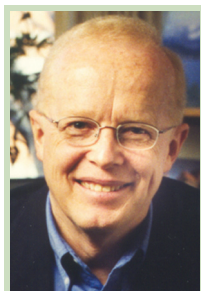


# Experts discuss telecoils and the future of hearing aid-compatible assistive devices

By David G. Myers

*So old, and yet so promising. That describes the venerable telecoil and its modern applications.*

*In some European countries, telecoils now routinely come with hearing aids and serve a dual purpose: to enhance telephone conversation and enable hearing aids to serve as customized, wireless speakers for broadcasting sound. In most churches with a PA system, in auditoriums, in every London taxi, and increasingly at bank teller stations, train ticket windows, pharmacy counters, and tourist information stations, induction loop systems broadcast sound directly to hearing aids. (The sound transmits to the telecoil sensor via magnetic energy from a wire loop around the listener.)*



David G. Myers

*In the United States, assistive listening is mostly hearing aid incompatible. But telecoils, and the hearing aid-compatible phones and assistive listening they enable, are making strides. Consider the following:*

- ❖ *All landline phones and, under FCC guidelines, more and more cell phones transmit not only sound but also a magnetic signal that enables enhanced listening in hearing aids with telecoils.*
- ❖ *In a recent Hearing Journal survey, hearing professionals reported that 62% of the hearing aids they dispensed in 2007 came with a telecoil, up from an estimated 30% a decade earlier. Although other estimates have been closer to 50%, most BTE aids worn by those most needing hearing assistance now come with telecoils.*
- ❖ *With support from hearing professionals and consumer groups, Arizona recently enacted a law requiring hearing professionals to explain the usefulness of telecoils to hearing aid purchasers.*
- ❖ *The Hearing Loss Associations of California and Michigan are now recommending hearing aid-compatible assistive listening. The California group states, "In all new and extensively remodeled buildings [with] PA systems, a loop should be permanently installed."*
- ❖ *Hundreds of loop systems are operational in West Michigan, including throughout the new Grand Rapids convention center and in both concourses and all gate areas of the Grand Rapids airport.*
- ❖ *Consumer have launched initiatives to promote hearing aid-compatible loop installations in many communities, including Tucson, Albuquerque, Racine (WI), St. Joseph/Benton Harbor (MI), New York City, and California's Silicon Valley.*

*To explore the significance of these developments for hearing professionals, hard-of-hearing consumers, and the hearing industry, The Hearing Journal invited me to convene a virtual conversation among several experts.*

*They are: **Bjorn Christ**, president of ReSound USA; **William Diles**, whose thriving audiology practice in Santa Rosa, CA, offers home TV room loop installations with hearing aid purchases; **Norman Lederman**, founder and research director of Oval Window Audio, a loop system manufacturer; **Bowen Marshall**, manager of R&D for IntriCon Tibbetts Corporation and principal design engineer for Global Coils SAGL, a leader in coil development and manufacturing; **Mark Ross**, professor emeritus of audiology at the University of Connecticut and a prominent advocate for the hearing-impaired; **Janice Schacter**, chair of New York City's Hearing Access Program, a consortium of the Alexander Graham Bell Association for the Deaf and Hard of Hearing, the League for the Hard of Hearing, and the Hearing Loss Association of America; and **Michael Wiersma**, marketing director of Premovation Audio, which has designed and installed hundreds of loop systems in Michigan and beyond.*

**MYERS:** Mark, when did you start using telecoils?

**ROSS:** Soon after I got my first hearing aid in 1952, it was retrofitted with a telecoil cube atop the body-worn aid in my chest pocket. I would activate it by pressing the inverted phone earpiece to the cube while talking into the microphone. I would get strange looks when I talked on the phone!

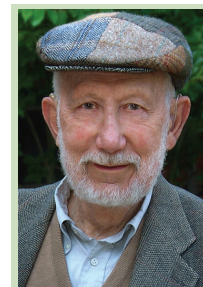
**MYERS:** And now?

