



Flight Dynamics Facility (FDF) Memorandum of Agreement (MOA) on FDF Communications Methodologies via the Open and Restricted IO Networks

Revision: 2

**Effective Date: 05/15/2012
Expiration Date: 05/15/2017**



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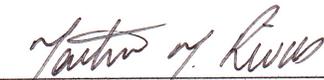


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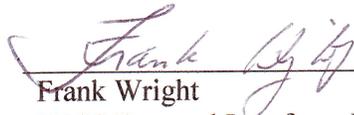
Submitted by:



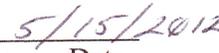
Martin Rivas
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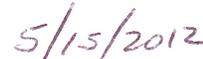
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Ambrose T. Levi
FDSS FDF Sustaining Engineering Domain Lead
GSFC FDF, Building 28


Date



Approved by:

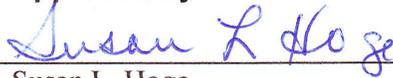


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This document makes obsolete the following document:

- FDSS-LOP-0069 (Revision 1) *Flight Dynamics Facility (FDF) Memorandum of Agreement (MOA) Communications Methodologies Via the Open and Restricted IO Networks*, effective: 08/15/2011

For this superseded and obsolete document discard all hard copies in accordance with Flight Dynamics (FD) Configuration Management Procedures, [FDSS-CMP-0001](#).



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Preface

This document identifies the processes and the responsible parties for the approved communications' standards and methods that apply to the FDF Open IO and Restricted IO Network customers. This document also describes the naming conventions and directory structures used in communications with the FDF.

Proposed changes to this document shall be submitted to the signatories along with supportive material justifying the proposed change. Changes to this document shall be made by complete revision.



Note: There is no provision for DCNs under the GSFC Management System [MS] compliance

Comments or questions concerning this document and proposed changes shall be addressed to:

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Change Information Page

List of Effective Pages		
Page Number	Version	Nature of Change
All	Original	Initial Release
All	1	Complete re-write for the modernization effort.
All	2	Ported document back to MS Word 2007, updated slightly throughout.



Table of Contents

1. Purpose.....	1
1.1 Scope.....	1
2. References.....	1
3. FDF Network Communication.....	2
3.1 Overview	2
3.2 FDF Communication Layout.....	3
3.3 FDF Services	4
4. Communications Process for the FDF CI (S)FTP Sites	4
4.1 Communicating with the FDF Customer Interface	4
4.2 FDF Customer Interface FQDNs	4
4.3 Protocols Allowed.....	4
4.3.1 SFTP and SCP	4
4.3.2 FTP	4
4.4 Firewall Rules (Open/Restricted IO Networks)	5
4.5 Customer Interface Directory Structure and Definitions	6
4.6 Functionality of the FDF Customer Interface Directories.....	7
5. FDF User Accounts.....	8
6. FDF Naming Conventions	8
6.1 Name Requirements	8
6.2 Past Conventions	8
7. FDF Information (FDFI) Website	9
8. FDF Customer Help and Information	9
8.1 The FDF Helpdesk	9
9. Records.....	10
10. Forms.....	10
Appendix A. Acronyms and Definitions	11
Appendix B. Change History Log.....	13



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Flight Dynamics Facility (FDF) Memorandum of Agreement (MOA) on FDF Communications Methodologies via the Open and Restricted IO Networks

1. Purpose

This document presents the approved communication standards that apply to Flight Dynamics Facility (FDF) customers, describes the communications systems functionality, and identifies the naming conventions and directory structures required for successful data transmissions. This document should be referenced in all Memoranda of Agreement (MOAs) that involve communication with the FDF.

1.1 Scope

This document applies to all FDF external customers that are and will be transmitting data to and from the FDF. FDF external customers must adhere to the communication methods presented in this document.

2. References

- FDSS-UG-0007 [*Flight Dynamics Facility \(FDF\) Customer Interface Layer \(CIL\) User's Guide*](#)
- FDSS-LOP-0132 [*Flight Dynamics Facility \(FDF\) Local Operating Procedures \(LOP\) for Firewall Rule Requests*](#)
- *Flight Dynamics Facility (FDF) Customer Account User Guide*, FDSS-LOP-0146.



