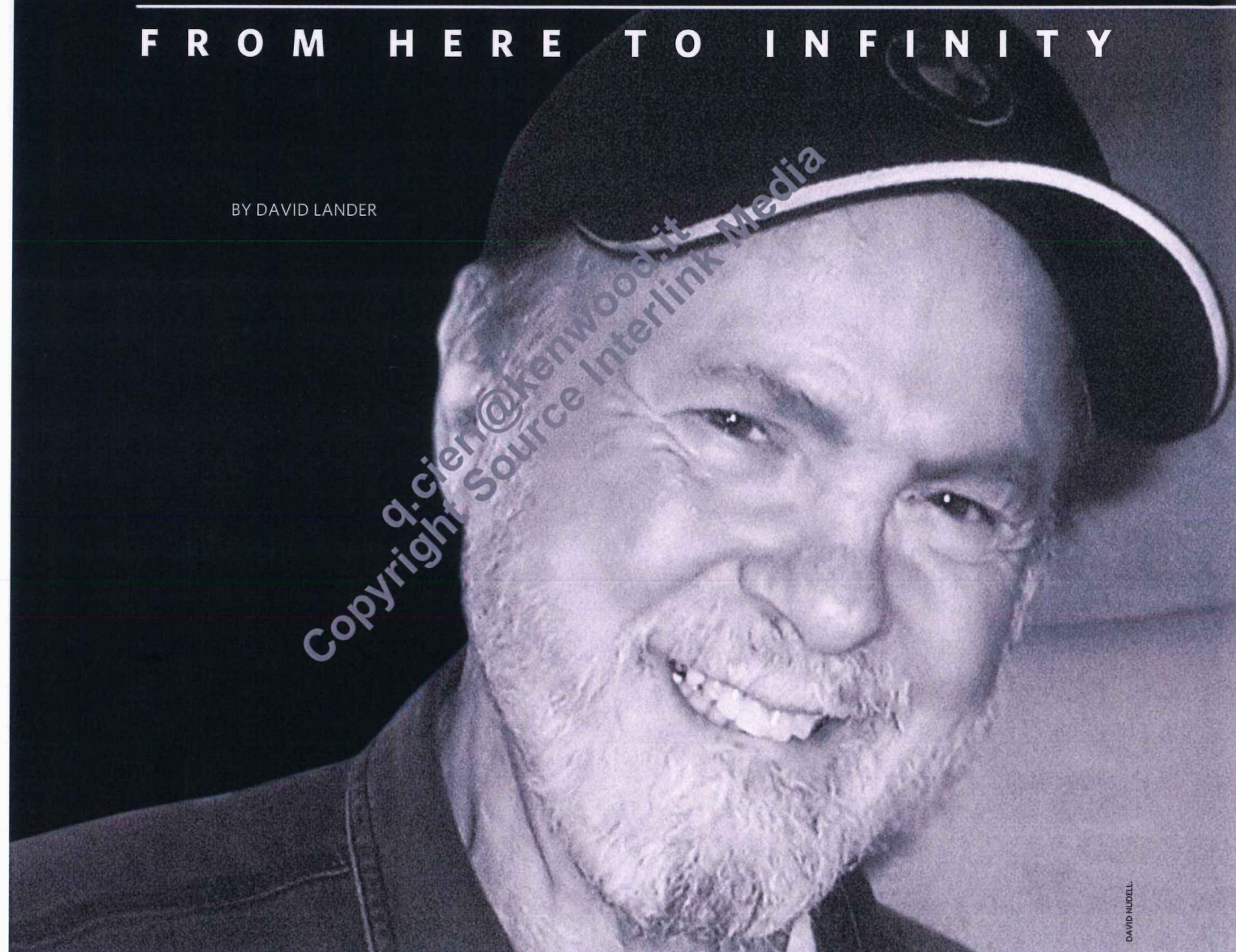


# ARNIE NUDELL

FROM HERE TO INFINITY

BY DAVID LANDER



DAVID NUDELL

**IMAGINE A SPEAKER FIRM** with an introductory product that pushes the outside of the performance envelope while tearing the pricing envelope to shreds. A reviewer in an audio journal that tilts toward the high end deems this speaker “appallingly expensive,” notes he would have bought the test sample if he’d had the money, and confesses that being without it makes him feel “rather as though a member of the family has passed away.” Now envision a speaker company at the peak of the industry sales curve, one so successful that a mainstream hi-fi magazine ranks it No.1 in market share for two separate years. Very different companies, right?

