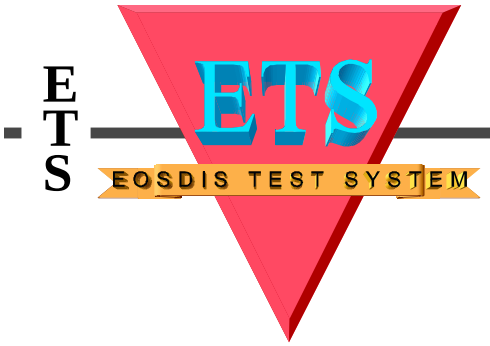
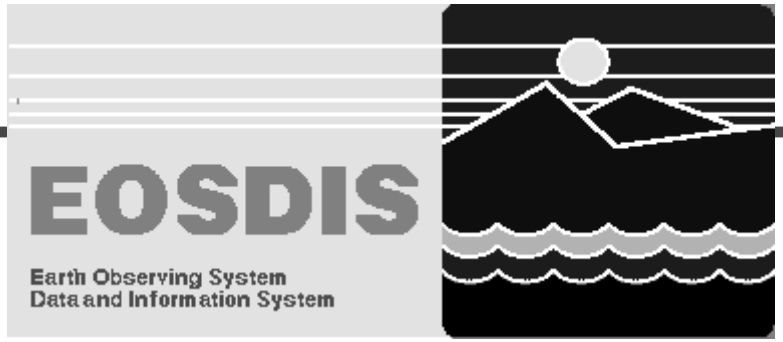




ETS Overview Training

November 18, 1996

Agenda

ETS

- **Training Overview**
- **ETS System Overview**
- **ETS Subsystem Functional Overview**
  - HRS Major Functions
  - MPS Major Functions
  - LRS Major Functions
  - SCTGEN Major Functions
- **ETS System Architecture and Interfaces**
- **ETS Test Scenarios and User Activities**
  - High-Rate EDOS Interface
  - EDOS - DACC Interface
  - DAAC - EDOS Interface
  - MPS - EOC Interface
  - MPS - EDOS Interface
  - SCITF/SSIM - EOC Interface
- **For More Information**

Training Overview

ETS Training Overview

ETS

- **ETS System Overview**
  - Provide high-level overview of ETS
    - ETS capabilities
    - ETS subsystems
    - ETS interfaces
    - Test scenarios
    - Typical user activities
  - Offer presentation to unlimited audience
- **ETS Subsystem Training**
  - Provide hands-on, familiarization training for each ETS subsystem
  - Rely on subsystem user's guides and operational scenarios as training materials
  - Provide subsystem hardware and software overview
  - Take students through typical pretest, test, and posttest activities
  - Offer training to maximum of six students per session
  - Train the trainees to train others in their own organizations

ETS Training Schedule

- **ETS System Overview** **11/18/96**
- **ETS Subsystem Training**
  - MPS 11/19/96, 8:00-12:00, B25, N155
  - LRS TBD
  - HRS TBD
  - SCTGEN TBD

ETS System Overview

ETS Overview

E T S

- **Earth Observing System Data and Information System (EOSDIS) Test System (ETS) provides capabilities to test and simulate EOS Ground System elements and interfaces to support EOSDIS integration and test activities**
- **ETS comprises three major and independent subsystems:**
  - High Rate System (HRS)
  - Multimode Portable Simulator (MPS)
  - Low Rate System (LRS)
- **ETS simulates limited EOS AM-1 spacecraft telemetry generation, command processing, and ground system functions**
- **ETS generates EOS AM-1 data using:**
  - ETS data generation utility: Simulated CCSDS Telemetry Generator (SCTGEN)
  - EOS AM-1Project Data Base (PDB)
  - External sources of data including recorded spacecraft data
- **ETS simulates limited functionality of EDOS, DAACs, and contingency network sites to support interface testing**

Subsystem Functional Overview

High-Rate System (HRS)
Major Functions

ETS

Primary Role: Function as EOSDIS return-link science data processing and interface test tool

- **Simulate TGT high rate return link by transmitting up to two serial science data streams**
  - ETS HRS data recorded using EDOS recorders at GSFC, data tapes sent to WSC, and tapes played back at 150 Mbps using EDOS recorders at WSC
  - ETS HRS data transmitted to EDOS at GSFC at 45 Mbps to simulate the store and forwarded data from WSC to GSFC
- **Simulate EDOS output to a DAAC by transferring data sets**
- **Simulate DAAC front end by capturing EDOS data sets**
- **Accept and playback SCITF test data on Ampex tapes**
- **Process SCITF-recorded spacecraft test data to generate CADU files and EDOS-compatible EDSs and PDSs**
- **Provide a GUI-based control environment that supports automated operations**
- **Provide simulation capabilities for OMD associated with data set delivery and reception**

Multimode Portable Simulator (MPS)
Major Functions

ETS

Primary Role: Serve as low fidelity spacecraft simulator to support testing of forward-link and non-science return-link processing

- **Simulate S-band telemetry formats and receive spacecraft commands to test serial data interface with EDOS**
- **Simulate low-rate telemetry formats and receive spacecraft commands in Nascom blocks to test contingency network interfaces to EDOS through EBnet (if still applicable)**
- **Simulate low-rate telemetry packets in EDOS formats (i.e., EDUs, rate buffered data files) to the EOC and receive spacecraft commands from the EOC as command data blocks**
- **Use AM-1 PDB for telemetry generation and command verification**
- **Respond to valid spacecraft commands in telemetry by updating the command link control word (CLCW) and setting end-item verifiers**
- **Provide OMD simulation capabilities for CODA and SCS Summary Reports**

