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EOSDIS Core System Project

ECS External Data Traffic Requirements

May 1997

Hughes Information Technology Systems
Upper Marlboro, Maryland

ECS External Data Traffic Requirements

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SUBMITTED BY

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Preface

This is the fourth formal delivery of Data Item Description (DID) 223/SE1. It is based on the third formal delivery distributed in November 1996 incorporating changes suggested by the reviewers. This document will be released, coincident with each major ECS program design review, and changed pages will be released on a quarterly basis and will continue for the duration of the ECS contract. Any questions related to this document should be addressed to George Mellis gmellis@eos.hitc.com or to the Data Management Office at:

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Abstract

This document provides the ESDIS Project office, and the NASA Science Internet (NSI) organization with information to size, specify, and budget for the necessary Government Furnished Equipment (GFE) common carrier circuits for use in EOSDIS Core System (ECS) Project. Current best estimates of the ECS-related, real-time and non-real time data flows to be supported for the AM-1, CHEM-1, Landsat 7, and PM-1 missions by the Earth Observing System (EOS) Data and Information System (EOSDIS) backbone network (EBnet), through the year 2002, are provided.

Data flows from missions past 2002 are not currently included herein. EBnet data flows for ADEOS II and RADAR ALT (JASON) are non-ECS, and therefore not in this document. Additionally the "raw" data flows to be supported by the NSI/Internet interface at each Distributed Active Archive Center (DAAC) are listed.

Estimates of the ECS-related data flows have been extracted from the EBnet Traffic Requirements database. This database is populated primarily with information from ESDIS Level 2 Requirements Document, Volume 0, Appendix D, and version 3.1 of the Ad Hoc Working Group on Production (AHWGP) scenarios (as expressed in the ECS Technical Baseline of February 1996). The AHWGP scenarios describe the processing of data from the AM-1 and Landsat 7 missions. Additional flows may result from processing of data from later missions, but information on such processing is not yet available.

Keywords: Inter-DAAC, Real-time, Non real-time, EBnet, Production, Reprocessing, Subsetting, AHWGP, NSI, ECS interfaces, Data distribution, SCF, IST, ADC

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Change Information Page

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1. Introduction

1.1 Identification

This is the fourth release of the ECS External Data Traffic Requirements document, whose requirements are specified in Data Item Description (DID) 223/SE1. DID 223 is a required deliverable under EOSDIS Core System (ECS) contract (NAS5-60000), attachment D, revision A.

1.2 Scope

This document describes all data flows to and from ECS, that are to be transported on the EBnet and the NSI/Internet Wide Area Networks (WAN) in support of the AM-1, CHEM-1, Landsat 7, and PM-1 missions through the year 2002. Data flows from missions beyond the year 2002 are not included herein. Data flows for ADEOS II and RADAR ALT (JASON) are non-ECS and therefore not in this document. The AHWGP scenarios describe the processing of data from the AM-1 and Landsat 7 missions. The resulting DAAC to DAAC data flows include processing, reprocessing, and dependency flows based on the subsetting of data products assumed by the AHWGP. Additional flows may result from processing of data from later missions, but information on such processing is not yet available. Additionally, the document identifies those flows between ECS and other associated/affiliated systems. Specifically, estimates of the (1) 24-hour average logical data flows, transported to and from all ECS sites, on EBnet and (2) output data flows on the NSI/Internet interfaces at each DAAC are provided.

The NASA Communications (Nascom) organization is responsible for design, implementation, and maintenance of the EBnet. Consequently, this document does not (1) specify the "burdened" traffic requirements or circuit size requirements for EBnet, (2) provide a topology for the EBnet WAN, since topology will depend on the existing circuit infrastructure, choice of circuit offerings, and the specific plan for migrating from the current V0 topology to the EBnet topology, (3) provide internet connectivity requirements for non-ECS locations, as these are defined and limited by the Earth Science Data and Information System (ESDIS)-NSI Inter-Project Agreement, and (4) provide information on the Local Area Network (LAN) requirements at the ECS-DAACs. The overhead factors for which ECS has partial responsibility (i.e. TCP/IP overhead and Scheduling contingency) are provided. These have been coordinated with Nascom.

1.3 Purpose

The purpose of this document is to provide the ESDIS Project office and the NSI organization with information on the data flow estimates to size, specify, provision and budget for, in a timely manner, the necessary Government Furnished Equipment (GFE) common carrier circuits for use in ECS. This document provides current estimates and assumptions regarding data flow volumes for the EBnet and NSI WANs.

1.4 Status and Schedule

The first formal release of this document was in May 1996, with plans to re-release the document concurrent with all subsequent program design reviews. In the interim, change pages will be released on a quarterly basis, in the first week of February, May, August and November throughout the life of the ECS contract starting in July 1996.

A majority of the updates for this release incorporate editorial comments from ESDIS. Since the data contained in this document flows from many independent sources, frequent changes are expected, therefore it is likely that some data will have changed between the time it is incorporated and the publication date.

1.4.1 Relationship to EBnet Traffic Requirements Database (ETRD)

As previously noted, the data included in Section 3 of this document is extracted from the EBnet Traffic Requirements database. In an effort to correlate the DID 223 data with the ETRD, the following history log is provided to associate a given DID 223 release to a corresponding ETRD release and it's associated CCRs.

DID 223 Release	ETRD Release date, Associated CCRs
May 1997	April 14, 1997, CCR #16
February 1997	January 10, 1997, CCRs #8 - 12
November 1996	October 23, 1996, CCRs #5, 6, 7
August 1996	June 19, 1996, CCRs #2,3,4
May 1996	May 1996, CCR #1

1.5 Document Organization

This document contains four sections.

