

INTRODUCTION AND SYSTEM OVERVIEW

ECS Pre-Release B Testbed Training

Overview of Lesson



- **Introduction**
- **ECS Overview**
- **Pre-Release B Testbed**
- **System Functional Overview**
- **Operational Software Configuration Overview**
- **Operation Hardware Configuration Overview**
- **Commercial Off-the-Shelf (COTS) Software Overview**
- **Operational Processes**

Overview of Lesson (Cont.)



- **Practical Exercises**
 - Tour of the facility
 - Performing an operator login and logout

Objectives



- **OVERALL:**
 - Describe the mission, goals, objectives, structure, functions, products, services and users of ECS
- **SPECIFIC:**
 - Describe the mission of ECS
 - Describe the ECS Pre-Release B Testbed support for Science Software Integration and Test (SSI&T) of...
 - » EOS AM-1
 - » Landsat-7
 - Describe how the ECS functions in terms of:
 - » general data flow
 - » ECS operations centers/locations

Objectives (Cont.)



- Describe the ECS operational software configuration of:
 - » Science Data Processing Subsystem (SDPS)
 - » Communications and System Management Subsystem (CSMS)
- Describe the ECS operation hardware configuration
- Describe commercial off-the-shelf (COTS) software
- Describe ECS operational processes
- Describe ECS facility layout and the locations of ECS components within the facility
- Log in to ECS
- Log out of ECS

Objectives (Cont.)



- **STANDARD: Describe specified characteristics of ECS without error in accordance with the lesson content.**
- **Lesson provides general familiarity with ECS and gives those who will be ECS operators and support staff a context and basis for subsequent lessons on specific aspects of the system**

ECS Overview - Mission



- **Mission to Planet Earth (MTPE)**
 - NASA research mission
 - space-, ground-, and aircraft-based measurements to study the processes leading to global climate changes and develop a predictive capability for earth systems on time scales of decades to centuries
 - NASA's contribution to the U.S. Global Change Research Program (USGCRP)
 - goal:
 - » advance scientific understanding of the entire Earth system by developing a deeper comprehension of the components of the system and the interactions among components

ECS Overview - Mission (Cont.)



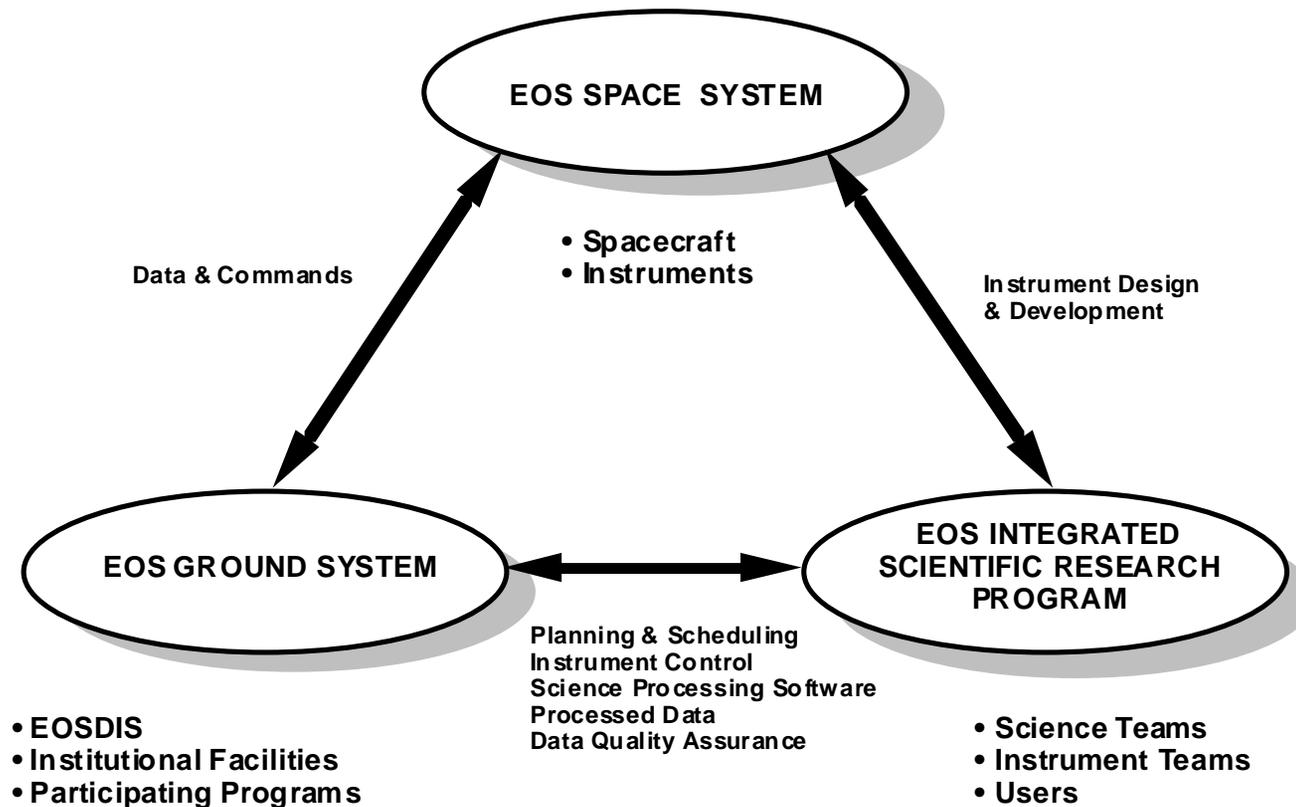
- **Earth Observing System (EOS)**
 - principal element of MTPE
 - designed to collect Earth Science data
 - emphasis on long-term, sustained data sets from carefully calibrated instruments on satellites in low-Earth orbits
 - goal:
 - » provide quantitative data from systematic, continuous satellite observations from low-Earth orbit for a minimum of 15 years

ECS Overview - Mission (Cont.)



- **Earth Observing System (EOS)**
 - **broad objectives:**
 - » **create an integrated scientific observing system to study Earth's critical, life-enabling, interrelated processes**
 - » **develop a comprehensive data and information system**
 - » **acquire and assemble a global database of remote-sensing measurements from space as a key to understanding global climate change**
 - **major contribution to distinguishing between natural variability in the Earth system and changes introduced by human activities**

ECS Overview - Mission (Cont.): Major EOS Segments



ECS Overview - Mission (Cont.):



- **Purpose of EOS program components**
 - **EOS Space System**
 - » acquire essential global Earth science data on a long-term sustained basis and in a manner that maximizes the scientific utility of the data and simplifies data analysis
 - **EOS Ground System (EGS)**
 - » provide the Earth Science research community with easy, affordable, and reliable access to the full suite of Earth science data from U.S. and International Partner (IP) platforms
 - **Integrated Scientific Research Program**
 - » investigate processes in the Earth System and improve predictive models

ECS Overview - Mission (Cont.)



- **EOS Data and Information System (EOSDIS)**
 - **NASA's overall Earth Science data system**
 - » **under the direction of the Earth Science Data and Information System (ESDIS) Project**
 - **ground system for the collection and analysis of science data on the dynamics of the Earth**
 - **supports the following activities:**
 - » **planning, scheduling and control of EOS spacecraft**
 - » **exchanging commands, data and algorithms with non-NASA entities involved in EOS**
 - » **coordinating activities with other data-gathering systems**
 - » **transforming observations into physical variables**
 - » **presenting data to science users, facilitating/ stimulating interactive scientific research**

ECS Overview - Mission (Cont.)



- **EOSDIS**
 - **Version 0 (V0) (initial version)**
 - » manages data from NASA's current and past Earth Science research satellites and field measurement programs
 - » provides data archiving, distribution and information management services
 - **EOS/ECS era**
 - » satellite/instrument command and control
 - » generation of data sets into climate models
 - » migration of V0 data into ECS

ECS Overview - Mission (Cont.)