**ROSS:** My personal use of telecoils has expanded considerably, most notably when I watch TV. The telecoil is by far the most convenient TV assistive listening device I've ever used, and I've used them all (hard wire, FM, infrared).

**MYERS:** That's my experience, too. I like being able to receive customized TV sound with the touch of a button. And I like being able to use the M/T setting, which also allows me to hear room sound.

**ROSS:** All my phones, except for one cell phone, include an audio output that projects to both ears via a neckloop. It makes a big difference.

**MYERS:** I agree. For phone listening, two ears are much superior to one. Dispensing professionals understand the benefits of binaural hearing, yet they provide few of their



Mark Ross

patients with the benefit of binaural phone listening, such as I have in my office via either a loop system that gets output from my phone or a binaural headset.

**ROSS:** I also use the neckloop when my wife persuades me to join her at religious services. Among all the gray-haired and bald-headed congregants with hearing aids, I'm one of just two who use the available FM receiver by patching in my neckloop. Many more could benefit from an induction loop ALD that broadcasts directly to their hearing aids. I also use a stereo set of silhouettes to listen to music. I direct the output of the CD player (this will also work with an iPod) to the silhouettes, enabling a dichotic signal.

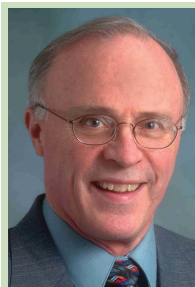
### A CHANGING TECHNOLOGY

**MYERS:** Bowen, as Mark's experience illustrates, telecoils are not a new invention. Over the last half century, how has the technology developed?

**MARSHALL:** I see four changes. First, we're now using high-permeability magnetic core materials that have greatly reduced the size from the original air-core

designs. This lets us put smaller telecoils in smaller hearing aids. Second, today's technology offers a superior magnetic structure, thanks to densely packed windings and magnetic end disks on cores. Third, telecoils can be integrated with a solid-state amplifier. This allows switching between mic and t-coil with little change to the hearing aid amplifier. This generally improves signal-to-noise ratio and allows hearing aid manufacturers to more easily match the frequency response (and thus speech quality) of the telecoil to that of the microphone. Finally, we now have amplified telecoils with much improved immunity to electro-magnetic interference (EMI), including from cell phones.

**LEDERMAN:** On the application side, we're also seeing clever new loop systems—such as systems built into handy clipboards with built-in and external



*Bowen Marshall*

microphones for “on the go” applications and in stand-alone (plug-and-play) countertop loop units that are being used at bank teller windows, check-in counters, in offices, and even in vehicles. Speaking of vehicles, a new generation of commercial vehicle loop systems is being developed in response to transit system requests. Other evolving applications of the induction process may be found in new forms of neck loops and behind-the-ear silhouettes, such as Mark referred to.

**MYERS:** What new developments are on the horizon?

**MARSHALL:** One possibility is that advances in non-coil magnetic sensors could eventually displace coils altogether. (The candidate technologies include Giant MagnetoResistance, Ballistic MagnetoResistance, fluxgate techniques, semiconductor, and nanotechnology devices.) Or DSP and RF techniques could improve delivery of acoustic signals to the ear so much that telecoils would be relegated to being loop receivers only. The upside is that telecoil performance could be optimized for loop signal detection.

**ROSS:** I see a need for some creative engineering with telecoils. For optimal telephone reception, horizontal positioning works best. But for loop reception, a vertical orientation is best. Often recommended is a compromise position that angles the telecoil so that adequate (though not optimal) inductive coupling can be achieved with both telephones and loops. However, since it is much easier for people to manipulate a telephone for optimal coupling than to angle their heads relative to a loop, I would suggest the vertical position as the normative one.

**MARSHALL:** My understanding is that loop system magnetic fields typically exceed telephone fields by about 10 dB. If so, wouldn't this allow approximately equal telecoil signals from both sources with the telecoil oriented as much as 70 degrees off vertical? Or is this true only for optimum location in a looped area?

