(Insert in 699-206, Spacecraft Support Equipment Functional Requirements Book)

Custodian: James Gerhard

Approved:

Henry M. Doupe
Support Equipment System Engineer

Said Kaki
ISS Electronics Task Manager

Cindy Kahn
ISS Systems Engineer

Cassini Orbiter
Functional Requirements Book
Imaging Science Subsystem (ISS) Support Equipment Requirements

CAS-4-2136

July 6, 1994

Jet Propulsion Laboratory

Table Of Contents

Page

List of References

Tables

(none)

Figures

1.0 SCOPE

This document establishes the Functional Requirements for the electronic ground support equipment (EGSE) for use with the imaging science subsystem (ISS). It is intended that this EGSE be designed to support the ISS at different modes and environments during the ISS development. These include subsystem integration, performance testing, calibration and Cassini system level testing at JPL and the Cape. The hardware and software design will not preclude the use of the EGSE in the post launch environment.

1.1 SUBSYSTEM DEFINITION

The ISS uses two separate camera designs to satisfy the scientific objectives. The first is a narrow angle camera (NAC) design which obtains high resolution images of the target of interest. The second is a wide angle camera (WAC) design which provides a different scale of image resolution and more complete coverage spatially. The spacecraft carries one NAC and one WAC. The NAC is also used to obtain navigational images for the mission with the WAC acting as a functionally redundant backup unit.

Each camera is a framing charge coupled device (CCD) imager. They differ primarily in the design of the optics: the NAC has a focal length of 2000 mm and the WAC has a focal length of 200 mm. Both cameras have a focal plane shutter of the Voyager/Galileo type, and a two wheel filter changing mechanism derived from the Hubble Space Telescope WF/PC. The detector is a CCD, cooled to suppress dark current and shielded from protons and electrons.

The electronics for each camera are identical and contain the signal chain and CCD drivers (located in the sensor head), The Cassini engineering flight computer (EFC), command and control logic, a power supply, mechanism drivers, a lossless digital data compressor, a lossy compressor and an interface to the Command and Data Subsystem (CDS). ISS command and telemetry functions will be handled by the electronics and software including storage of science commands, expansion of commands, collection of science imaging data and telemetry, transmission of imaging data and telemetry to CDS and receipt of commands from CDS.

The CCD detector design is a square array of 1024^2 pixels, each pixel 12 micrometers on a side. The detector will use three phase, front side illuminated architecture, with a coating of lumogen phosphor to enhance ultraviolet response.

The ISS provides a variety of effective data rates to match the input rates of the spacecraft solid state recorder (SSR). There are also several options for data compaction, including on-chip pixel summation, data encoding and digital data compression. See FIGURE 4-2136:-01, "WAC and NAC Camera Assembly".

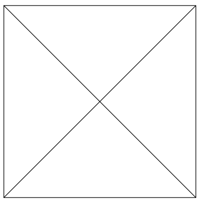

FIGURE 4-2136:-01 WAC and NAC Camera Assembly (June 28, 1994)

2.0 APPLICABLE DOCUMENTS

Applicable parts of the following documents are a part of this functional requirement to the degree that these documents either reflect the source of the requirements or define the interfaces of environments in which the Cassini EGSE must operate.

CAS-4-2036	Cassini ISS Functional Requirements
CAS-3-190	Cassini Structual Design Criteria
CAS-3-210	Cassini Temperature Control Requirements
CAS-3-220	Cassini Electronic Equipment Design Criteria Requirements
CAS-3-240	Cassini Environmental Design Requirements
CAS-3-250	Cassini Power Requirements
CAS-3-260	Cassini Electrical Grounding and Interfacing
CAS-3-310	Cassini S/C Information System
CAS-3-330	Cassini Fault Protection Requirements
CAS-3-360	Cassini Safety Requirements
CAS-3-1110	Cassini S/E Interface Circuits
CAS-3-1120	Cassini SE Functional Requirements
CAS-3-1360	Cassini SE Safety Requirements

3.0 FUNCTIONAL REQUIREMENTS

3.1 GENERAL REQUIREMENTS

The ISS EGSE shall not damage, in any circumstance, the ISS camera under test in its various configurations. *(3897)*

The design of the ISS EGSE shall allow good access to all equipment for maintenance purposes. *(3898)*

The ISS EGSE shall comply with the safety requirements and shall not endanger operating personnel. *(3899)*

The ISS EGSE hardware design shall follow the modularity concept. *(3900)*

The ISS EGSE shall utilize two CRTs, one for housekeeping data, the other for science data. *(3901)*