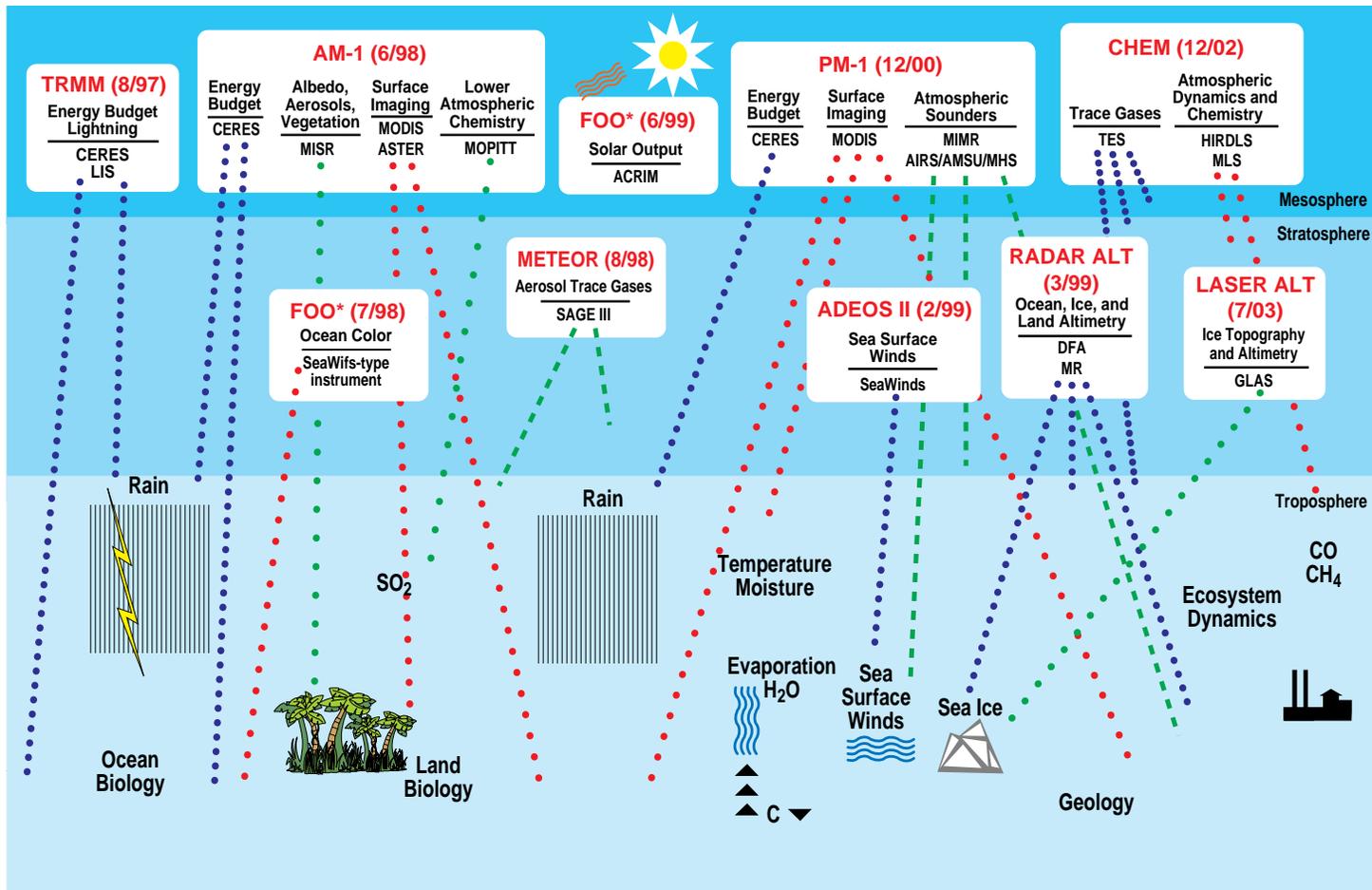
- **EOSDIS Services**
 - user support
 - data archive management and distribution
 - information management
 - product generation
 - spacecraft command and control
 - data capture and telemetry processing

ECS Overview - Mission (Cont.)



- **EOSDIS data products**
 - Level 0 - “raw” data
 - Level 1A - time-referenced, annotated
 - Level 1B - processed to sensor units
 - Level 2 - derived geophysical variables
 - Level 3 - variables mapped on space-time grid scales
 - Level 4 - model output or results from analyses of lower-level data

Sample EOS Instruments and Measurements



98EO01-007 (V2)

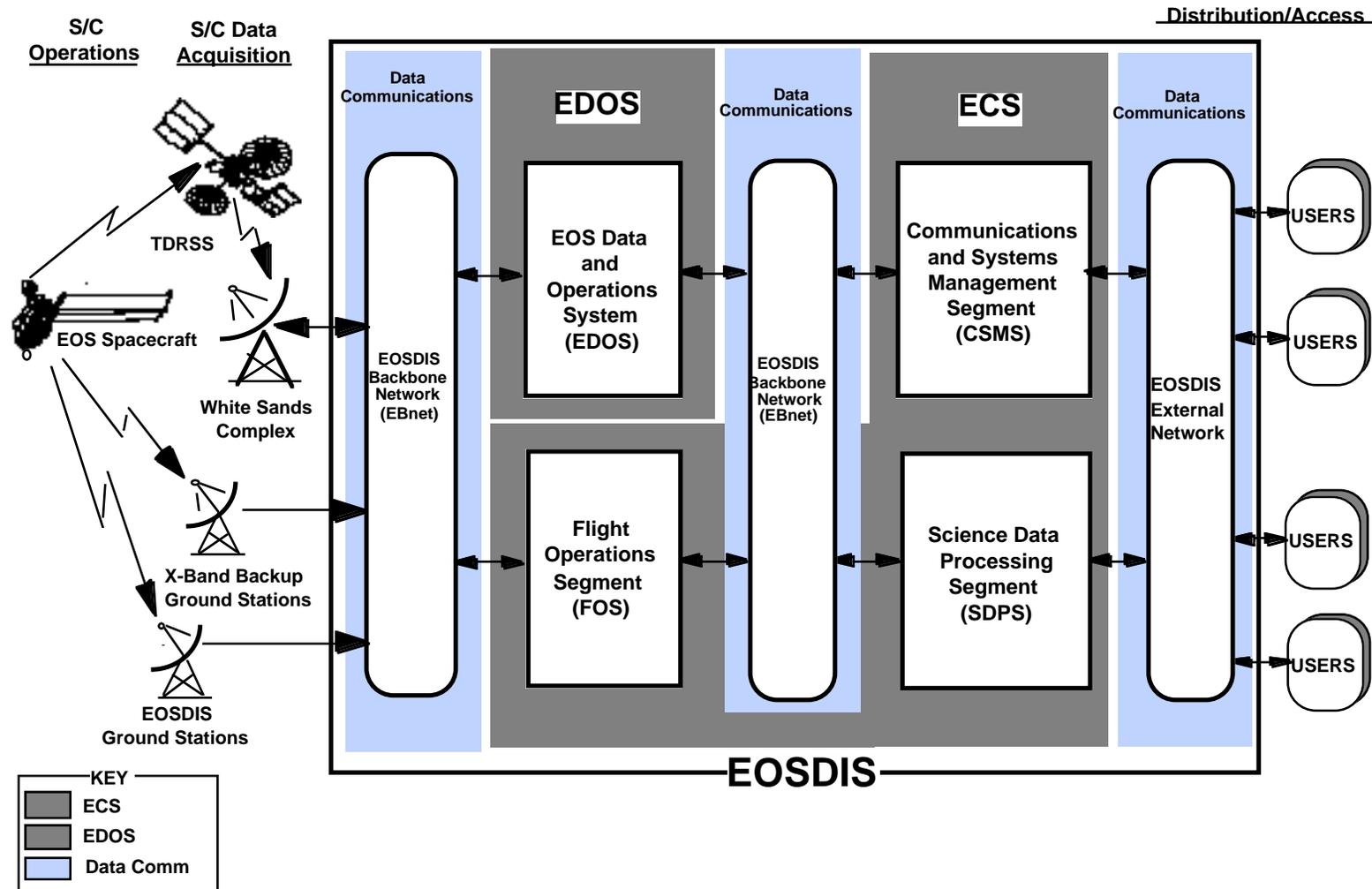
*FOO = Flight of Opportunity

ECS Overview - Mission (Cont.)



- **EOSDIS Components**
 - **EOS Data and Operations System (EDOS)**
 - » spacecraft data capture and distribution
 - **EOSDIS Backbone Network (EBnet)**
 - » data communication services
 - **EOSDIS Core System (ECS)**

EOSDIS Principal Components



ECS Overview - Mission (Cont.)

