SHOZO KINOSHITA SPEAKER DESIGNER

Speaker designer Shozo Kinoshita (pronounced Kin-oshi-tar) is little known outside specialist loudspeaker circles. His part in the design of the monitor used in the new generation of Tom Hidley rooms, however, has evoked considerable interest in his design approach. Terry Nelson recently had the opportunity to discuss monitor speaker systems with him

Shozo Kinoshita was with the Pioneer company of Japan for 17 years where he ended up in the development section of their TAD division. He left there in July 1984 to go independent and found his own company, Rey Audio. This enabled him to expand his ideas into complete systems without having to work within the confines of a large company although he still retains ties with TAD as a technical consultant.

Kinoshita's first involvement with studio monitoring was in the modifying of systems already installed, which gave a solid foundation on which to build his own ideas for monitor speakers. From modifying systems it was but a step to go on to custom-building monitors for studios, and this ultimately led to the Hidley/Kinoshita monitor.

"The first, what I would call 100%, system was put into Sedic Studios in Tokyo in 1983. This was the first time that I worked with Tom Hidley and the ties were strengthened the following year at the Paris AES where we were able to have a real communication and lay down the parameters for the new speakers and our collaboration as it is now.

"I feel that the monitor system is the voice through which the creative language of the musician and engineer speaks. We expect musicians to be able to produce sounds that are pleasing to the ear and to be able to articulate correctly; they must also be able to interpret dynamics that range from the brutal to the subtle. It can therefore be considered an anomaly if the monitor system cannot do the same. The present range of monitors shows no breakup at sound pressure levels of over 120 dB while at the same time retaining a very linear response to low level signals."

Kinoshita feels that three main factors govern the design of a successful monitoring system for today's (and tomorrow's) studios.

- Directivity control: "The system must be able to present a linear response throughout the defined listening area. It thus follows that the monitor must be integrated with the acoustical design of the room for the optimum interface of the speaker to the room."
- Imaging: "The stereo imaging has to be very precise and give the correct localisation information. The room also has to be capable of reproducing frequencies properly down to 20 Hz."
- Simple design: "Though this might appear to be a contradiction in terms, it is important that the design of the system be as simple as possible."

Broken down into components, the Kinoshita system consists of a horn, ported cabinet, 2-way passive crossover and standard TAD drivers (these were designed by Kinoshita in the first place).

RH-3 horn

The result of much experimentation over 10 years, the horn is made out of Apitong wood that, due to its extreme rigidity and damping, allows a very natural and smooth response. The throat features aerodynamically designed phasing fins for optimum control of directionality and very low reflection characteristics at the horn mouth for wide range frequency response.

The horn is driven by a TAD *TD-4001* compression driver, which features a very light Beryllium diaphragm and massive *ALNICO* magnet, together with a precision annular phasing plug.

A peculiarity of the horn/driver combination is that the *TD-4001* has a 4 in diaphragm looking into a 2 in throat. This permits an exceptionally wide frequency response of 630 Hz to 20 kHz.

Bass enclosure

After considerable computer analysis, Kinoshita found that it was possible to attain flat response down to 20 Hz using a ported cabinet. However, this meant that the enclosure had to be suitably massive and be braced in such a manner as to eliminate all standing waves. As with the horn, Apitong laminated wood is used for the cabinet

SHOZO KINOSHITA SPEAKER DESIGNER

because of its excellent structural properties.

Drivers for the enclosure are TAD *TL-1601A* (either one or two depending on the cabinet model) 15 in bass units which feature "excellent linearity and a clear, natural sound quality at all sound pressure levels". The roll-off point for the speaker is 800 Hz hence the crossover frequency of 630 Hz.

Crossover

A fairly surprising feature of the Hidley/ Kinoshita monitors is that they use a 2-way passive crossover, so the obvious question was—why passive?

"In my case a simple but very good reason! I have over 20 years of experience in the design of passive crossovers so it seemed preferable to stay with that rather than explore what, for me, would be fairly new territory.

"I came to the conclusion during my development work at TAD that the simpler the system, the better it is, which is why I have chosen a 2-way system that features a wide frequency response in each band.

"If we look at crossover design, one of the main problems facing any crossover is that of phase. Whereas it is possible to adjust one crossover point for phase, it gets extremely difficult—to say the least—when you come to 3- or 4-way systems.

"This is not to say that things are easy. Let us take a basic 1-pole filter as an example (**Fig 1a**). Here we have a 90° phase difference at the crossover point which when summed gives us 0°. This may seem OK but a phase difference still exists between the high and low frequencies. In order to get over this problem we have developed a special phase compensation circuit that makes the HF/LF sum in-phase at all phase angles (**Fig 1b**).