Low-Rate System (LRS)
Major Functions

ETS

Primary Role: Provide functional EDOS interface between the EOC and either the SCITF or SSIM

- **Simulate EDOS forward link processing by receiving Command Data Blocks from EOC, checking EDOS ground message headers, extracting forward link data, and forwarding data to SCITF/SSIM**
- **Transmit forward link data to SCITF/SSIM at 125 bps, 1 Kbps, 2 Kbps, or 10 Kbps**
- **Simulate EDOS low rate return link processing functions by receiving and processing up to two S-band serial data streams at data rates up to 512 Kbps**
- **Perform return-link processing, including frame synchronization, Reed-Solomon decoding and error correction, packet reassembly, CLCW extraction, and EDU construction at data rates up to 1 Mbps**
- **Transmit return link data as EDUs and rate buffered data files to EOC**
- **Provide a GUI-based control environment that supports automated operations**
- **Generate and transmit OMD messages to EOC reflecting actual data processed**

Simulated CCSDS Telemetry Generator (SCTGEN) Major Functions

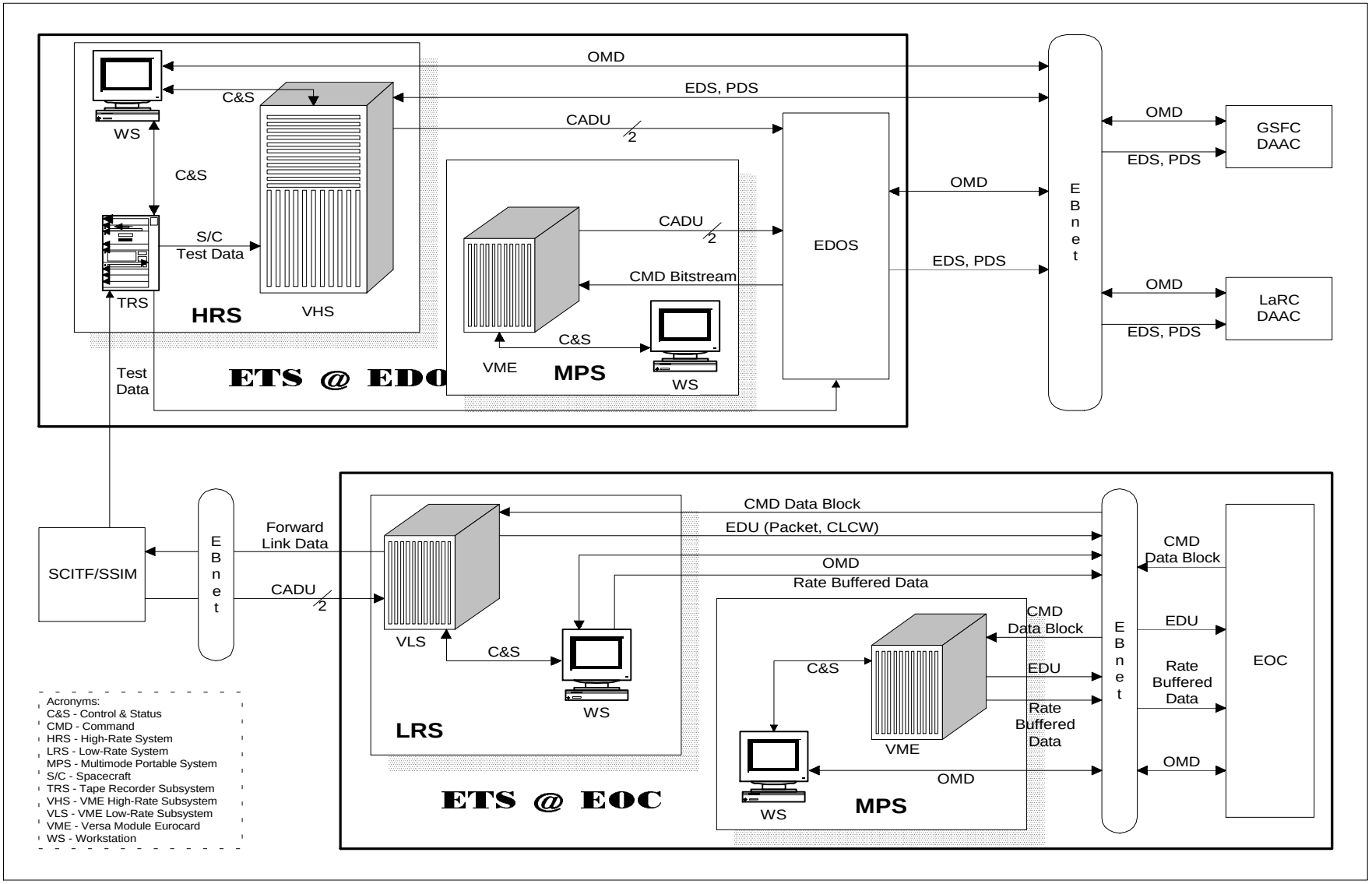
ETS

Primary Role: An EOSDIS data generator tool used to simulate EOS AM-1 return link and forward link data formats

