

## Hubble Space Telescope Telemetry Access using the Vision 2000 Control Center System (CCS)

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**Abstract.** Major changes to the Space Telescope Ground Systems are presently in progress. The main objectives of the re-engineering effort, Vision 2000<sup>1</sup>, are to reduce development and operation costs for the remaining years of Space Telescope's lifetime. Costs are reduced by the use of commercial off the shelf (COTS) products wherever possible.

Part of CCS is a Space Telescope Engineering Data Store, the design of which is based on modern Data Warehouse technology. The purpose of this data store is to provide a common data source for telemetry data for all HST subsystems. This data store will become the engineering data archive and will provide a query-able DB for the user to analyze HST telemetry. The access to the engineering data in the Data Warehouse is platform-independent from an office environment using commercial standards (Unix, Windows/NT, Win95). Latest Internet technology is used to reach the HST community. A WEB-based user interface allows easy access to the archives.

Some of the capabilities of CCS will be illustrated: sample of real-time data pages and plots of selected historical telemetry points.

### 1. CCS Architecture

A Web browser with Java support and an account to establish a secure Internet HTTP connection to the Goddard Space Flight Center (GSFC), is everything needed in order to use the new Control Center System (CCS). Then full access to the telemetry of the Hubble Space Telescope (HST) is given (Figure 2). A public version of CCS<sup>2</sup> is also available.

How does that work? The telemetry data stream of HST is transferred to the Front End Processor (FEP) via Nascom (Figure 1). FEP provides a communication interface between the vehicle and ground control. It also captures all the

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<sup>1</sup><http://vision.hst.nasa.gov/>

<sup>2</sup><http://v2mb20.hst.nasa.gov:4041/demo.html>

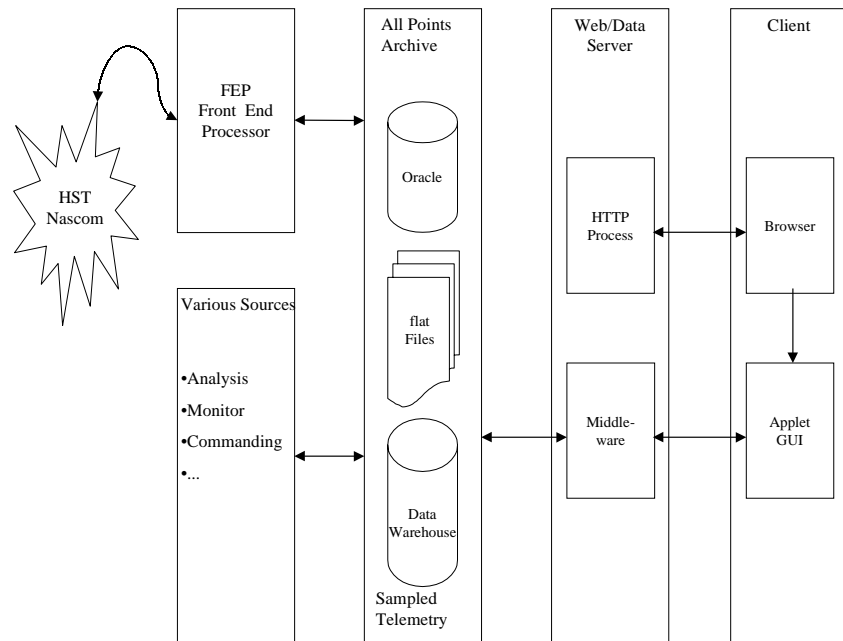


Figure 1. CCS Archive Architecture

downlinked data and forwards them to the attached All Points Archive. Besides the All Points Archive there is also the Red Brick Data Warehouse for sampled data. Without the warehouse the All Points Database containing several terabytes of telemetry parameters would be of limited use only. The warehouse samples data to reduce their size. In this way it is possible to further analyze them on standard platforms like Pentium PCs. The warehouse also provides derived engineering parameters and advanced query options. The warehouse is still under construction, but a Java applet prototype<sup>3</sup> is already available at the home page of the Science & Engineering Systems Division (SESD) at STScI.

In order to support its heterogeneous clients and DB servers a three-tiered solution was chosen (Mickey, 1997). A Java applet on the client side speaks to a middleware component on the data server. The middleware then takes care of the DB access. Rifkin (1997) gives a more comprehensive description.

## 2. Applications

CCS's main task is not scientific data reduction. Nonetheless, it provides the means to develop e.g., new calibration algorithms. This is possible, because for the first time, one can have access to all engineering parameters via the Internet. So far, only a very limited subset of telemetry parameters is available through

<sup>3</sup><http://www.sesd.stsci.edu/>



Figure 2. CCS Archive Query Form (l.) and Real-Time Data Page (r.)

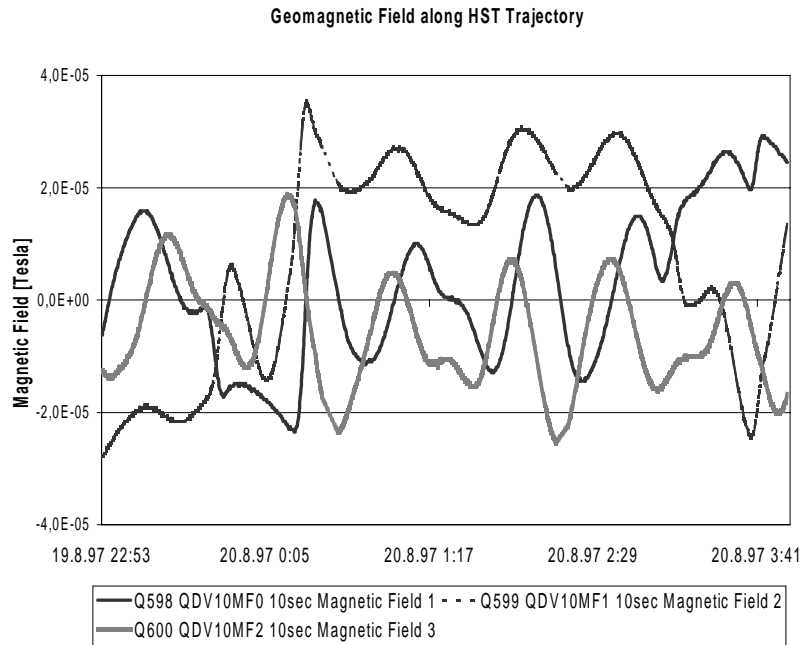


Figure 3. Geom. Field (3 Components) over a Period of 3 Orbits

observation log files. One possible application is mentioned here to illustrate this.

The Faint Object Spectrometer (FOS) of the Hubble Telescope is an instrument that was replaced during the 2nd Shuttle Servicing Mission in February 97. As part of the final archive for this instrument, ST-ECF would like to apply an improved model of the geomagnetic field to the calibration pipeline. The required magnetometer readings from the onboard sensors are not part of the observation log files, but CCS could now provide the missing values. Figure 3

shows these magnetometer readings for a 5-hour-period, which equals roughly three HST orbits.

### **3. Outlook**

CCS will become operational in April 98. At this point it will provide all the functionality required for the 3rd Shuttle Servicing Mission in 1999. By the end of 1999 the data warehouse will be fully populated, i.e., it will contain the telemetry back to launch in 1990.

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### **References**

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