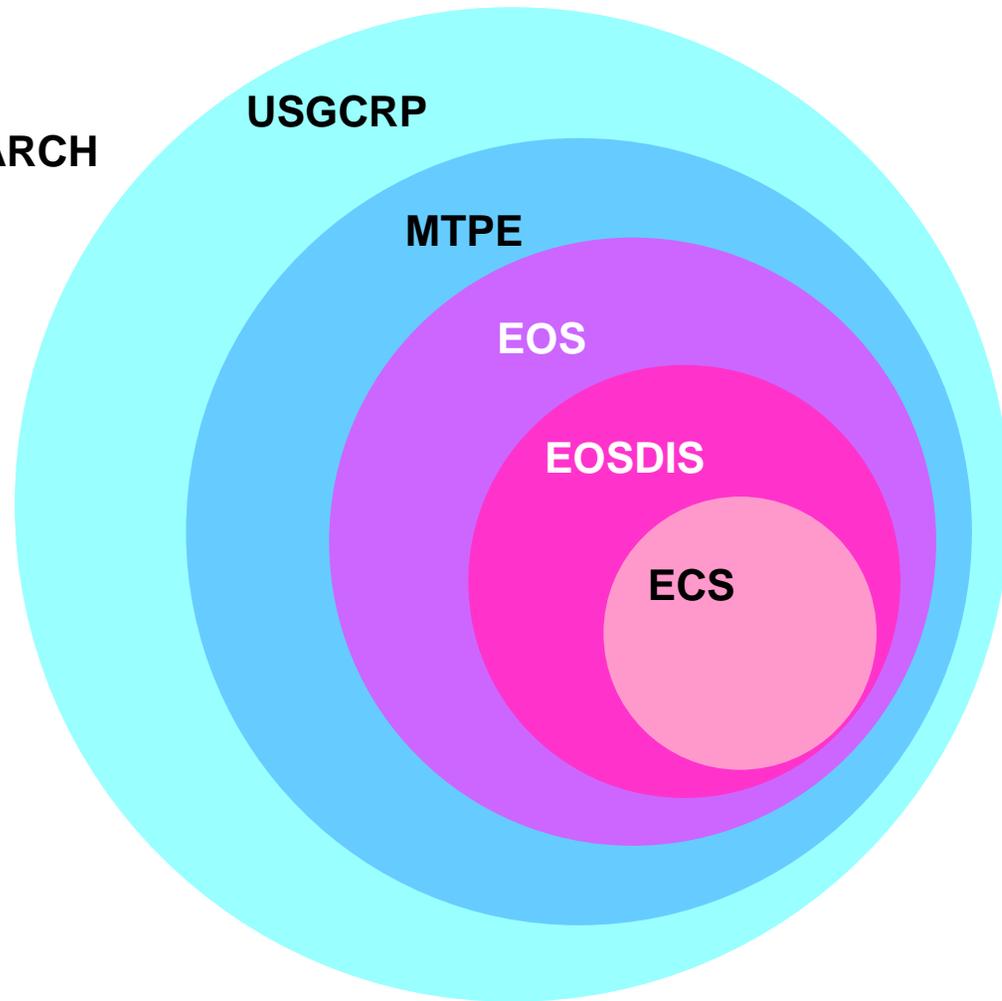


- **EOSDIS Core System (ECS)**
 - Major component of EOSDIS
 - Mission
 - » provide centralized mission and instrument command and control functions, and distributed (but common) product generation, archiving, and information management functions for the EOSDIS
 - Main Functions
 - » provide control of EOS spacecraft and instruments
 - » process data from EOS instruments
 - » manage and distribute EOS data products and other selected data sets to the scientific community

Relationship of ECS to Global Change Research



WORLDWIDE
GLOBAL CHANGE RESEARCH



ECS Overview - Mission (Cont.)



- **ECS components/segments**
 - **Science Data Processing Segment (SDPS)**
 - **Communications and System Management Segment (CSMS)**
 - **Flight Operations Segment (FOS)**

ECS Overview - Mission (Cont.)



- **Science Data Processing Segment (SDPS)**
 - **Receives, processes, archives and manages all data from EOS and other NASA Probe flight missions**
 - **Provides support to users in accessing data and products**
 - **Promotes the utilization and exchange of data (advertising service)**
 - **Provides the infrastructure for the development, experimental usage and quality-checking of new Earth Science algorithms**
 - **Distributed system - located at Distributed Active Archive Centers (DAACs)**

ECS Overview - Mission (Cont.)



- **Communications and System Management Segment (CSMS)**
 - Interconnects users and service providers
 - Transfers information among ECS and EOSDIS components
 - Monitors and coordinates EOSDIS components
 - Supports a wide range of status information, coordination, administration and maintenance services
 - **CSMS subsystems**
 - » **Systems Management Subsystem (MSS)**
 - » **Communications Subsystem (CSS)**
 - » **Internetworking Subsystem (ISS)**

ECS Overview - Mission (Cont.)



- **Flight Operations Segment (FOS)**
 - **Manages and controls EOS spacecraft and instruments**
 - **Performs mission planning, scheduling, control, monitoring and analysis**
 - **Interacts with other NASA institutional facilities**
 - » **Flight Dynamics Facility (FDF)**
 - » **Network Control Center (NCC)/Space Network Control (SNC)**
 - **FOS elements**
 - » **EOS Operations Center (EOC)**
 - » **Instrument Support Terminal (IST)**

Pre-Release B Testbed



- **ECS development proceeds in phases**
 - **Interim Release 1 (Ir1)**
 - » preliminary release for concept validation and testing (January 1996)
 - **Pre-Release B Testbed**
 - » deployed in May-June 1997 at four DAACs
 - » supports science software integration and test (SSI&T) in support of Instrument Teams (ITs) for Landsat-7 and EOS AM-1 missions
 - » based on the canceled Release A
 - **Releases B, C and D**
 - » support for future EOS missions, such as EOS AM-1 and EOS PM-1

Pre-Release B Testbed (Cont.)



- **Testbed support of SSI&T**
 - **starts with the delivery of science software to the DAACs**
 - **continues until either....**
 - » **successful integration of all expected science software packages into the ECS Pre-Release B Testbed**
 - » **scheduled end date for SSI&T support (September 1, 1997)**
 - **performed at the following DAACs:**
 - » **Goddard Space Flight Center (GSFC)**
 - » **Langley Research Center (LaRC)**
 - » **Earth Resources Observation Systems (EROS) Data Center (EDC)**
 - » **National Snow and Ice Data Center (NSIDC)**

Pre-Release B Testbed (Cont.)



- **SSI&T support for the following instruments:**
 - **EOS AM-1 satellite**
 - » **Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER)**
 - » **Clouds and the Earth's Radiant Energy System (CERES)**
 - » **Multi-angle Imaging SpectroRadiometer (MISR)**
 - » **Moderate-Resolution Imaging Spectroradiometer (MODIS)**
 - » **Measurements of Pollution in the Troposphere (MOPITT)**
 - **Landsat-7 satellite**
 - » **Enhanced Thematic Mapper Plus (ETM+)**
 - **Meteor 3M-1 satellite**
 - » **Stratospheric Aerosol and Gas Experiment (SAGE) III**

Pre-Release B Testbed (Cont.)



- **Science software is developed independently of ECS by Instrument Teams at their local Science Computing Facilities (SCFs)**
 - science software may be developed on a variety of computer platforms using many versions of compilers and operating systems
 - **SSI&T is the process by which IT science software is tested and integrated into the ECS at the DAACs**

Pre-Release B Testbed (Cont.)



- **SSI&T goals**

- **Ensure that the delivered PGEs conform to ESDIS Project standards**
- **Load the PGEs on DAAC computers**
- **Integrate the PGEs with the DAAC version of the SDP Toolkit and execute them using the ECS Planning and Data Processing Subsystem**
- **Verify that the data products and results are the same as those produced at the SCFs**

Pre-Release B Testbed (Cont.)



- **Release B**
 - first operational release of the ECS
 - to be delivered in two phases:
 - » Release B.0 scheduled completion December 30, 1997
 - » Release B.1 delivery September 1, 1998.
- **Release B.0**
 - consists of all functions critical to mission success at launch and for initial science activities related to support of the AM-1 and Landsat-7 satellites and their instruments
- **Release B.1**
 - provides all remaining Release B functions

Pre-Release B Testbed (Cont.)



- **Release B.0 mission objectives:**
 - Support AM-1 operations
 - Support Landsat-7 operations
 - Perform science data processing
- **Release B.1 mission objectives**
 - same objectives as Release B.0 plus the following additional objective:
 - » Support Advanced Earth Observing Satellite (ADEOS) II operations