- **Generate CCSDS return link data consisting of:**
  - CCSDS Version 2 Coded Virtual Channel Access Data Units (CVCDUs) and Channel Access Data Units (CADUs)
  - CCSDS Version 1 Packets
- **Encapsulate user-provided packet data into CVCDUs and CADUs**
- **Generate EDOS data products consisting of:**
  - EDOS Data Units (EDUs)
  - Expedited Data Sets (EDSs)
  - Production Data Sets (PDSs)
- **Provide limited capability to generate forward link data in form of Command Link Transmission Units (CLTUs) and Command Data Blocks**
- **Simulate errors in the generated or user-provided test data**
- **Generate expected results summary of test data and errors**
- **Store test data on disk and tape storage media**

System Architecture and Interfaces

System Architecture



ETS Interfaces

ETS

- **EDOS**
- **EOC**
- **EBnet/Nascom**
- **Contingency Network Sites (WOTS, DSN, and GN stations)**
- **DAACs**
- **SCITF**
- **SSIM**

ETS Test Scenarios and User Activities

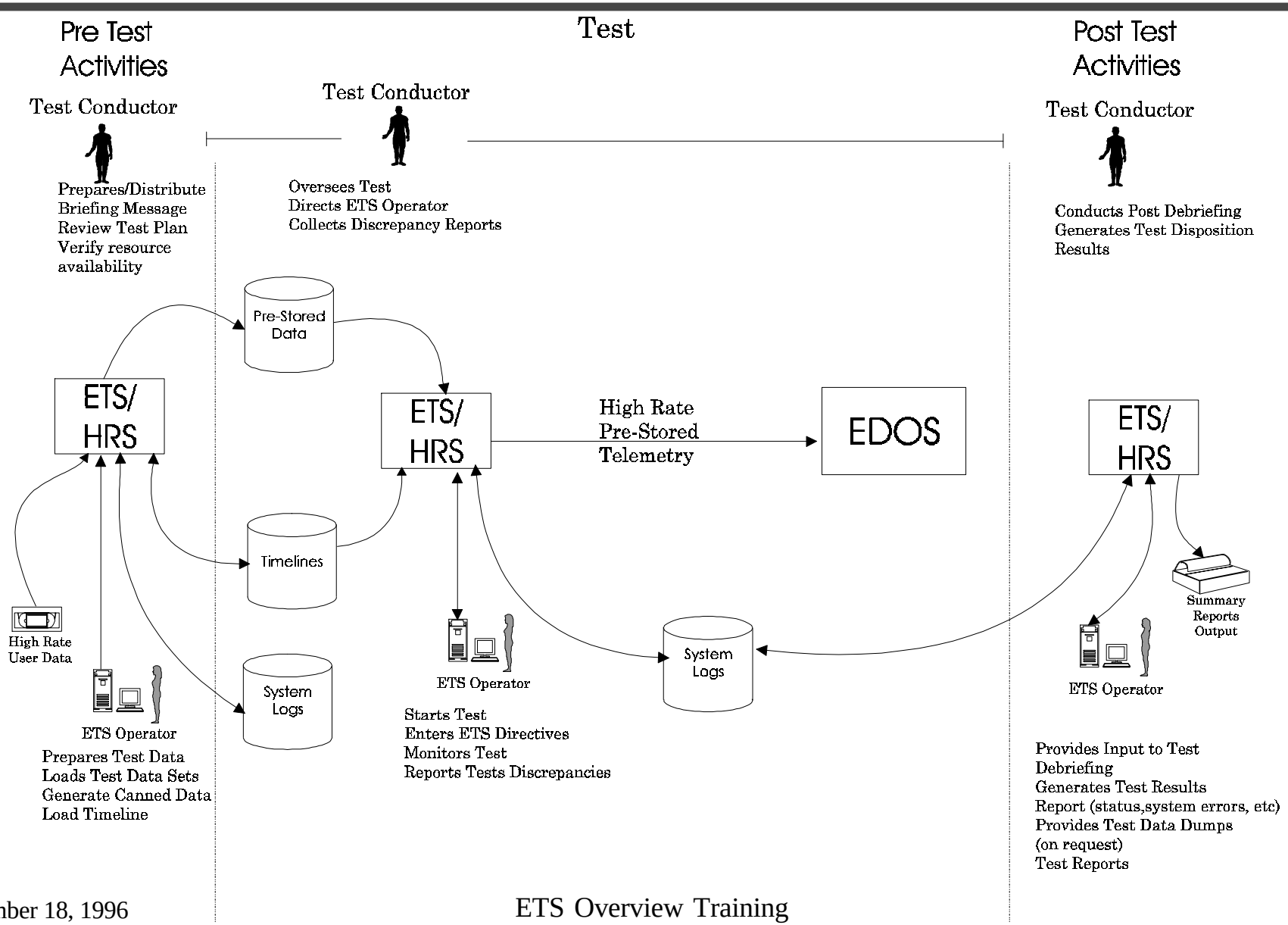
Test Scenarios Using ETS

			Other Possible Test Participants				
Test Scenario	**ETS Unit**	**Element Simulated**	**AM-1 / SSIM**	**EOC**	**EDOS**	**Contingency Stations**	**DAACs**
1. High-Rate EDOS Interface	**HRS**	**S/C**		**X**	**X**		**X**
2. EDOS - DAAC Interface	**HRS**	**EDOS**					**X**
3. DAAC - EDOS Interface	**HRS**	**DAAC**			**X**		
4A. MPS - EOC Interface	**MPS**	**S/C & EDOS**		**X**			
4B. MPS - EDOS Interface	**MPS**	**S/C**		**X**	**X**	**X**	
5. SCITF/SSIM - EOC Interface	**LRS**	**EDOS**	**X**	**X**			