3.2 POWER REQUIREMENTS

The ISS EGSE shall operate using 115V 60 Hz single phase power. *(3903)*

The power consumption shall be less than 5 KW. *(3904)*

Power failure and momentary power drop out shall not damage the ISS EGSE if a timely recovery is not possible. *(3905)*

The ISS EGSE shall be grounded through a single point ground via the ground pin in the input power connection. *(3906)*

The ISS EGSE shall be electrically isolated from the spacecraft ground and from other support equipment of the subsystem, as per document CAS-3-260 "Electrical Grounding and Interfacing". *(3807)*

The ISS EGSE shall have an isolation transformer through which it receives power. *(3907)*

3.3 INTERFACE REQUIREMENTS

FMECAs and Circuit Data Sheets shall be generated for the power interface, the direct access interface and the analog telemetry interface. *(3909)*

3.3.1 REMOTE TERMINAL INTERFACE UNIT (RTIU)

The ISS EGSE shall utilize an RTIU to simulate the Command and Data Subsystem (CDS) as per documents CAS-3-271 "Spacecraft Intercommunications", CAS-3-281 "Telemetry Formats and Measurements", CAS-3-291 "Uplink Formats and Command Tables" and CAS-3-310 "Spacecraft Information System". *(3911)*

3.3.2 DIRECT ACCESS

The ISS EGSE direct access system shall operate properly when connected to the ISS by cable lengths up to 300 feet. *(3913)*

The ISS EGSE direct access system shall read raw image data directly from the ISS Main Electronics Assembly (MEA) in either 1X1, 2X2 or 4X4 modes. The ISS EGSE direct access system shall include twelve bits of data, data control bits and summation mode bits. *(3914)*

3.3.3 ETHERNET

The ISS EGSE shall have a dedicated ethernet port connected to the ATLO test LAN. *(3916)*

The ISS EGSE shall include a second ethernet connection for X-terminal operation and for sending test data directly to the Multi-mission Image Processing Lab (MIPL). *(3917)*

3.3.4 HEATERS

The ISS EGSE shall have the capability of controlling replacement and decontamination heaters. *(3919)*

3.3.5 POWER DISTRIBUTION

The ISS EGSE shall provide 30V power with over and under voltage protection, current limiting, and running time meter during pre-SAF operations. *(3921)*

The ISS EGSE shall log and display voltage, current and high/low limits with alarms during pre-SAF operation. *(3922)*

3.4 SOFTWARE REQUIREMENTS

Data being generated by the Cassini ISS instrument and received by the ISS EGSE is considered real-time, while data that has been previously received and recorded is considered non-real-time. Background processing is defined as any process in the ISS EGSE system which is not directly involved in handling or processing real-time data. *(3924)*

The tasks supporting the interface to the Cassini ISS instrument (i.e. data acquisition) and data storage shall be sufficiently independent of the tasks which perform science and engineering display processes so that the display processors can be accessing previously recorded (non-real-time) data and can do so without interfering with real-time data acquisition. *(3925)*

All data acquired by the ISS EGSE shall be cataloged in a database. *(3926)*

The database shall include all information about the stored data on disk, optical disk or tape, and shall include search and query functions. *(3827)*

3.4.1 REAL-TIME PROCESSING REQUIREMENTS

Data acquired through the direct access port or the RTIU is considered real-time data. *(3930)*

Real-time processing shall include acquiring and storing housekeeping and science data. *(3931)*

Data acquired shall be stored in the exact format as it was acquired from the instrument. *(3932)*

All data stored shall be time tagged to a resolution of one second. *(3933)*

3.4.2 BACKGROUND PROCESSING REQUIREMENTS

Background processing includes those tasks which access data already stored in the ISS EGSE to generate data products. These tasks shall operate concurrently in the system with the real-time on a non-interference basis with regards to the system resources. *(3935)*

3.4.2.1 ACCESS AND PROCESSING OF HOUSEKEEPING DATA

The most recent 20 megabytes worth of data shall be maintained in on-line storage for processing by background or non-real-time tasks. *(3937)*

The ISS EGSE shall provide display of operator selected measurement channels on the housekeeping data monitor. *(3938)*

Each channel shall be identified by name and displayed in raw data units or engineering units (if applicable). *(3939)*

The system shall provide operator controllable tolerance suppression and alarm testing in real-time of each channel. *(3940)*

The operator shall be able to select any of several pre-defined display pages of engineering, measurement and status data at random during housekeeping data processing. *(3941)*

Print-out of operator selected measurements shall be identified and processed identically as for the CRT display. *(3942)*

The system shall provide a means for retrieval of selected archived engineering data from tape to system mass storage for further processing. *(3943)*

