THE KENNEDY CENTER

Assistive Listening Systems for People with Hearing Loss:

A Guide for Museum Settings

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The John F. Kennedy Center for the Performing Arts has long championed the rights of people of all abilities to engage in and learn through the arts. We strive to provide equity and access across programs, performances, events, and facilities, and foster that same commitment within the larger arts community.

We are committed to creating innovative and effective educational programs, models, and resources, including a series of practical guides about accessible and universally usable arts and cultural programs and facilities.

With millions of people with disabilities living across the world, accessibility is an asset to be valued in welcoming new visitors and keeping audiences as their lives change[1]. We hope this guide will assist in fulfilling the ultimate goal of making arts and cultural institutions accessible to all.

Sincerely,

Mario R. Rossero,
Senior Vice President, Education

Betty Siegel,
Director, VSA and Accessibility

[1] Americans with Disabilities 2010, Population Report (Issued 2012), U.S. Census Bureau, retrieved June 2013 from www.census.gov/prod/2012pubs/p70-131.pdf

The information presented in this handbook is intended solely as guidance and is neither a determination of an organization's legal rights and responsibilities under any federal, state or local law or regulation. Organizations should confer with legal counsel regarding specific compliance issues and concerns.

Part I: To Begin

What is an Assistive Listening System (ALS)?

An assistive listening system (ALS) is a tool designed to improve audibility in certain environments. It delivers sound to the listener without interference or loss of intelligibility by reducing the noise-to-sound ratio.

The system is comprised of several components (more on this in Part III), including receivers, which are often referred to as Assistive Listening Devices (ALDs). Systems can also be used in conjunction with compatible personal hearing devices, such as hearing aids with telecoils and cochlear implants.

Assistive listening systems are used in small and large assembly areas, such as classrooms or meeting rooms, auditoriums, lecture halls, and theaters. They may also be used as auxiliary aids to provide effective communication in the context of museum programs, such as exhibitions, docent-led tours, and education programs.

Who Uses ALSs?

ALSs are most effective for people with mild to moderate hearing loss, but can also benefit individuals with more severe hearing loss who use hearing aids and cochlear implants.

Statistics regarding hearing loss in the U.S. vary. According to the National Institutes of Health (NIH), approximately 17 percent (36 million) of American adults report some degree of hearing loss.[1] Researchers at Johns Hopkins University found that "overall, about 30 million Americans, or 12.7 percent of the population, had hearing loss in both ears. That number jumps to about 48 million, or 20.3 percent, for people who have hearing loss in at least one ear."[2] The Centers for Disease Control and Prevention (CDC) say, "Hearing loss is one of the most common chronic health conditions in the United States. Among older adults, it is third after high blood pressure and arthritis."[3]

All statistics show the prevalence of hearing-related disabilities increasing significantly with age, as demonstrated by these numbers from the NIH:

Percentage of American Adults Reporting Hearing Loss by Age[1]

- 18% of adults ages 45-64 years
- 30% of adults ages 65-74 years
- 47% of adults ages 75 years or older

Within the hearing loss community, there is a great deal of diversity with regard to degree of hearing loss and the use of personal hearing devices. Though assistive listening systems can be helpful for many people, museums should be prepared to simultaneously provide effective communication such as captioning and sign language interpretation for visitors who have more severe or complete hearing loss.

[1] NIH Senior Health, Hearing Loss, National Institutes of Health, retrieved February 2015 from www.nihseniorhealth.gov/hearingloss/hearinglossdefined/01.html

[2] One in Five Americans Has Hearing Loss, Press release dated November 14, 2011, Johns Hopkins University, retrieved February 2015 from www.hopkinsmedicine.org/news/media/releases/one_in_five_americans_has_hearing_loss

[3] Collecting Data on Worker Hearing Loss: Epidemiology in Action, NIOSH Science Blog, The Centers for Disease Control and Prevention, retrieved February 2015 from http://blogs.cdc.gov/niosh-science-blog/2014/12/03/epi-hl/