Test Scenario #1: High-Rate EDOS Interface

- **Description**
  - Provide data source to test EDOS capability to capture and process high-rate science data
- **Activities**
  - Generate and store data according to user's test data specifications
  - Set up activity schedule to control data transmission
  - Transmit data at requested data rate to EDOS
  - Provide data that can be processed into level-zero products
  - Optionally, have EDOS transmit data sets to the DAACs

Test Scenario #1: High-Rate EDOS Interface

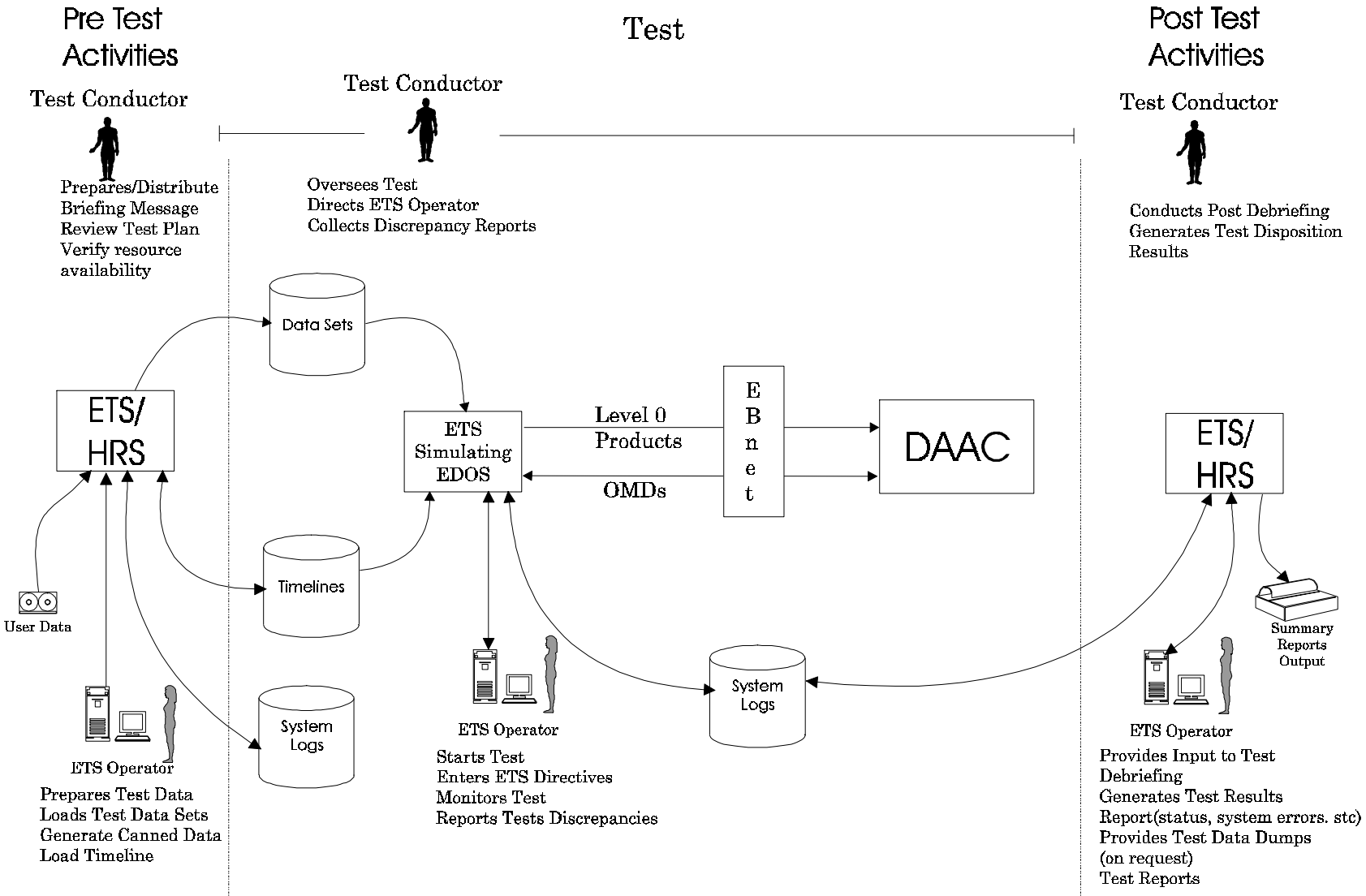


Test Scenario #2: EDOS - DAAC Interface

ETS

- **Description**
  - Simulate EDOS by transmitting data sets to a DAAC to support EDOS - DAAC interface testing
- **Activities**
  - Prepare test data sets
    - Capture from EDOS
    - Simulate using SCTGEN
    - Process using HRS
  - Transmit data sets to DAACs
  - Transmit and receive OMD associated with data set delivery