All data replayed from tape shall be identified within the system so as to not be confused with real-time data. *(3944)*

3.4.2.2 ACCESS AND PROCESSING OF SCIENCE DATA

Every image recorded shall include a header record containing a title, test identification, date, instrument configuration parameters, process parameters and selected status channels. *(3946)*

The most recent 70 images shall also be maintained in system disk storage, in both VICAR format and original data format, for processing by background and non-real-time tasks. *(3947)*

The operator shall be able to display an image on the color CRT at a rate of one image per minute. *(3948)*

The system shall compute and print average, minimum and maximum, standard deviation, and histograms of displayed image. *(3949)*

The system shall generate area dumps of selected images to the operators terminal or printer. *(3950)*

The system shall allow the operator to display any image or part of an image in current mass storage. *(3951)*

The system shall be able to generate a housekeeping and/or science dump consisting of printed records of science and/or housekeeping data. *(3952)*

The system shall allow user selected images to be read from tape or optical disk into system hard disk for further processing. *(3953)*

Image averaging, stretching, subtraction and division, using a subset of the VICAR software installed in the ISS EGSE. *(3954)*

The system shall be able to transmit images to MIPL through ethernet in VICAR formats. *(3955)*

3.4.2.3 INSTRUMENT COMMANDING

The ISS EGSE is capable of sending two types of commands, discrete and block. Discrete commands are commands that are sent individually, while block commands are sent in a group. *(3957)*

The ISS EGSE shall be capable of sending commands at any pre-defined time. *(3958)*

The maximum rate at which discrete commands can be sent to the instrument shall be one command per second from the ISS EGSE. *(3959)*

A command processor shall check each discrete command sent to the instrument for command validity and parameter limits. The ISS EGSE shall prompt the operator if invalid commands or invalid parameters are found. The EGSE shall prompt the operator to verify the desire to send critical commands. A critical command is any command that could cause damage to the instrument or other hardware. *(3960)*

The ISS EGSE command processor shall display, in the system CRT display, the command currently being sent and the next command to be sent. All commands sent to the instrument shall be time-tagged and recorded in a system history log file. *(3961)*

Command blocks shall be generated by the operator as a file using a text editor, and stored on disk. Once a command file has been generated, it shall by checked by an EGSE command block validation program. The command block validation program shall check for valid commands and their parameter limits. If the command block file has no invalid commands or parameters, the ISS EGSE shall add a checksum header to the top of the command block file deemed valid. Any critical commands found shall generate a prompt to the operator to verify the desire to include the critical command in the command block file. *(3062)*

3.4.2.4 SYSTEM HISTORY LOG FILE

The ISS EGSE shall generate a record of operations and interactions with the instrument. This log shall contain all commands sent to the instrument, engineering and status outputs, and selected ISS EGSE status messages, as well as error messages. In formation shall have the option of being sent to the hard disk for storage, or to the printer for continuous printing of the system log. *(3964)*

3.4.2.5 DATA ARCHIVAL

All data received by the ISS EGSE shall be recorded on optical disk or 1/4 tape media. Archived data shall contain sufficient time tags and other annotations to clearly identify every channel/frame, etc. Archival products shall be of two types, housekeeping data and science data. *(3966)*

When housekeeping data is being received, the ISS EGSE shall record all housekeeping data on the hard drive. A message shall be generated to notify the operator to archive housekeeping data onto tape or optical disk when ever the hard disk is at 90% full. A message shall also be generated to tell the operator when to change archive optical disks or archive tapes. *(3967)*

All science data shall be archived on the hard drive. A message shall be generated to notify the operator to archive science data onto tape or optical disk when the hard drive is at 90% full. A message shall also be generated to tell the operator when to change archive tapes. *(3968)*

The ISS EGSE shall be able to convert all science data stored on hard disk, tape or optical disk to VICAR format, and send it to MIPL via ethernet. *(3970)*

3.4.2.6 OPERATOR CONTROL INTERFACE

The ISS EGSE operator control interface shall provide control to the system operator of the allocations of system resources to individual tasks, selection of output products to be generated, and selection of control parameters. *(3972)*

The ISS EGSE operator control interface shall allow on-screen display and editing of operator inputs, and provide a means to print all accepted operator control inputs. *(3973)*

3.4.2.7 TEXT EDITOR

The ISS EGSE shall provide a means by which the operator may generate and edit command files. *(3974)*

3.4.2.8 SYSTEM PERFORMANCE AND FAULT CHECKING

The ISS EGSE shall contain a self-diagnosis capability to determine if failures occur during system operation. The self-diagnosis system shall report these failures to the system operator. Each identified error shall be reported on the system operators display terminal in a clear, explanatory error message. Whenever possible, the self-diagnosis system shall prompt the operator to perform corrective action (i.e., change a full disk or tape, or other such operations). *(3977)*

All applicable Cassini Level 3 Requirements in which the ISS EGSE must satisfy can be found in Appendix A of this document. *(3978)*

4.0 FUNCTIONAL DESCRIPTIONS

4.1 GENERAL FUNCTION DESCRIPTION

A total of three identical ISS EGSEs will be built, one for bench check out (BCE), and two for ground support (EGSE1 and EGSE2). The ISS EGSE consists of three racks housing all computers and equipment (except for a buffer box used for the direct access during some BCE and SAF operations).