- Section 1 identifies the document and describes its scope, purpose and objectives.
- Section 2 identifies parent, applicable, and information documents.
- Section 3 provides an overview of the EBnet WAN and an estimate of the ECS-related data flows to be transported on the EBnet (during the years 1997 to 2002). The ECS-related data flow estimates are based on (1) EDOS to ECS-elements data transfers in support of the various ECS missions (2) DAAC to DAAC processing and reprocessing flows in support of the various missions previously identified, (3) DAAC to DAAC data flows resulting from standard product generation, reprocessing and subsetting in support of the ECS mission (4) User query and Query-responses, and (5) ADC operations.
- Section 4 provides estimates of the data volumes distributed electronically from the DAACs to the science users in the 1997-2000 time frame and estimates for the Instrument Support Terminals (IST) data flows via the NSI/Internet provider. IST data flows provided via EBnet are included in Section 3.
- Appendix A lists the detailed DAAC to DAAC data flows required to support the processing, reprocessing, and movement of data from the processing DAAC to the archive DAAC(s), in cases where these are different. This information is supplied by the ECS Science Office and is based directly on the AHWGP scenarios. A table listing QA data flows by DAAC is shown in Appendix B.

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2. Related Documentation

2.1 Parent Documents

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

301-CD-002-003	System Implementation Plan for the ECS Project
423-10-01-1	Goddard Space Flight Center, Earth Science Data and Information System (ESDIS) Project -- Level 2 Requirements, Volume 1, December 1996
423-41-01	Goddard Space Flight Center, EOSDIS Core System Statement of Work, December 1996
423-41-02	Goddard Space Flight Center, Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System, June 1994

2.2 Applicable Documents

The following documents are referenced herein and are directly applicable to this document.

423-10-01-0	Goddard Space Flight Center, Earth Science Data and Information System (ESDIS) Project -- Level 2 Requirements, Volume 0, Appendix D, February 1993
210-TP-001-006	ECS Technical Baseline for the ECS Project
505-41-17	Goddard Space Flight Center, Interface Requirements Document Between EOSDIS Core System (ECS) and the NASA Science Internet (NSI), October 1995
505-41-18	Goddard Space Flight Center, Interface Requirements Document Between EOSDIS Core System (ECS) and MITI ASTER GDS Project July 1995
505-10-31	Goddard Space Flight Center, Earth Science Data and Information System (ESDIS) - NASA Science Internet (NSI) Inter-Project Agreement, April 14, 1994

2.3 Information Documents

The following documents, although not be directly applicable, amplify or clarify the information presented in this document. These documents are non-binding in nature.

828-RD-001-002	Government Furnished Property for the ECS Project
160-TP-005-001	Reducing Inter-DAAC Data Transfers Through Subsetting, Technical Paper for the ECS Project
161-TP-001-001	EOSDIS Product Use Survey, Technical Paper for the ECS Project
164-TP-001-002	Methodology for Estimating DAAC-to-DAAC User-query Traffic, Technical Paper for the ECS Project
194-00313TPW	ECS User Characterization Methodology and Results, Technical Paper for the ECS Project
210-TP-001-006	ECS Technical Baseline (Latest ESDIS approved version), February 1996
none	NASA Internet (NI) Earth Observing System (EOS) Networking Project Plan, September 1996, Author: NI-EOS Networking Project, NASA Ames Research Center

3. EBnet Wide Area Network Flows

3.1 EBnet Overview

The EBnet is a Wide Area Network (WAN) that provides, in combination with other institutional and public networks, connectivity between geographically distributed EOSDIS facilities to support ECS mission operations and data production functions. Specifically, EBnet will provide connectivity between the ECS DAACs, the Earth Observing System (EOS) Data and Operations System (EDOS) facilities, selected ADCs, and other designated EOSDIS sites. The EBnet WAN provides the data transport service between elements of EDOS (GSIFs and LZPF) and ECS (EOC, DAACs, etc.). The EBnet WAN will be designed, implemented and maintained by the Nascom organization at GSFC.

3.2 ECS-related EBnet Data Flows

The ECS-related data flows to be transported on the EBnet in support of the AM-1, CHEM-1, Landsat 7, and PM-1 missions, and also Inter-DAAC user queries and institutional facilities such as the Flight Dynamics Facility (FDF) at GSFC are presented in this section. At the present time, ECS related EBnet data flows for ADEOS II and RADAR ALT (JASON) are external to ECS. The data consists of all data flows via EBnet, which "touch" ECS resources including, DAACs and the EOC. They can be summarized under the following categories:

- Real Time Data Flows - Time critical spacecraft data such as command and telemetry data. These flows are further delineated as having a 1 minute MTTRS or a 4 hour MTTRS requirement. These are discussed in section 3.2.2
- Non Real Time Data Flows - All other data flows supporting the aforementioned missions, etc.. All non real time data flows have a 4 hour MTTRS requirement. The non real time data flows have been further segregated into "DAAC to DAAC" data flows, and "Non-DAAC to DAAC" data flows. These are discussed in section 3.2.3.

Estimates of the individual data flows for each of these categories are listed in the following sections. The following notes apply to these estimates:

1. The real time data flow estimates provided in this working paper have been extracted from the EBnet Traffic Requirements Database (ETRB). This information is based on:
    - Review draft of Change 26 to Table 4 of the EDOS/ECOM Requirements document (dated 9/20/95) for the AM-1 mission.
    - Impacts of the adaptive downlink architecture.
    - Appendix D of ESDIS Level 2 Requirements Document, Volume 0.