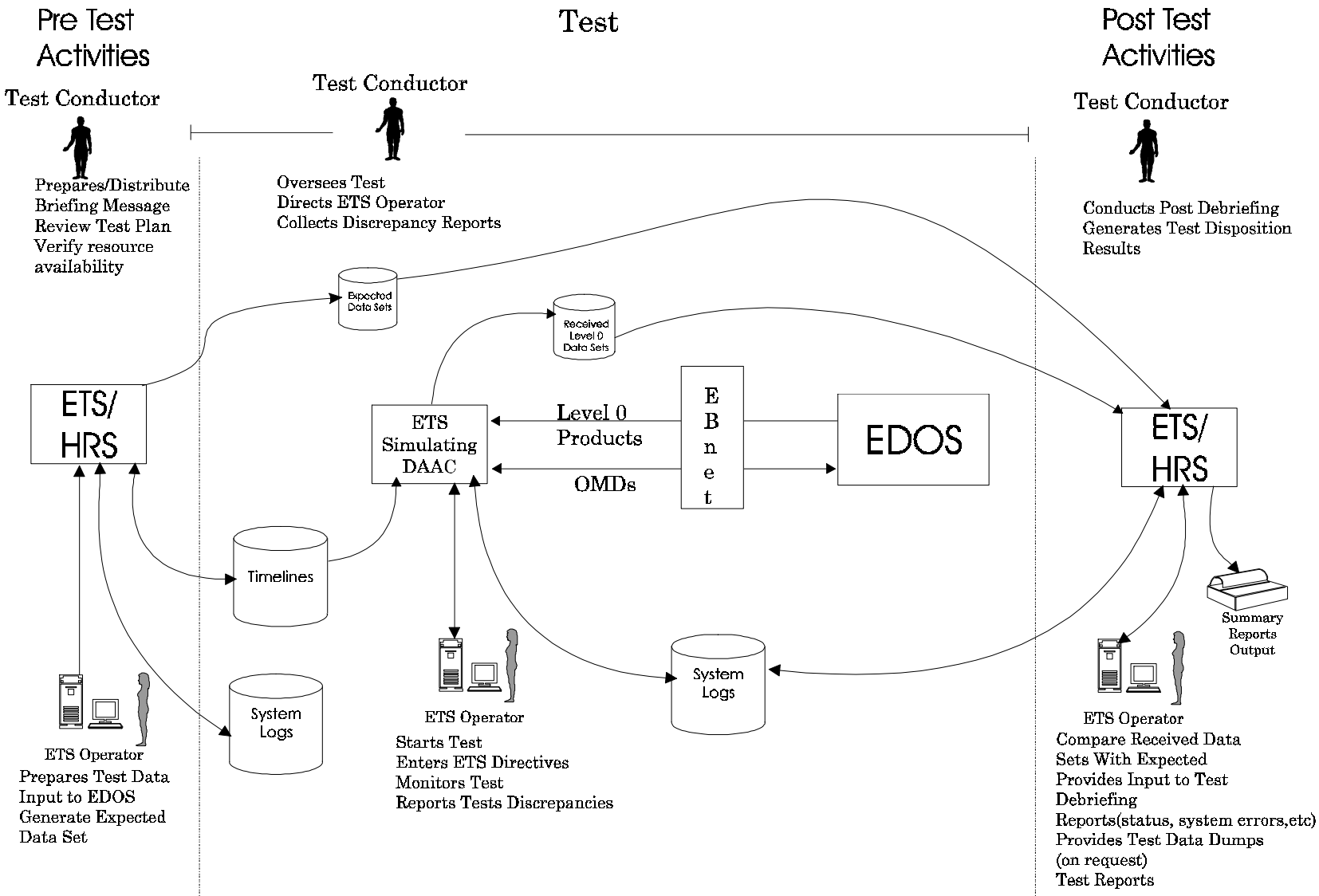
Test Scenario #2: EDOS - DAAC Interface



Test Scenario #3: DAAC - EDOS Interface

- **Description**
  - Simulate DAACs by receiving data sets transmitted by EDOS to support EDOS - DAAC interface testing
- **Activities**
  - Simulate DAAC only for data set capture
  - Receive and store data set from EDOS
  - Transmit and receive OMD associated with data set delivery
  - Optionally, verify structure of received data set, or compare data set to expected results if ETS used initially to create and transmit input science data to EDOS

Test Scenario #3: DAAC - EDOS Interface



Typical HRS User Activities

ETS

- **Pretest**
  - Develop activity schedule to automate test session
  - Create configuration setup files
  - If new test data required, prepare test data using SCTGEN or user-provided data
  - If test data tape required for playback at EDOS/WSC, transmit ETS data to EDOS data capture system for recording and tape generation
- **Test**
  - Transmit or receive test data, as applicable for the test scenario
  - Monitor system status, data quality, and accounting displays
  - Enable/disable data logging options
- **Posttest**
  - View/Print final summary status
  - If required for test, verify or compare actual received data with SCTGEN-produced expected results using ETS data set verification and comparison tools (DVT and DCT)
  - View system activity log