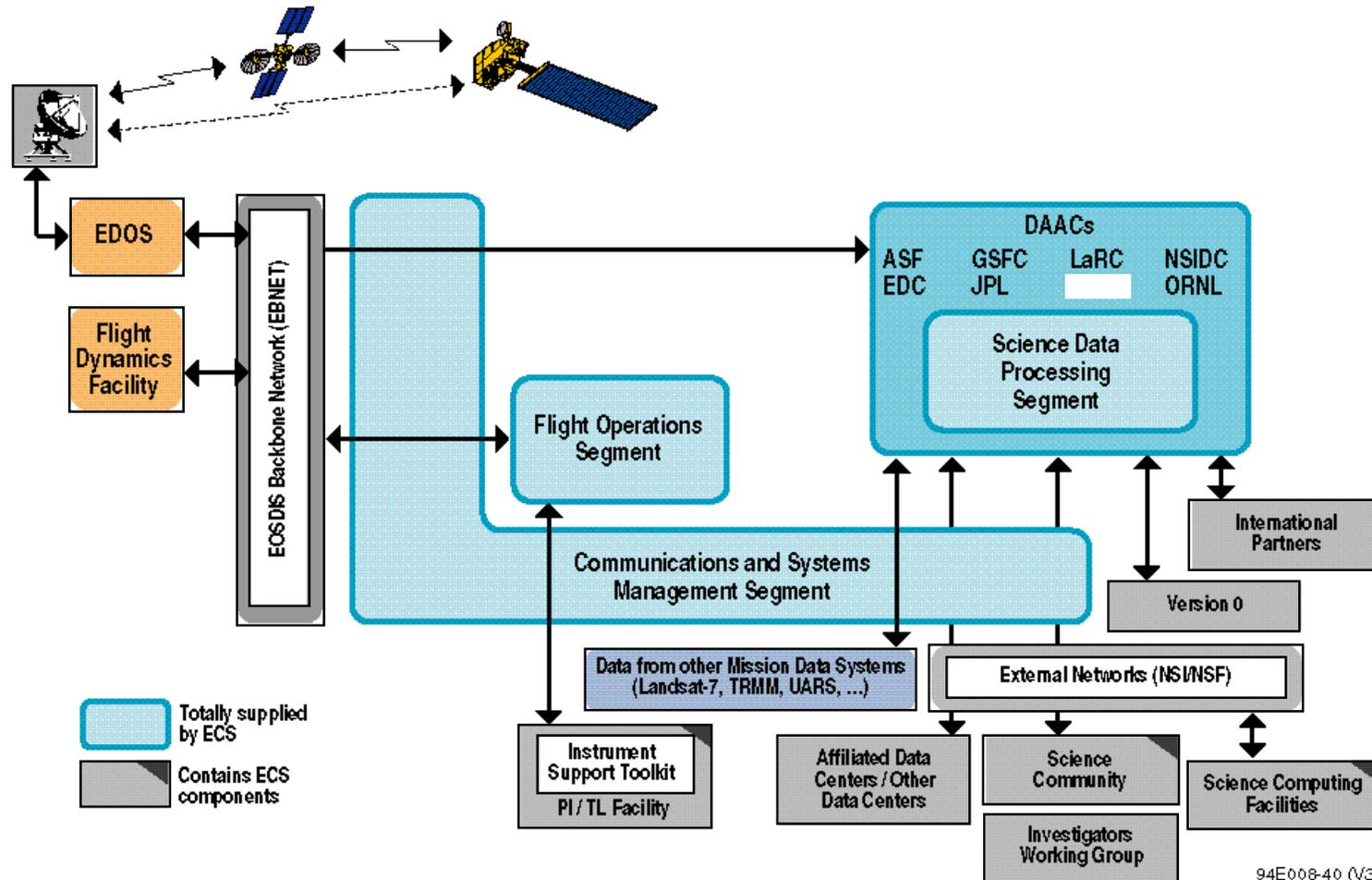
System Functional Overview



- **EOSDIS Data Flow**

- **ECS components and other EOSDIS (non-ECS) components support the following types of services:**
 - » **data product generation**
 - » **archive**
 - » **distribution**
 - » **information management**
 - » **spacecraft/instrument command and control**
- **internal interfaces**
 - » **DAACs**
 - » **System Monitoring and Coordination functions**
 - » **EOS Operations Center (EOC) - Flight Operations**

EOSDIS Data Flow



94E008-40 (V3)

System Functional Overview (Cont.)



- **Data from EOS AM-1 satellite instruments**
 - transmitted from EOS satellites through the Tracking and Data Relay Satellites (TDRS) to the receiving station (White Sands, NM)
 - » generally (nominally) transmitted in a single, combined telemetry stream
 - then the data are transmitted via EOSDIS Backbone Network (EBnet) circuits to the EDOS Level Zero Processing Facility (LZPF) at GSFC
 - satellite data are processed to recover the raw instrument data at LZPF
- **EOS missions subsequent to AM-1**
 - science data will be transmitted to the LZPF from high-latitude X-band EOSDIS ground stations in Alaska and Norway

System Functional Overview (Cont.)



- **International Partner (IP) satellites**
 - **downlink directly to the International Partner Ground Systems (IPGSs) via their ground receiving stations**
 - **data from NASA instruments on the IP platforms are either....**
 - » **transmitted to GSFC via commercial networks**
 - » **sent on hard media (disk or tape)**
- **Landsat-7**
 - **transmits downlink data**
 - » **directly to the Landsat-7 Ground Station (LGS) at the Earth Resources Observation Systems (EROS) Data Center (EDC)**
 - » **to International Ground Stations**

System Functional Overview (Cont.)



- **EDOS**

- responsible for spacecraft data capture and distribution
- processes satellite data to recover the raw, Level 0 instrument data
- distributes Level 0 instrument data for archiving and processing
 - » to the ECS SDPS (designated DAACs)
 - » via EBnet
- provides archive services for Level 0 data
 - » EDOS Data Archive Facility (DAF), Fairmont, WV

System Functional Overview (Cont.)



- **EDOS (Cont.)**

- provides space and ground interfaces between the EOS spacecraft via the Space Network (SN)/ Tracking and Data Relay Satellite System (TDRSS) and the EOS Ground System (EGS), the EOC, and DAAC elements of EOSDIS
- provides an interface for the uplink (transmission to the spacecraft) of commands

System Functional Overview (Cont.)



- **Suppliers of non-EOS data products (data sets)**
 - **Affiliated Data Centers (ADCs)**
 - » allow access to non-EOS data sets to satisfy ECS user queries and to provide ancillary data for the generation of ECS standard products
 - » National Environmental Satellite Data and Information Service (NESDIS) of the National Oceanic and Atmospheric Administration (NOAA) (for example)
 - **other mission data systems**
 - » Landsat Processing System (LPS)
 - » ECS provides user access, and product archive and distribution functions for Landsat-7 data and information
 - **Other Data Centers (ODCs)**

System Functional Overview (Cont.)



- **Ancillary data are transferred over external networks**
 - **NASA Science Internet (NSI)**
 - **National Science Foundation (NSF) Internet**

System Functional Overview (Cont.)



- **DAACs**

- **house the ECS computing facilities and operational staff needed for product generation and managing and storing...**
 - » **EOSDIS data**
 - » **associated metadata**
 - » **associated browse data**
- **receive requests for data products and other archived information from users**
- **distribute requested data**
- **provide open access to the EOS data by all members of the science community**
 - » **previous research satellite projects granted selected investigators proprietary data rights for a number of years after data acquisition**

System Functional Overview (Cont.)



- **ECS users**
 - most science users access EOS data products at the DAACs via external networks such as the NSI
 - include facilities and organizations not participating directly in the EOS Program
 - » users of other NASA data systems and archives
 - » users of other government data systems and archives
 - » university research users
 - » international investigators/data centers
 - » commercial data systems
 - may acquire ECS-provided tool sets permitting them to search for and order data

System Functional Overview (Cont.)



- **EOS Internal Communications**
 - **CSMS provides system management functions and communications services for ECS**
 - » local area network (LAN) services
 - » connectivity to external networks
 - **DAACs exchange data via the EBnet**
 - » DAAC may receive data products generated at other DAACs which it needs as inputs to its own processing
 - » DAAC distributes data products it produces to other DAACs which need those products as input

System Functional Overview (Cont.)



- **EBnet**

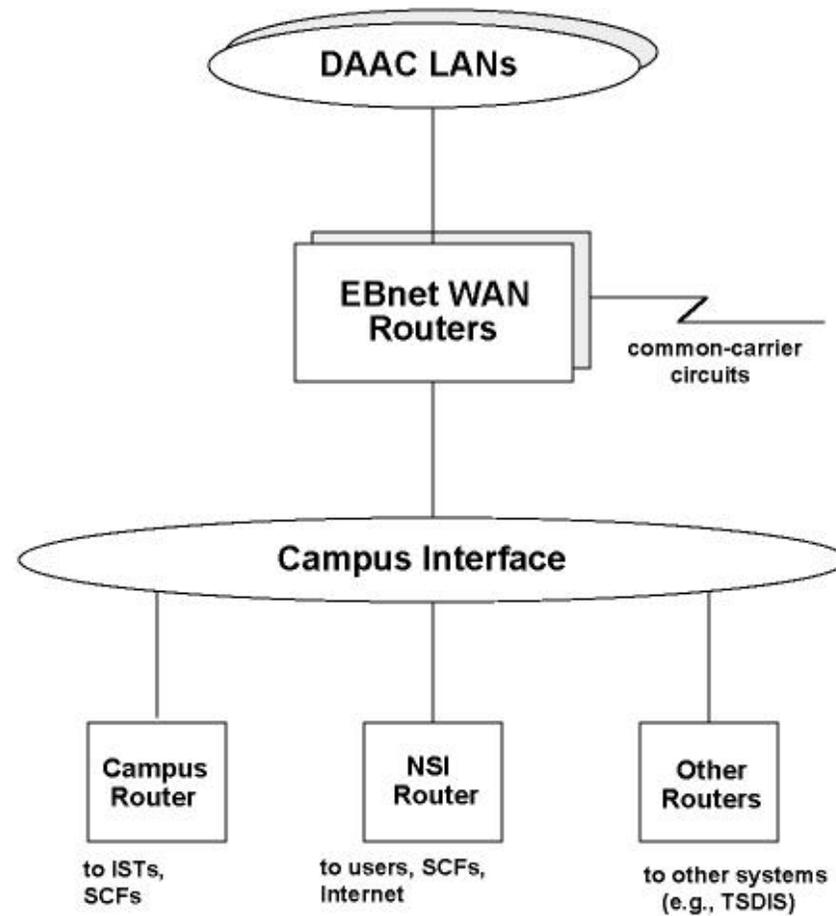
- provides wide-area communications circuits and facilities between and among various EOS Ground System (EGS) elements
- transports spacecraft command, control, and science data nationwide on a continuous basis, 24 hours a day, 7 days a week
 - » real-time data include mission-critical data related to the health and safety of on-orbit space systems and raw science telemetry as well as prelaunch testing and launch support
 - » science data include information collected from spacecraft instruments and various levels of processed science data including expedited data sets, production data sets, and rate-buffered science data

System Functional Overview (Cont.)