Part II: Getting Started

Community Inclusion

When purchasing equipment or providing accommodations for accessibility, it is best practice to include knowledgeable people with disabilities in an advisory capacity. There is much diversity among people with hearing loss and the technologies they use. By inviting multiple perspectives, organizations can make decisions that reach the widest user group within the hearing loss community. Many states, counties, and cities have a commission, council, or service center that can advise an organization on the type of system that will work best in their venue and give referrals to vendors or technical resource centers. Other good resources include local or national chapters of organizations that provide services to individuals who are deaf or who have hearing loss such as:

Alexander Graham Bell Association for the Deaf and Hard of Hearing
3417 Volta Place, N.W.
Washington, DC 20007-2778
(202) 337-5220 Voice (202) 337-5221 TTY
info@agbell.org
www.listeningandspokenlanguage.org

Association of Late-Deafened Adults, Inc. (ALDA)
8038 MacIntosh Lane, Suite 2
Rockford, IL 61107-5336
(866) 402-2532 Toll Free (815) 332-1515 Voice/TTY
info@alda.org
www.alda.org

Hearing Loss Association of America
7910 Woodmont Avenue, Suite 1200
Bethesda, MD 20814-7022
(301) 657-2248 Voice (301) 657-2249 TTY
info@hearingloss.org
www.hearingloss.org

National Association of the Deaf
8630 Fenton Street, Suite 820
Silver Spring, MD 20910-3819
(301) 587-1788 Voice (301) 587-1789 TTY
www.nad.org

Statewide Services for Deaf and Hard of Hearing People

This list identifies two different types of statewide services; (1) commissions or state offices mandated to serve people who are deaf and hard of hearing, and (2) state coordinators of rehabilitation services for people who are deaf: http://www.gallaudet.edu/clerc-center/info-to-go/national-resources-and-directories/statewide-services.html

Legal Obligations

Many museums and other cultural institutions are unaware of or confused by their legal obligations to provide ALSs. The Americans with Disabilities Act (ADA) requires assistive listening systems to be installed in small and large assembly areas (such as classrooms or meeting rooms, auditoriums, lecture halls, and theaters), in new construction, and in alterations to existing facilities. An ALS may also be used as one of several listed auxiliary aids and services to facilitate effective communication for programs in a variety of settings, as well as between museum staff and visitors who are deaf or have hearing loss.

Effective Communication: People who have vision, hearing, or speech disabilities ("communication disabilities") use different ways to communicate. For example, people who are blind may give and receive information audibly rather than in writing, and people who are deaf may give and receive information through writing or sign language rather than through speech.

The ADA requires that Title II entities (State and local governments) and Title III entities (businesses and nonprofit organizations that serve the public) communicate effectively with people who have communication disabilities. The goal is to ensure that communication with people with these disabilities is equally effective as communication with people without disabilities.

From Revised ADA Requirements: Effective Communication
US Department of Justice Civil Rights Division Disability Rights Section

This booklet addresses legal obligations as defined by the current 2010 Americans with Disabilities Act (ADA) Title III regulation and its Standards for Accessible Design (the Standards).

Requirements for assistive listening systems exist in regulations for both Section 504 of the 1973 Rehabilitation Act and the ADA. When seeking information about ALS requirements, organizations should consult the most current federal standards as well as any local and state regulations and standards. Organizations may also need to comply with other regulations, and should check the resources listed in this chapter before making any decisions about assistive listening systems. Organizations should always follow the more stringent guidelines when covered by regulations with differing requirements.

When Are Assistive Listening Systems Required?

Organizations may determine whether assembly areas in their facilities are required to have assistive listening systems under the Standards by answering the following questions:

- Is audible communication integral to the use of the space?
- Is audio amplification provided?

If the answer to both questions is "yes," the organization is obligated to provide an assistive listening system for the assembly area in question.

An assembly area is defined as: A building or facility, or portion thereof, used for the purpose of entertainment, educational or civic gatherings, or similar purposes. For the purposes of these requirements, assembly areas include, but are not limited to, classrooms, lecture halls, courtrooms, public meeting rooms, public hearing rooms, legislative chambers, motion picture houses, auditoriums, theaters, playhouses, dinner theaters, concert halls, centers for the performing arts, amphitheaters, arenas, stadiums, grandstands, or convention centers.[1, 2]

[1] 2010 ADA Standards for Accessible Design, Section 106.5 Defined Terms

[2] 2006-2007 Architectural Barriers Act Accessibility Standard (ABAAS), F106 Definitions

How Many Receivers are Required?