Typical SCTGEN User Activities

ETS

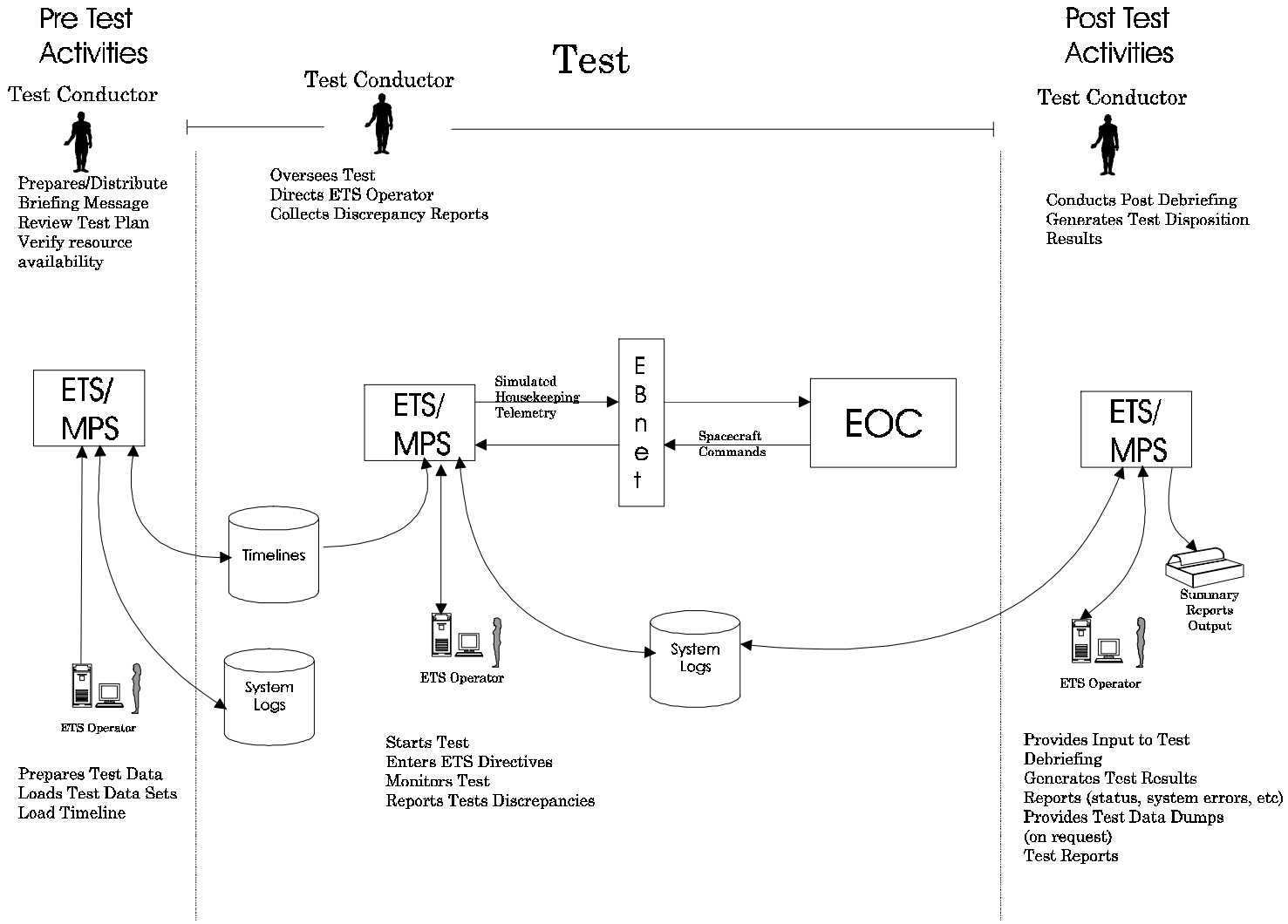
- **Pretest**
  - Develop data generation specification
  - Generate expected results from specification
  - Generate test data
  - Verify test data
  - Log test data file name, descriptors, and storage location
- **Only pretest phase activities applicable for SCTGEN**

Test Scenario #4A: MPS - EOC Interface

ETS

- **Description**
  - Use MPS to verify EOC capabilities to receive and process low-rate telemetry and to transmit command sequences without requiring EDOS for test support
- **Activities**
  - Support tests that will help validate EOC operational and command procedures
  - Minimally, transmit properly formatted, static telemetry data to EOC
  - Create scenario files and activate modeling functions to provide for controlled variations in telemetry parameter values
  - Observe updates on display screens to CLCWs and end-item verifiers in response to valid commands received from the EOC
  - Log telemetry transmitted or commands received to support test analysis
  - Transmit simulated CODA and SCS Summary Reports