4.2 BCE TEST CONFIGURATION (PRE-SAF)

The heart of the ISS EGSE is a SUN SparcStation 10 computer with 64 megabytes of RAM, 848 megabytes of hard drive space, a 1152 X 900 pixel color graphics monitor for science data, and a 1280 X 1024 pixel color graphics X-terminal for housekeeping data. Also included, a 150 megabyte tape drive and 650 megabyte optical disk used for archiving, a CD ROM, laser printer, and keyboard with mouse.

Interfaces included in the SUN SparcStation are a general purpose interface bus (GPIB), an S16D interface (high speed 16-bit parallel), and two ethernet interfaces. The GPIB interface is used for controlling and monitoring an HP 3852A Data Acquisitio n and Control Unit, with plug in modules for reading camera heater temperatures, power switching of heaters and main power, and options for optical stimulus control. The GPIB is also used for controlling an HP 66000A Modular Power System, which is used for controlling and monitoring power supplied to the instrument. The S16D interface is used for the direct access, which reads raw image data from the instrument, allowing the EGSE operator to inspect raw data, and display direct access images. Two ethernet interfaces are available on the SUN SparcStation. The first ethernet interface is used to control a remote terminal interface unit (RTIU), which is our pre-SAF CDS. This ethernet will ultimately be used at SAF, connecting to the ATLO test LAN. The second ethernet interface will be used for the second X-terminal CRT, as well as allow the operator to send science data directly to MIPL for analysis. A CCD simulator checks camera electronics without a sensor head. See FIGURE 4-2136:-02, "Pre-SAF ISS EGSE Configuration".

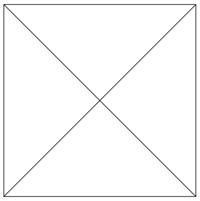

FIGURE 4-2136:-02 Pre-SAF ISS EGSE Configuration (June 28, 1994)

4.3 SAF CONFIGURATION

The ISS EGSE SAF configuration requires less ancillary equipment than the BCE mode. The RTIU, power supply system for heaters and main power, data acquisition and control unit, and CCD simulator will no longer be necessary at SAF. See FIGURE 4-2136:-03, "ISS EGSE SAF Configuration".

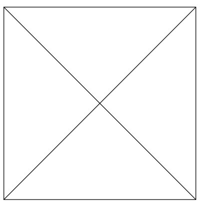

FIGURE 4-2136:-03 ISS EGSE SAF Configuration (June 28, 1994)

4.4 SIMULTANEOUS CAMERA TESTING

During BCE operations, the ISS EGSE shall be capable of providing a means for testing the NAC and WAC cameras simultaneously. Although only one RTIU is required to send commands to both cameras, two power supply systems are required, therefore, to ISS EGSEs shall be used. See FIGURE 4-2136:-04, "Simultaneous Camera Testing". *(4016)*

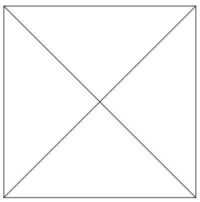

FIGURE 4-2136:-04 Simultaneous Camera Testing (June 28, 1994)

5.0 INTERFACE DEFINITIONS

5.1 RTIU

The RTIU interfaces the ISS EGSE to the instruments Bus Interface Unit (BIU). The RTIU is a VME based computer, with 1553B bus and ethernet interface designed by section 348. The RTIU allows the EGSE to send commands, command blocks, and memory down loads to the instrument. The RTIU will also send to the EGSE, housekeeping and science data packets sent from the instrument. The RTIU will perform transactions for Real Time Interrupt (RTI), Dead Time Start (DTS), spacecraft time, science and housekeeping pickup broadcasts. Both the WAC and NAC BIUs will connect to the same RTIU, thereby giving the EGSE the capability of sending separate commands to both cameras and receive science and housekeeping data from both cameras simultaneously. *(4019)*

5.1.1 RTIU COMPUTER INTERFACE

The RTIU is connected to the ISS EGSE SUN SparcStation via an exclusive ethernet interface. While at SAF, the ethernet interface will connect to the ATLO test LAN instead of the RTIU. *(4021)*

5.2 POWER SUPPLY

The HP 66000 modular power system will be used as the ISS EGSE power supply during all pre-SAF operations. It will provide main power to the ISS instrument as well as heater power. The core of the HP 66000 is a seven inch high mainframe which is capable of accommodating up to eight programmable 150 Watt DC power supply modules. See FIGURE 4-2136:-05, "HP 66000 Modular Power Supply".