Wrong. *Stereophile*'s founder, J. Gordon Holt, made the comments quoted above about the ServoStatik 1,<sup>1</sup> the loudspeaker that launched Infinity Systems—the same Infinity Systems that *Stereo Review* later determined, in two annual surveys, was the industry segment's market leader. Much of

<sup>1</sup> JGH's *Stereophile* review of the Servo-Statik 1, as well as several follow-up reviews, can be found at [www.stereophile.com/floorloudspeakers/845/index.html](http://www.stereophile.com/floorloudspeakers/845/index.html).—Ed.

The audio visionary and founder of Infinity Systems opens up on nuclear physics, electrostatics, and designing the perfect loudspeaker.

the credit—for Infinity’s high-end products and high sales volume alike—belongs to Arnie Nudell, who grew up in Los Angeles, and cofounded the company there in 1968. I recently called him in Colorado, where he now lives, and where he’s at work on a speaker with advanced versions of technologies he pioneered. Here’s what Nudell had to say about his route to Infinity, and about some of the firm’s achievements during his two-decade tenure as president and head of product development.<sup>2</sup>

**David Lander:** *You were exposed to some serious classical music while growing up in Los Angeles, and you displayed a clear affinity for it.*

**Arnie Nudell:** When I was seven or eight, I was taken to see the San Francisco Opera production of [Verdi’s] *Il Trovatore*, and I fell in love with opera that moment. Every year from then on, when the San Francisco Opera came down to L.A. for two weeks, I begged and cajoled, and I got somebody to take me to all the operas every season. At 12 or 13, I was in a large youth orchestra, where I was first-chair clarinetist. We were doing the Beethoven Fifth Symphony and were asked to raise our hands if we wanted to conduct a movement. Of course, my hand went up immediately. I got to conduct the third and fourth movements. I had the score, and I just memorized it. To this day, I know every note.

**DL:** *Your first career was in science, unrelated to music, and you worked around some scientific equipment that was every bit as compelling as the music you favor. Tell us about that.*

**AN:** While I was getting my bachelor’s degree in nuclear physics at UC Berkeley, I worked in the Bevatron lab [at the on-campus Berkeley National Laboratory]. Bevatron was the largest particle accelerator in the world at the time. Then I went to UCLA for graduate work and got my master’s degree in physics. I was studying for a PhD, and had satisfied all the course requirements, but I was getting tired and bored, frankly, so

I got a summer job at Hughes Research Laboratory, and right at that time Ted Maiman, who worked there, discovered the laser. It was the first time anybody had seen coherent light, and I was at Hughes Research Lab when it happened. I was called by no fewer than 10 dif-

ferent companies saying, “If you want to work for us, we’ll pay you a lot of money.” So I immediately took a job at Aerospace Corporation, a new company funded by the Air Force, in El Segundo. I set up a laser lab and made it all work.

**DL:** *When did you begin working with speakers?*

**AN:** I had been working with speakers since I was, oh, 10 to 12 years old, going to electronics stores, putting together parts. I took my parents’ console apart and put new speakers in it. At Aerospace Corporation, I was so absorbed in trying to get that lab set up, and doing some basic research with some of the scientists there, I had no time for speakers. I got back to them after I started a job with Litton Industries, in the San Fernando Valley. At Litton, we developed a way to make a laser range-finder to measure distance within a couple of feet. They were already making the inertial navigation systems for the F4D aircraft that was flying then in Vietnam, and when pilots making bombing runs missed their targets and came around again, the potential for getting shot down was very high. What we proposed—I went to the Pentagon to give a couple of talks about this—was a system whereby you could ultimately have

the laser range-finder connected to the inertial navigation system so, as a plane came in, the laser would pulse a number of times and give the computer in the inertial navigation system updates of the exact distance to the target.

