the vendor the repair or replace a failed spare, the greater the need to stock more than one spare at the site or centrally at the EDF.

g. Quantities of like equipment at the site. Fewer quantities of an equipment item at the site make it less cost effective to stock its spares at the site because the stocks provide coverage against fewer ECS functions.

h. Technical skills required to diagnose and resolve HW failures. Some equipment is extremely complex to maintain and requires extensive training for LMCs to become qualified to perform maintenance. The costs to hire/train/retain such highly skilled technicians is very high. For such equipment, it is generally more cost effective to purchase the configured item, rather than its parts, and to contract for depot maintenance support of the configured item. By doing so, LMC staffing costs are reduced.

i. Risk of spares obsolescence. Risk of parts obsolescence is high in computer and communications technology. If frequent system upgrades are expected or if equipment is expected to be replaced in the near term, it is generally more cost effective to provide contracted maintenance or lease spares than to purchase the spares.

j. Costs to lease versus buy. Purchased computer parts are replaced by the vendor as upgrades are introduced. If it is deemed beneficial to the ECS configuration that it be upgraded, such upgrades would have to be purchased as well as any spares previously purchased.

Because spares are purchased for the purpose of providing an immediate replacement for failed critical system components, spares are not intended to, and should not be used to, increase the site's performance, capacity, or functionality. Spares are controlled and their use recorded and reported by the site's LMC. LMCs shall not attempt to install or remove parts on equipment in which they are not currently certified. Because of cost considerations, some spares may be stocked at the EDF rather than at each site. Such spares are available to support all sites and can be delivered to the site within 24 hours. LMCs will contact the ILS Office to request centrally stocked spares. LMCs should not cannibalize (i.e. take component parts) to effect repair of another system.

Stocks of repair parts will be maintained at the level required to sustain the ECS A_o and MDT goals. As spares are used to replace failed components, their use shall immediately be reported by the LMCs in the Inventory Logistics Management (ILM) system. If the item is reparable, the LMC will request a return materials authorization (RMA) number from the maintenance vendor. If it is not reparable, the LMC tags it as such and requests disposition instructions from the ILS Office. Procedures specified in Sections 22 and 23 of the ECS Operations Procedures (DID 611) and the ECS Property Management Plan (DID 602) apply.

4.3 Maintenance Contractor Spares

For most ECS equipment, spares will not be stocked because maintenance contracts with the OEMs and third party maintenance providers should be adequate to meet operations requirements. Such maintenance contracts prohibit ECS personnel from physically removing, replacing, or repairing internal components on equipment under maintenance contract. Maintenance contractors provide replacement parts for the repair of equipment for which they have maintenance responsibility. These contractors may stock spares at ECS sites for the same purposes as described in this document. However, such spares are the property of the maintenance contractor and shall not be used by ECS personnel without the explicit approval of the maintenance contractor. Unauthorized use could result in cancellation of the maintenance contract and additional costs to the Project to reactivate the contract or to obtain other maintenance support.

4.4 Insurance Spares

ECS equipment that is under an on-site maintenance contract will not have spares purchased and stocked at the site unless they are stocked as insurance spares. Insurance spares are replacement parts bought by the ECS Project to insure that essential parts are available to repair function-critical equipment. ECS may purchase insurance spares under the following conditions:

a. the maintenance provider does not stock replacement parts within two hours of the site

b. the equipment is a key component within one of the critical ECS function threads and its failure would render the function inoperable in excess of 6 hours.

4.5 ECS Spares Listing

Appendix A contains a list of spares to be purchased and stocked in support of the ECS systems at the DAACs, SMC, and the EOC. These spares will, when purchased or leased, be recorded in the ILM system and their status monitored thereafter by the ILS Office.

Appendix A. Release 2.0 Spares List

See Table A-1, ECS Spares List, on next page.

Table A-1. ECS Spares List (1 of 2)

