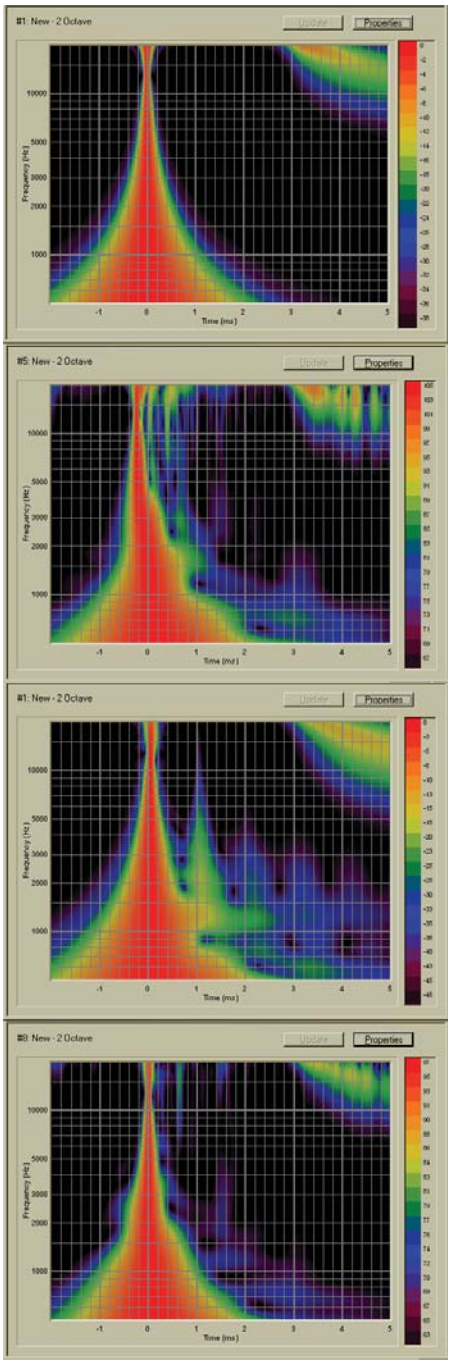
NT Design Challenges: The goal for NT loudspeakers was to provide the pristine, transient performance, smooth frequency response, and lack of coloration of direct radiating studio monitors while providing the powerful, high output needed for professional PA applications. This meant horn-loading was required for output capability. However, inherent to horns are two, un-studio-like, but well-known problems: transient smearing or “splashiness” and honk. These problems are caused by internal reflections within the horn and phase plug. Figure 1 shows the spectrogram of an ideal, point-source loudspeaker. Figures 2 and 3 show the spectrograms of an NT loudspeaker optimized with conventional digital signal processing (DSP).

Figures 1 to 4 (top to bottom)



In Figure 2 the spectrogram is set to show some vertical lines in the highest two octaves. These are internal reflections being emitted from the phase plug after the initial signal. These cause splashy-sounding transients, significantly reducing "crispness" and high frequency detail. This also causes transient information to be masked by the reflections from previous signals. Correcting this by phase plug redesign would significantly degrade efficiency, bandwidth, and frequency response flatness.

In Figure 3 the spectrogram is set to show broader, vertical spikes of sound reflecting from the mouth back into, then back out of the horn. The period of these repeated spikes corresponds to the frequency of the prominent, green, horizontal lobe. This lobe shows in-phase summation of the original signal and these subsequent reflections. All this causes the familiar "honk" in horns, the amount varying with a horn's specific geometry and beamwidths. Both transient splashiness and honk problems are sometimes assumed to be non-minimum phase phenomena and uncorrectable. NT proves these assumptions are incorrect.