2. Real time data flow estimates provided are “peak, raw (unburdened)” rates.

3. The non-real time inter-DAAC data flow estimates are based on the AHWGP scenarios expressed in the February 1996 ECS Technical baseline. The following notes apply to these data flows:

   - Data flows from the Landsat 7 and AM-1 missions only are estimated
   - Data flows from instruments launched after the year 2002 are not included
   - Data products are subsetted (where appropriate) prior to transfer on EBnet WAN
   - User query and query response data flows (years 1998-2000) are included
   - Data flow estimates represent "raw", 24 hour-average logical flows. No factors for scheduling contingency, circuit utilization, or protocol overhead are applied.

4. The intra-EDC data flows between the Landsat Processing System (LPS) and the EDC DAAC is extracted from the EOSDIS-Landsat 7 IRD (7/1995)

3.2.1 Data Flow Analysis

The following tables have been created using the EBnet Traffic Requirements Database, which has been developed and maintained by the EBnet Project Office. The database information is the result of the following analysis.

A mutual exclusion analysis of the real-time data flows was performed . This consisted of sorting the traffic requirements by spacecraft, mission phase, data type, source and destination. For each source destination group only the record with the highest data rate was included - others were marked to be excluded.

A mutual exclusion analysis of the rate-buffered traffic to the EOC was performed. This consisted of sorting the traffic requirements by spacecraft, mission phase, data type, source and destination; for each source destination group only the record with the lowest data rate was included - others were marked to be excluded. The lowest peak rate data flow was included because of the three rates specified (16 Kbps, 256 Kbps and 512 Kbps), the lowest rate is the one for which a requirement exists. The capability to support data flows at the remaining two rates (256 Kbps and 512 Kbps) are desirables.

3.2.2 Real Time Data Flows

Table 3.2.2-1 contains a consolidated list of the real time data flows (for the pre-launch operations and the on-orbit phases) to be transported from the source to the destination sites on EBnet for the AM-1, CHEM-1, and PM-1 missions, and related institutional real time flows. The values provided are peak data rates. This data is extracted from the EBnet Traffic Requirements Database.

Table 3.2.2-1. Real Time Data Flows (peak, Kbps)

Mission	Source	Destination	Phase	Description	DataSource	1997	1998	1999	2000	2001	2002
AM-1	EDOS at GSFC	EOC	On-Orbit Operations	Housekeeping Data Stream	Volume 0 Appendix D	0	32	32	32	32	32
AM-1	EDOS at GSFC	EOC	Pre-Launch	Housekeeping Data Stream	Volume 0 Appendix D	32	32	0	0	0	0
AM-1	EOC	EDOS at GSFC	On-Orbit Operations	Commands	Volume 0 Appendix D	0	10	10	10	10	10
AM-1	EOC	EDOS at GSFC	Pre-Launch	Commands	Volume 0 Appendix D	10	10	0	0	0	0
AM-1	EOC	EOP	Pre-Launch	Telemetry, Commands, and CODAs	ICD: EBnet-EOC; 2/96; 540-031	56	56	0	0	0	0
AM-1	EOC	ETS / 25	Pre-Launch	Telemetry, Commands, and CODAs	ICD: EBnet-EOC; 2/96; 540-031	56	56	0	0	0	0
AM-1	EOC	ETS LRS	Pre-Launch	Telemetry, Commands, and CODAs	ICD: EBnet-EOC; 2/96; 540-031	56	56	0	0	0	0
AM-1	EOC	ETS MPS	Pre-Launch	Telemetry, Commands, CODAs, and Rate Buffered data	ICD: EBnet-EOC; 2/96; 540-031	56	56	0	0	0	0
AM-1	FSTB	EOC	On-Orbit Operations	Flight Software Testbed	ICD: EBnet-EOC; 2/96; 540-031	0	56	56	56	56	56
AM-1	FSTB	EOC	Pre-Launch	Flight Software Testbed	ICD: EBnet-EOC; 2/96; 540-031	56	56	0	0	0	0
AM-1	SAS in EOC	EOC	On-Orbit Operations	Spacecraft Analysis System	ICD: EBnet-EOC; 2/96; 540-031	0	512	512	512	512	512
AM-1	SAS in EOC	EOC	Pre-Launch	Spacecraft Analysis System	ICD: EBnet-EOC; 2/96; 540-031	0	512	0	0	0	0
AM-1	SAS in EOC	SDF	On-Orbit Operations	Spacecraft Analysis System	ICD: EBnet-EOC; 2/96; 540-031	0	512	512	512	512	512
AM-1	SSIM	EOC	Pre-Launch	Telemetry	ICD: EBnet-SSIM; 3/96; 540-092	512	512	0	0	0	0
CHEM-1	EDOS at GSFC	EOC	On-Orbit Operations	Housekeeping Data Stream	Volume 0 Appendix D	0	0	0	0	0	32
CHEM-1	EOC	EDOS at GSFC	On-Orbit Operations	Commands	Volume 0 Appendix D	0	0	0	0	0	2
Institutional Services	EDOS at GSFC	ECS SMC	All	Operations Management Data	Table 4 - CH26 - 9/20/95	56	56	56	56	56	56
Institutional Services	EDOS at GSFC	EOC	All	Operations Management Data	Table 4 - CH26 - 9/20/95	56	56	56	56	56	56
Institutional Services	EOC	ECS SMC	All	Operations Management Data	Table 4 - CH26 - 9/20/95	56	56	56	56	56	56
Institutional Services	EOC	EDOS at GSFC	All	Operations Management Data	Table 4 - CH26 - 9/20/95	56	56	56	56	56	56
Institutional Services	EOC	FDF/32	All	Institutional Services	ICD: EBnet-EOC; 2/96; 540-031	512	512	512	512	512	512
Institutional Services	EOC	NCC	All	Institutional Services	ICD: EBnet-EOC; 2/96; 540-031	56	56	56	56	56	56
Institutional Services	FDF/32	EOC	All	Institutional Services	ICD: EBnet-EOC; 2/96; 540-031	512	512	512	512	512	512
Institutional Services	NCC	EOC	All	Institutional Services	ICD: EBnet-EOC; 2/96; 540-031	224	224	224	224	224	224
PM-1	EDOS at GSFC	EOC	On-Orbit Operations	Housekeeping Data Stream	Volume 0 Appendix D	0	0	0	32	32	32
PM-1	EOC	EDOS at GSFC	On-Orbit Operations	Commands	Volume 0 Appendix D	0	0	0	2	2	2