I was at Litton Industries for a four- or five-year period, and during that time I met John Ulrick. He was one of the electronics guys in that laser group, and he was very interested in music and audio. We decided that we could put some of the new technologies we were using in aerospace into loudspeakers.

**DL:** *You’re referring to servo technologies.*

**AN:** Yes. These technologies that were used in the inertial navigation system were called servo technologies, and they use feedback to correct various moving mechanisms for accuracy. A bass speaker is a moving mechanism, and we felt that, if we could put feedback around a bass speaker, we could give it flat frequency response down to 16Hz. And much lower distortion, since adding feedback to a system lowers the distortion.

We worked on that for a very long time, at least two and a half years—this was after hours—and when we came up with the servo bass system, the first thing we did was to A/B it with a four-thirds Klipsch I had made in my garage: one that was one-and-a-third times the size of a normal Klipschorn, with a 15" woofer instead of a 12" woofer. The bass system in the four-thirds Klipschorn, at the time, was state of the art. And the servo bass system destroyed it.

**DL:** *Your servo bass system used its own amplifier.*

**AN:** It needed its own servo amplifier, and there was no such thing on the market, so we had to design one. And we needed some device to sense the motion of the speaker. What happens is, as the speaker moves, the sensor puts out a small voltage that is fed back to the audio input of

the amplifier. That voltage is compared to the audio input voltage, and if there’s a difference between those two signals, that difference is fed back into the audio amplifier, which instantaneously corrects the woofer’s performance. It flattens the frequency response and dramatically decreases the woofer’s

distortion. We then needed a midrange and a tweeter with the same low distortion and wide bandwidth characteristics as the woofer. The only such technology at the time was electrostatic.

**DL:** *A lot of people back then were great fans of the KLH Nines. How did you and John feel about them?*

**AN:** We loved the KLH Nines, but they had problems. They couldn’t play loudly enough. They beamed too much high-frequency energy, so if you were standing in front of the tweeters they would kill your ears; standing off axis was the only way you could listen. And they couldn’t really reproduce low bass. They were very clean speakers, and we liked the electrostatic sound, but we did not like the inefficiency and beaming.

**DL:** *What did you do to make the electrostatic aspects of your speaker better?*

**AN:** We spoke with RTR Industries. They were manufacturing speakers, and had bought the Janszen electrostatic patent. We knew that some modification of the Janszen tweeter would be excellent, but it couldn’t just be a large, square plate; what we had to do was make the tweeter very much narrower and fairly long. It ended up made of various elements and a meter long. Then we and RTR developed an electrostatic midrange using similar but not exactly the same technology. Once we had the tweeter elements in the correct geometry,



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<sup>2</sup> An earlier *Stereophile* interview with Arnie Nudell, along with interviews with his colleagues at Infinity, John Ulrick and Cary Christie, was published in January 1995, Vol.18 No1.—Ed.

and had the midrange elements, and had the servo bass, we started putting it all together. That also took us a long time, I think six to eight months, and when we played it, it did just what we thought it would do. We realized, wow, we had something. We took it to Walt Lewsadder at Woodland Stereo, and he said, "I've never heard anything like it, and none of my customers have either. Can you make some?" We said, "We're not sure, we're trying." He said, "I can sell all you can make." I said, "For \$2000 [per pair]?" He said, "No problem."

**DL:** As you've often pointed out, that speaker, which you named the ServoStatik, and the Volkswagen Beetle had similar price tags. Did you use a pricing formula to arrive at that figure?

**AN:** I didn't know from pricing formulas. I was a scientist. We looked at our costs, which included a very expensive servo amplifier and a servo woofer that you couldn't buy; we designed it and had it custom made. The electrostatic panels had to be custom made as well. We also used Brazilian rosewood, which was rare and expensive, but we wanted the speaker to look like fine furniture.