**LEDERMAN:** Good question. In a well-designed and properly installed loop system, there should be sufficient signal strength throughout the loop's interior to offset some telecoil deviation from true vertical. Although small horizontal telecoils sometimes require people to cock their heads slightly for optimum reception, loop systems work well for most people even when telecoil orientations are less than the vertical ideal.

**MARSHALL:** Most design engineers for hearing aid manufacturers are aware of the orientation issue. However, they are often forced by packaging constraints or compromises between loop and telephone performance to sacrifice 2-3 dB from the optimum telecoil orientation. Sometimes a slightly larger, more sensitive telecoil can offset the signal reduction. Obviously, the type and size of the hearing aid have a big influence on the telecoil location and orientation and thus on its performance. Offering loop functionality in a canal aid is further complicated by the limited height available for a vertical telecoil and the need to orient coils horizontally to maximize telephone pickup because of the greater distance between the canal location and phone receiver.

**CHRIST:** Our BTE telecoils globally are in the fixed vertical position optimal with loop systems. This works well for users in the U.S. as well. If the user wants to use the telecoil for phone use, the dispenser can change the gain and

response in our Aventa to overcome the shortcoming of the vertical orientation. As Mark noted, the user can also adjust the phone for optimum reception with the telecoil. Holding the phone below the



*Bjørn Christ*

BTE captures the telecoil "hot spot."

**MYERS:** Is the same true of ReSound ITE aids?

**CHRIST:** In these, the telecoils are installed horizontally to optimize the phone signal. When space constraints force us to place the coil vertically, patients sometimes complain of not receiving an optimum signal when using their phones.

**MYERS:** How many of your ITE aids have telecoils?

**CHRIST:** Telecoils are standard in the full- and half-shell models, and optional in canal models. Telecoils also are standard in the 60, 70, 71, and 80 BTE series, which can be fitted as open products using flex or thin tubing. They're not available in the Air, Pulse, and dot instruments, which have a digital feedback-suppression system that permits effective phone use with normal sound. The Air-type aids can be used without problems with the phone because they're open, which allows the acoustic

signal from the phone to enter the ear canal normally, and because the BTE placement doesn't result in the phone handset covering the mic and causing feedback.

#### OVERCOMING OPPOSITION

**ROSS:** I think one major cultural difference between the U.S. and Europe is that Americans are generally more obsessed with youth and cosmetics. T-coils mean more visibility, bringing attention to a wearer's "imperfection" and age.

**MYERS:** I cringe every time I see an ad for "invisible" CIC hearing aids, conveying the unsubtle message that hearing loss is something to be ashamed of, something to be hidden. Surely, that's the opposite of the message most hearing professionals hope to convey. Bjørn, as a native of Denmark, are you struck by the differing access to hearing aid-compatible assistive listening in Europe compared with the U.S.?

**CHRIST:** Yes, compared with Europe the use of loop systems here, though growing, is still minimal. Here, most ALDs provided by theaters, places of worship, and other public facilities consist of either an FM or infrared system and an accompanying headset or earpiece. The fact that most American hearing aid wearers use the telecoil for the phone rather than for loop assistive listening informed our decision to orient the ITE telecoils for optimum phone reception.

**ROSS:** If ever we get past the notion that a telecoil is strictly about telephones, I would strongly recommend that just about every hearing aid include one. But first we have to get over the chicken-and-egg dilemma. I'm convinced we would have more large-area installations, as in the U.K., if most aids could effectively receive the signal. Down the road, we can look forward perhaps to a more effective way of providing auditory access in all kinds of facilities. But for now we have the telecoil and we should take advantage of its capabilities.

**MYERS:** In Holland, MI, where most major public facilities are now looped, we surmounted the chicken-and-egg problem by getting facilities looped and keeping our hearing professionals "in the loop." They then began equipping nearly all their patients with telecoils. If the hearing industry would agree that everyone—people with hearing loss, dispensing professionals, and hearing aid manufacturers—would benefit by doubling the functionality of hearing aids, I believe we could accelerate the movement toward the ideal of putting a suitable telecoil into virtually every hearing aid.