- **EBnet (Cont.)**
 - **serves as the interface to other systems**
 - » **DAACs**
 - » **users**
 - » **NSI**
 - **includes a campus interface**
 - » **provides communications between the Wide Area Network (WAN) and Local Area Network (LAN)**

EOSDIS Backbone Network (EBnet)



System Functional Overview (Cont.)



- **Science Computing Facilities (SCFs)**
 - located at science investigator facilities
 - perform scientific research
 - develop science data processing software
 - provide data archiving and distribution capabilities
 - employ a user interface that facilitates browsing, requesting, and delivering data from archives to investigators
 - some perform scientific quality assurance of EOS data products (applicable SCFs for the investigators responsible for the products)

System Functional Overview (Cont.)



- **Science Computing Facilities (SCFs) (Cont.)**
 - use ECS-provided “toolkits” to support the SCF activities
 - » **Science Data Processing (SDP) Toolkit** is used for developing and validating science algorithms at the SCF and transferring the algorithms to the DAACs
 - » **Instrument Support Terminal (IST) Toolkit** (available at some SCFs) supports planning and scheduling of spacecraft instruments

System Functional Overview (Cont.)



- **Science Computing Facilities (SCFs) (Cont.)**
 - software for generating EOS *standard* science data products is developed by the science investigators at their facilities
 - » Investigator-developed software and algorithms for EOS standard products are integrated with the ECS and installed at the DAACs
 - EOS *special* products are produced at the investigator facilities
 - special products that become community-accepted become standard products through an Investigator Working Group (IWG)-determined assessment
 - » software eventually becomes integrated into the production environment at the DAACs

System Functional Overview (Cont.)



- **EOC - EOS Flight Operations (FOS)**
 - **EOS missions (flight operations) are coordinated from the EOC**
 - » spacecraft operations
 - » instrument operations
 - **Non-U.S. instruments on U.S. platforms are operated and monitored through IP Instrument Control Centers (ICCs)**
 - **FOS (at the EOC)**
 - » maintains spacecraft and instrument health and safety
 - » monitors spacecraft performance

System Functional Overview (Cont.)



- **EOC - EOS Flight Operations (FOS) (Cont.)**
 - **FOS interfaces with EDOS for the following functions:**
 - » **provides spacecraft and instrument uplink data to EDOS**
 - » **receives real-time or spacecraft recorder and instrument housekeeping data, spacecraft and instrument command status data, and spacecraft processor memory dump data from EDOS**
 - » **exchanges accounting, fault coordination, data operations status, and planning information with EDOS**
 - » **coordinates data delivery services with EDOS**

System Functional Overview (Cont.)



- **EOC - EOS Flight Operations (FOS) (Cont.)**
 - **EOC interfaces with the Flight Dynamics Facility (FDF) for the following functions:**
 - » receives predicted orbit data, including predicted ground track for scheduling from the FDF
 - » receives contact scheduling data from the FDF
 - » cooperates with FDF in the development of plans for corrective firings for spacecraft maneuvers
 - » receives, schedules, and implements plans from FDF
 - » provides attitude sensor data to the FDF for determining spacecraft attitude
 - **FDF**
 - » monitors the spacecraft attitude and navigation system performance
 - » provides orbit and attitude products to support both flight operations and science processing

System Functional Overview (Cont.)



- **EOC - EOS Flight Operations (FOS) (Cont.)**
 - provides the SDPS with the following types of information:
 - » spacecraft information, including orbit data
 - » acquisition plans and schedules
 - exchanges planning and scheduling information with the IP-ICCs
 - sends mission status to the IP-ICCs
 - receives instrument commands and status from the IP-ICCs
 - exchanges instrument planning and scheduling information with the IST

System Functional Overview (Cont.)



- **Instrument uplink data**
 - generated by the instrument team using the IST
 - received, validated at a high level, and integrated by EOC
 - EOC receives instrument status information from the IST to perform high-level monitoring
- **SMC (CSMS)**
 - EOC receives EOS management and operation directives, including science policy and guidelines from the IWG plan, via the SMC (CSMS)
 - EOC furnishes EOC management and operations status via the SMC (CSMS)

System Functional Overview (Cont.)



- **EOSDIS Version 0 (V0)**
 - early "working prototype" of selected EOSDIS functionality
 - hosted and operated by the DAACs
 - interconnects existing data systems at the DAACs via electronic networks
 - provides services such as....
 - » data ingest
 - » archive
 - » catalog
 - » distribution
 - » user support services

System Functional Overview (Cont.)



- **EOSDIS Version 0 (V0)**
 - does not have all the functional capabilities, fault tolerance, or reliability provisions of the ECS
 - has been used and evaluated by the users
 - » has provided feedback concerning the required functional capability of the ECS
- **SDPS provides interoperability with V0 during the ECS early development phases**
- **SDPS will participate in the migration of V0 data to ECS**

System Functional Overview (Cont.)



- **NASA institutional services**
 - **Space Network (SN)**
 - » **Tracking and Data Relay Satellite System (TDRSS)**
 - » **Ground Terminals**
 - » **Network Control Center**
 - **Flight Dynamics Facility (FDF)**
 - **NASA Communications (NASCOM)**
 - » **NASCOM Operational Local Area Network (NOLAN)**
 - **Deep Space Network (DSN)**
 - **Ground Network (GN)**
 - **X-Band Backup Ground Stations**

System Functional Overview (Cont.)



- **NASA institutional services (Cont.)**
 - Wallops Orbital Tracking Station (WOTS)
 - Program Support Control Network (PSCN)
 - Sensor Data Processing Facility (SDPF)

System Functional Overview (Cont.)



- **ECS Operations Locations (current and future)**
 - **Distributed Active Archive Centers (DAACs)**
 - » Alaska SAR Facility (ASF)
 - » EROS Data Center (EDC)
 - » Goddard Space Flight Center (GSFC)
 - » Jet Propulsion Laboratory (JPL)
 - » Langley Research Center (LaRC)
 - » National Snow and Ice Data Center (NSIDC)
 - » Oak Ridge National Laboratory (ORNL)
 - » Socioeconomic Data Applications Center (SEDAC)
 - **System Monitoring and Coordination Center (SMC)**
 - **EOS Operations Center (EOC)**
 - **ECS Sustaining Engineering Organization (SEO)**
 - **ECS System Integrated Logistics Support Organization (ILS)**

System Functional Overview (Cont.)



- **Institutions with which ECS has interfaces**
 - **Science Computing Facilities (SCFs)**
 - **International Partners' Instrument Control Centers (IP-ICCs)**
 - **Instrument Support Terminal (IST) Sites**
 - **Affiliated Data Centers (ADCs)**
 - » **NOAA/National Environmental Satellite, Data, and Information Service (NESDIS)**
 - » **National Center for Environmental Prediction (NCEP)**
 - » **Space Science and Engineering Center of the University of Wisconsin**
 - » **Incorporated Research Institutions for Seismology (IRIS) Data Center**

System Functional Overview (Cont.)



- **DAACs**
 - **Areas of specialization**
 - » **ASF - Synthetic Aperture Radar Study, Polar Processes**
 - » **EDC - Land Processes Imagery**
 - » **GSFC - Upper Atmosphere, Atmospheric Dynamics, Global Biosphere, Geophysics**
 - » **JPL - Ocean Circulation and Air-Sea Interaction**
 - » **LaRC - Tropospheric Radiation Budget, Aerosols, Chemistry**
 - » **NSIDC - Cryosphere (Non-SAR)**
 - » **ORNL - Biogeochemical Dynamics**
 - » **SEDAC - Policy/Decision Making Applications of Combined MTPE and Socio-Economic Data**

System Functional Overview (Cont.)



- **DAACs (Cont.)**
 - **Testbed DAACs**
 - » **EDC**
 - » **GSFC**
 - » **LaRC**
 - » **NSIDC**

System Functional Overview (Cont.)



- **DAACs (Cont.)**

- **Functions:**

- » **Integration and test of science software**
 - » **archiving science software files/documentation**
 - » **supplying operational environment for science software**
 - » **executing science software to produce standard data products**
 - » **archiving and distributing standard data products**
 - » **accepting, archiving and distributing special products generated by other facilities**
 - » **advertising data and providing user support**

System Functional Overview (Cont.)



- **SMC**
 - **not active for Testbed**
 - » **at least some functions will be part of the Testbed**
 - **to be located at GSFC (Release B.0)**
 - **Enterprise Monitoring and Coordination (EMC) - set of CSMS services at the SMC**
 - » **MSS provides a system-wide management view for monitoring and control purposes**
 - » **CSS provides services (e.g., electronic mail and bulletin boards) for coordination**

System Functional Overview (Cont.)



- **SMC (Cont.)**
 - **Functions::**
 - » **performance management (system-wide performance analysis/management)**
 - » **configuration management (system-wide baseline configurations)**
 - » **security management (detect system-wide trends and incidents)**

System Functional Overview (Cont.)



- **SEO**
 - located at GSFC
 - responsive to the ESDIS Project Office and the Project Scientist
 - system perspective on:
 - » maintenance
 - » sustaining engineering
 - » training
 - analyzes how to integrate new technologies and concepts into ECS
 - monitors M&O activities to assure ECS reliability, maintainability and availability

System Functional Overview (Cont.)