**DL:** With both you and John Ulrick working at Litton full time, how did you manage to build the first ServoStatiks?

**AN:** We called Cary Christie. He was an insurance guy, but an excellent woodworker. He came in, and he cranked out those cabinets as fast as he could, by hand. We hired a couple of people to put together the amplifiers. Then, during the evening, John, Cary, and I put the speakers together, and tested them. That was in my garage in Woodland Hills. I think it took us two weeks to build and test each one.

**DL:** And Woodland Stereo sold them.

**AN:** So fast we couldn't build them quickly enough.

**DL:** Where did you get the capital to turn a garage enterprise into a real company?

**AN:** From one of the largest electronic reps in the Los Angeles area, Black and Strong. We dealt with them because we had to order parts for the laser range-finder—we were installing it in the F4D aircraft—and they wanted to get into manufacturing. We told them about the ServoStatik, and they listened to it at Woodland Stereo, and talked to people who had bought them. Then they came to us and said, "How about starting a manufacturing company?" And I said, "What? Leave Lit-



Top: Infinity in the early days; Arnie Nudell is front right, with John Ulrick to his right and Cary Christie at front left. Bottom: The awesome IRS.

ton and do something else?" I couldn't fathom it, frankly, but we did. John and I left, and we hired Cary full time. We got ourselves a small place in Chatsworth and we started building speakers. One of the things that really put us on the map was a *High Fidelity* magazine review. It was for the first issue that had CBS Labs measurements, so we sent one pair to CBS Labs. It measured  $\pm 2$ dB from 20Hz to 20kHz, and they were stunned. By the way, over the years, nothing else in *High Fidelity* magazine ever measured like that.

**DL:** In 1978, you stunned people with your Infinity Reference Standard, the IRS. Its EMIT tweeters used samarium cobalt, a magnetic material you'd read about in a German medical magazine you happened to pick up during a trip abroad. It was then being used for eyelid implants, for people whose eyelids drooped. The implants worked in conjunction with magnets placed behind the top rims of patients' eyeglasses.

**AN:** Here were very tiny, powerful magnets, the missing link to making a magnetic speaker that would be much more robust, could be made to play much louder, would be more reliable, and could do all the things an electrostatic did, and more. For example, we knew we could make the mass-per-unit area of a ribbon driver very low, but we needed very powerful magnets to do this, and the samarium-cobalt magnet fit the bill. I did research on it and found out some of them were being

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manufactured in Japan, so I flew over and found the people who were making them, got samples, and flew back. That was the beginning of all our ribbon planar-magnetic loudspeakers.

**DL:** What led you to conceive a four-column, 7.5'-tall speaker in the first place?

**AN:** We knew that, using a line source of tweeters, a line source of midranges, and servo woofer systems, we could make a real line-source loudspeaker system and finally create the dynamic range of live music. A real line source has to be nearly room height, so there's no ceiling or floor bounce. If you use it as a dipole, you get a kind of figure-8 configuration from the front to the back, but it goes to zero at the loudspeaker, and the sidewalls get virtually no radiation either. So making a line source of that size and using it as a dipole, we were able to eliminate ceiling and floor reflections, left and right sidewall reflections, and negate the room in a big way.

**DL:** According to sales statistics Stereo Review once published, Infinity was the biggest speaker company in the US for two years. You didn't achieve that distinction with high-end speakers alone.

**AN:** We brought the technology of our high-end speakers lower and lower, to speakers most people could afford. We had a speaker called the 2000A, which came right after the Servo-Statik. It was a large bookshelf speaker, but it used an array of electrostatic tweeters and a transmission-line bass and midrange. Nobody had ever done that before. We got a review in *Stereo Review* that was the biggest rave; if nothing else launched us, that was it. We made the best speakers in the world, and we brought our line down until we were selling tons of other speakers that used similar technologies. We were selling a \$200/pair speaker that used the same tweeter as the IRS.

