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P. 15

OASIS-CC

OASIS-CC PRESENTATION

Laboratory for Atmospheric and Space Physics
Operations and Information Systems Group

University of Colorado at Boulder

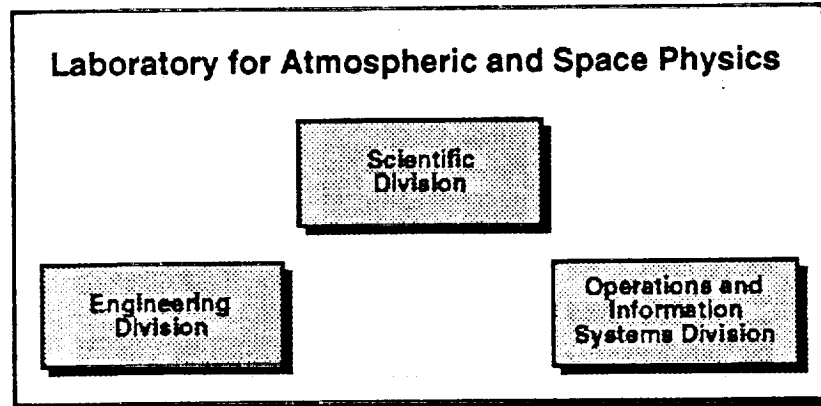
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CU/LASP Organization

Laboratory for Atmospheric and Space Physics



CU/LASP employs 100 professional researchers and engineers
and 60 undergraduate and graduate student researchers



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CU/LASP Flight Projects

LASP scientists and engineers have participated in the following NASA space flight missions

- Orbiting Solar Observatory 5
- Orbiting Geophysical Observatory 4, 5 & 6
- Orbiting Astronomical Observatory 2
- Mariner Venus 5
- Mariner Mars 6 & 7
- Mariner Mars 9
- Orbiting Solar Observatory 8
- Atmosphere Explorer C & D
- Voyager 1 & 2
- Pioneer Venus Orbiter
- Solar Mesosphere Explorer
- Spartan Halley
- Galileo Jupiter Orbiter
- Hubble Space Telescope
- Upper Atmosphere Research Satellite
- Mars Observer
- Cassini Saturn Orbiter
- Earth Observing System
- - 200 Sub-Orbital Rocket Experiments

Asterisks denote projects for which LASP built or is building one or more instruments

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What is the OASIS Project?

- The Operations and Science Instrument Support (OASIS) project is a long-term effort to help produce operations capabilities that can support space science missions of the next century
 - Past funding from NASA Office of Space Science and Applications and Goddard Space Flight Center
 - By providing a comprehensive concept for future mission operations systems we can enable new kinds of missions by increasing flexibility and functionality while substantially reducing life-cycle costs and project development time
- We have implemented portions of the OASIS concept in software under the general name OASIS-R/T
 - OASIS-CC — OASIS Command and Control, for monitoring and controlling science instruments and spacecraft during test, integration, launch and on-orbit operations
 - OASIS-PS — OASIS Planning and Scheduling, for scheduling instrument and spacecraft operations

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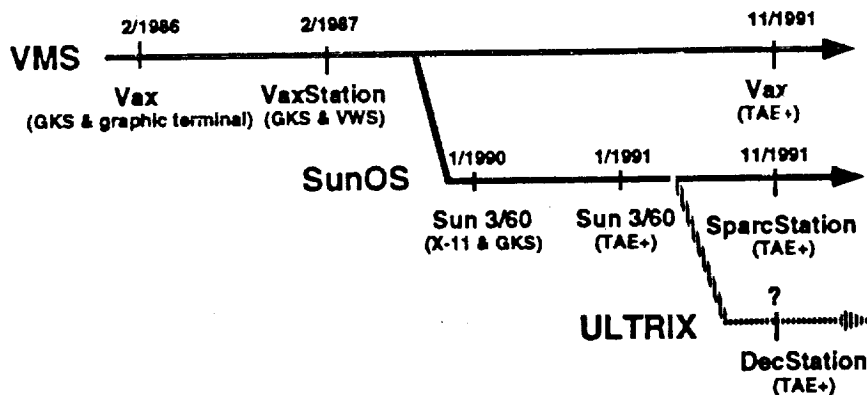
Fundamental User Requirements for OASIS-CC Software

- Usable by scientists and engineers who aren't programmers and who don't want to be programmers
 - Software must be easy to install, tailor for application, and operate
 - Must perform all primary functions without need for any additional software coding and without need for other costly software packages
- Applicable throughout the project life cycle:
 - Instrument development, test and integration, launch, and on-orbit operations
- Extremely flexible
 - Need to be able to modify data definitions and processing functions quickly and easily without writing new software
 - Built-in support for a wide variety of communications protocols
- Good user interface
 - Graphical user interface that can be tailored by users
 - Operations language that is more English-like and which eliminates the main deficiencies of STOL

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OASIS-CC

OASIS-CC Evolution



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OASIS-CC FUNCTIONALITY DESCRIPTION

User Interface
CSTOL
Language processing
Communications
Data processing
Data transfer
Recording
Command

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OASIS-CC

Something to remember

OASIS-CC is table driven. Most of what follows are generic capabilities of the system. Users only need to provide the contents of the tables.