#### MAKING THE MOST OF TELECOILS

**MYERS:** Let's turn to the experts on our panel who *are* working to take advantage of the telecoil's capabilities. Bill, what inspired you to start offering free home

loop installations with every hearing aid purchase?

**DILES:** I've always had a loop in my main fitting room, and the benefit to patients has been obvious. But for years, I pondered how to deliver the technology to them—and do so affordably. When I discovered that my teenage son could do it, we started including an installed TV room loop with every hearing aid fitting.

**MYERS:** How many homes have you equipped, and how do you manage this?

**DILES:** We've installed loops in over 1500 homes. We use three installers: a retired patient, a college student, and my son. Installations are usually easy, and only rarely are we unable to complete the task. For the occasional repair, the college student goes to the home for a \$25 service fee.

**MYERS:** What has this meant to your clients' satisfaction with their TV listening and with their hearing aids?

**DILES:** Our patients often find the telecoil/loop program to be their favorite hearing aid feature. Having a loop in their

home greatly improves their satisfaction with the hearing aids, as we've confirmed through satisfaction surveys. Since the loop is a hearing aid-compatible solution—as opposed to headphones, which are incompatible and compete with our core product—it gives patients one more reason to enjoy their hearing aids. Many are so happy with the TV room result that they request another for the bedroom.

**MYERS:** How has this affected your business?

**DILES:** In the 5 years we've included loops with our fittings, we've seen a tremendous growth in business. I've always believed word of mouth is the best advertising, and our patients enjoy talking about the “magic” we have created in their home. Hearing aid returns for credit have also plummeted.

**MYERS:** Norman, what inspired you to start Oval Window Audio back in 1984?

**LEDERMAN:** In the 1970s, I spent a summer in London at the Royal National Institute for Deaf People, where I explored

its wealth of information on loop systems. Returning to the United States I found only one company that manufactured small-area loop systems. Larger systems were fabricated by activists and enthusiasts in their basements and garages. In our first decade, we sold mostly to individuals and schools.

**MYERS:** What have been some notable recent installations?

**LEDERMAN:** The U.S. Senate and House of Representatives have installed loop systems in numerous hearing rooms and the main chamber where the President delivers the State of the Union address. Fun installations have included equipping magicians with loop systems and in-the-ear loop receivers that connect them to their assistant, and intern counselors with their supervisors.

**MYERS:** That reminds me of the communications systems that Ampetronic, a U.K. loop manufacturer, installed in America's Cup yachts. Mike, what interesting installations has your audio engineering firm done?



**WIERSMA:** We recently did a large performance hall, including the main orchestra, mezzanine, and balcony seating areas, as well as all side boxes and galleries—all run by a dozen loop drivers.

**MYERS:** Janice, as an advocate for people with hearing loss, you've played a key role in significant installations through your work with the Hearing Access Program. What's your aim?

**SCHACTER:** Our goal is to assist entertainment venues—museums, theaters, amusement parks, cruise ships, etc.—in becoming accessible for the entire hearing loss population.

**MYERS:** Can you give us some examples?

**SCHACTER:** It's a growing list: the New York Historical Soci-

ety, soon more than two dozen subway information booths and three buses here in New York. Also, the Museum of Modern Art's classroom, Temple Emanu-El (the world's largest Jewish house of worship), the Kentucky Derby Museum, and the Chrysler Museum. Loops will also be coming to Ellis Island, Graceland, and a pilot program for the New York City Transit and Limousine Commission.

**MYERS:** Aren't you also working with the National Park Service?

**SCHACTER:** Yes, the Park Service has mandated that all parks must have assistive listening systems and open captions for all videos and films.

**MYERS:** Norman and Mike, I'm often asked about interference and sound spillover to adjacent rooms. How often do these or other issues prove problematic?