Note: In launch years, both pre-launch and on-orbit flows are provided for each spacecraft. Care should be given not to overlap these flows when calculating the total flow between any two points.

3.2.3 Non-Real Time Data Flows

The following categories of non-real time data flows have to be to be transported on the EBnet:

- Production Data Flows for AM-1 Platform
- Reprocessing Data Flows for AM-1 Platform
- DAAC to DAAC User Query Flows
- DAAC to DAAC User Query-Response Flows

Estimates of the consolidated "raw" 24 hour average "DAAC to DAAC" data for the ECS supported missions for the years 1997-2002 are listed in Table 3.2.3-1. The data flows listed above are included in these estimates. Non-DAAC to DAAC data flows are listed in Table 3.2.3-2. The data contained in both tables is extracted from the EBnet Traffic Requirements Database.

Table 3.2.3-1. Non-Real Time Non-DAAC to DAAC Data Flows (Kbps)

Mission	Source	Destination	Phase	Description	DataSource	1997	1998	1999	2000	2001	2002
AM-1	ASTER GDS	EOC	On-Orbit Operations	EOC Database Transfer & Command Groups	ASTER GDS Interface Meeting 10/96	27	27	27	27	27	27
AM-1	ASTER GDS	GSFC DAAC	On-Orbit Operations	Human Computer Interface	ASTER GDS Interface Meeting 10/96	27	27	27	27	27	27
AM-1	EDOS at GSFC	EOC	On-Orbit Operations	Housekeeping Data Stream	Volume 0 Appendix D	0	16	16	16	16	16
AM-1	EDOS at GSFC	EOC	Pre-Launch	Housekeeping Data Stream	Volume 0 Appendix D	16	16	0	0	0	0
AM-1	EDOS at GSFC	GSFC DAAC	Pre-Launch and On-Orbit Operations	Level 0: MODIS, Ancillary, Housekeeping		7389	14778	7389	7389	7389	7389
AM-1	EDOS at GSFC	LaRC DAAC	On-Orbit Operations	Level 0: MOPITT		0	4216	4216	4216	4216	4216
AM-1	EDOS at GSFC	LaRC DAAC	Pre-Launch	Level 0: MOPITT		4216	4216	0	0	0	0
AM-1	EOC	ASTER GDS	On-Orbit Operations	EOC Database Transfer & Command Groups	ASTER GDS Interface Meeting 10/96	27	27	27	27	27	27
AM-1	GSFC DAAC	ASTER GDS	On-Orbit Operations	Human Computer Interface	ASTER GDS Interface Meeting 10/96	27	27	27	27	27	27
CHEM-1	EDOS at GSFC	EOC	On-Orbit Operations	Housekeeping Data Stream	Volume 0 Appendix D	0	0	0	0	0	16
CHEM-1	EDOS at GSFC	GSFC DAAC	On-Orbit Operations			0	0	0	0	0	74
CHEM-1	EDOS at GSFC	LaRC DAAC	On-Orbit Operations			0	0	0	0	0	4153
CHEM-1	EDOS at GSFC	TBD DAAC	On-Orbit Operations	Level 0: ODUS		0	0	0	0	0	57
Landsat-7	LPS	EDC DAAC	On-Orbit Operations	Inter-DAAC	EOSDIS-Landsat-7 IRD - 7/95	51111	51111	51111	51111	51111	51111
Not Specified	NOAA / NESDIS	LaRC DAAC	Not Specified	Ancillary Data		198	198	198	198	198	198
PM-1	EDOS at GSFC	EOC	On-Orbit Operations	Housekeeping Data Stream	Volume 0 Appendix D	0	0	0	24	24	24
PM-1	EDOS at GSFC	GSFC DAAC	On-Orbit Operations	Level 0:		0	0	0	8182	8182	8182
PM-1	EDOS at GSFC	LaRC DAAC	On-Orbit Operations	Level 0:		0	0	0	21	21	21
PM-1	EDOS at GSFC	TBS DAAC	On-Orbit Operations	Level 0:		0	0	0	135	135	135
METEOR	WFF	LaRC DAAC	On-Orbit Operations	Science Data	SAGE 3/METEOR	0	133	133	133	133	133

Notes:

1. The data flow estimates listed above are based on information contained in the EBnet Traffic Requirements Database (as provided by Booz Allen and Hamilton on 4/14/97).
2. The values for Expedited data flow rates included in the table are the average data rates within the required delivery time (less EDOS processing time) based on the peak instrument data rate.
3. The estimates may change when modifications related to (a) Landsat-7 traffic on GSFC - EDC link and (b) other pending changes are incorporated in the EBnet Traffic Requirements database.
4. An asterisk (*) indicates flows previously associated with the MSFC DAAC that are currently assigned to the GSFC DAAC. Further analysis of these flows will be necessary before a final disposition can be made.
5. Data flow values shown as “0.0” indicate less than 100 bps; a blank field indicates that no data flow is estimated.