Mfgr	Part No.	Item Description	Type Maint Spt	EOC Spr Qty	EDC Spr Qty	EDF Spr Qty	GSFC Spr Qty	LARC Spr Qty	NSIDC Spr Qty	Total Spr Qty
APC	ACI2014CDW-R1	4X2 SCSI switch	T&M		1	1	1	1	1	5
CBL	BRIM-F6	FDDI bridge router module	8x5x4	2	1	1	1	1	1	7
CBL	ESX-1320	Ethernet switch	8x5x4	1						1
CBL	FPIM-00	FDDI- multimode connector	8x5x4	1	1	1	1	1	1	6
CBL	MICROMMAC	Hub, 24 port, 10baseT 24E	8x5x4		1	1	1	1	1	5
CIS	MEMRSPFLC16M	RSP flash credit card	8x5x4		1	1	1	1	1	5
CTI	PT2000	Top Gun barcode scanner	None			1				1
DEC	RZ29B-VA	4.3 GB HD SCSI Int RAID	7x24x4	2						2
Fore	7302-01	FDDI-DAS card	AdvRepl	1	1	1	1	1	1	6
Fore	7101-00	Packet engine	AdvRepl		1	1	1	1	1	5
HP	40621	Keyboard	8x5x4			1				1
HP	46060B	Mouse 3 button	8x5x4			1				1
MIE	CFG1353771	Millennia PC	Depot			2				2
NA	ENET Cable	150' of Enet w/RJ45s	None	3	3	3	3	3	3	18
NA	FDDI Cable	150' of fiber with MIC to MIC	None	3	3	3	3	3	3	18
NAP	X219	9 GB HD for net apps	Depot	2						2
NCD	0600191	Mouse	Depot		1	1	1	1	1	5
NCD	9100813	Keyboard	Depot		1	5	1	1	1	9
NCD	HMXPro	X-term w/16 MB ROM	Depot		1	1	1	1	1	5
SGI	P2-D2GS	2GB HD	16x7x4		1	1	1	1	1	5
SGI	064-0048-001	4 GB HD	16x7x4		1	1	1	1	1	5
SGI	PS-RAID-5X4	4.3 GB HD for RAID	16x7x4		1	1	1	1	1	5
SGI	PS-RAID-5x9	8.8 GB HD	16x7x4		1	1	1	1	1	5
SUN	X567A	2.1 GB HD FW SCSI 2	8x5x4		1	1	1	1	1	5
SUN	X5204A	4.2 GB HD Dis UniPak	8x5x4		1	1	1	1	1	5
SUN	X1015A	FDDI sgl attach S Bus card	8x5x4		1	1	1	1	1	5
SUN	5540-2706-04	2 GB HD FW SCSI	8x5x4		1	1	1	1	1	5
SUN	540-2699-01	2 GB HD internal	8x5x4		1	1	1	1	1	5
SUN	X765A	2.1 GB HD FW SCSI 2	8x5x4		1	1	1	1	1	5
SUN	540-2730-03	2.1 GB HD internal	8x5x4		1	1	1	1	1	5
SUN	X5206A	4 GB HD for SPARC array	8x5x4		1	1	1	1	1	5
SUN	X5251A	9 GB HD internal	8x5x4		1	1	1	1	1	5
SUN	540-2951-01	9.1 GB HD FW SCSI 2	8x5x4		1	1	1	1	1	5
SUN	501-3143-01	FDDI dual attach S Bus	8x5x4		1	1	1	1	1	5
SUN	X595A	Fiber channel optical module	8x5x4		1	1	1	1	1	5
SUN	320-1234-02	Keyboard	8x5x4	1	1	1	1	1	1	6

Table A-1. ECS Spares List (2 of 2)

Mfgr	Part No.	Item Description	Type Maint Spt	EOC Spr Qty	EDC Spr Qty	EDF Spr Qty	GSFC Spr Qty	LARC Spr Qty	NSIDC Spr Qty	Total Spr Qty
SUN	NE SUN1	Mouse, 3 button	8x5x4	1	1	1	1	1	1	6
SUN	X1053A	SBUS Fast SCSI 2 Ethernet	8x5x4		1	1	1	1		4
SUN	X1057A	SBUS fiber chan host adapt	8x5x4		1	1	1	1	1	5
SUN	2610A	SBUS I/O board	8x5x4		1	1	1	1	1	5
SUN	2012	SCSI single end	8x5x4		1	1	1	1	1	5
SUN	595-3217-02	Turbo graphics card	8x5x4				1			1
SUN	595-3865-01	Turbo graphics card	8x5x4		1	1		1	1	4
SYN	2000-2914-04	Concentrator, FDDI	AdvRepl	1	1	1	1	1	1	6
SYN	D1909A	FDDI Card	AdvRepl	1	1	1	1	1	1	6
SYN	D1858-1913A	FDDI workgroup processor	AdvRepl		1	1	1	1	1	5
Wyse	900983-07	Monitor	None		1	1	1	1	1	5
YAM	CDE-100	Ext CD ROM recorder	None			1				1
ZTC	S-500	Bar code RS232 printer	8x5x4			1				1

AdvRepl = Advance Replacement

Abbreviations and Acronyms

A_O	Operational Availability
CDRD	Contract Data Requirement Document
CDRL	Contract Data Requirements List
COTS	Commercial Off-the-Shelf
DAACs	Distributed Active Archive Centers
DID	Data Item Description
ECS	EOSDIS Core System
EDC	Earth Resources Observation Systems (EROS) Data Center
EDF	ECS Development Facility
EOSDIS	Earth Observing System (EOS) Data and Information System (DIS)
EOC	EOS Operations Center
EOS	Earth Observing Systems
EROS	Earth Resources Observation Systems
FOS	Flight Operations Segment
GSFC	Goddard Space Flight Center
HDBK	Handbook
HW	Hardware
ILS	Integrated Logistics Support
LaRC	Langley Research Center
LCC	Life Cycle Cost
M&O	Maintenance and Operations
MDT	Mean Down Time
MTBF	Mean Time Between Failure
NASA	National Aeronautics and Space Administration
NHB	NASA Handbook
OEM	Original Equipment Manufacturer
PAIP	Performance Assurance Implementation Plan

RMA	Reliability, Maintainability, and Availability
RRR	Readiness Release Review
SEO	Sustaining Engineering Organization
SMC	System Monitoring Center
SW	Software