

Research Status Report #6

Well, I'm off and running with my research project now that I've settled upon the Tascam 24-bit DAT recorder as a topic. The 24-bit DAT recorder is truly a new and revolutionary invention for the audio industry. Tascam, the world's largest manufacturer of recording equipment and accessories, debuted this machine merely three months ago at the NAMM convention in July 1998. The innovation inherent with the advent of this new DAT capability comes to light when one considers that the DAT format has remained unchanged for the past 12 years.

Since 1986, the DAT player's basic functions have essentially stayed the same, utilizing 16-bit consumer technology which was available even earlier with the release of the compact disc in 1983. When the 16-bit format was established, "engineers were aware that this standard severely compromised the quality of the recorded signal," and that, "the human ear is capable of discerning music at sensitivity levels that require 20 bits or more sample resolution." (Levitt) Unfortunately 16-bit was, at the time, "the highest quality that could be attained with the chips and processors available." (Levitt) To get an idea of the vast increase of information resolution between a 16-bit and 24-bit encoder, one only has to compare the available combinations between a binary 16-digit number and a binary 24-digit number: in 16-bit systems, 65,536 levels are possible whereas a full 16,777,216 levels are possible with the 24-bit. The difference is staggering. Obviously, much greater sonic detail can be achieved with 24-bit quantization. The "HR" in the 24-bit DAT recorder's title refers to this "high resolution" capability.

Related to the increase in resolution power is the decrease of inherent noise in the system. Noise is necessarily added to any digital system in the form of dither to blur and encode the discrete steps between quantization levels. Since more quantization levels exist in a 24-bit system, the spacing between each step is thus smaller than exists in a 16-bit system. As the amplitude of dither is calculated to be slightly greater than one quantization step, a 24-bit system will need a smaller dither level to mask the system's digital distortion. Less dither introduced into the digital system equates to less noise and therefore an increased signal-to-noise ratio. As a sidebar, I just want to mention that this new DAT recorder, while having 24-bit A/D converters, is only equipped with 20-bit dithered D/A converters. Perhaps the introduction of a true 24-bit D/A converter will have to wait until a later edition, although one must admit that very few analog devices are able to appreciate the difference between 20- and 24-bit reproduction.

Enough talk about the advantages of the 24-bit recorder; let's see how Tascam implements this technology in its new machine. The new deck seems quite similar on the outside to previous DAT recorders in the Tascam line (such as the industry standard professional model DA-30 MKII). By doubling the tape speed, Tascam can fit 24-bits into a standard DAT tape meant for 16-bit recorders. Tapes therefore only last half as long, though, i.e. a 120-minute DAT tape will only offer 60-minutes of record time on the new 24-bit recorder. All standard sampling rates are available: 48, 44.1, and 32 kHz. Both AES/EBU and S/PDIF digital inputs and outputs are included, as well as the standard XLR balanced and RCA unbalanced ins and outs. The machine itself is no

bigger than previous DAT recorders and shares most of the front panel features that exist on earlier models. Basically, "the machine's interface is logical and straightforward: There is no learning curve, and anyone who's familiar with a DAT deck could start using the DA-45HR right away." (Petersen) Tascam, therefore, has truly endeavored to ease this new technology into the marketplace. In fact, this model is list priced at \$1,999, just a few hundred dollars away from 16-bit models by Panasonic and Sony which list at \$1,695. As an added compatibility, the DA-45HR can play and record 16-bit tapes with just a flick of a switch. Conversely, however, tapes recorded on the 24-bit machine in 24-bit mode will not be playable upon 16-bit machines.

With the advent of this increased sampling resolution, digital audio tape seems to promise staying power as the standard format for professional mixdown and mastering applications. The 24-bit version is easy to interface with the currently available 24-bit digital consoles and can also be used to store edited material from workstations. Some questions arise, however, with this new technology. Will other manufacturers begin to offer similar 24-bit machines or will 16-bit DAT recorders continue to proliferate in the marketplace, making it sometimes difficult to playback 24-bit tapes? Also, will this new DAT format herald a similar revolution in the compact disc industry with 24-bit CD players that are 16-bit compatible? In general, too, what is digital audio tape's eventual lasting power in the industry? Although DAT has become a standard, it may one day be replaced by hard disk storage because of DAT's problems with magnetic tape stretching and breaking, as well as DAT's editing impossibilities due to the helical scan nature of the recorded tracks. I cannot foretell the future, but I will endeavor to research this new DAT format in the hopes of being able to predict the impact this 24-bit format will have on the audio industry.

Bibliography

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