Table 3.2.3-2. Non-Real Time DAAC to DAAC Data Flows (Kbps)

Source	Destination	Phase	Description	DataSource	1997	1998	1999	2000	2001	2002
ASF DAAC	EDC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	1	1	0	0
ASF DAAC	GSFC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	1	1	1	0	0
ASF DAAC	JPL DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	1	1	0	0
ASF DAAC	LaRC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	1	1	0	0
ASF DAAC	NSIDC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0
EDC DAAC	ASF DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0
EDC DAAC	GSFC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	1	1	2	2	0	0
EDC DAAC	GSFC DAAC	On-Orbit Operations	Inter-DAAC: MODIS supporting MODIS (Reprocessing)	AHWGP Reprocessing Spreadsheet; 6/96	310	310	2118	4236	7230	7230
EDC DAAC	JPL DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	1	1	0	0
EDC DAAC	LaRC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	1	1	0	0
EDC DAAC	NSIDC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0
GSFC DAAC	ASF DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0
GSFC DAAC	EDC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	1	1	1	1	0	0
GSFC DAAC	EDC DAAC	On-Orbit Operations	Inter-DAAC: MODIS supporting MODIS (Reprocessing)	AHWGP Reprocessing Spreadsheet; 6/96	4151	4151	8101	16201	16201	16201
GSFC DAAC	GSFC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	1	1	2	2	0	0
GSFC DAAC	JPL DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	7	7	11	11	0	0
GSFC DAAC	LaRC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	3	3	4	4	0	0
GSFC DAAC	LaRC DAAC	On-Orbit Operations	Inter-DAAC: MODIS supporting MISR (Reprocessing)	AHWGP Reprocessing Spreadsheet; 6/96	8007	8007	17761	35523	39016	39016
GSFC DAAC	LaRC DAAC	Pre-Launch and On-Orbit Operations	Inter-DAAC: VIRS supporting CERES (Reprocessing)	AHWGP Reprocessing Spreadsheet; 6/96	2	2	4	4	0	0
GSFC DAAC	NSIDC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	1	1	0	0
GSFC DAAC	NSIDC DAAC	On-Orbit Operations	Inter-DAAC: MODIS supporting MODIS (Reprocessing)	AHWGP Reprocessing Spreadsheet; 6/96	62	62	123	246	245	245
JPL DAAC	ASF DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0
JPL DAAC	EDC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0
JPL DAAC	GSFC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0
JPL DAAC	GSFC DAAC	On-Orbit Operations	Inter-DAAC: NSCAT supporting DAS (Reprocessing)	AHWGP Reprocessing Spreadsheet; 6/96	0	0	1	1	0	0
JPL DAAC	LaRC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0
JPL DAAC	NSIDC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0
LaRC DAAC	ASF DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0
LaRC DAAC	EDC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0
LaRC DAAC	EDC DAAC	On-Orbit Operations	Inter-DAAC: MODIS supporting MISR (Reprocessing)	AHWGP Reprocessing Spreadsheet; 6/96	226	226	781	1561	2219	2219
LaRC DAAC	GSFC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	3	3	5	5	0	0
LaRC DAAC	JPL DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	1	1	1	1	0	0
LaRC DAAC	NSIDC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0
NSIDC DAAC	ASF DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0
NSIDC DAAC	EDC DAAC	On-Orbit Operations	Inter-DAAC: MODIS supporting MODIS (Reprocessing)	AHWGP Reprocessing Spreadsheet; 6/96	107	107	215	429	429	429
NSIDC DAAC	GSFC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0
NSIDC DAAC	JPL DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	25771	25777	58270	116465	130683	130683
NSIDC DAAC	LaRC DAAC	Not Specified	Inter-DAAC User Queries / Query Responses	DID-220 UQ/QR/ADS Tables	0	0	0	0	0	0

Note: Data flow values shown as “0.0” indicate less than 100 bps; a blank field indicates that no data flow is estimated.

3.3 Overhead Factors

The data flows described in Section 3.2.3 and listed in Tables 3.2.3-1 and 3.2.3-2 are average rates. No overhead factors or burdens of any kind have been applied to these flows. These flows have to be converted into peak flows to specify EBnet circuits sizes. The overhead factors for which ECS has partial responsibility (i.e. factors for TCP/IP overhead and scheduling contingency) and their values may be found at the EBnet Home Page, http://skynet.gsfc.nasa.gov/ebnet. (See under "Explanation of Summary and Assumptions" for Ebnet traffic requirements database.)

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4. NSI Data Flow Estimates at ECS Interfaces

4.1 NSI Overview

The NASA Science Internet (NSI) is an open, international computer network that serves the NASA science and research community. NSI will provide effective network communications between and among EOS researchers, EOS facilities, and the general science community. The NSI connects almost 200 sites worldwide. It interconnects to research, educational, and commercial networks via Network Access Points (NAPs) and Metropolitan Area Exchanges (MAEs). NSI provides Internet access to the GSFC, EDC, JPL, LaRC, NSIDC, ASF, and ORNL DAACs. The Internet Protocol (IP) and the associated upper layer protocols are used by NSI to interoperate with ECS.

The NSI is managed by a Network Operations Center (NOC) from the Ames Research Center. The NOC monitors the network 24 hours/day, 7 days/week. The NOC also coordinates with other network provider NOCs to identify any circuit problems and resolve them in a timely manner. Information is transmitted between ECS and NSI to enable network communications and network management. Data to cooperatively provide services such as fault management, security management, and performance management will be shared between NSI and ECS.