"Still on the subject of phase, it is also very important that the mechanical phase alignment of the system goes hand-in-hand with the electronic phase alignment. For example, the HF horn has a 270° phase difference at the cut-off frequency which also contributes to the very natural characteristic of the horn."

Other characteristics of the Kinoshita crossover include a compensation circuit for even power output from the HF and LF drivers as well as tailoring the horn response at both ends of its audio spectrum. "The compensation circuits that are usually found for use with constant directivity horns only correct for the high frequencies, here the low end is taken care of as well (**Fig 2**)."

The problem of crosstalk is also attacked by the use of a balanced network for the low pass filter circuit. "Crosstalk can occur in unbalanced networks through the use of a common earth; by using balanced techniques this can be eliminated."

Last but not least among the features of the crossover is its ability to handle high power without clipping. "The units are designed to handle 3 kW before clipping and all condensers and inductors are of the highest quality. The inductors use LC-OFC winding techniques and a special core which provides for a minimum of power loss."

The vertical monitor

"The general demand for high power and flat response has made the double 15 in woofer almost mandatory. Most systems place the drivers side by side and, providing the enclosure is aimed correctly, the audio image obtained is satisfactory (**Fig 3**). However, if the system is arranged vertically (**Fig 4**) problems will arise due to the difference between the distance from the woofers when listening on-axis to the horn, and result in poor definition.

FIG. 1a
1-POLE FILTER

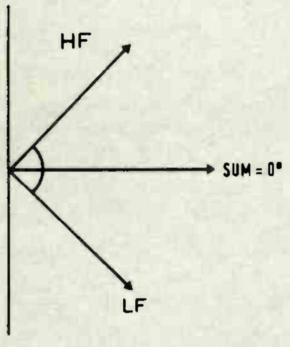


FIG. 1b
KINOSHITA PHASE COMPENSATION

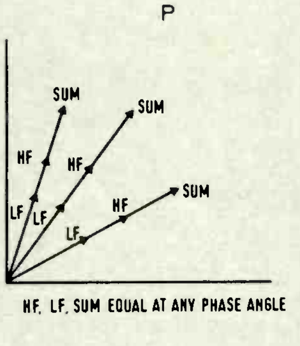


FIG. 2
CROSSOVER COMPENSATION

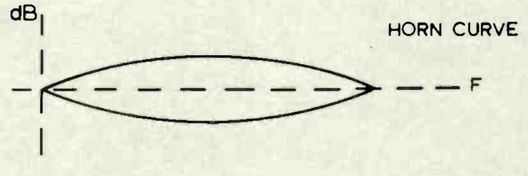


FIG. 3
GENERAL DOUBLE WOOFER SYSTEM

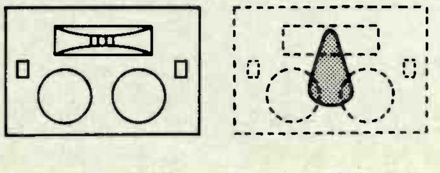
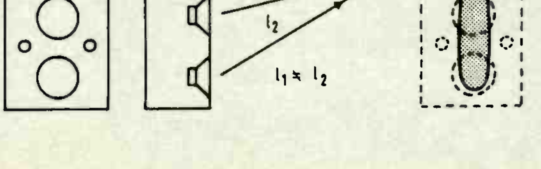


FIG. 4
CONVENTIONAL VERTICALLY ARRAYED DOUBLE WOOFER SYSTEM



SHOZO KINOSHITA SPEAKER DESIGNER

"The solution to the problem is to place the horn between the woofers and, providing the enclosure is angled so that the listening point is on-axis to the horn, this enables the low and high frequencies to combine correctly and provide a clear audio image (**Fig 5**).

"If we come back to our first example, what I call a general double woofer system, research has shown that one of the most serious problems with this type of installation is that of interference between the direct sound and the reflections from the floor and ceiling of the control room, especially in the 100 to 300 Hz range (**Fig 6**). With the vertical monitor these interferences disappeared due to the differing path lengths from the woofers, resulting in a very smooth response. An added bonus of the vertical array with a central horn is that the spacing of the woofers makes for better low frequency driving capabilities, providing of course that the enclosure follows the necessary construction and tuning techniques."