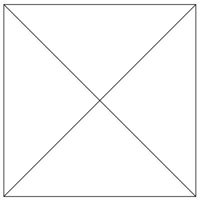

FIGURE 4-2136:-05 HP 66000 Modular Power Supply (June 28, 1994)

5.2.1 POWER SUPPLY OUTPUT RATINGS

Output Voltage	0 - 35 Volts
Output Current	0 - 4.5 Amps
Output Power	150 Watts Max.

5.2.1.1 RIPPLE AND NOISE

With a frequency in the range of 20 Hz to 20 Mhz and outputs ungrounded or either terminal grounded, the following results apply:

Constant Voltage RMS	5 mV
Peak - Peak	10 mV
Constant Current RMS	2 mA

5.2.1.2 REGULATION

With change in output voltage or current for any load or line change within ratings, the following results apply:

Load Regulation:	Voltage	1 mV
	Current	0.2 mA

Line Regulation:	Voltage	1 mV
	Current	0.3 mA *(4029)*

5.2.2 POWER SUPPLY COMPUTER INTERFACE

The HP 66000 connects to the ISS EGSE via the GPIB bus. *(4031)*

5.2.2.1 PROGRAMMABLE FUNCTIONS

Output Voltage	Output Current
Output Sequencing	Output Enable/Disable
Fault Interrupt	Over-voltage Protection

The ISS EGSE will use over-current and over-voltage, tripping supply if condition exists. *(4034)*

5.2.2.2 RELAY CONTACT SPECIFICATIONS

Max. Input Voltage	300 V DC
	250 V RMS
Max. Input Current	2 A DC
	3 A RMS

5.2.2.3 READBACK FUNCTIONS

Actual Measured Voltage	Actual Measured Current
Present Module Status	Programming Error Codes
Fault Codes	

5.2.2.4 COMMAND PROCESSING TIME

Average time required for the output voltage to begin change following receipt of digital data is less than 20 mS.

5.2.2.5 OUTPUT RESPONSE TIME

The time for the output voltage to change from 10% to 90% or from 90% to 10% of the rated output is less than 20 mS.

5.2.3 POWER SUPPLY CONTROL AND METER PANEL

A power supply control and meter panel is mounted in a rack along with the HP 66000 modular power system. For each power source being supplied to the instrument, main power, replacement and decontamination heaters, there is a volt meter, amp meter, and time meter. There is also a time meter for the entire ISS EGSE system. See FIGURE 4-2136:-06, "Power Supply Panel".

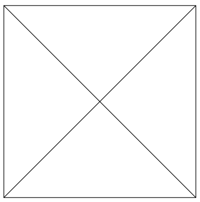

FIGURE 4-2136:-06 Power Supply Panel (June 28, 1994)

At the top of the power supply panel is a cover plate which protects manual on/off switches from being accidentally flipped. Normally, power switching is done via the ISS EGSE SUN SparcStation power window. Moving the switch marked manual/computer to the manual position activates control of the power supplies to the three switches marked on/off for main, and replacement and decontamination heaters.

Computer power switching is done by an HP 44729A 8-channel power controller module. This module is part of the HP 3852S data acquisition and control unit, which mounts in the same rack as the HP 66000 power supply and the power supply panel.

5.3 DATA ACQUISITION

The HP 3852A data acquisition and control unit is also used to read and log heater temperatures during BCE operations. An HP44711A high speed FET multiplexer module is used in the HP 3852A data acquisition unit for temperature measurement. See FIGURE 4-2136:-07, "HP 3852S Data Acquisition and Control Unit".