4.2 Data Flow to Users at ECS Interfaces

The following sections discuss the different types of user flows at ECS interfaces. Outflows to users via the ECS-NSI/Internet interface at each DAAC consist of three data types:

- Archived Products
- IST Data
- QA Data

4.2.1 Archived Products Data Flow Estimates

To estimate the volume of data to be distributed electronically the data sets were categorized as follows:

- Version 0 migrated data
- Landsat 7 data
- RADAR ALT (JASON)
- SWS, and AM-1 data

The volume of V0 migrated data to be distributed via the network was based upon current DAAC experience and projected changes in the future. Recent trends regarding the data volume distributed from each DAAC as a function of the sizes of the archive and their science user community were analyzed in cooperation with the DAAC personnel. Projections were then made as to how the archive size will increase with the addition of new data through 1997 and how the user community might expand accordingly.

Launch date assumptions:

Landsat 7	May 31, 1998
AM-1	June 30, 1998
METEOR	Aug. 1998
ADEOS II	Feb. 1, 1999
RADAR ALT (JASON)	March 1, 1999

These numbers and analyses do not include PM numbers.

The volume of Landsat 7 data to be distributed was assumed to be the amount specified in the Landsat data system specification, namely 58 GB/day, for 365 days/year.

The current ESDIS policy, the ECS technical baseline of February, 1996 and the ECS "tiger team cost scrub" has resulted in a data volume distribution estimate of 1.25 times production to the users from each DAAC: (.625X via media and .625X electronically over the NSI). Table 4.2-1 lists data flows to users (.625X electronic dataflow) from ECS DAACs. The "ECS User Characterization Methodology and Results" (September 1994, 194-00313TPW), white paper documents the methodology used to determine user flows.

Table 4.2-1. Data Flows to Users (Kbps) via Networks

From	3Q98	3Q99	3Q00	3Q01	3Q02
ASF	2114	2502	2744	2375	2381
EDC	6891	8160	8535	7983	7992
GSFC	27603	34114	37207	33280	33349
JPL	1560	1873	2029	1760	1765
LaRC	11022	13492	14649	13226	12930
NSIDC	828	991	1073	947	949
Total	50018	61132	66237	59571	59366

Notes:

1. Data volume distributed equals .625X production for the period indicated.
2. The volume of V0 migrated data distributed to users is extrapolated from current estimates of the ratio of distributed volume and archive volume at each DAAC.
3. Landsat-7 data distribution of 58GB/day is included.
4. The AM-1 production volumes are based on input from the AHWGP.
5. Does not include distribution from V0 DAAC.

These are raw data rates, i.e. no overhead has been applied.

The QA data is included in the .625X electronic data flow requirements therefore it is not broken out separately in Table 4.2-1. Refer to Appendix B for QA flows by DAAC. The following is a summary of the assumptions used in estimating the QA traffic for each instrument team.

CERES - QA traffic is based on information provided by the CERES PI (Bruce Barkstrom to the NASA/ESDIS/SPSO. The CERES PI indicated the data products which will be shipped to each of his team members, by epoch (calendar quarter). The February 1996 AHWGP baseline has been used to estimate the data volumes associated with the data products. The QA information provided by the PI only covers the TRMM (TRMM portion will be removed in a future version) and AM-1 data processing.

MOPITT - QA traffic is based on information provided to the AHWGP by the MOPITT data processing development team leader (Paul Bailey). This information identifies specific products to be shipped to the SCF for QA. The February 1996 AHWGP baseline has been used to estimate the data volumes associated with the data products.

MODIS - The MODIS SDST leader (Ed Masuoka) has estimated that 10% of the MODIS products will be needed for QA. The February 1996 AHWGP baseline has been used to estimate the associated data volumes.

Other Instruments - The other instrument teams whose data are produced by ECS have not provided specific QA estimates. We have assumed that 10% of their products will need to be shipped for QA, as in the case of the MODIS data.

Note that the subsetting and decimation calculations implicitly assume that the distribution sizes of subsetted/decimated orders, after reduction, is the same distribution as other orders not subsetted/decimated. This is equivalent to assuming the original data volume prior to subsetting/decimation is larger for requests where the subsetting/decimation is desired relative to those where it is not requested. A different total distribution volume would be calculated if it was assumed that the sizes of subsetted/decimated orders and non-subsetted/decimated orders are the same before subsetting/decimation.

Sources used for the analysis include:

EOSDIS Product Use Survey Results, 1995

The Relative DAAC Access Frequencies(RDAFs) were used from this survey even though that analysis did not include all the products available at all DAACs.

Also the RDAFs we used equates volume with accesses which may not be accurate.

Also the RDAFs were for the Release B timeframe and have been expanded to the timeframes after Release B.

More details about the Survey can be found in the Technical Paper # 161-TP-001-001.

InterDisciplinary Science (IDS) Team, Ad Hoc Working Group for Consumers

Only 13 of the 28 teams responded and that data was used to extrapolate with the help of the RDAFs from the EOSDIS Product Use Survey to represent all teams.

The data that was used for the IDS teams were originally collected for 1999 and 2000. The needs were almost identical for those years. We have assumed that 1998, 2001 and 2002 have the same needs for IDS users.