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OASIS-CC: User interface

- The interface uses the Transportable Application Environment Plus (TAE +)
 - TAE+ is a Motif-compliant, portable environment for developing and running interactive, window, text and graphical object-based application systems
 - TAE+ is developed and supported by GSFC
 - TAE+ includes a workbench, an intuitive tool that supports the design and layout of an application's user interface
 - Code (Ada or C) generated by the workbench is linked with the OASIS-CC code to generate the executable program
- Using TAE+ a user can develop simple or extremely elaborated user interfaces.

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OASIS-CC: User interface (cont.)

- User input is done via :
 - push button
 - slider
 - form-filling
 - radio button
 - check box
 - menu selection
- The user can also input CSTOL statements via keyboard entry

- Data in the OASIS-CC current value table can be used to:
 - Drive alphanumeric display
 - Animate icons (rotation, distortion, translation)
 - Drive icons that represent a system's state
 - Drive stripchart-like plots

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OASIS-CC: CSTOL

- The Colorado System Test and Operations Language (CSTOL) is derived from GSFC's STOL
- Improvements over STOL:
 - A distinctly English-like syntax
 - The ability to access database tables through a query language
 - A mechanism for expanding the language through macros
 - Support of engineering units
- CSTOL is designed for scientists, engineers, ground controllers who develop, test and operate spacecraft and payloads
- CSTOL was built as a test for many of the requirements for the Space Station User Interface Language
- CSTOL accommodates people with little or no programming experience
- CSTOL's English-like syntax makes it readable and self-documenting

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OASIS-CC: CSTOL (cont.)

CSTOL provides users with the means to perform the following functions :

- Evaluate expressions, where variables in the expression can be data from a spacecraft or instrument
- Make decisions based on information returned by the spacecraft or instrument
- Initiate and control procedures written in CSTOL
- Maintain the OASIS database
- Call up and terminate displays
- Make and break communication links
- Send commands to the spacecraft or instrument

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OASIS-CC: Communications

- Generic protocol support is provided:
 - DECNET, mailbox and RS-232 for the VMS version
 - TCP/IP (stream socket) and RS-232 for the SunOs version
 - Other protocol handlers can be developed if required by an application (example: NASCOM for the RHISE application and the LDBP application, DADS/ADS for the SSFP DMS testbed application, 16-bit parallel interface)
 - The VMS version provides an IEEE-488 capability
- Future developments:
- IEEE-488 for SunOs version
 - 1153 for SunOS version

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OASIS-CC: Data processing

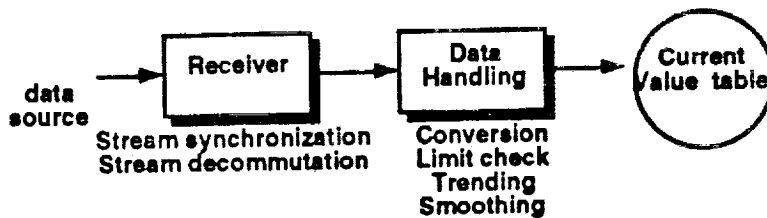
- Stream synchronization
- Stream decommutation (super-commutation, sub-commutation, packetized telemetry)
 - Binary data
 - Floating point data
 - ASCII formatted data (I, F or A format)
 - Interfacing to a hardware decommutator may be done in the near future (concept already tested)
- Conversion from raw (unsigned integer) values to unitized real values
- Conversion from raw discrete values to state values (like ON, OFF)
- Limit checking
 - High/Low, Red/Yellow
 - Red limit can trigger the execution of a CSTOL procedure
 - State check
 - Unsafe state can trigger the execution of a CSTOL procedure
 - Delta check

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OASIS-CC: Data processing (cont.)