- **ILS Organization**

- **system-level logistics support of commercial off-the-shelf (COTS) software and hardware**
 - » **procurement**
 - » **accounting**
 - » **installation**
 - » **maintenance**
 - » **training**

System Functional Overview (Cont.)



- **EOC**
 - **located at GSFC**
 - **EOS mission control center**
 - » **mission planning**
 - » **command and control of U.S. EOS spacecraft and instruments**
 - **operated by the Flight Operations Team (FOT)**
 - » **maintains spacecraft and instrument health and safety**
 - » **monitors spacecraft performance**
 - » **performs spacecraft engineering analysis**
 - » **monitors mission performance of instruments**

System Functional Overview (Cont.)



- **SCFs**

- home for the Principal Investigators (PIs) and/or Instrument Teams (ITs)
- develop/update algorithms and science software
- calibrate EOS instruments
- produce special data sets (products)
- perform data quality checking
- analyze EOS data

System Functional Overview (Cont.)



- **International Partners Instrument Control Centers**
 - provide instrument plans and schedules to EOC
 - coordinate scheduling conflicts with EOC
 - send instrument commands to spacecraft via EOC

System Functional Overview (Cont.)



- **Instrument Support Terminal (IST) Sites**
 - **ISTs are software toolkits delivered by ECS to PI and TL sites for U.S. EOS instruments**
 - **ISTs provide interfaces with EOC to enable PI/TL participation in the following activities related to their instruments:**
 - » **planning**
 - » **scheduling**
 - » **commanding**
 - » **monitoring**

System Functional Overview (Cont.)



- **ADCs**
 - **non-EOS data centers**
 - » **provide access to non-EOS data or non-EOSDIS services required by EOS**
 - » **receive selected EOS data sets**
 - **ADC-provided services may include helping develop algorithms/software for data processing**
 - **NOAA National Environmental Satellite Data and Information Service (NESDIS)**
 - » **makes available data from geostationary and polar-orbiting meteorological satellites**

System Functional Overview (Cont.)



- **ADCs**
 - **NOAA National Environmental Satellite Data and Information Service (NESDIS)**
 - » geostationary and polar-orbiting meteorological satellite data
 - **National Center for Environmental Prediction (NCEP)**
 - » routine weather and climate forecasts for the U.S.
 - **Space Science and Engineering Center of the University of Wisconsin**
 - » Level 1 data from NOAA Geostationary Operational Environmental Satellites (GOES)
 - **Incorporated Research Institutions for Seismology (IRIS) Data Center**
 - » takes Wide Band Data Collection System data

Operational Software Configuration Overview



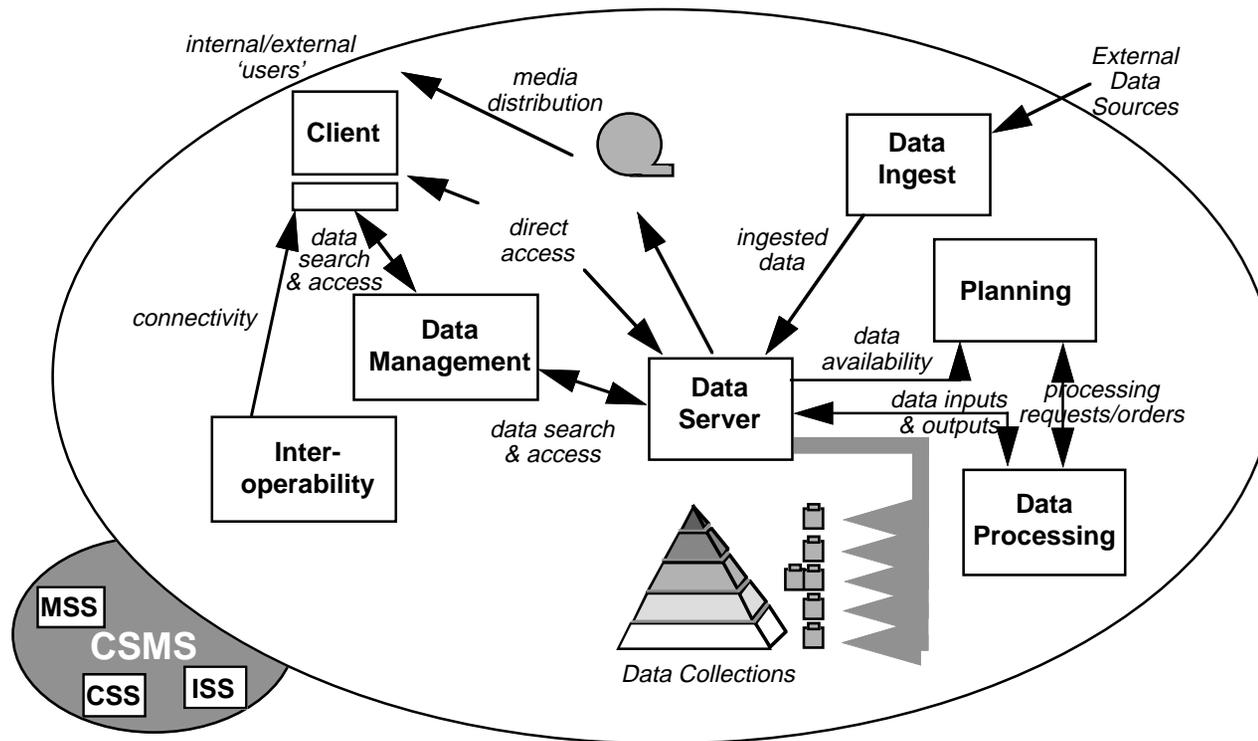
- **Major functional components used by M&O:**
 - **Science Data Processing Segment (SDPS)**
 - **Communications and System Management Segment (CSMS)**

Operational Software Configuration Overview (Cont.)



- **SDPS subsystems (7)**
 - **Client Subsystem (CLS)**
 - **Interoperability Subsystem (IOS)**
 - **Data Management Subsystem (DMS)**
 - **Data Server Subsystem (DSS)**
 - **Ingest Subsystem (INS)**
 - **Planning Subsystem (PLS)**
 - **Data Processing Subsystem (DPS)**

Science Data Processing Segment (SDPS)



Operational Software Configuration Overview (Cont.)



- **SDPS functional groupings**
 - **data storage and management (Data Server Subsystem)**
 - » **archive science data**
 - » **search for and retrieve archived data**
 - » **manage the archives**
 - » **stage data resources needed as input to or resulting as output from science data processing**

Operational Software Configuration Overview (Cont.)



- **SDPS functional groupings (Cont.)**
 - **data search and retrieval (Client Subsystem, Data Management Subsystem and Interoperability Subsystem)**
 - » “data pull side” of the system
 - » science user interface functions (CLS)
 - » data search support functions (DMS)
 - » location of services and data (IOS)

Operational Software Configuration Overview (Cont.)



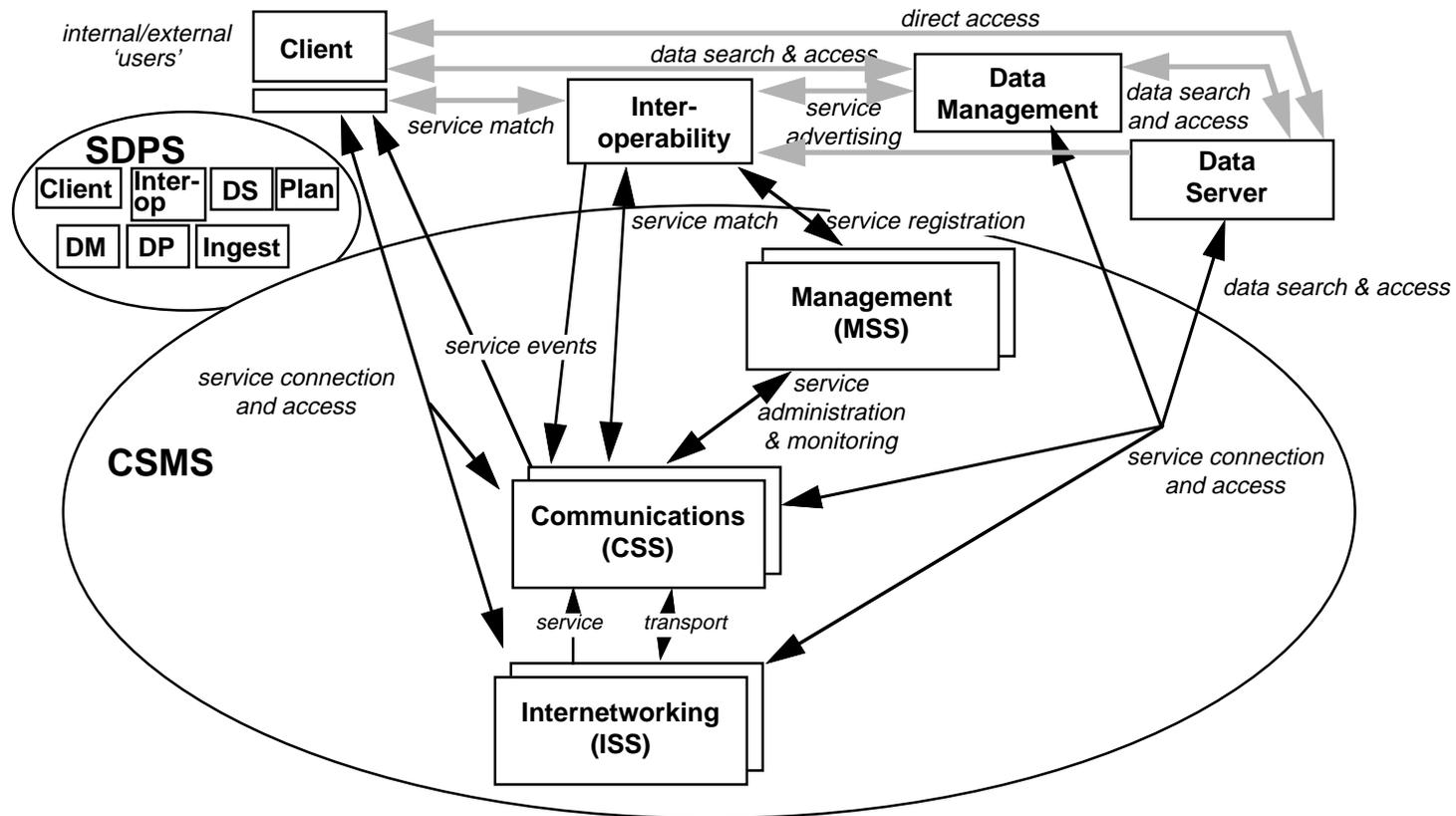
- **SDPS functional groupings (Cont.)**
 - **data processing (Data Processing Subsystem and Planning Subsystem)**
 - » “data push side” of the system
 - » processing environment for science software (DPS)
 - » long- and short-term planning of science data processing (PLS)
 - » management of the production environment (PLS)
 - **data ingest (Ingest Subsystem)**
 - » “data push side” of the system
 - » interfaces with external applications
 - » data staging capabilities
 - » storage buffer for Level 0 data