4.2.2 IST Data Flow Estimates

The IST toolkit enables PIs and TLs who are not physically located at the EOC to participate in the planning, scheduling, commanding and monitoring of their instruments. The current understanding is that data is transferred between the ISTs and the EOC LAN via the NSI and campus networks, although EBnet will provide connectivity between the EOC and Valley Forge IST, and also between the EOC and Japan ICC. The NSI data flows exist between the EOC (at Goddard) and sites with ISTs at GSFC, JPL, LaRC, NCAR, and University of Toronto. The total number of ISTs per site is shown in Table 4.2.2-1. The network performance requirements for the IST to EOC data transfer is shown in Table 4.2.2-2. Since the EOC to Valley Forge, and EOC to Japan ICC flows are supported by EBnet, they are contained in Table 3.2.3-2. The EOC to IST data flows represent the driving data flows because this data flow is larger than the ISTs to EOC flow.

Table 4.2.2-1. EOC to IST Connectivity for AM-1 Timeframe

From	To	Number of ISTs	Transport Network
EOC	GSFC	3	NSI
EOC	JPL	3	NSI
EOC	LaRC	6	NSI
EOC	NCAR	1	NSI
EOC	University of Toronto	1	NSI
TOTAL		**14**	

Note: The EOC to IST data flow estimation details are documented in Section 5.2.2, "IST Connectivity Trade," of the FOS Design Specification (305-CD-040-001) dated October 1995

Table 4.2.2-2. EOC to IST Network Performance Requirements

Function	Parameter	50%	90%	99%
File Transfer (7MB)	Transfer Time	3 Min.	4 Min.	8 Min.
Interactive Commands	Round Trip Time	500 ms	1 sec	2 sec
Real Time	Latency Jitter	1 sec	2 sec	4 sec

Note: Performance Requirements derived from EOSDIS External Networks Review, May 8, 1996

Appendix A. DAAC to DAAC Data Transfer Estimates

The attached spreadsheets list the DAAC to DAAC production data flows for AM-1 and SAGE, required to support processing, reprocessing and movement of data from the processing DAAC to the archive DAAC, in cases where they are different. This data is a consolidated view from the AHWGP. It is turned over to the EBnet development organization for incorporation into the ETRD which in turn is used to create the Tables presented in Section 3 of this document. The flows are sorted by DAAC, spacecraft and instrument. Furthermore, the data is presented as kilobits per second (kbps), to the nearest 1 kilobits per second. Data flow rates less than 1 kilobit per second are shown as "0" bits per second.

DAAC to DAAC Production Transfers for AM-1 Mission

Launch Date: 30 June, 1998

			Kbps - 4th Quarter					
Source --> Destination	**Supporting**	**Type**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
EDC --> GSFC	**DAS**	MODIS		0	1497	1497	1497	1497
	MODIS	MODIS		310	310	310	310	310
	TOTAL			310	1808	1808	1808	1808
GSFC --> EDC	**ASTER**	MODIS		968	867	867	867	867
		Ancillary		5	5	5	5	5
		Subtotal		973	872	872	872	872
	MODIS	MODIS		3178	3178	3178	3178	3178
		Ancillary		1	1	1	1	1
		Subtotal		3178	3178	3178	3178	3178
	TOTAL			4151	4050	4050	4050	4050
GSFC --> LaRC	**CERES**	MODIS		7951	7951	7951	7951	7951
	MISR	DAS		46	46	46	46	46
		MODIS		0	9698	9698	9698	9698
		Ancillary		8	8	8	8	8
		Subtotal		54	9752	9752	9752	9752
	MOPPIT	MODIS		0	703	703	703	703
		Ancillary		2	2	2	2	2
		Subtotal		2	705	705	705	705
		Less Duplicates		0	-8654	-8654	-8654	-8654
	TOTAL			8007	9754	9754	9754	9754
GSFC -- > NSIDC	**MODIS**	MODIS		61	61	61	61	61
JPL --> GSFC	**DAS**	NSCAT	<1	<1	<1	<1	<1	<1
LaRC --> EDC	**ASTER**	MISR		224	553	553	553	553
	MODIS	MISR		2	2	2	2	2
	TOTAL			226	555	555	555	555
NSIDC --> EDC	**ASTER**	MODIS			107	107	107	107
	MODIS	MODIS		107	107	107	107	107
		Less Duplicates		0	-107	-107	-107	-107
	TOTAL			107	107	107	107	107

DAAC to DAAC Reprocessing Transfers for AM-1 Mission

Launch Date: 30 June, 1998

			Kbps - 4th Quarter					
Source --> Destination	**Supporting**	**Type**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
EDC --> GSFC	**DAS**	MODIS				1497	4492	4492
	MODIS	MODIS			310	931	931	931
	TOTAL				310	2428	5423	5423
GSFC --> EDC	**ASTER**	MODIS			867	2601	2601	2601
		Ancillary			5	15	15	15
		Subtotal			872	2616	2616	2616
	MODIS	MODIS			3178	9533	9533	9533
		Ancillary			1	2	2	2
		Subtotal			3178	9535	9535	9535
	TOTAL				4050	12151	12151	12151
GSFC --> LaRC	**CERES**	MODIS			7951	23854	23854	23854
	MISR	DAS			46	139	139	139
		MODIS			0	9698	29094	29094
		Ancillary			8	23	23	23
		Subtotal			54	9860	29256	29256
	MOPPIT	MODIS			0	703	2109	2109
		Ancillary			2	7	7	7
		Subtotal			2	710	2116	2116
	Less Duplicates				0	-8654	-25963	-25963
	TOTAL				8007	25769	29262	29262
GSFC -- > NSIDC	**MODIS**	MODIS			61	183	183	183
JPL --> GSFC	**DAS**	NSCAT			<1	<1	<1	<1
LaRC --> EDC	**ASTER**	MISR			224	1001	1659	1659
	MODIS	MISR			2	5	5	5
	TOTAL				226	1007	1665	1665
NSIDC --> EDC	**ASTER**	MODIS			0	107	322	322
	MODIS	MODIS			107	322	322	322
	Less Duplicates				0	-107	-322	-322
	TOTAL				0	322	322	322