**LEDERMAN:** Conventional loops will naturally bleed sound outside their perimeters. In the few situations where this is a problem, such as side-by-side theaters or meeting rooms, one can design a low-spill system, or the loop perimeter can simply be reduced or phased configurations employed to contain the sound.

**WIERSMA:** Norman's right. Spillover can be managed with either a surrounding cancellation loop or a phased array within the loop that creates a low-spill system. Interference

is rarely a problem. When it occurs, often due to old fluorescent lights (which can be replaced) or a particular guitar pickup or condenser type mic, we can easily address the problem, sometimes by keeping the loop away from the stage.

**LEDERMAN:** When the electromagnetic interference is outside the facility, as from an adjacent power distribution system, a loop system may be impractical. But that's rare. A more significant challenge is where to place the loop wire. That depends on the building dimensions and architectural features, such as how much steel is embedded in a structure. Before the loop wire is permanently installed, we recommend a "pre-installation listening check."

#### A PROMISING FUTURE

**MYERS:** Looking to the future, what excites you most?

**WIERSMA:** New technologies and installation techniques are making hearing loops more



*Janice Schacter*



*Michael Wiersma*

adaptable and more affordable. And, as word spreads, the demand for loops becomes greater.

**LEDERMAN:** I, too, am excited about loop systems becoming more widely employed and appreciated. Eventually, new technologies may supplant loop systems, but until that day comes, the simple elegance and cost effectiveness of induction loops will continue to make this technology attractive and useful to just about any hearing aid wearer.

**MYERS:** Bjørn, as one who advocates not so much for loop systems *per se* as for a doubled functionality for nearly all hearing aids, I'm wondering what the prospects are for an alternative wireless assistive listening system that is similarly *miniaturized* (can work in all aids), *low-power* (won't require large batteries), virtually *free* (and thus affordable to anyone), and *inconspicuous* (unlike the headsets available with hearing aid-incompatible assistive listening systems, as well as with loop systems for any without telecoils).

**CHRIST:** Loop systems and telecoils have a tremendous advantage over current and upcoming technologies as regards cost. I am hard-pressed to come up with competing technologies that will seriously challenge the performance/price equation of loops in the next 5 years. And from a cosmetics/stigma point of view, telecoils are even finding their way into micro-BTEs these days.

**MYERS:** So, could telecoils potentially be included in all the new open-fitting mini-BTEs?

**CHRIST:** Yes. And if we leave the cost constraint for a while, the concept of miniaturized, low-power, inconspicuous hearing

instruments (with twin functionalities of sound amplification and reception of sound from remote sources) will undoubtedly find its way to market eventually. The key to mass commercialization and mass availability of this functionality is, in my opinion, for the hearing aid industry to latch on to other industries doing volume business in this area, instead of building upon technology that may reach only limited volume, as would be the case of technology used exclusively for hearing instruments. Work in this area has already begun, and I'm confident that one day we will find that our industry is shaping other industries as a consequence of these new technologies. But we have to bring costs down if we want to realize the full potential of the hearing aid as a listening system.

**MYERS:** Your vision of "twin functionalities" for hearing aids brings to mind the vision of Sergei Kochkin, director of the Better Hearing Institute. Sergei argues that the way to increase adoption of hearing aids is to increase their utility. Doubling their functionality with simply operated "miniaturized internal wireless receivers in *every* hearing aid" will promote hearing aids and reduce the stigma. Some countries are already using loop systems to approach that goal. I'm encouraged by the progress we're beginning to make here in the U.S., thanks to people such as all of you.

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**David G. Myers**, PhD, is Professor of Psychology at Michigan's Hope College and author of 17 books, including *A Quiet World: Living with Hearing Loss* (see [davidmyers.org](http://davidmyers.org)). He is also the creator of [www.hearingloop.org](http://www.hearingloop.org), a source for information about hearing aid-compatible assistive listening. Readers may contact Dr. Myers at [myers@hope.edu](mailto:myers@hope.edu).