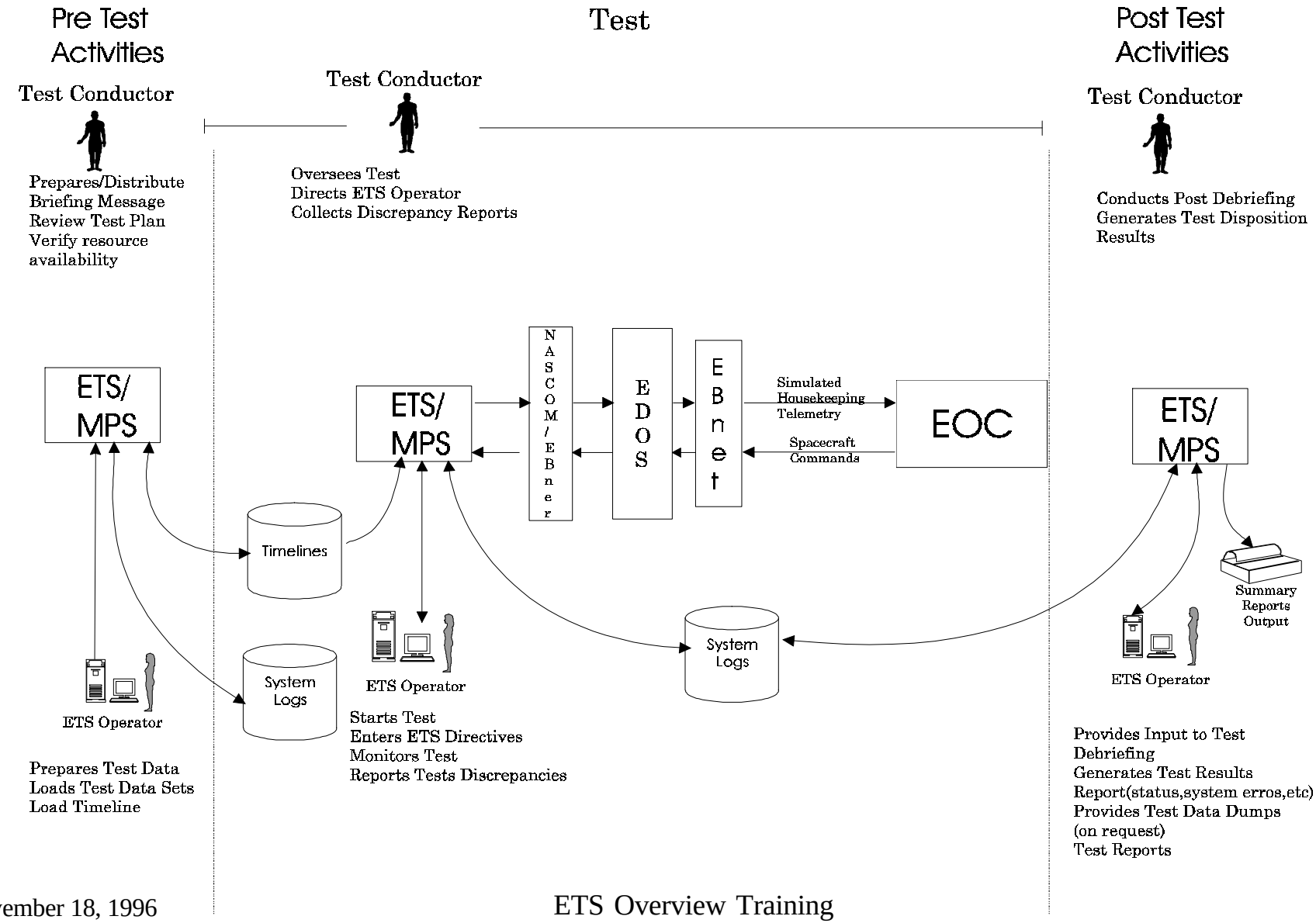
Test Scenario #4A: MPS - EOC Interface



Test Scenario #4B: MPS - Contingency Site - EDOS Interface

- **Description**
  - Use MPS as low-rate spacecraft simulator to support EDOS and EOC interface testing in normal and contingency network operations
- **Activities**
  - Nominally, provide clock and data source of low-rate spacecraft data to EDOS, which then processes and transmits the real-time and rate buffered ETS test data to the EOC
  - Receive forward link data from EDOS from EOC-transmitted command data blocks
  - For contingency network test support, MPS supports 4800-bit Nascom block interface for telemetry and command data
  - Test Scenario 4A activities also applicable here