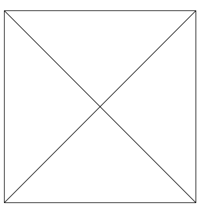

FIGURE 4-2136:-07 HP 3852S Data Acquisition and Control Unit (June 28, 1994)

5.3.1 TEMPERATURE MEASUREMENT

There are four platinum resistive thermal device (RTD) temperature sensors for both the NAC and WAC camera that are be monitored by the ISS EGSE during BCE operations. Each sensor connects to the HP 44711A FET multiplexer module, which the EGSE monitors continually via the GPIB. Default scan rates for the temperature sensors are once per second, however scan rate changes can be implemented by the operator. Each scan pass causes the EGSE to check for high and low limits (configurable by the operator), update the display, and record the new value with a time tag in a file on the hard drive. Temperature measurement points for both the NAC and WAC cameras are:

1) Filter Wheel Housing
2) CCD
3) Sensor Head
4) Forward Optics

5.3.2 HEATER CONTROL

Both the NAC and the WAC cameras have two decontamination heaters, however the NAC has four replacement heaters, while the WAC camera only has three. The heater locations for the NAC and WAC cameras are:

<u>NAC</u>

1) CCD Replacement Heater
2) Rear Optics Replacement Heater
3) Primary Mirror Replacement Heater
4) Secondary Mirror Replacement Heater
5) Decontamination Heater #1
6) Decontamination Heater #2

<u>WAC</u>

1) CCD Replacement Heater
2) Rear Optics Replacement Heater
3) Forward Optics Replacement Heater
4) Decontamination Heater #1
5) Decontamination Heater #2

5.4 ETHERNET INTERFACE

The ISS EGSE SUN SparcStation computer has two ethernet interfaces, one for communicating with the housekeeping data X-terminal and sending images directly to MIPL, and the other for commanding the RTIU during BCE operations or connecting to the ATLO test LAN during SAF operations. See FIGURE 4-2136:-08, "Ethernet Configurations".

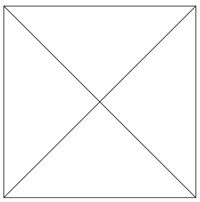

FIGURE 4-2136:-08 Ethernet Configurations (June 28, 1994)

5.5 DIRECT ACCESS

The direct access interface allows the ISS EGSE to acquire raw image data directly from the ISS main electronics assembly (MEA). The direct access interface also allows testing and viewing of key signals and clocks throughout the MEA. *(4056)*

Each direct access signal is buffered at the spacecraft electronics before it is sent to the direct access ports. There is a separate direct access connector for the NAC and WAC cameras. Twelve foot cables connect the instruments direct access ports to the direct access buffer boxes, where the signals are opto-coupled to Harris HS245 line drivers. All signals are optically isolated, providing 3000 V DC isolation. Power for the buffer boxes is provided by the direct access receiver located in the ISS EGSE racks. *(4057)*

The opto-coupled and buffered direct access signals are then sent out over a 300 foot cable to the direct access receiver, where they are buffered again and sent to the S16D interface card located in the SUN SparcStation. *(4058)*

Two signals, FRAME and LATCHDATA allow the direct access receiver to handshake with the S16D interface card, where the DATA signals are read from 8 Kbyte FIFOs, directly into the SUNs memory. All other signals are sent to breakout test terminals where they can be easily monitored. See FIGURE 4-2136:-03, "ISS EGSE SAF Configuration" for direct access configuration. *(4059)*

5.5.1 DIRECT ACCESS SIGNALS

Instrument Designation	Signal Name*	Signal Function
CCE-J5-9 & 10	DA_RDB0	Raw Data Bit 0
CCE-J5-11 & 12	DA_RDB1	Raw Data Bit 1
CCE-J5-13 & 14	DA_RDB2	Raw Data Bit 2
CCE-J5-15 & 16	DA_RDB3	Raw Data Bit 3
CCE-J5-18 & 19	DA_RDB4	Raw Data Bit 4
CCE-J5-20 & 21	DA_RDB5	Raw Data Bit 5
CCE-J5-22 & 23	DA_RDB6	Raw Data Bit 6
CCE-J5-24 & 25	DA_RDB7	Raw Data Bit 7
CCE-J5-26 & 27	DA_RDB8	Raw Data Bit 8
CCE-J5-28 & 29	DA_RDB9	Raw Data Bit 9
CCE-J5-30 & 31	DA_RDB10	Raw Data Bit 10
CCE-J5-32 & 33	DA_RDB11	Raw Data Bit 11
CCE-J5-7 & 8	FRAME	Frame Ready Clock
CCE-J5-5 & 6	LATCHDATA	Data Ready Clock
CCE-J5-1 & 2	SUM0	Summation Mode Bit 0
CCE-J5-3 & 4	SUM1	Summation Mode Bit 1
CCE-J5-34 & 35	DA_IO0	I/O Port 0 - Multipurpose
CCE-J5-36 & 37	DA_IO1	I/O Port 1 - Multipurpose

CCE-J5-38 & 39	DA_IO2	I/O Port 2 - Multipurpose
CCE-J5-40 & 41	DA_IO3	I/O Port 3 - Multipurpose

* NAC signal names are preceded by an N, WAC signal names preceded by a W.