3. FDF Network Communication

3.1 Overview

The FDF performs all mission operations activities on a separate network, the FDFNetHome within the Restricted IO Network. External connectivity to the FDFNetHome is limited by design. The FDF external communications are managed by the Customer Interface Layer (CIL), with two instances, on the Open IONet (FDFNetO) and the Restricted IO Network (FDFNetR).

The FDF supports multiple communications protocols, and has the flexibility to add more if needed. The protocols supported are:

Protocol	Definition	Use in the FDF
FTP	File Transfer	Data distribution and receipt from the CI
GMSEC	GSFC Mission Services Evolution Center	Currently internal, expansion planned to external sites
HTTP	Hypertext Transfer Protocol	FDF information website access
HTTPS	Hypertext Transfer Protocol Secure	Data distribution to select sites
SCP	Secure Copy	Use by special arrangement
SFTP	Secure File Transfer	Data distribution and receipt from the CI
SMTP	Simple Mail Transfer	Data and message delivery via email
SSH	Secure Shell	SFTP and SCP
TCP/IP	Transmission Control Protocol/Internetwork	Interface to MUD
UDP	User Datagram	Via the MUD to NASCOM

Table 2-1: Protocols supported by the FDF

3.2 FDF Communication Layout

The FDF communication layout for Phase 1 is shown in Figure 2-1: FDF Communication Layout.

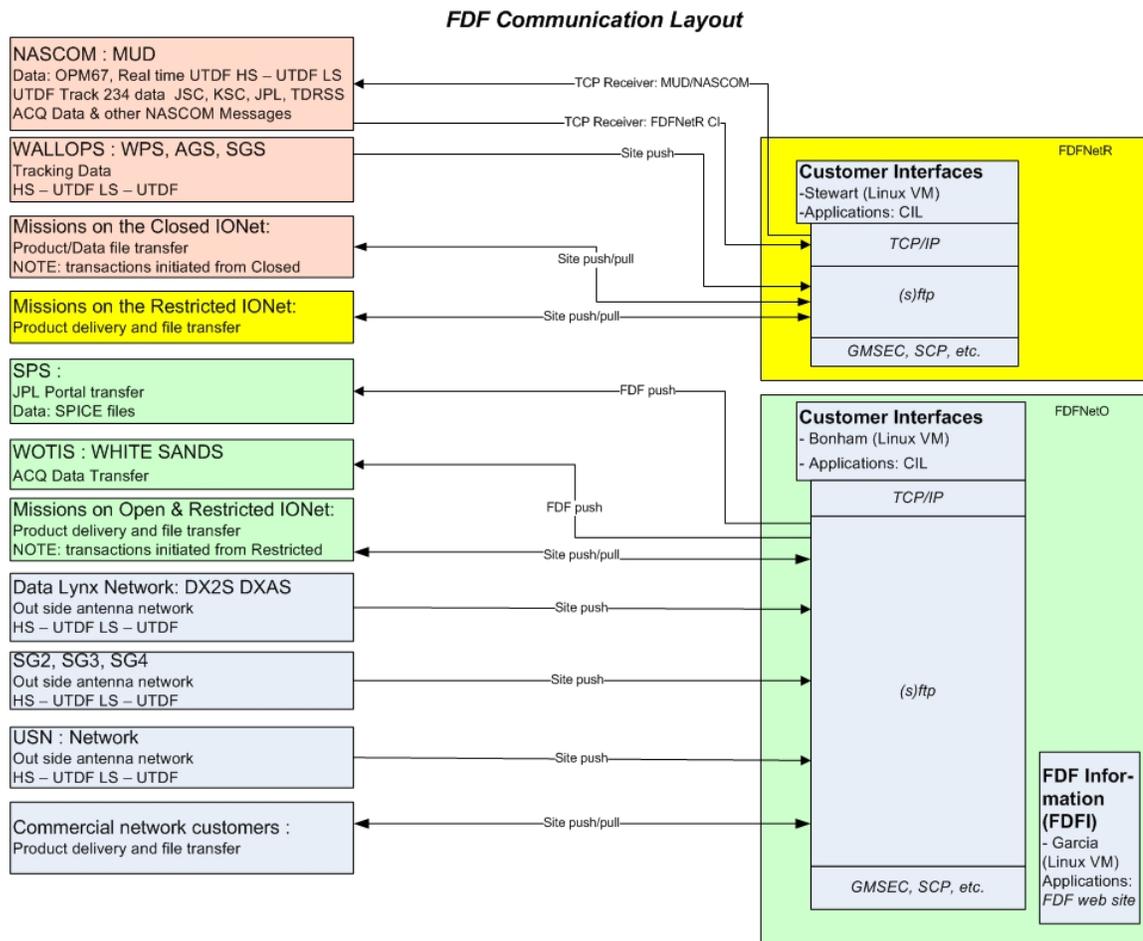


Figure 2-1: FDF Communication Layout

The CI SFTP sites and the NASCOM messages are the principle means of data communication in and out of the FDF.

