



## PROPULSION TEST DATA ACQUISITION AND CONTROL SYSTEMS (DACS)

### SUMMARY

The Propulsion Test Office at the White Sands Test Facility (WSTF) currently operates the second generation of automated Data Acquisition and Control Systems (DACS). The new systems have proven their merit in tests of Space Shuttle components, including the improved auxiliary power unit, orbital maneuvering subsystem, aft reaction control subsystem, and a myriad of reaction control thrusters. Custom control and monitoring software has also been developed and implemented for such applications as safely establishing closed loop startup and shutdown profiles for a liquid propellant rocket engine with turbo pump feed system. The four DACS incorporate current computing technology features for efficient and safe testing. Extensive use of both high-speed memory networks and standard network communications allows for safely automated test operations and the distribution of test results in near real-time. Graphical user interface technology provides optimum test article telemetry monitoring and control system interaction. The DACS provides customers data processing and analysis services both in real-time for test control and monitoring at WSTF and posttest at their place of business. All improvements have resulted in reductions of both maintenance costs and energy usage.

### DIGITAL DATA ACQUISITION AND AUTOMATED CONTROL CAPABILITIES PER TEST STAND

- On-site computer engineering services for customized real-time data and control solutions
- 1.2 million samples per second (SPS) aggregate data acquisition
- Maximum practical single channel sample rate of 100,000 SPS
- Automated firing sequence for 304 channels with 1 ms precision
- Large online firing profile list (100 maximum)
- Automated limit monitoring, alarms, and firing sequence shutdown
- Graphical user interface provides windows of tabular and trend plot data display
- Near real-time displays on-site via WSTF local area network (LAN)
- Multiple computed measurement capability
- Flexible LAN accessed, multi-user, integrated instrumentation data base

#### Data Storage

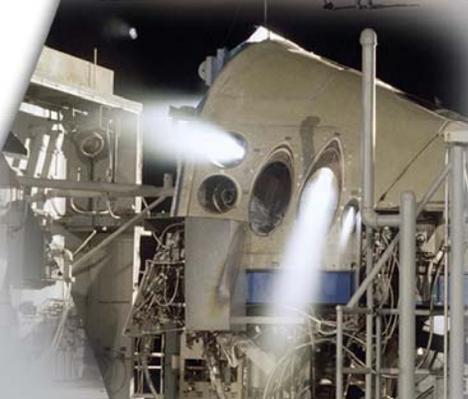
- 173 gigabyte redundant array of independent disks
- 950 gigabyte automated data backup tape library archive

#### Two Analog to Digital Converters per System

- 1 million SPS aggregate, 20 analog channels
- 100,000 SPS aggregate, 768 analog, and 544 discrete channels
- Single channel sample rates 10 to 100,000 SPS
- Effective digital resolution (13 bits plus sign, 8192 counts)

#### Five Dedicated Processors per System

- Acquisition and storage server
- Real-time logic and calculated measurements server
- Display server
- Automated Control mini-computer
- Automated backup tape library server



# National Aeronautics and Space Administration

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## User Workstations and Peripherals

- Six user workstations
- High-Speed Laser Printer/Plotter

## GENERAL INSTRUMENTATION AND ANALOG DATA RECORDING CAPABILITY

### Typical instrumentation signal conditioning

- Pressure
- Acceleration
- Voltage
- Temperature
- Strain
- Current
- Flow
- Force
- Position

### Strip Chart Recorders

- Frequency response is dc to 20 KHZ
- Two 64-channel High Speed Units in 400 test area and five in 300 test area
- Eleven multi-channel low speed units in each test area

### Two 42-Track Instrumentation Tape Recorders per Test Area

- One direct intermediate band 42-track FM recorder
- One wide-band group II 42-track FM recorder
- Two frequency multiplexed, 160 channel data systems

One general purpose 512 channel, 1 millisecond resolution, discrete event recorder per test area

## DATA ANALYSIS AND DISTRIBUTION SYSTEM

### System of Networks and File Servers

- Provides data and data analysis tools to the user
- Serves all online DACS posttest data and 10 gigabytes restored from archive
- Test data retained 5 years or longer at customer request for restoration on-line from tape
- Test data may be downloaded to other computers via file transfer protocol (FTP)
- Download to personal workstations in comma separated variable (CSV) format
- Access on-site via LAN and off-site via NASA Integrated Services Network
- Download customer defined reduced data formats to compact disks or other media

### Predefined DADS Interactive Data Reduction Applications

- Various combinations of min/max/average/median/standard deviation/Integral
- User defined time intervals to compute and time increments to report data points
- Engine chamber pressure OK, fire switch search, and limit checking event analysis
- Multiple reaction control thruster propulsion system evaluation
- Reaction control thruster acceptance test performance evaluation
- Thrust measurement system evaluation and calibration
- On-site computer engineering services for customer defined application development

## CONTACT

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