**DL:** Why, and when, did you sell the company?

**AN:** By the mid-1970s, Black and Strong had made a lot of money with Infinity. But Infinity was growing very quickly, therefore demanding more money for growth, and they said, "We're too small now. We have to find you a buyer." Eastern Air Devices [later called Electro Audio Dynamics] bought out Black and Strong's share of Infinity, and bought my stock, along with John's and Cary's, for an unspecified amount that was to be based on future earnings. EAD also owned KLH, and after a couple of years they sent me to Boston to run it for a while. KLH was by then an old company and was failing, and I didn't want the job. But I ended up with it, and I spent a year and a half or two years running both KLH and Infinity. At one point I stayed in Boston for two weeks every month—a pain—but they put me up at the Ritz Carlton and gave me full access to the hotel's enormous wine cellar, so it wasn't too awful.

**DL:** In the early 1980s, Harman entered the picture. How did that happen?

**AN:** EAD wanted out of the audio business and thought Harman, a conglomeration of audio companies, would be a good home for Infinity. I talked to Sidney Harman and said, "This company's incredibly successful. Right now it's a cash cow, and I'd like to keep it that way." And Sidney said, "Boy, that would be incredible, because we don't have any cash cows at Harman." That was 1983 or '84. When the deal was struck, and we worked for Harman International, we were absolutely independent.

**DL:** You continued to work for Harman, as president of Infinity and head of product development, for five years. Tell us about your interaction with Sidney Harman, a very strong-minded individual, to say the least.

Infinity's Black Widow tonearm was one of the first audio products to use carbon-fiber.

**AN:** I interacted a lot with Sidney. Sidney had his ideas about the audio business, and I had my ideas, but with Infinity I got my way every time. We had a cadre of independent dealers and chains—no big chains—about 200 separate companies around the US in all.

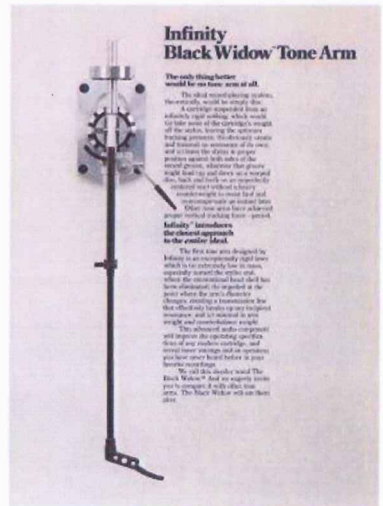
Circuit City started to rise at that point, and Sidney predicted it would be the most successful retail company in the long run. I didn't challenge him on that notion, but with regard to our distribution I said that, if they would take us, all of our other dealers would go away. Finally, after many hours of conversation—which I did enjoy, to be honest—we kept distribution the way I wanted it. And he always wanted to move Infinity over to Northridge, California, to be part of the big family. I just refused. I said, "We have our own identity, and the only way to keep it sacrosanct is to stay separate."

**DL:** Harman still owns Infinity. Why did you leave?

**AN:** I wore too many hats. I was very, very tired, I just couldn't do it anymore. I traveled all around the world for seminars and meetings—Europe, Southeast Asia. I had to plan my schedule about seven months in advance. I'd just had enough.

**DL:** Speakers weren't Infinity's only cutting-edge products. Tell us about some of the others.

**AN:** Infinity had many other firsts—the Black Widow tonearm, for example, a very low-mass graphite arm, which we made because a lot of the new cartridges were highly compliant, and a light tonearm allowed them to work



**ARNIE SAYS:**  
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perfectly. Infinity became the No.1 tonearm manufacturer in the world, ahead of SME. Another thing we worked on was a class-D switching amplifier, using solid-state devices in the way they were meant to be used: for switching. Mostly John worked on it, and when he left Infinity, probably in 1981 or '82, he formed a company that made switching amplifiers. Nobody had ever made one for audio before, and we brought it to market, but it was too complicated a problem at that particular time. In the mid-70s, there just weren't enough solid-state devices on the market to make it work properly, so we discontinued it. But we were the first to produce that kind of amplifier. We also came out with the first FET preamplifier, and we made an air-bearing turntable and arm.

To be honest, we were on a roll, and we thought we could do any of these things. We were interested in a variety of technologies, and thought we could apply them better than anyone else. In some cases—the tonearm, for example—we were right. In several other cases, not so much. But there's a great sadness in the story, too. Infinity is now a commodity. They're not much of a company anymore. It's a damn shame. We were tops. ■