The chart below shows the number of receivers that an auditorium, theater, or assembly area must have based upon seating capacity. When using a space that does not have a designated seating capacity (like an outdoor festival), organizations can use the figures below as a guideline. In order to determine the number of receivers for docent-led tours or for museum settings where there is no theater or auditorium, but the exhibition contains audio only or audio visual programs, administrators may want to compare visitor statistics against the table below to determine a reasonable number based on attendance. It is important to remember that a minimum of two receivers is recommended, and that covered entities have a responsibility to provide aids and services when needed to communicate effectively with people who have communication disabilities.

Capacity of Seating in Assembly Area	Minimum Number of Required Receivers	Minimum Number of Receivers Required to be Hearing Aid Compatible
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats [1]	2
51 to 200	2, plus 1 per 25 seats over 50 seats [1]	1 per 4 receivers [1]
51 to 200	20, plus 1 per 33 seats over 500 seats [1]	1 per 4 receivers [1]
1001 to 2000	35, plus 1 per 50 seats over 1000 seats [1]	1 per 4 receivers [1]
2001 and over	55 plus 1 per 100 seats over 2000 seats [1]	1 per 4 receivers [1]

[1] Or fraction thereof.

Of the available receivers, 25 percent, but no fewer than two, must be hearing aid compatible, per the chart above. If the entire seating area is served by an induction loop system, hearing aid compatible receivers are not required. However, the venue is still obligated to provide the minimum number of receivers as outlined above.

Best Practice: The numbers of required receivers in the table are minimums. Consider your audience: It may be best to have additional receivers to accommodate groups of individuals with hearing loss (e.g. patron groups from senior centers).

What Makes a Receiver Hearing Aid Compatible?

A receiver is considered to be hearing aid compatible* when it can interface with a telecoil installed in an individual's personal device, such as a hearing aid or cochlear implant. If a visitor has to remove his or her own hearing aid in order to use the receiver, or if the provided earbud or earphone interferes with the individual's personal device, the receiver would not be considered hearing aid compatible.

*some people may use the term "T-coil compatible."

Additional Technical Requirements for Receivers

The following specifications are outlined in the Standards:

- All receivers must have a built-in 1/8 inch (3.2 mm) standard mono jack.
- Systems must be capable of providing a sound pressure level of 110 decibels (dB) minimum and 118 dB maximum with a dynamic range on the volume control of 50 dB.
- Signal-to-noise ratio for internally generated noise in assistive listening systems shall be 18 dB minimum.
- Peak clipping shall not exceed 18 dB of clipping relative to the peaks of speech.

Signage

Assembly areas must notify visitors that assistive listening systems are available by posting signs with the international symbol of access for hearing loss. Signage can also function as a reminder to staff that these and other assistive technologies are available to visitors.

The signs must be posted at each assembly area or where entrance fees are paid. For example, if a museum has an IMAX® theater, an auditorium, and a planetarium, and one central ticketing area that serves all of the above spaces, a sign must be posted either at the entrance to each of the three spaces or at the central ticketing location. While not specifically required, it is advisable to place signs in prominent locations near the ticketing office, at the entrance to or in the auditorium lobby, at any information desks, and at the location where the receivers are distributed. Organizations should also post information about the availability of an assistive listening system on their websites.

Best Practices:

- Post access symbols in exhibitions and spaces where receivers are available.
- Use text with the symbol. For example: “Assistive listening available. For a device, see (add the distribution location in your facility).”
- Create a comprehensive indoor signage plan for assistive listening and other accessibility-related services during the exhibit planning and design process. The plan can help determine the best approach for where and how frequently signage is posted.
- If an induction loop is installed, add a “T” to the bottom right corner of the assistive listening symbol so visitors know it’s available.