6.0 PERFORMANCE PARAMETERS

6.1 OPTICS PARAMETERS

The following tables describe the ISS performance parameters.

6.1.1 NARROW ANGLE CAMERA OPTICS PARAMETERS

Type	Ritchey Chretien
Focal length	2000 mm
Relative aperture	f/10.5
Spectral range	200 - 1100 nm
Number of filters	24
Pixel FOV	6.0 microradian/pixel
Field of view	0.35 x 0.35 deg

6.1.2 WIDE ANGLE CAMERA OPTICS PARAMETERS

Type	Refractor
Focal length	200 mm
Relative aperture	f/3.5
Spectral Range	380 - 1100 nm
Number of filters	18
Pixel FOV	60 microradian/pixel
Field of view	3.5 x 3.5 deg

6.2 DETECTOR PARAMETERS

The following information is both the NAC and WAC cameras.

Type	CCD

Format	1024 x 1024 pixels
Pixel size	12 x 12 um
Full well	100,000
On-chip processing	1,400,000
Dark Current	< 0.1 e^-/pixel/sec at operating temperature
Charge transfer efficiency	0.99996 at operating temperature
System Read Noise	< 60 e^- rms (goal of 20 e^- rms) at EOM
Minimum Frame Time	12 seconds
Data Rate Range	Six selectable rates
Data Encoding	Two 12 to 8 bit encoding, table lookup 2:1 lossless data compression and lossy compression
Gain States	4
System MTF	> 0.15 at 32 line pairs/mm
Exposure Selection	Focal-plane shutter controlled by command
Exposure Times	5 msec to 20 min, simultaneous WAC/NAC shuttering po.

6.3 OTHER PARAMETERS

Scattered Light	goal < 10E-4 for theta=6° <10E-10 for theta = 40°
Dynamic Range	4096
Residual Image Effect	unmeasurable level
NAC Alignment	Control ± 0.3 mrad Knowledge ± 0.05 mrad
WAC Alignment	Control ± 1.0 mrad Knowledge ± 0.1 mrad
Mechanism Lifetime	>300,000
Contamination	NAC 266 micrograms/sq cm WAC 1375 micrograms/sq cm
Operating Temperature	-10° C to +25°C
Non-Operating Temperature	-20° C to +35°C

7.0 PHYSICAL CHARACTERISTICS AND CONSTRAINTS

7.1 ISS EGSE

There are a total of three complete ISS EGSE systems, each comprised of one SUN SparcStation 10, an X-Terminal and a VME based embedded computer (RTIU), power supply system, data acquisition system, and direct access all housed in three 19 racks, 60 high.

Each single rack assembly shall not exceed 1000 pounds. *(4074)*

The center of gravity of each rack shall not be higher than 40% of the total rack height. *(4075)*

Each rack shall have identifying labels on front and back. *(4076)*

Racks with drawers or extenders shall maintain stability with all modules fully extended. *(4077)*

The RTIU, power supply system, and data acquisition system are all housed in the EGSE equipment, but will not be required during SAF operations. FIGURE 4-2136:-09, "ISS EGSE Rack Layout" shows the ISS EGSE physical configuration.

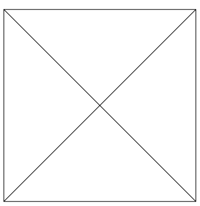

FIGURE 4-2136:-09 ISS EGSE Rack Layout (June 28, 1994)

7.1.1 ISS EGSE SAF FLOOR LAYOUT

FIGURE 4-2136:-10, "ISS EGSE SAF Floor Layout" shows the ideal SAF floor layout for the ISS EGSE. Only the racks are considered hard equipment is this figure. Up to three people will be working in the ISS EGSE SAF area.

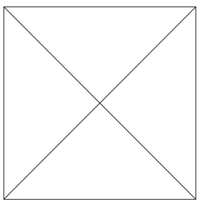

FIGURE 4-2136:-10 ISS EGSE SAF Floor Layout (June 28, 1994)

7.1.2 DIRECT ACCESS BUFFER BOX

The ISS EGSE buffer box dimensions are 10 X 8 X 2 and will be located near the instrument (less than twelve feet) during BCE and SAF operations. See FIGURE 4-2136:-11, "ISS EGSE Direct Access Buffer Box".

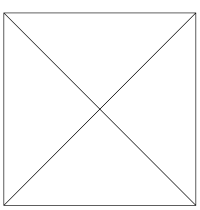

FIGURE 4-2136:-11 ISS EGSE Direct Access Buffer Box (June 28, 1994)

7.1.3 DIRECT ACCESS CABLING AND CONFIGURATION

See FIGURE 4-2136:-12, "Direct Access Cabling and Configuration" for ISS EGSE direct access cabling and configuration.

