NETWORKABLE TELEMETRY DATA RECORDERS BASED ON COTS COMPUTER TECHNOLOGY

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ABSTRACT

Advances in several related technologies have brought together the previously incompatible goals of incorporating as much COTS technology as possible into the telemetry data recording architecture, providing operators with the kinds of real-time graphical data displays that they are accustomed to, and allowing these same data display systems to share data across a network and write to common database files accessible from centralized workstations.

KEYWORDS

Telemetry data recorder, chart recorder, COTS

INTRODUCTION

Paper-based chart recorders have long been the staple of flight test telemetry stations. In recent years, advances in A/D technology, CPU, and printing technologies have allowed recorders to become more and more computer-like, incorporating many new capabilities and advantages. Today, most chart recorders accept both analog and digital input data, process all data digitally, have some kind of video monitoring display capability. Although they mimic computers, they are still built on proprietary hardware, and cannot run Windows applications. The purpose of this paper is to introduce a completely COTS (Commercial, off-the-shelf) based telemetry recorder – and to review its capabilities and benefits to today's telemetry station.

SECTION 1 – SYSTEM OVERVIEW

COTS computer architecture offers a host of advantages to the user, including inexpensive upgrades as computer technology moves forward in CPU speed, memory, long term data storage, and overall processing power. The basic architecture of the system looks like this:

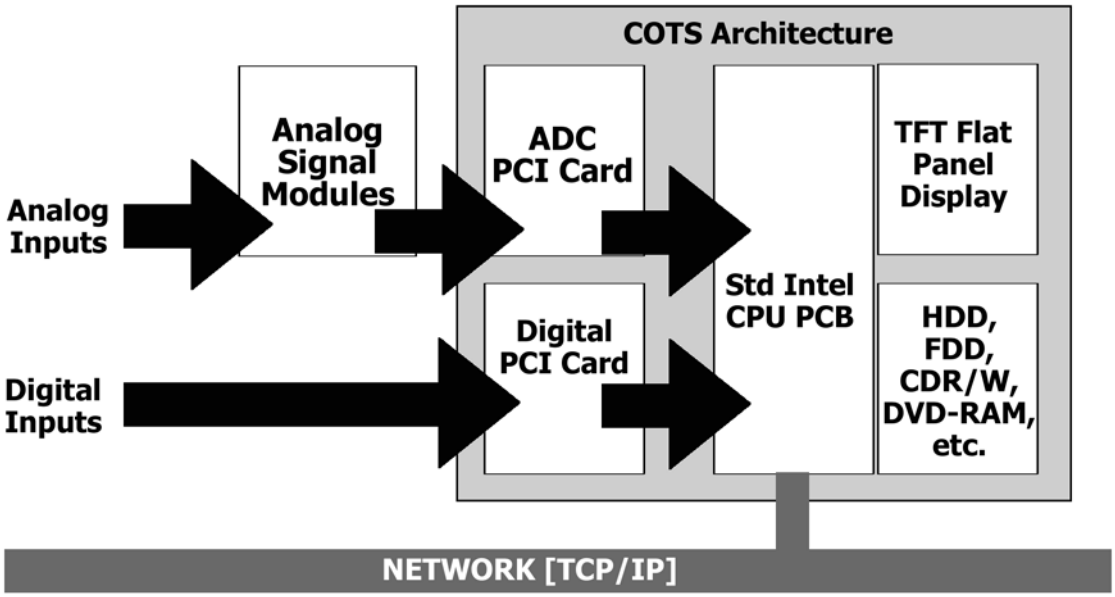

Figure 1 – Basic System Architecture

Data can be input as analog voltages, or already digitized via a variety of formats and protocols. Off-the-shelf PCM data input cards can be added to the system, as long as they are standard formats such as PCI, PXI, PCM-CIA, USB, IEEE-1394 Firewire, and other standardized formats as they emerge. Analog data is routed through signal conditioners which provide 1000Vrms of isolation channel-channel and channel-ground. Signal conditioners are single-channel and completely modular. They can be plugged/unplugged without powering the system down.

Once past the analog front-end, the system is completely COTS, based on industrial grade off-the-shelf computer components, including an Intel Pentium CPU motherboard or slot CPU and PCI backplane. Analog data are digitized using a PCI A/D board from a major supplier for ease of upgrade and replacement. Digital and analog data are processed by the CPU and software, and displayed on a flatpanel display. See Figure 2 for an example of the display.