EAW Focusing™ : Using innovative analysis tools and methods developed by EAW, the specific parameters of these problems were isolated and analyzed as to the solutions using DSP. However, the desired complex filter responses required accuracies grossly lacking in conventional DSP filters based on the Bilinear Z Transform (BZT). These filters sacrifice response accuracies in the upper audible octaves to avoid mathematical difficulties involving the Nyquist frequency. This results in filter response magnitude errors of over 15 dB, with equally flawed phase performance. Using FIR (Finite Impulse Response) filters would have resulted in latencies in excess of acceptability for real time use. Gunness Focusing avoids these issues while employing the exact, complex, filter responses required.

The results of applying Focusing to an NT loudspeaker are shown in Figure 4. Both time smear and "honk" are largely gone, making NT's spectrogram look quite similar to the ideal in Figure 1. NT's exceptional frequency and phase responses can be seen in the Performance Data. The change in phase below about 300 Hz simply reflects the overall high pass characteristic of the loudspeaker.

Amplification: NT's amplifiers are designed specifically for real audio signals by using advanced, intelligent, power supply control to provide superior audio quality, extraordinary efficiency, cool operation, and invariance to ac mains disturbances. Circuit protection includes separate power supply and amplifier thermal protection, HF and overall amplifier overload, and a two-state, over-current limiter. The protection circuits are self-resetting, minimizing audio down-time.

Weight: As with any portable loudspeaker, particularly with integral electronics, the engineering challenge was eliminating all possible sources of excess weight without compromising EAW's heritage of exceptionally strong and acoustically inert enclosures. To this end, EAW engineered NT like a finely tuned racecar, where a high efficiency engine, aluminum flywheel, unique chassis design, drilled foot pedals, and the like reduce weight, while maintaining strength, and improving performance. Among NT's weight-saving design elements are: unique joinery to eliminate interior cleats; fly-cutting excess wood, where the full thickness is not needed; removal of unneeded grille railing; structural aluminum fly tracks that also serve as handles; and unique, neodymium, Orbital Magnet Arrays™ to reduce driver magnet weight. The electronic design is so efficient, the entire electronics package (including DSP, heat sinks, connectors, etc.) for the full-range 1500 W power plant, as well as for the 2000 W subwoofer power plant, weighs only 9 lb / 4.1 kg!

The result of this attention to detail is that NT loudspeakers approach the weight of popular, plastic enclosure, self-powered loudspeakers. However, NT loudspeakers provide the robust, physical and acoustical performance of Baltic birch plywood enclosures and a lot more amplifier power.

Dependability: NT loudspeakers are bi-amplified, with separate digital processing and amplification for the LF and HF drivers. The processing incorporates sophisticated digital limiting specifically tailored to driver limitations on typical, real audio signals. The limiting is also specifically tailored to minimize reduction in sound quality when operating. This permits very high SPLs with little risk of damaging the drivers.

NT's integral power amplifiers use proven, high efficiency, technology. The DSP settings for all models are stored in the amplifier assemblies, with dip switches to re-configure them for any model. While the likelihood of failure is small, a complete amplifier assembly for any NT full-range model or NT subwoofer can be easily replaced in minutes.

NT enclosures have the same birch plywood construction as used in legendary EAW touring products. No weight-saving modifications impact the ruggedness of this construction. This same mechanical toughness extends to the amplifier design. This means NT loudspeakers are well-equipped to handle the physical rigors of hard, professional use.

Summary: EAW's engineering efforts resulted in the NT Series: robust, compact, lightweight, loudspeakers that provide the pristine, transient performance, smooth frequency response, and lack of coloration of direct radiating, studio monitors. Unlike studio monitors, NT has the exceptional power, output, and directional capabilities as well as the mechanical durability required for professional PA applications.

SPECTROGRAMS: EAW's proprietary spectrograms show the spectrum or frequency content of sound (vertical axis) and its variation in time (horizontal axis), the colors representing intensity. The width of the data reflects the size of the sliding time window applied to the data, which increases in size with lower frequency. The “data” in the upper right is simply a limitation of the spectrograph's mathematics and has no relevance.

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