The CI SFTP sites are:

- The FDF Customer Interface ([Bonham](#) - FDFNetO)
- The FDF Customer Interface ([Stewart](#) - FDFNetR)

The FDF Information (FDFI) web site is primarily for the purpose of providing information about the FDF and instructions on how to apply for an account.

The FDF Customer Interfaces require accounts but the FDFI website does not.



3.3 FDF Services

Prior to requesting FDF support, missions and projects are encouraged to contact the FDF and develop a mutual agreement on the support requirements and timelines. This should be documented in a memorandum of agreement (MOA) or interface control document (ICD). This aids in timely preparations for the support.

4. Communications Process for the FDF CI (S)FTP Sites

4.1 Communicating with the FDF Customer Interface

The FDF Communication Servers ([Bonham](#) = Open IO Network, [Stewart](#) = Restricted IO Network) are for mission operation communications only.

No remote shelling is allowed on the Customer Interface. However, command line interfaces are allowed, as well as polling a directory on the Customer Interface for data retrieval.

It is recommended by the FDF that all Customer Interface users configure automated processes to GET and PUT data.

4.2 FDF Customer Interface FQDNs

The FQDNs (Fully Qualified Domain Names) for the FDF Customer Interface are:

- a. bonham.fdfneto.nascom.nasa.gov is the server on the FDFNetO.
- b. stewart.fdfnetr.rio.nascom.nasa.gov is the server on the FDFNetR.

4.3 Protocols Allowed

Protocols allowed for the CI sites are SFTP, FTP, and SCP. SFTP/SCP is preferred, FTP is only permitted/accepted when SFTP is not allowed or feasible.

4.3.1 SFTP and SCP

The SFTP/SCP access is through port **22**.

The FDF will accept properly authenticated public keys from a MOC or Station. Keys may be sent via e-mail, or login to bonham.fdfneto.nascom.nasa.gov or stewart.fdfnetr.rio.nascom.nasa.gov and add the public key to your `.ssh/authorized_keys` file. *The FDF will not send out any public or private keys to be accepted by any systems.*

4.3.2 FTP

The FTP access is through port **21**.



4.4 Firewall Rules (Open/Restricted IO Networks)

The FDF Customer Interface on the Open and Restricted IO Networks are managed by the Internet Protocol Network Operations Center (IPNOC) at GSFC. All FDF Customer Interface users must first comply with all IPNOC rules and regulations before any transmissions can take place. The FDF also has an inner firewall that is managed by the FDF security staff. All FDF Restricted and Open IO Network Communication Server users must supply the FDF security staff with an IP Address of the system(s) that will be communicating with the FDF.

Once IP addresses are received, those addresses are submitted to code 700 for implementation of firewall rules, with an appropriate FDF ISSO or CSO following procedures in [FDSS-LOP-0132](#), *Flight Dynamics Facility (FDF) Local Operating Procedures (LOPs) for IONet Firewall Rule Requests*. Customers should be informed that Firewall Rule Requests can take a considerable period of time to be completed as changes to Firewall Rules may not be made during periods of Network Freezes (when changes are not allowed to be made) and approvals that are required for making changes, even when not dealing with mission related network freezes, may take several business days to resolve. *Typical response times are measured in terms of weeks. Please understand this clearly when submitting requests.*



Note: It is important to verify the IP addresses that are submitted for use in Firewall rules. With the use of Network Address Translation and other similar methods of hiding internal IP address information, the IP address that is shown on a computer system may not be the IP address that is known to the outside world and would be shown in communication with other systems (such as the FDF). If the wrong IP address information is presented to the FDF for submission in Firewall rule requests the communications that is required will not be possible until the correct address is obtained and the original submission is updated. *That sort of mix-up can add WEEKS to the resolution of a firewall rule request.*

If you require assistance in determining what IP address you are communicating from, please contact the FDF Customer Account Manager at the contact points listed in this document. By enlisting additional support, the IPNOC engineers can get involved in tracing the communications and they can help determine what address is required for use in the firewall rules.