- Smoothing and trending
- Print-on-change
- Pseudo-measurement generation:
 - Generically via the execution of a CSTOL procedure by the equation-CLP

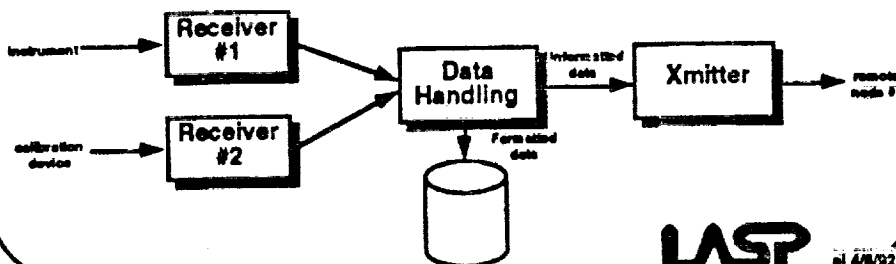


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OASIS-CC: Data transfer

- Two mechanisms are provided: Bridge and Router
 - Both mechanisms use the communication services provided by OASIS-CC
- Bridge:
- Allows transfer via file or over communication links of processed data in a format defined by the user
 - Useful to transfer time-correlated science and engineering data for quick-look processing



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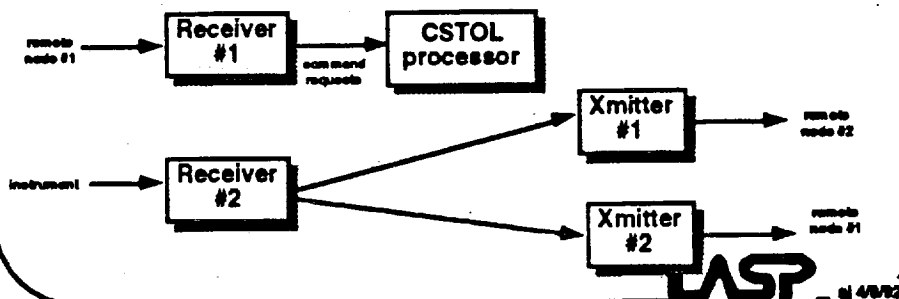
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OASIS-CC: Data transfer (cont.)

- Router:

- Bi-directional mechanism:

- Allows the transfer of raw data over communication links
 - Allows the transfer to a CSTOL processor of CSTOL statements received on communication links
- ##### - Useful for distributing realtime data to remote nodes or executing command requests from remote nodes



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OASIS-CC: Recording

- Recording of downlink data
 - Raw data can be recorded and replayed
 - Processed data can be recorded (via the Bridge capability)
 - Comments can be added by the user at recording time to qualify the recorded data
- Event messages can be recorded

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OASIS-CC: Command

- Translation from an high-level (e.g., CSTOL) representation of a command into an instrument command

- Examples:

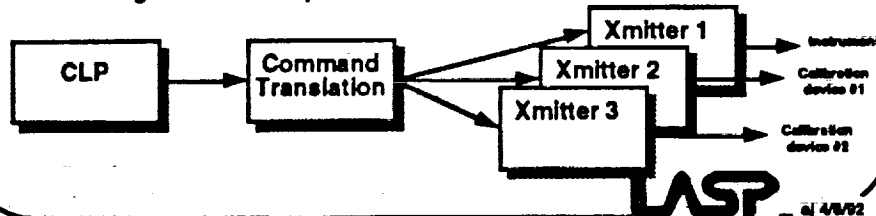
CSTOL	TRANSLATION
slew grating to 1800	⇒ CC229F08
slew grating to 1216.0 a	⇒ CC229F08
set observation list to 5	⇒ CC220605
set entrance slit to stellar	⇒ CC220780
move extender to 10.0 mm	⇒ 3FCC280C83
move extender to 1.0 cm	⇒ 3FCC280C83
close gripper	⇒ move gripper to 6.0 cm

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OASIS-CC: Command (cont.)

- Instrument commands can be:
 - Binary (when the natural representation of the instrument command is a bit pattern)
 - ASCII (when the natural representation is a character string)
- Instrument commands can be:
 - Discrete
 - Serial (i.e., a command containing subfields)
- Instrument microprocessor load support
- From one CLP, commands can be directed to multiple targets over multiple communication lines



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OASIS-CC SUPPORT

Utility programs

Documentation

Support office

Anomaly reporting and configuration management

Release documentation

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OASIS-CC

OASIS-CC: Utility programs

- Database-related programs:
 - Load Database: from ASCII to internal representation
 - Dump Database: from internal representation to ASCII
 - Report Database: from internal representation to report format
 - DDP (Database Development Package): a user-friendly database builder program, using TAE+ (in development)
- Parser-related program:
 - Convert Table: from ASCII to internal representation
- Event log file:
 - Dump Events: to search and create a printable file from the event log file

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OASIS-CC: Documentation

- CSTOL Reference Manual
- Database Guide
- System Manager's Guide
- Installation Guide
- Graphics Editor User's Guide

- Up-to-date with the current version of OASIS-CC, with TAE+ version-specific documentation:
 - Installation guide
 - Application developer's guide