SECTION 2 – DATA VIEWING

The size and resolution of the display are extremely important, because this display replaces the vestigial chart paper. The operator must be able to monitor the data using this display, so there can be no compromises. A display of at least 18” is very adequate, and will still fit within a standard 19” rack enclosure. A resolution of 1280x1024 or better is important to providing the kind of display resolution that is required for chart viewing.

Emulating the traditional chart recorder display with it’s 8 vertical traces, is critical to operator acceptance. Of course, a wide variety of other displays can also be used, including digital meters with a video image behind it, a high-speed scope, an FFT analyzer, X-Y plots, and more. The recorder display can be stopped at any time while data recording continues in the background, and rewound to show data recorded 5, 10 or even 20 minutes earlier. Zooming can be used freely to

expand both the time and amplitude axes. Even when the screen is stopped, small meters above each trace continue to show the real time activity of each input, including alarm and min/max levels reached.

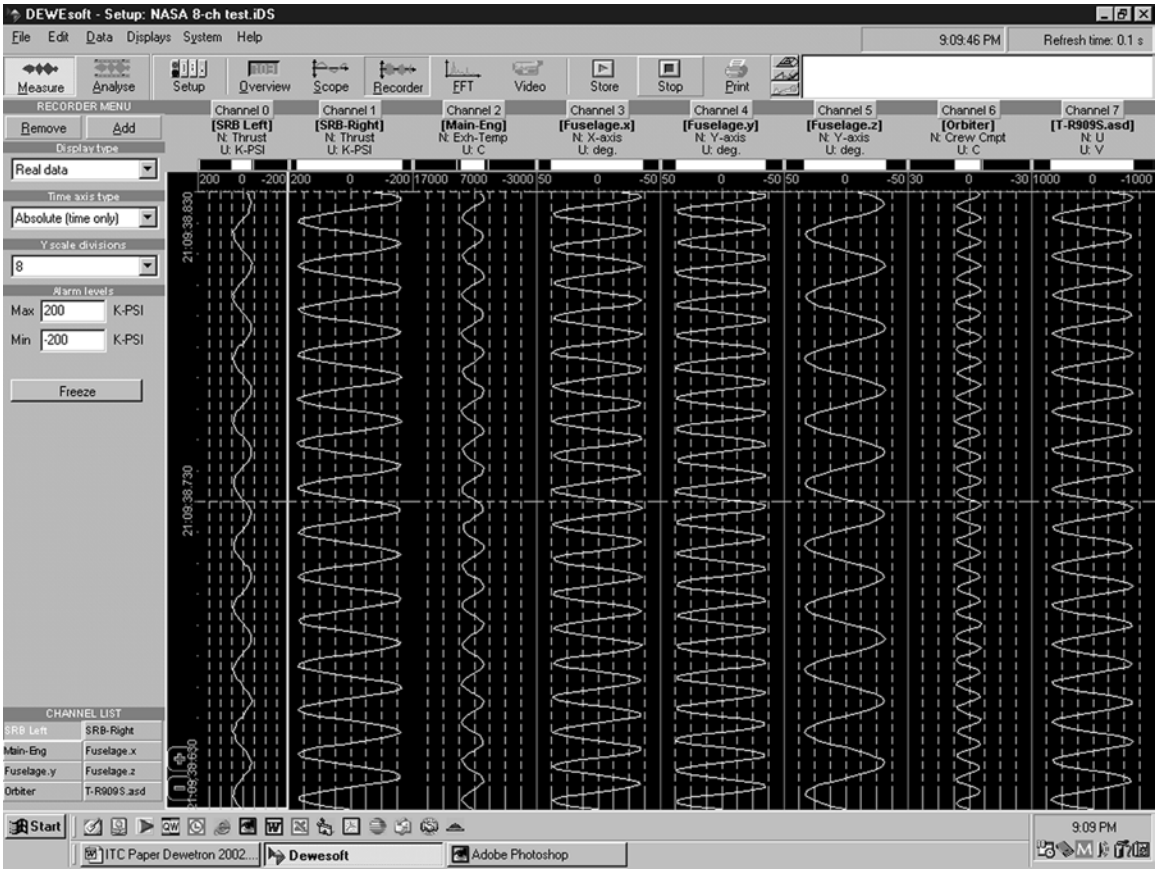

Figure 2 – Main Recorder Display

SECTION 3 – PAPER OUTPUT

Paper is not absent from the system, of course, and can be printed in via any printer available, local or network. Special thermal array media is not required, and data can be printed in full color. Charts can be printed at any time during recording, or afterwards. Paper output can be made in single-sheet format, or in series of sequentially-numbered sheets. See figure 3 for an example of a single-sheet on-screen preview:

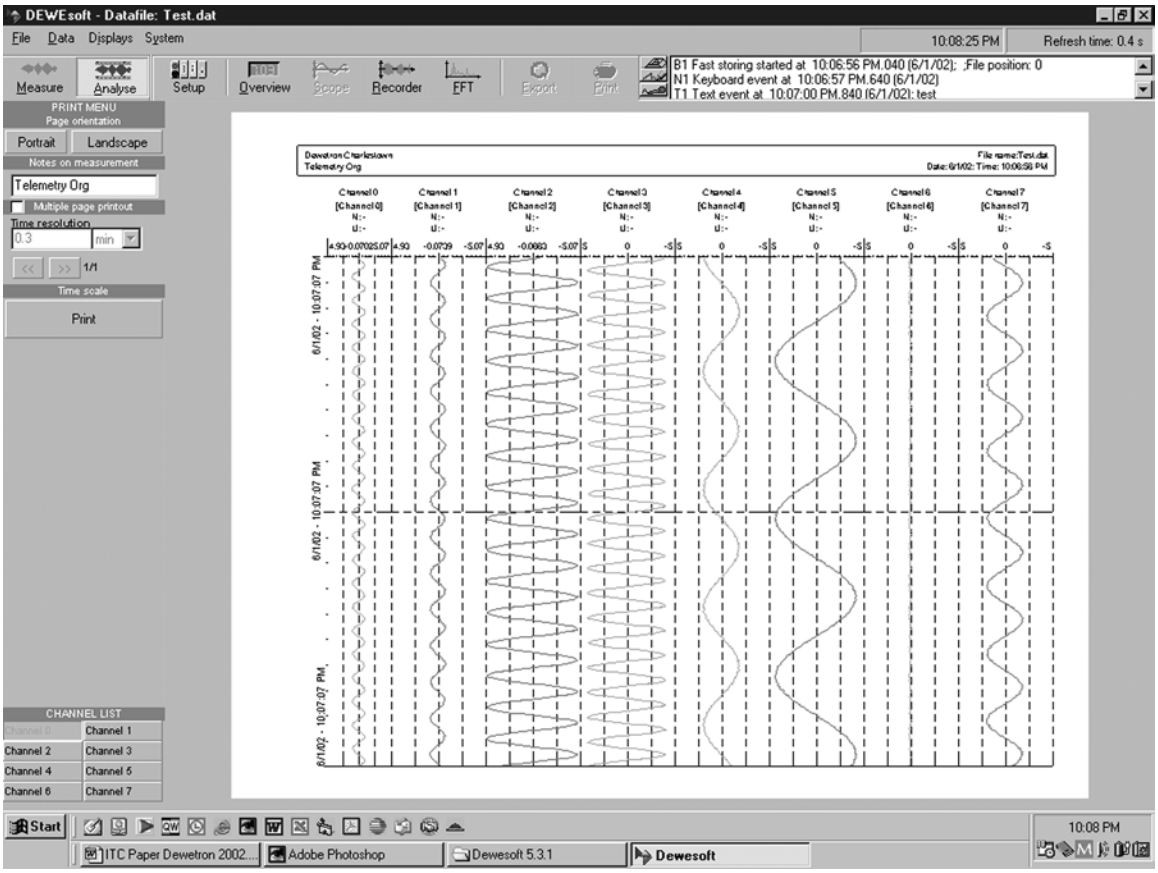

Figure 3 – On-screen paper output preview

SECTION 4 – NETWORK-BASED OPERATION

Rather than have operators frantically trying to set up each recorder before and between missions, then start and stop them manually, they can be networked together . A high-speed Ethernet interconnection is allows the systems to be controlled from a central station, to share common reusable setup files, and to write data to a common database. From a central workstation, an operator can monitor one or more recorders, picking channels from them or displaying the entire screen from any of them for remote viewing. If a central station is not available or desirable, recorders can write data independently to their own hard disks, internal or removable.

A demonstration of client/server capability will be demonstrated during the paper presentation, where data being recorded on one or more machines will be shown on a central client workstation.

Post-mission data export and analysis is facilitated by the open-architecture/COTS nature of the telemetry data recorder, and the ability to review any aspect of the data off-line both graphically and by entering a specific time-code is shown. Export to a variety of standard data file formats is provided, including MATLAB™, Excel™, I-DEAS™, ASCII, and more.

CONCLUSION

Ground stations can save considerable time and money by utilizing COTS computer-based data recorders. COTS systems accept all manner of PCI and open architecture PC hardware, including some that have already been the object of large capital investments. Aside from the initial cost savings due to their lower costs, COTS systems will pay dividends well into the future due to their ease of upgrading.