Operational Software Configuration Overview (Cont.)



- **CSMS subsystems (3)**
 - **Communications Subsystem (CSS)**
 - **Systems Management Subsystem (MSS)**
 - **Internetworking Subsystem (ISS)**

Communications and System Management Segment (CSMS)



Operational Software Configuration Overview (Cont.)



- **CSMS functional groupings**
 - **Communications Subsystem**
 - » **key to the interoperation of SDPS subsystems in an object-oriented, distributed-object communications environment**
 - » **CSS provides the distributed-object communications environment**
 - » **allows software objects to communicate reliably without regard to location or the specifics of the communications mechanisms**
 - » **provides infrastructure services for the distributed object environment based on Distributed Computing Environment (DCE)**
 - » **provides common facilities for file transfer, electronic mail, bulletin board services and remote terminals**

Operational Software Configuration Overview (Cont.)



- **CSMS functional groupings (continued)**
 - **Systems Management Subsystem**
 - » provides network and system management for all ECS resources (hardware and software)
 - » decentralized system
 - » two-level ECS management view - EMC & LSM
 - » agents (software that interacts with a device's control software to facilitate the exchange of command information) provide information to or receive commands from MSS
 - » proxies monitor software applications that do not interact directly with MSS (e.g., DPS is the proxy for the science software it executes)
 - » general management functions include security management and configuration management

Operational Software Configuration Overview (Cont.)



- **CSMS functional groupings (continued)**
 - **Internetworking Subsystem**
 - » provides local area networking (LAN) services at ECS installations to interconnect and transport data among ECS resources
 - » provides access services to link ECS LAN services to wide-area networks (WANs), point-to-point links and institutional network services (e.g., NSI)

Operation Hardware Configuration Overview



- **ECS equipment**
 - **general types**
 - » **server hosts**
 - » **science processors**
 - » **operator interfaces (workstations or X-terminals)**
 - » **temporary data storage units**
 - » **printers**
 - » **network equipment, including fiber distributed data interface (FDDI) network equipment**

Operation Hardware Configuration Overview (Cont.)



- **Servers**
 - **HP J210**
 - **SGI Challenge L**
 - **SGI Challenge XL**
 - **SGI Indigo**
 - **SUN Sparc 20/50**
 - **SUN Sparc 20/71**
 - **SUN Sparc 20/712**

Operation Hardware Configuration Overview (Cont.)



- **Science processors**
 - SGI PC XL
 - SGI Indigo Impact
- **Workstations**
 - SUN Sparc 20/50
- **X-Terminals**
 - NCD HMX-Pro

Operation Hardware Configuration Overview (Cont.)



- **Temporary storage, working storage or database management system (DBMS) data files**
 - **HP redundant arrays of inexpensive disks (RAIDs)**
 - **SUN RAIDs**
 - **SGI RAIDs**
 - **8mm stackers**
 - **4mm stackers**
 - **6250 tape drives**

Operation Hardware Configuration Overview (Cont.)



- **Printers**
 - HP LaserJet 4M+
- **Internetworking equipment**
 - FDDI network equipment

Operation Hardware Configuration Overview (Cont.)



- **DAAC Hardware Summaries**
 - Refer to Tables 4 and 5 in the Student Text
- **Testbed configured from the hardware and software assets of the canceled ECS Release A**
 - Not all subsystems of Release A have been included in the Testbed
 - Some subsystems are present but are not expected to be used for Testbed operations
 - » mission of the Testbed is to support Science Software Integration and Test (SSI&T) rather than the whole range of operations planned for Release A

Operation Hardware Configuration Overview (Cont.)



- **Testbed equipment functions**
 - **planning (PLS)**
 - **science processing (DPS)**
 - **SSI&T (DPS)**
 - **ingest client (INS) (present but not used)**
 - **access control and management (DSS) (present but not used)**
 - **working storage (DSS) (present but not used)**
 - **data repository (DSS) (present but not used)**
 - **distribution and ingest peripherals (DSS) (present but not used)**
 - **system management (MSS)**
 - **distributed computing (CSS)**
 - **internetworking (ISS)**

Operation Hardware Configuration Overview (Cont.)



- **Planning Subsystem**

- **planning hardware**

- » **planning server (SUN Sparc 20/71)**
 - » **planning workstation (SUN Sparc 20/50)**
 - » **RAIDs**

Operation Hardware Configuration Overview (Cont.)



- **Data Processing Subsystem**
 - **science processing**
 - » science processors (SGI PC XL)
 - » queuing server (SUN Sparc 20/71)
 - » X-Terminals (NCD HMX-Pro)
 - » 8mm tape stacker
 - » RAIDs
 - **science software integration and test (SSI&T)**
 - » SSI&T workstations/DBMS servers (SUN Sparc 20/50)
 - » SSI&T workstations (SUN Sparc 20/50)
 - » printers (HP LaserJet 4M+)

Operation Hardware Configuration Overview (Cont.)



- **Ingest Subsystem**
 - not required for Testbed operations
 - ingest client
 - » ingest servers (SGI Indy or SGI Challenge L)
 - » 8mm tape stackers
 - » RAIDs (shared by ingest servers)
 - » front-end SUN (SUN Sparc 20/50, SUN Sparc 20/712)

Operation Hardware Configuration Overview (Cont.)



- **Data Server Subsystem**
 - not required for Testbed operations
 - access control and management
 - » access/process coordinator (APC) servers (SGI Challenge L)
 - » RAIDs (shared by servers)
 - » operations workstations (SUN Sparc 20/50)
 - » front-end SUN (SUN Sparc 20/50)
 - working storage
 - » RAIDs (shared by FSMS servers)

Operation Hardware Configuration Overview (Cont.)



- **Data Server Subsystem (continued)**
 - **data repository**
 - » **File Storage Management System (FSMS) servers (SGI Challenge XL)**
 - » **Database Management System (DBMS) servers (SGI Challenge XL)**
 - » **archive robot (EMASS AML/Mod 2)**
 - » **linear magnetic drives (3590)**
 - » **RAIDs (supporting DBMS servers)**

Operation Hardware Configuration Overview (Cont.)



- **Data Server Subsystem (continued)**
 - **distribution and ingest peripherals**
 - » **distribution servers (SUN Sparc 20/712)**
 - » **RAIDs (shared by distribution servers)**
 - » **8mm tape stacker**
 - » **4mm tape stacker**
 - » **tape drive (6250)**
 - » **printers (HP LaserJet 4M+)**

Operation Hardware Configuration Overview (Cont.)



- **Systems Management Subsystem**
 - management hardware
 - » Management Subsystem (MSS) servers (HP J210/1)
 - » configuration management (CM) servers (SUN Sparc 2/50 or SUN Sparc 20/71)
 - » MSS Netscape server (SUN Sparc 20/50)
 - » MSS workstations (SUN Sparc 20/50)
 - » RAIDs (shared with the Communications Subsystem)
 - » printers (HP LaserJet 4M+)

Operation Hardware Configuration Overview (Cont.)



- **Communications Subsystem**
 - **distributed computing**
 - » **Communications Subsystem (CSS) server (HP J210/1)**
 - » **RAID (shared with the Management Subsystem)**

Operation Hardware Configuration Overview (Cont.)