FIG.5
VERTICAL MONITOR AND ITS SOUND IMAGE

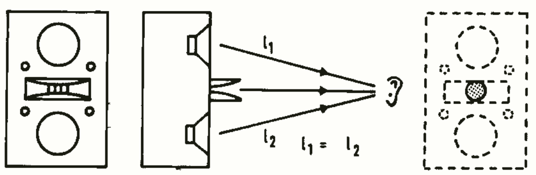


FIG.6
LOW FREQUENCY RESPONSE OF GENERAL SPEAKER SYSTEM IN MONITOR ENVIRONMENT

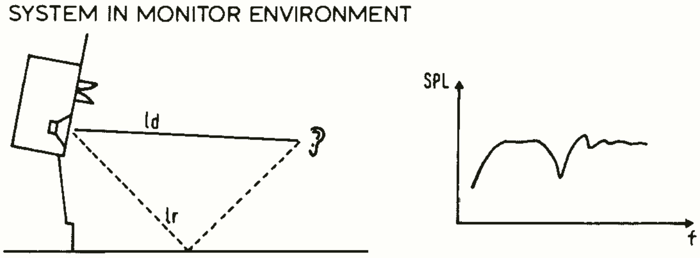
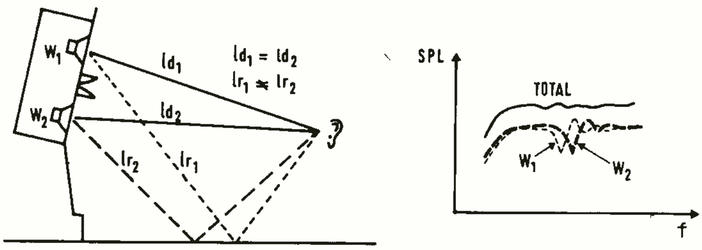


FIG.7
LOW FREQUENCY RESPONSE OF VERTICAL MONITOR IN MONITOR ENVIRONMENT



The 20 Hz monitor

"The advent of digital recording and the compact disc has brought an increased awareness of the importance of low frequencies. Whereas the human ear does not exactly 'hear' frequencies as low as 20 Hz, they are still perceived as vibrations and can play an important part in the overall perception of music or other audio signals.

"The reproduction of 20 Hz signals has led to the development of the model *5V* monitor. This necessitated a large cabinet which gave the additional benefit of reducing the action of standing waves on the drivers due to the extended low frequency tuning."

Essential to the proper operation of the 20 Hz monitoring system is a suitable acoustical design of the control room. Installation in one of the new Hidley Design rooms requires that the enclosures be completely encased in concrete and isolated from the internal structure of the room. This means that all the low frequency energy being put out by the system is going out into the room and not being absorbed by structural deficiencies and resonances. It also follows that the room construction must be massive enough to provide proper control over the low frequency reverberation characteristic of the room in order to provide an accurate response.

Compression driver vs soft dome

A criticism often levelled at compression high frequency drivers is that they are prone to distortion. I asked Shozo Kinoshita how he felt about the subject.

"I think the real question here is one of measurement. If we accept the 1 W for a given SPL at 1 m standard then the average dome driver will give between 92 and 95 dB/1 W whereas a horn-loaded compression driver will tend to give around 112 dB/1 W, or a 20 dB difference. In order for the dome transducer to give the same SPL as the horn system at 1 W, we will need to drive it with around a 100 W of power. This in turn will cause the voice coil to heat up with the subsequent rise in impedance and it is under these conditions that the unit should be measured in order to give any meaningful comparisons.

"Control room pressure levels are often up to the 130 dB mark and the monitor system must be able to handle this kind of power capability while at the same time retaining an identical fidelity at low levels—which the Hidley/Kinoshita monitor does."

Future developments

"I personally feel that the Vertical Monitor is one answer for the future control room—there is never only one solution! The next stage for me is

Tom Hidley comments

The vertical monitor came about after the initial experience obtained at Sedic studios, where the monitors used employed a horizontal dual-woofer configuration. We were lucky enough to have the studio as a test-bed and make the necessary modifications to the system and the surrounding area when this type of monitor is used.

At present there are five Hidley/Kinoshita monitors: the model *1* which is a single woofer system; the model *2* which uses twin woofers in a horizontal configuration for control rooms where vertical height is limited; and models *3V*, *4V* and *5V* which are vertical monitors with a low frequency response ranging from 31 Hz to 24 Hz to 20 Hz respectively. Experience has shown that the frequency response is better than the quoted ±2.5 dB tolerance and I am amazed at the quality of the sound which shows up in the fidelity of reproduction and the complete lack of listening fatigue—even at high pressure levels.

My original intention for monitors sold outside Japan was to use the TAD components, crossover and horn and have the cabinets built in Europe and the United States. However, it soon became apparent that one of the secrets of the system is the Apitong wood that is grown in Japan where it has a different density to elsewhere. The weight/bracing ratio is an all-important element of the design and so all systems are handbuilt in Japan.

nearfield monitoring and I am already looking into the design of a high quality nearfield monitor that can be used for signal evaluation without introducing misleading colourations. If you really want to check how your mix is going to sound on the average hi-fi (or low-fi) speaker, the easiest thing is to play it through an average domestic system!"