4.5 Customer Interface Directory Structure and Definitions

The FDF has configured the folders on the Customer Interface to coincide with the job that they are to perform. The directory structure is shown in Figure 4-1: FDF CI SFTP Directory Structure.

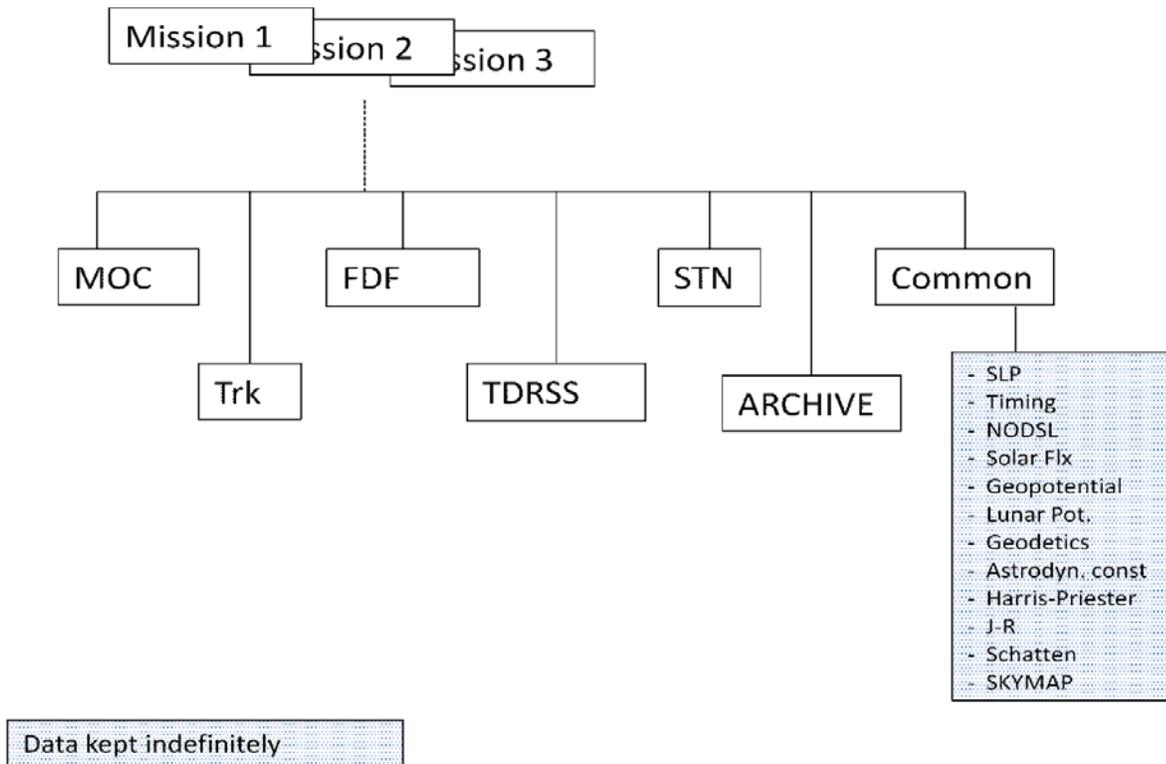


Figure 4-1: FDF CI SFTP Directory Structure

Below is a list of default subdirectories and definitions of the folders that exist on the FDF Customer Interface.

- **/FDF** = This directory is used to transfer data *to the FDF*.
- **/MOC** = This directory is used to transfer data *to the MOC*.
- **/COMMON** = This directory is used to make available data that is used by multiple missions. This folder will only be available if your account has rights to view the common data.
- **/TDRS** = This directory holds TDRS files. The TDRS directory will only be available if the user has been granted the approval by FDF management to view the TDRS data.
- **/TRK** = This directory is used for incoming (*to the FDF*) tracking data.
- **/STN** = This directory is used for outgoing data (*from the FDF*) to a station.



Other subdirectories can be added as required, and each of the default directories can themselves have subdirectories. The directory structure should be specified in the mission MOA or ICD.