Test Scenario #4B: MPS - Contingency Site - EDOS Interface



Typical MPS User Activities

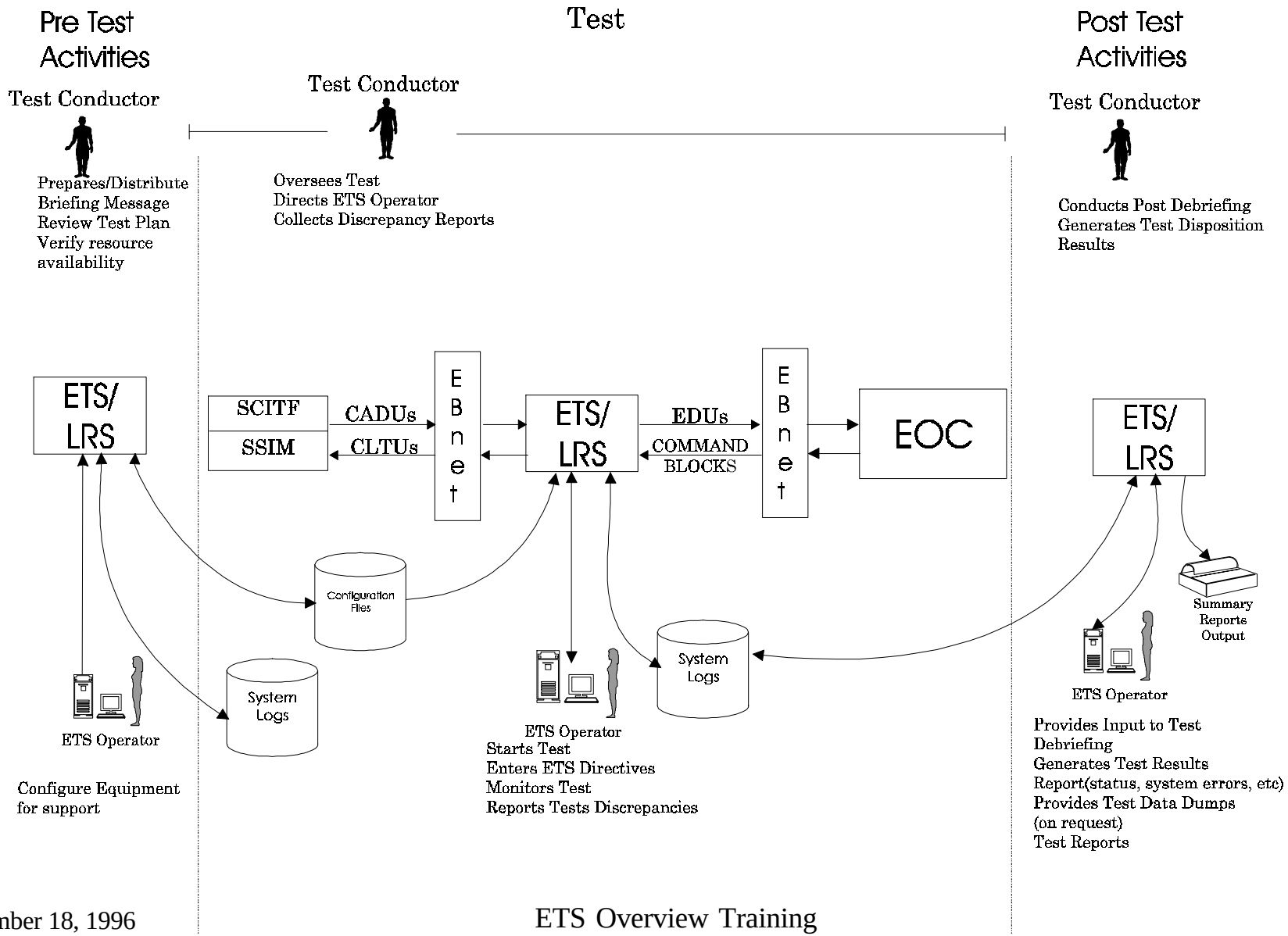
ETS

- **Pretest**
  - Modify CMD and TLM files when new PDB received
  - Create test scenario file to control data contents, formats, and rates, for example
  - Load external data file of packets for interleaving
  - Generate canned OMD messages
- **Test**
  - Control and monitor system functions
  - Monitor data quality and accounting displays
  - Enable/disable CODA simulation and transmission
  - Enable/disable data logging options
  - Control scenario file execution
  - Inject errors and adjust TLM parameter values and modeling associations
- **Posttest**
  - View/Print final summary status
  - Delog stored data
  - View system activity log

Test Scenario #5: SCITF/SSIM - EOC Interface

- **Description**
  - Use LRS to emulate EDOS in providing low-rate forward and return link processing functions
- **Activities**
  - Requires external source of spacecraft command and telemetry data
  - Receive command data blocks from EOC
  - Serialize commands and transmit forward link data to spacecraft facility or simulator
  - Receive two low-rate, serial telemetry streams from spacecraft facility or simulator
  - Reformat data and transmit as EDUs and rate buffered data to EOC
  - Transmit CODA and SCS Summary Reports based on processed data

Test Scenario #5: SCITF/SSIM - EOC Interface



Typical LRS User Activities

ETS

- **Pretest**
  - Create configuration setup files, if different than standard configuration set
- **Test**
  - Select source of external S/C data (SCITF or SSIM)
  - Load configuration file
  - Monitor data quality and accounting displays
  - Enable/disable CODA generation and transmission
  - Enable/disable data logging options
- **Posttest**
  - View/Print final summary status
  - Delog stored data
  - View system activity log

For More Information

ETS

- **ETS Homepage**
  - URL: http://esdis.gsfc.nasa.gov/ivv/ets.html
  - Homepage provides access to ETS requirements, design documents, and user's guides available in Adobe Portable Document Format (PDF)

- **ETS Contacts**
  - Willie Fuller, ETS Project Manager
    - GSFC Code 513
    - 614-5302
    - wfuller@pop500.gsfc.nasa.gov
  - John McGarry, Code 510 ETS Team Lead
    - CSC
    - 794-2991
    - john_mcgarry@cscgt.gsfc.nasa.gov
  - Chandru Mirchandani, Code 520 ETS Team Lead
    - Loral
    - 286-7967
    - chandru@vlsi9.gsfc.nasa.gov

Acronyms

ETS

AM-1	morning equatorial crossing spacecraft series
CADU	channel access data unit
CCSDS	Consultative Committee for Space Data Systems
CLCW	command link control word
CLTU	command link transmission unit
CMD	command
CODA	customer operations and data accounting
CVCDU	coded virtual channel data unit
DAAC	Distributed Active Archive Center
DCT	data comparison tool
DSN	Deep Space Network
DVT	data verification tool
EBnet	EOSDIS Backbone network
EDOS	EOS Data and Operations System
EDS	expedited data set
EDU	EDOS data unit
EGS	EOS Ground System
EOC	EOS Operations Center
EOS	Earth Observing System
EOSDIS	Earth Observing System Data and Information System
ESDIS	Earth Science Data and Information System
ETS	EOSDIS Test System
GN	Ground Network
GSFC	Goddard Space Flight Center
GUI	graphical user interface

Acronyms (continued)

E T S

HRS	High-Rate System
Kbps	kilobits (thousands of bits) per second
LRS	Low-Rate System
Mbps	megabits (millions of bits) per second
MPS	Multimode Portable Simulator
Nascom	NASA Communications
OMD	operations management data
OMDSIM	OMD Simulator
PDB	project database
PDS	production data set
SCTGEN	Simulated CCSDS Telemetry Generator
SCS	spacecraft contact session
S/C	spacecraft
SCITF	Spacecraft Integration and Test Facility
SSIM	Spacecraft Simulator
TBD	to be determined
TGT	TDRSS Ground Terminal
TLM	telemetry
VME	versa module eurocard
WOTS	Wallops Orbital Tracking Station
WSC	White Sands Complex