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OASIS-CC: Support office

Four types of support can be provided:

- Phone support for application developer
- Applications developer class
- Specific code development
- Application development

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OASIS-CC Anomaly reporting and release documentation

- Reporting mechanism existing currently on the SPAN network:
 - Allows the users to report anomalies or request enhancements
 - Each report is automatically assigned a number
 - Users can refer to this number to track their reports
 - The reports are also used to support configuration management
- Each new release is documented in a release note:

```
----- Release of OASIS V02.06.03 ----- 12/18/92
This is the release note for OASIS V02.06.03.
VMS version:
The following program and parser files have been released:
-----
* OASIS      V02.06.03   OASIS_DEC.EXE (OPX version)
* PARSER     V02.06.03   PARSER_INT.DAT
* REPORT     V02.06.03   REPORT.COM
This version of OASIS is compiled using Dec/Ada 1.5 and has been tested under
the following configurations:
-----
VMS   Dec/ADA  VMS
4.7   3.1     3.2
5.0   3.1     4.0
5.1   3.0     4.0
5.1   3.1     4.1
5.3   4.1     4.2
```

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OASIS-CC

OASIS-CC AS A TOOL

- Examples of utilization
- Support of instrument development
- Support of spacecraft integration and test
- Support of flight operations

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OASIS-CC

OASIS-CC: Examples of utilization

- UARS/SOLSTICE instrument

OASIS-CC is used to support instrument functional test, calibration, integration and flight operations

- JSC Space Station Freedom DMS testbed

OASIS-CC was used in four nodes of the testbed (OMA, OMGA, APEM and POIC nodes) located at JSC and at MSFC

- ESA Astronaut training

OASIS-CC is used to access MSFC's Payload Crew Training Complex from ESTEC in Noordwijk

- Long Duration Balloon Project

OASIS-CC will be used along with OASIS-PS to acquire balloon experiment data, TDRSS ODM messages and issue GCM requests

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OASIS-CC: Examples of utilization (cont.)

- SOLCON flight operations

From ESTEC in Noordwijk, OASIS-CC was used to monitor and control the SOLCON experiment aboard the last ATLAS flight

- DMSP and DSCS ground station demonstration

OASIS-CC was used to demonstrate low-cost, transportable satellite operation and control systems

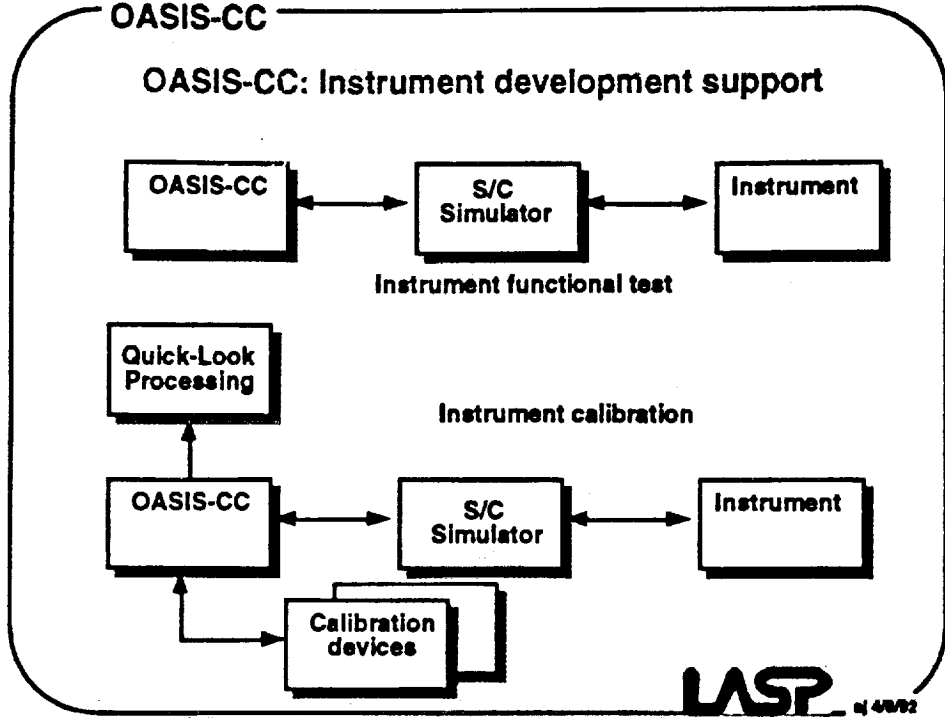
- EOS/SOLSTICE II and CASSINI/UVIS

OASIS-CC will be used during the functional tests, calibration and integration of these two instruments

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OASIS-CC: Instrument development support



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