4.6 Functionality of the FDF Customer Interface Directories

- **FDF:** This directory is used by the FDF external customer to deposit data for FDF ingestion. The data from the /FDF directory is copied over to FDFNetHome first; then the FDF deletes the file from the /FDF directory.

File privileges for FDF customers on this directory are **read write (RW)**. All data within the FDF directory must adhere to the FDF naming convention agreed to with the MOU or ICD.

- **MOC:** This directory is used by the FDF to deliver data to FDF customers. The FDF pushes data to the /MOC directory for retrieval by the FDF customer. After the customer has retrieved the data, it is the customer's responsibility to delete all files from the /MOC directory.

Files older than 40 days are automatically deleted by the FDF. File privileges for FDF customers on this directory are **read write (RW)**.

- **COMMON:** This directory contains data that is used by multiple missions. The COMMON directory is updated as needed by the FDF.

File privileges for FDF customers on this directory are **read only (R)**. A mission named COMMON is available for those customers who only need access to the common data. Data will persist on this directory for an extended period of time due to the nature of the data provided.

- **TDRS:** The TDRS directories are for the missions that require TDRS support. This directory is only visible if permission is granted by the FDF. The TDRS directories are updated as needed by the FDF.

File privileges for FDF customers on this directory are **read only (R)**.

- **TRK:** This directory is used by stations to deliver tracking data for FDF ingestion. The tracking data from the /TRK directory is ingested by the Phase 1 FDF and then deleted from the /TRK directory.

File privileges for stations on this directory are **read write (RW)**.

- **STN:** This directory is used if the FDF has to deliver any data to the station. File privileges for stations on this directory are **read write (RW)**. Files older than 40 days are automatically deleted by the FDF.



5. FDF User Accounts

Customers apply for access to systems within the FDF by following the process laid out in Section 4 of FDSS-LOP-0146 *Flight Dynamics Facility (FDF) Customer Account User Guide*.

6. FDF Naming Conventions

The naming conventions for data files are documented in the appropriate agreement documents between FDF and its customers and data providers.

6.1 Name Requirements

The file names need to include the mission or spacecraft name, the file type, the date and time, and an extension. It is very important that identical names not be used for successive products. Other than that, there are very few restrictions on what file names can be.

File naming conventions for specific products are set by mutual agreement with the FDF. Once the file naming convention is agreed to, file names must not be changed without mutual agreement by both parties.

6.2 Past Conventions

Prior to the Modernized FDF, there were very specific file naming conventions imposed by the software. They are documented in this section as many of the existing missions conform to these.

FDF file naming requirements for FDF data transfer is:

<mission name>_<file type>_<time tag>.<other>.<file extension>

where

- ***<mission name>*** should be an abbreviated name, preferably 3 characters of the mission's name (e.g., SDO) without any space or special characters.
- ***<file type>*** can be any combination of words and characters without any space or underscore characters in between. File types must be pre-determined, such as ephem, iirv, inp, SpinMnvr (spin maneuver), etc. The FDF will need to know the exact ***<file type>*** field spelling (which is also case sensitive).
- ***<time tag>*** field can be any time format without any underscores. For example: ***yyyymmdd***, or ***yyyymmdd***.
- ***<other>*** field is optional, such as "TR," "HZ," or version number, e.g., V01. This field is not required.
- ***<file extension>*** can be anything, e.g., .bin, .txt, .pc, etc.



7. FDF Information (FDFI) Website

The Phase 1 FDF website provides descriptive information about the FDF and its services. Only information about the FDF and information on how to request a CI SFTP account are provided. No downloadable data are available through the web site. Access to the site does not require an account. The web site address is <http://fdf.gsfc.nasa.gov>.

The proposed web site directory structure is shown in Figure 7-1: FDF Information (FDFI) Menu Tree.