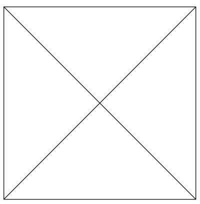

FIGURE 4-2136:-12 Direct Access Cabling and Configuration (June 28, 1994)

7.2 POWER

The ISS EGSE requires standard 60 Hz, 110 Volts AC power serviced by one Type 2613 Hubble female cord connector. *(4087)*

8.0 SAFETY CONSIDERATIONS

8.1 PERSONNEL SAFETY

The ISS EGSE shall be designed for personnel safety per JPL standard safety practices. *(4090)*

8.2 INSTRUMENT SAFETY

The ISS EGSE shall provide a large red operating lamp to indicate when power is applied to the instrument. Lamps shall also be present for replacement and decontamination heaters, indicating on states. *(4092)*

Power supplies to the instrument shall have manual override as well as over/under voltage/current limitations with alarms. *(4093)*

9.0 APPENDIX A - CASSINI LEVEL 3 REQUIREMENTS

These are the driving requirements from CAS-3-260 "Electrical Grounding and Interfacing". See requirement excerpt in the matrix that follows. [Parents: 2195, 2197, 2221, 9300, 9309, 9324, 9325, 9326, 9330, 9334, 9338, 11476, 13905, 14006, 50442, 60939, 60941, 60944, 60946, 60949, 60951, 60953, 60955, 60957, 60959, 60961, 60963, 60967, 60973, 60974, 60976, 60980, 60986, 60988, 60990, 60994, 61000] *(419)*

REFERENCE

CAS-4-2136 Source Requirements Cross-Reference					
DRIVING REQUIREMENT SOURCE			CAS-4-2136 REQUIREMENT		
DOC	PARA	RQID	PARA	RQID	DESCRIPTION
CAS-3-260	3.2.3.2	2195	9.0	419	
CAS-3-260	3.3	2197	9.0	419	
CAS-3-260	3.3.4	2221	9.0	419	
CAS-3-260	3.3.5.5	9300	9.0	419	
CAS-3-260	3.3.6.2	9309	9.0	419	
CAS-3-260	3.3.6.3.4	9324	9.0	419	
CAS-3-260	3.3.6.4	9325	9.0	419	
CAS-3-260	3.3.7	9326	9.0	419	
CAS-3-260	3.3.7	9330	9.0	419	
CAS-3-260	3.3.8	9334	9.0	419	
CAS-3-260	3.3.8	9338	9.0	419	
CAS-3-260	3.3.8	11476	9.0	419	
CAS-3-260	3.3.6.1	13905	9.0	419	
CAS-3-260	3.3.8	14006	9.0	419	
CAS-3-260	3.3.1.1.1	50442	9.0	419	
CAS-3-260	4.2.1	60939	9.0	419	
CAS-3-260	4.2.1.1	60941	9.0	419	
CAS-3-260	4.2.1.2.1	60944	9.0	419	
CAS-3-260	4.2.1.2.2	60946	9.0	419	
CAS-3-260	4.2.1.2.3	60949	9.0	419	
CAS-3-260	4.2.2	60951	9.0	419	

CAS-4-2136 Source Requirements Cross-Reference					
DRIVING REQUIREMENT SOURCE			CAS-4-2136 REQUIREMENT		
DOC	PARA	RQID	PARA	RQID	DESCRIPTION
CAS-3-260	4.2.2.1	60953	9.0	419	
CAS-3-260	4.2.2.2	60955	9.0	419	
CAS-3-260	4.2.2.2.1	60957	9.0	419	
CAS-3-260	4.2.2.3	60959	9.0	419	
CAS-3-260	4.2.2.4	60961	9.0	419	
CAS-3-260	4.3	60963	9.0	419	
CAS-3-260	4.3.1	60967	9.0	419	
CAS-3-260	4.3.2	60973	9.0	419	
CAS-3-260	4.3.2	60974	9.0	419	
CAS-3-260	4.3.3	60976	9.0	419	
CAS-3-260	4.3.4.1	60980	9.0	419	
CAS-3-260	4.3.4.3	60986	9.0	419	
CAS-3-260	4.3.4.4	60988	9.0	419	
CAS-3-260	4.3.5	60990	9.0	419	
CAS-3-260	4.3.7	60994	9.0	419	
CAS-3-260	4.3.9.1	61000	9.0	419	

REQUIREMENT ID INDEX