Live sound

Shozo Kinoshita's company, Rey Audio, is involved with live sound as well as studio

SHOZO KINOSHITA SPEAKER DESIGNER

monitoring and is well-known on the Japanese concert scene.

"The enclosures we use are similar in conception to the studio monitors and the system is 2-way. In fact the system is built out of high and low frequency modules which can be stacked horizontally or vertically, depending on the configuration required (**Fig 8**)."

The low frequency cabinets have a range of 30 Hz to 1 kHz and are direct radiator ported enclosures. Kinoshita gives his views on direct radiators versus horn-loaded bass cabinets.

"First of all it is a question of frequency response. With the ported enclosure we have, it is completely flat. With a horn enclosure there would be a 'bump' in the frequency response and the low end would not go down as far—unless of course the cabinet was so huge as to be unpractical. With our design we can cover the sub-bass through to the low mids with one cabinet. However, it is still quite large and very heavy!

"I also feel that in general, direct radiator systems tend to have more 'punch' and have a more 'solid' feel to the sound. This said, very careful attention has to be paid to the stacking of the system. Too many people still think they can just put up boxes and that it will work."

We talked about the fact that some systems can sound very powerful close to but soon lose coherence at relatively small distances.

"This is a question of stacking and overall design. The longest throw situation we have done up till now has been 600 m and it sounded satisfactory at the back.

"The tuning of the bass cabinets is extremely important. Thiele and Small have done excellent work but they are still limited conditions. The tunings we use also incorporate computer design work from Bart Locanthi.

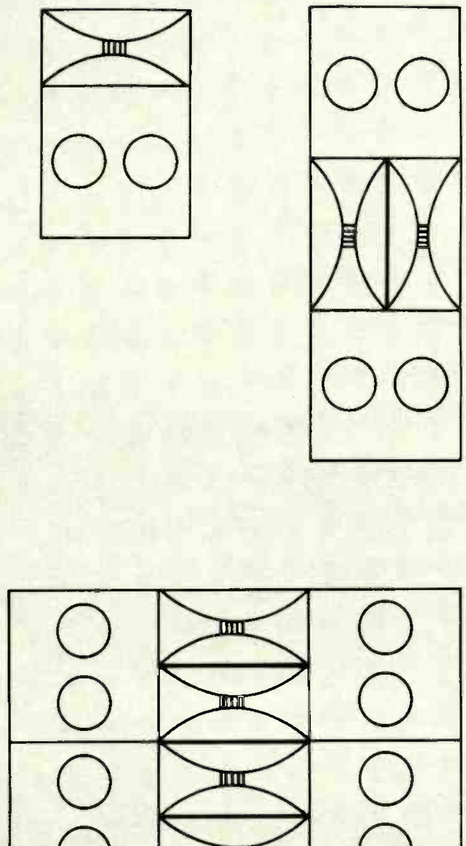
"When dealing with sound reinforcement systems it has to be borne in mind that everyone has their own idea of what they should sound like and how they want them to be used. It is therefore very important that systems being sold to PA companies be built in close liaison with the client.

"For ourselves, the next area we will be looking at is that of stage monitoring (in Japan), which we hope to do this year. This is a field that is still very much in its early stages and should provide an interesting challenge."

At the time of this interview 80% of Japanese studios were equipped with Kinoshita monitors with 75 systems in use worldwide (a figure which will have already changed by the time this is read). A common feature to all these installations is the lack of equalisers in the system—"these are neither required nor desirable!"—together with what often amounts to unmitigated praise of the sound. However, that is something that has to be judged on an individual basis.

Studio monitoring is one of those subjects that can arouse fierce passions in partisans of this or that system and/or designer. However, the common goal is to let us hear the music as it really is and from this standpoint Shozo Kinoshita has to be placed among the more influential monitor designers.□

FIG.8
SPEAKER CONFIGURATIONS - REY AUDIO



I would like to thank Larry Ishikawa of *Prosound* magazine in Japan, for his invaluable assistance as translator.

Specifications

Model	Response	Sensitivity	Nominal Impedance	dB SPL/m	Width (mm)	Height (mm)	Depth (mm)	Horn Protrusion (mm)	Weight (kg)
1	±2.5 dB 26 Hz to 20 kHz	95 dB SPL	8 Ω	120	1.118	762	508	183	110
2	±2.5 dB 28 Hz to 20 kHz	98 dB SPL	4 Ω	126	1.125	800	600	183	140
3 V	±2.5 dB 31 Hz to 20 kHz	98 dB SPL	4 Ω	126	725	1240	580	183	150
4 V	±2.5 dB 24 Hz to 20 kHz	98 dB SPL	4 Ω	126	850	1200	620	183	200
5 V	±3 dB 20 Hz to 20 kHz	98 dB SPL	4 Ω	126	1.100	1300	700	183	250