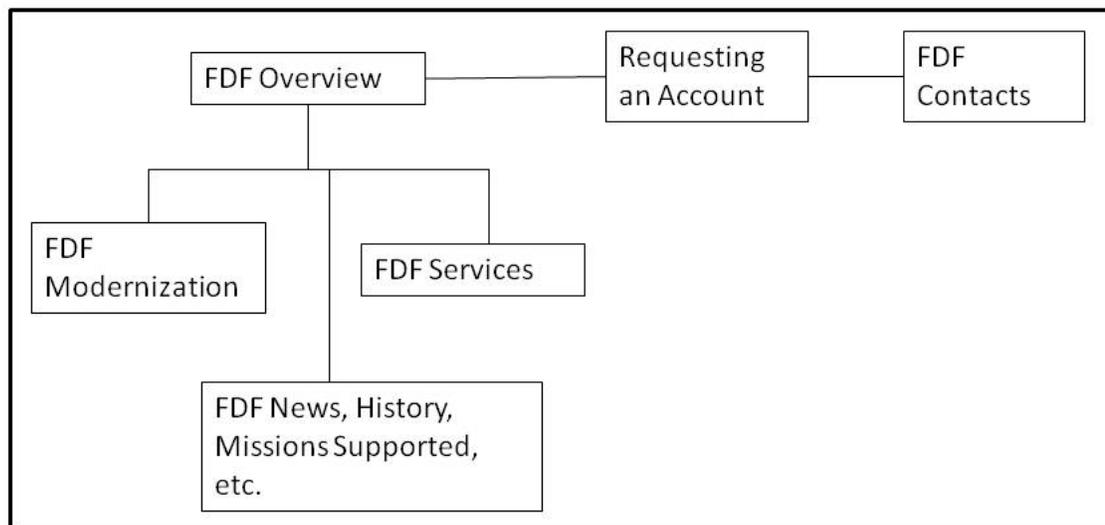


Figure 7-1: FDF Information (FDFI) Menu Tree

8. FDF Customer Help and Information

The FDF Sustaining Engineering staff performs routine maintenance as needed at periodic intervals. Most of the maintenance that is performed has no impact to the user community; however, if there is a chance the user community would be impacted the FDF Sustaining Engineering team will notify the user community in a timely fashion.

8.1 The FDF Helpdesk

The FDF has a helpdesk to respond to any FDF communication concerns which is staffed from 7:00 a.m. (EST) to 6:00 p.m. (EST) M-F, with no coverage outside of the nominal workweek except during launch, early orbit, or other critical operations. The FDF helpdesk can be reached at 301-286-2303 or 301-286-6250.

 Note: An alternative to telephone contact is the FDF Customer Account Manager e-mail list (gsfc-fdf-cam@lists.nasa.gov). E-mail sent to that address reaches multiple individuals and should be responded to once reviewed by the appropriate parties.



9. Records

Title	Description
None	

10. Forms

Number	Title
None	



Appendix A. Acronyms and Definitions

<u>Acronym</u>	<u>Definition</u>
CCSDS	Consultative Committee for Space Data Systems
CIL	Customer Interface Layer
CNE	Center Network Environment
COTS	Commercial Off-the-Shelf
CSO	Computer Security Official
FD	Flight Dynamics
FDCC	Federal Desktop Core Configuration
FDF	Flight Dynamics Facility
FDPC	Flight Dynamics Product Center
FDSS	Flight Dynamics Support Services
FECF	Front End Communications Processor
FQDN	Fully Qualified Domain Name
FTP	File Transfer Protocol
GPR	Goddard Procedural Requirements
GMSEC	GSFC Mission Services Evolution Center. GMSEC usually refers to the messaging architecture created and support by the center.
GSFC	Goddard Space Flight Center
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
IO	Input Output
IPNOC	Internet Protocol Network Operations Center
IT	Information Technology
LAN	Local Area Network
LOP	Local Operating Procedure
MCDL	Master Controlled Document Listing
MOA	Memorandum of Agreement
MOC	Mission Operations Center
MON	Monitoring Requirement
MS	Management System
MUD	Multicast Unicast Device
NASA	National Aeronautics and Space Administration



<u>Acronym</u>	<u>Definition</u>
NPR	NASA Procedural Requirements
ODIN	Online Desktop Initiative (since replaced by ACES)
OS	Operating System
SBU	Sensitive but Unclassified
SCP	Secure Copy Protocol
SFTP	Secure File Transfer Protocol
SMTTP	Simple Mail Transfer Protocol
SSH	Secure Shell
URL	Uniform Resource Locator



Appendix B. Change History Log

Revision	Effective Date	Description of Changes
Original	10/27/2010	FDSS-CCR-0103
1	08/15/2011	FDSS-CCR-0190
2	05/15/2012	FDSS-CCR-0248