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Introduction: What is WaveTrak?

Thank you for purchasing WaveTrak!

WaveTrak is an application designed for scientists and engineers who want to use the Macintosh for flexible and efficient data acquisition, organization and processing. WaveTrak acquires waveforms either by importing previously digitized data from files or the clipboard (**WaveTrak DB** version), or by performing analog-to-digital conversion using a MacADIOS II A/D board from GW Instruments and the optional WaveTrak A/D Library (**WaveTrak AD** version). Once digitized, WaveTrak organizes the signals in a flexible "waveform database" built around HyperCard. WaveTrak uses the HyperCard environment to simplify data acquisition and organization. For most experiments, clicking "ready made" buttons is all that is required. However, the designers of WaveTrak recognize that in the diverse fields of modern science or engineering, the program must offer enough flexibility to address many different requirements. Scripting with the WaveTrak data acquisition toolbox, a collection of over 70 functions specifically designed for signal acquisition and processing, allows you to extensively customize the environment to meet your specific needs.

WaveTrak has been carefully designed to address four fundamental problems inherent in capturing and manipulating digitized data:

Simplifying data capture

WaveTrak divides waveform acquisition into two categories: 1) importing data from a disk file or the clipboard that had been digitized previously, or 2) perform real-time analog-to-digital conversion on the Mac with WaveTrak's *Data Acquisition Toolbox*. The first will be most useful for those who perform data acquisition using hardware on another platform, but wish to take advantage of the Macintosh's ease of use to store and manipulate their data. WaveTrak is an ideal environment, because once the information is imported, sophisticated analyses can be easily scripted using the WaveTrak's *DSP Toolbox*. The user can thus consolidate large amounts of digitized data, scattered perhaps among hundreds of disk files and sub-directories, into a single WaveTrak stack, which functions as an organized, flexible and programmable waveform database.

With the *Data Acquisition Toolbox* and a MacADIOS II data acquisition card from GW Instruments (Somerville, MA), analog and digital signals can be captured and generated from within WaveTrak directly on the Mac. Traditionally, interfacing hardware and software in a real-time environment, such as A/D conversion, has been difficult. This problem was addressed by selecting HyperCard as an easy-to-use and customizable front end. HyperCard has the advantage of a friendly user interface, strong database capabilities, and programmability. Using familiar buttons and HyperTalk scripts, the user communicates with the optimized library routines which make up the core of the WaveTrak application. An extensive set of ready-made buttons is provided for most routine A/D conversion, signal generation and analysis tasks. The real-time and computation-intensive signal processing functions are written in C and assembly language for maximal performance. WaveTrak therefore is best described as a "hybrid" application, that appear to the user as a familiar HyperCard stack, yet retains the power and functionality of a compiled application.

Flexibility

The diverse fields of science and engineering, because of their very nature, require that many tasks that you will want to perform will be unique; no single off-the-shelf application will satisfy every requirement. Undoubtedly, many experiments have been abandoned because making the computer/acquisition board combination do what is needed would have been too difficult or time consuming. WaveTrak contains powerful *Data Acquisition Toolbox*, which provides routines specially designed for A/D conversion and a *DSP Toolbox* for performing digital signal processing on data captured on the Mac or imported from another platform. If the pre-programmed buttons don't do exactly what you need, you can easily script your own custom functions. Accessing the data acquisition card is no harder than scripting in HyperTalk, using the language extensions provided in the WaveTrak libraries. Modifying existing scripts is even easier: most reside in buttons, which you can copy and paste as you need. Open the button, change a line of HyperTalk, and you just changed the A/D converter sampling rate, or the TTL output bit that will toggle 100 µs after the start of the acquisition, or the cut-off frequency of your digital lo-pass filter.

As you become more experienced, you can string together a series of WaveTrak commands in your own custom buttons to perform very complex tasks - perhaps creating a unique set of buttons for each type of experiment. You can choose the

level at which you want to interact with WaveTrak, from using the supplied pre-programmed functions directly, to scripting in HyperTalk using WaveTrak's extensions, to writing your own XCMDs or

XFCNs in Pascal, C or assembly language. The main point is that WaveTrak encourages you to open and modify scripts to suit your specific requirements.

Data management

A number of programs on the market will perform data acquisition. The problem which then arises is how to organize and store hundreds of waveforms acquired over the course of an experiment? How do you find the trace from last Tuesday, obtained 5 min. after a certain event? Cluttering a hard disk with hundreds of separate files and folders is not the answer. In WaveTrak, each digitized waveform is stored on a separate card in the WaveTrak stack. In addition to the wave itself, each trace card contains a time stamp, hardware parameters (e.g. system gain, sampling rate, temperature, etc...) and an optional comment so you can annotate specific traces, then search for these comments to quickly find a specific record. Arrow buttons allow you to easily navigate from trace to trace, and from experiment to experiment. In effect, the WaveTrak stack functions as a personal laboratory information manager, a type of electronic laboratory notebook and database in one, capable of dynamically storing and organizing tens of megabytes of digitized data.

Compatibility and exportability

It is essential that you have the capability of exporting your data to other applications for further analysis, graphing and page layout. WaveTrak includes a collection of commands that translate your digitized waveforms into standard Mac graphics objects for pasting into e.g. Canvas or MacDraw, or tables of numerical data for pasting into programs specializing in statistical or mathematical analysis such as Igor, Statview or Excel. If WaveTrak does not support a certain function, you can easily export your data to another specialized application that can; you will therefore never be restricted.

We are confident that you will find WaveTrak extremely powerful and at the same time, very flexible. We are committed to working with our customers to continually improve the program so please drop us a line with comments and suggestions. Enjoy!