DAAC to DAAC Production Transfers for SAGE III (METEOR) Mission

Launch Date: August, 1998

			Kbps - 4th Quarter					
Source --> Destination	**Supporting**	**Type**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
GSFC --> LaRC	**SAGE III**	Ancillary	0	1	1	1	1	1
	Less Duplicates	(with AM-1)	0	-1	-1	-1	-1	-1
	TOTAL		0	0	0	0	0	0

DAAC to DAAC Reprocessing Transfers for SAGE III (METEOR) Mission

Launch Date: August, 1998

			Kbps - 4th Quarter					
Source --> Destination	**Supporting**	**Type**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
GSFC --> LaRC	**SAGE III**	Ancillary			1	2	2	2
	Less Duplicates (with AM-1)				-1	-2	-2	-2
	TOTAL				0	0	0	0

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Appendix B. QA Flows by DAAC

The attached spreadsheet lists QA flows by DAAC in kbps with the following assumptions:

QA Flows by DAAC (kbps)

DAAC	3Q 98	3Q 99	3Q 00	3Q 01	3Q 02
EDC	2840	3156	3217	3217	3217
GSFC	3338	3338	3338	3338	3338
JPL		47	47	47	47
LaRC	1858	1616	1644	2284	1644
NSIDC	148	148	148	148	148

Assumptions:

1. QA flows for CERES and MOPITT (from the LaRC DAAC) are based on detailed scenarios provided by these teams regarding the data products that they will need to access for QA.

2. QA flows for MODIS (from the EDC, GSFC and NSIDC DAACs) are based on an estimate (provided by the MODIS Science Data Support Team) that MODIS will need to access 10% of their data products for QA.

3. Other instrument teams have not provided any specific estimates of their QA requirements. QA flows for these instruments are estimated by assuming that they will need to access 10% of their data products for QA.

4. All estimates use the data volumes provided by the instrument teams through the AHWGP, as incorporated in the February 1996 ECS Technical Baseline.

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Abbreviations and Acronyms

ACRIMSAT	Active Cavity Radiometer Irradiance Monitor Satellite
ADC	Affiliated Data Center
ADEOS	Advanced Earth Observing Satellite
AHWGP	Ad Hoc Working Group For Production
AI&T	Algorithm Integration & Test
ASF	Alaska Synthetic Aperture Radar Facility
ATM	Asynchronous Transfer Mode
bps	Bits per second
CCR	Configuration Change Request
CDRL	Contract Data Requirements List
CERES	Clouds and Earth's Radiant Energy System
CSMS	Communications and Systems Management Segment
DAAC	Distributed Active Archive Center
DAO	Data Assimilation Office
DAS	Data Assimilation System
DCN	Document Change Notice
ECS	EOSDIS Core System
EDC	EROS Data Center (DAAC)
EOC	EOS Operations Center (ECS)
EOSDIS	Earth Observing System Data and Information System
ESDIS	Earth Science Data and Information System (GSFC)
ESN	EOSDIS Science Network
FIX	Federal Internet Exchange
FOS	Flight Operations Segment (ECS)
GB	gigabyte (10^9)
GFE	Government Furnished Equipment

GFP	Government Furnished Property
GSFC	Goddard Space Flight Center
GV	TRMM Ground Validation Data
HIRS/2	High-Resolution Infrared Sounder/Version 2
IAS	Image Assessment System (Landsat)
ICC	Instrument Control Center (ECS) (ASTER)
IDR	Incremental Design Review
IDS	InterDisciplinary Science
IP	International Partner; Internet Protocol
IPA	Inter Project Agreement
IR-1	Interim Release-1
IRD	Interface Requirements Document
IST	Instrument Support Terminal (ECS)
JPL	Jet Propulsion Laboratory
Kbps	Kilobits per second
LaRC	Langley Research Center
LIS	Lightning Imaging Sensor
MAE	Metropolitan Area Exchange
M&O	Maintenance & Operations
Mbps	Megabits per second
MDT	Mean Downtime
MISR	Multi-Angle Imaging SpectroRadiometer
MODIS	Moderate-Resolution Imaging SpectroRadiometer
MOPITT	Measurements of Pollution in the Troposphere
MTTR	Mean Time To Repair
MTTRS	Mean Time To Restore Service
NAP	Network Access Point
NASA	National Aeronautics and Space Administration
Nascom	NASA Communications

NCAR	National Center for Atmospheric Research
NOAA	National Oceanic and Atmospheric Administration
NOC	Network Operations Center
NOLAN	Nascom Operational Local Area Network
NSI	NASA Science Internet
NSIDC	National Snow and Ice Data Center (DAAC)
ETRD	EBnet Traffic Requirements Database
ORNL	Oak Ridge National Laboratory (DAAC)
PACOR	Packet Processor
PDR	Preliminary Design Review
PI	Principal Investigator
PI/TL	Principal Investigator/Team Leader
QA	Quality Assurance
QC	Quality Control
RMA	Reliability, Maintainability, Availability
RRR	Release Readiness Review
SBUV/2	Solar Backscatter Ultraviolet/version 2
SCF	Science Computing Facility
SMC	System Management Center (ECS)
SSM/I	Special Sensor for Microwave/Imaging (DMSP)
SWS	Sea Winds
TBD	To Be Determined
TL	Team Leader
TMI	TRMM Microwave Imager
TSDIS	TRMM Science Data & Information System
WAN	Wide Area Network

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