- **Internetworking Subsystem**
 - **internetworking hardware**
 - » **FDDI switch**
 - » **Alantec Power Hub 7000 with FDDI cards and power supplies**
 - » **FDDI concentrators**
 - » **bay networks**
 - » **FDDI cables**
 - » **Ethernet hub**
 - » **Cabletron Micro MAC-22E w/BRIM F6**
 - » **Ethernet cables**
 - » **local area network (LAN) analyzer**
 - » **communications cabinets**

COTS Software Overview



- **COTS software acquired for Release A**
 - refer to Table 6 in the Student Text
- **COTS essential to Testbed operations**
 - HP OpenView
 - Sybase
 - Distributed Defect Tracking System (DDTS)
 - AutoSys/AutoXpert
 - ClearCase

COTS Software Overview (Cont.)



- **HP OpenView (HPOV)**
 - **available through the Management Subsystem (MSS)**
 - » **monitors and reports on the performance of ECS hardware components**
 - » **displays the current status of ECS hardware resources**
 - » **can access and display performance data that has been logged by the database management program (Sybase)**
 - » **receives notification of faults and alerts the resource manager, production monitor and user services**

COTS Software Overview (Cont.)



- **HP OpenView (HPOV) (continued)**
 - **used by ECS personnel involved in resource management and fault management at the DAACs and the SEO**
 - » **DAAC Resource Manager**
 - » **DAAC System Test Engineer**
 - » **DAAC Computer Operators**
 - » **SEO System Test Engineer**

COTS Software Overview (Cont.)



- **Sybase**
 - relational database management system (DBMS)
 - located on the Data Servers (SDPS)
 - manages Earth Science data
 - implements spatial searching
 - handles system administrative and operational data
 - » maintains logs
 - » database backup
 - » maintenance of database transaction logs
 - » database recovery

COTS Software Overview (Cont.)



- **Sybase (continued)**
 - **manages other databases**
 - » **e.g., site event history database**
 - **has query capability**
 - » **access to site logs for detailed data used in system-wide fault data collection, trending, long-term fault analysis**
 - **has report writing capability**
 - **users:**
 - » **DAAC Database Administrator**

COTS Software Overview (Cont.)



- **Distributed Defect Tracking System (DDTS)**
 - available through the Management Subsystem (MSS)
 - supports configuration management by acting as the ECS Change Request Manager
 - » keeps track of Configuration Change Requests (CCRs)
 - users:
 - » DAAC Maintenance Coordinators
 - » ILS Logistics Engineer
 - database administrators:
 - » CM Administrators at the DAACs and SEO

COTS Software Overview (Cont.)



- **AutoSys/AutoXpert**
 - production scheduling tool
 - part of the data processing subsystem (DPS)
 - supports production processing in the SDPS
 - » job monitoring
 - » scheduling
 - » fault notification
 - » restart
 - assists in determining
 - » effects of failure of a Data Processing Request (DPR)
 - » cause of failure
 - » actions to be taken due to the failure
 - user:
 - » DAAC Production Monitor

COTS Software Overview (Cont.)



- **ClearCase**

- software baseline and change manager
- provides version control of software objects
- used for installing new/revised software code
- used for checking software to confirm problems
- users:
 - » DAAC and SEO Software Maintenance Engineers
- database administrators:
 - » CM Administrators at the DAACs and SEO

Operational Processes



- **ECS Operational Processes**
 - refer to Table 7 in the Student Text
- **Testbed Operational Processes**
 - **System Operations Management**
 - » **System Administration**
 - » **Network Administration**
 - » **Problem Management**
 - » **System Troubleshooting**
 - » **Configuration Management**
 - **Science Operations**
 - » **Production Planning and Processing**
 - » **Database Administration**
 - » **Software Maintenance**
 - » **Science Software Integration and Test**

Operational Processes (Cont.)



- **System Administration**
 - **DAAC and SEO System Administrators perform system administration functions**
 - » installing workstations
 - » starting up and shutting down the system
 - » backing up and restoring the system
 - » maintaining the system log
 - » controlling access to the system
 - » monitoring system security

Operational Processes (Cont.)



- **System Administration (continued)**
 - **software tools (examples):**
 - » HP OpenView
 - » Management Subsystem (MSS) graphical user interfaces (GUIs)

Operational Processes (Cont.)



- **Network Administration**
 - **SEO and DAAC System Administrators, system-level Network Analyst and DAAC Resource Managers perform network administration functions**
 - » maintaining LAN and local DCE configuration
 - » network performance monitoring
 - » reporting on network operations
 - **software resources (examples)**
 - » ClearCase
 - » HP OpenView

Operational Processes (Cont.)



- **Problem management**
 - **all M&O operations and support personnel are involved in problem management activities**
 - » **identifying, documenting, investigating, and resolving problems with ECS hardware, software, documentation, and procedures**
 - » **writing Non-Conformance Reports (NCRs)**
 - » **managing NCRs through the problem resolution process**
 - **software resource:**
 - » **DDTS**

Operational Processes (Cont.)



- **System Troubleshooting**
 - **all ECS operators participate in troubleshooting of the systems they operate**
 - » **identifying, locating, analyzing, and determining the cause of system faults**
 - » **monitoring system status and performance**
 - **DAAC and SEO System Administrators**
 - » **perform troubleshooting of their systems**
 - **ECS Fault Manager**
 - » **focal point for inter-ECS site problems**
 - » **provides support for other centers' troubleshooting activities**

Operational Processes (Cont.)



- **System Troubleshooting (continued)**
 - **software resources (examples)**
 - » **HP OpenView**
 - » **Sybase**
 - » **MSS GUIs**

Operational Processes (Cont.)



- **Configuration Management**
 - **DAAC and SEO CM Administrators provide configuration management and monitoring at their respective levels**
 - » **ensure that hardware, software, and procedure changes to the baseline are properly documented and coordinated**
 - » **manage Change Request Manager database**
 - » **manage SW Change Manager database**
 - » **manage Baseline Manager database**
 - **support the respective Configuration Control Boards**

Operational Processes (Cont.)



- **Configuration Management (cont.)**
 - **software resources:**
 - » **ClearCase**
 - » **XRP-II**
 - » **DDTS**

Operational Processes (Cont.)



- **Production Planning and Processing**
 - **DAAC Production Planners and Production Monitors perform the production planning and processing functions**
 - » **production planning is intended to make optimum use of computing resources when generating science data products (during production processing)**
 - » **DAAC Production Planners develop daily, weekly and monthly DAAC science production schedules. They maintain the production database, specifying science software characteristics and priorities**
 - » **DAAC Production Monitors manage processing schedules, monitor science software execution, and support science software integration and test (SSI&T)**
 - **software resources**
 - » **Production Request Editor GUI**
 - » **Planning Workbench GUIs**
 - » **AutoSys/AutoXpert**

Operational Processes (Cont.)



- **Database Administration**

- **DAAC Database Administrators perform database administration functions**
 - » maintain databases
 - » install SQL server products
 - » manage disk storage space
 - » manage ECS personnel accounts and privileges
 - » perform database backup and recovery operations
 - » perform daily database synchronization
- **software resources:**
 - » Sybase

Operational Processes (Cont.)



- **Software Maintenance**

- **Many ECS jobs involve software (both commercial and custom software) maintenance functions**
 - » installing (including configuring) software
 - » troubleshooting software problems
 - » correcting software problems
- **SEO and DAAC System Administrators**
 - » install software on host computers and workstations
- **System-level and DAAC Maintenance Coordinators**
 - » coordinate the actions of COTS vendors regarding resolution of SW problems and upgrades
 - » coordinate with the Software Maintenance Engineer to ensure adequate and timely assistance

Operational Processes (Cont.)



- **Software Maintenance (continued)**
 - **SEO System Engineer**
 - » responds to system-wide software problems
 - » works with DAAC personnel in analysis of software requirements, problems, anomalies and formulation of recommended solutions
 - **SEO and DAAC Software Maintenance Engineers**
 - » produce, deliver and document corrections, modifications and enhancements to ECS software (including COTS)
 - » adapt or incorporate COTS software for ECS use
 - **software resources:**
 - » **ClearCase**

Operational Processes (Cont.)



- **Science Software Integration and Test (SSI&T)**
 - **DAAC Science Software I&T Support Engineers and DAAC Science Data Specialists perform the SSI&T functions**
 - » provide support to scientists in the development and integration of science software for both updates and new science software into the DAAC ECS system
 - » perform standards-checking on all delivered software, including source code, scripts, process control files and related documentation
 - » provide support for metadata updates and additions for science data products
 - » support the investigation and resolution of science processing problems
 - » lead ECS-related long-range planning and preparations for data set SSI&T
 - **software resource:**
 - » **ClearCase**

Exercise: Tour of the Facility



- **Follow a tour guide on a tour of the facility and observe the positions of ECS components in the facility**
- **Ask the tour guide relevant questions**

Exercise: Performing an Operator Login and Logout



- **Observe the instructor's login to ECS**
- **Login to ECS**
- **Observe the features of ECS as the instructor describes them**
- **Observe the instructor's logout from ECS**
- **Log out from ECS**