Resources

For technical assistance, information on legal requirements, and accessibility design standards contact:

Access Board
1331 F Street, NW, Suite 1000
Washington, DC 20004-1111
(800) 872-2253 Voice (800) 993-2822 TTY
info@access-board.gov
www.access-board.gov

Americans With Disabilities Act National Network
(800) 949-4232 Voice/TTY
www.adata.org

U.S. Department of Justice
950 Pennsylvania Avenue, NW
Civil Rights Division,
Disability Rights Section – 1425 NYAV
Washington, D.C. 20530
(800) 514-0301 Voice (800) 514-0383 TTY
www.ada.gov

Part III: About the Technology

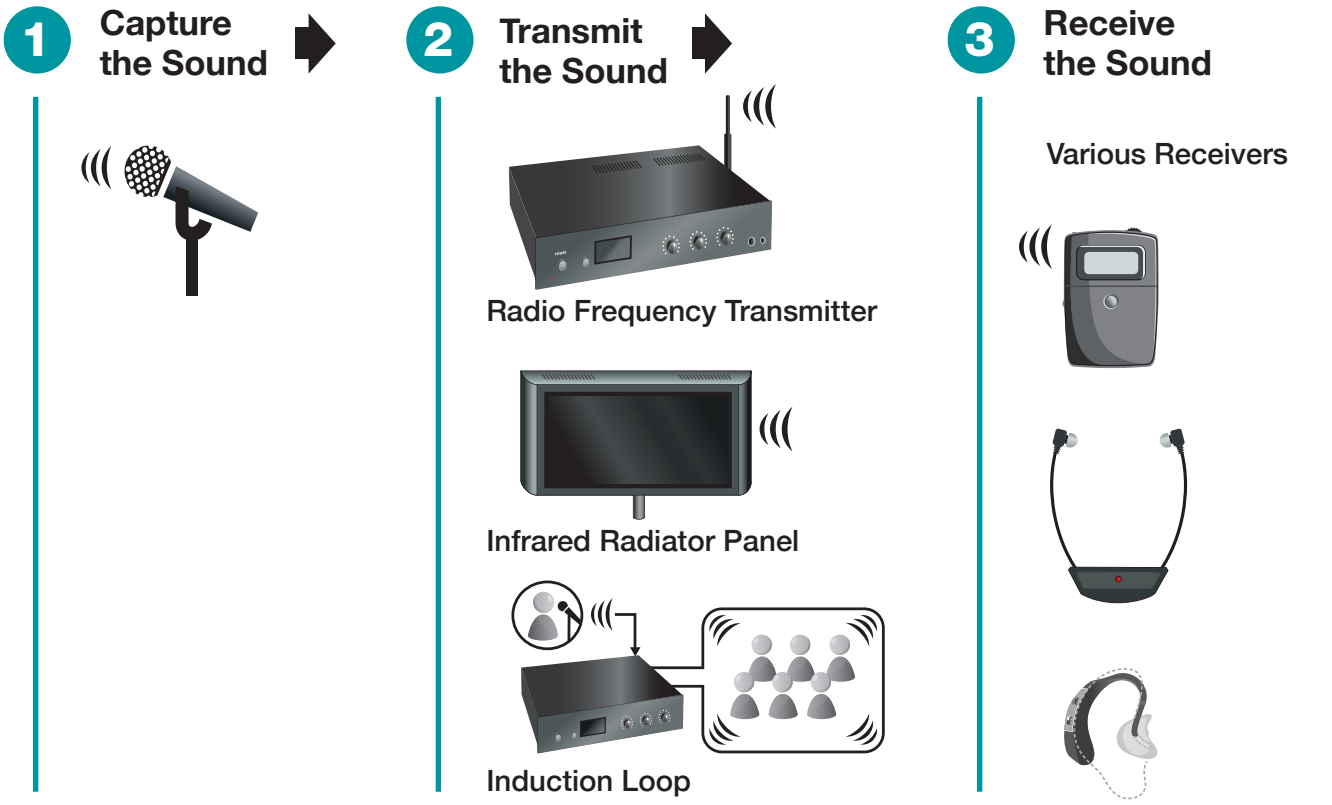
How Assistive Listening Systems Work

There are many types of assistive listening systems but all function using the same basic principles:

Step 1: Capture the sound. Use high-quality microphones to capture the sound as close to the source as possible.

Step 2: Transmit the sound. The sound captured by the microphone is converted to a signal and broadcast to the covered area.

Step 3: Receive the sound. The person using the system has a receiver that picks up the signal sent by the transmitter. The receiver may be one that is purchased as part of the system and distributed by the venue or it may be the patron's own hearing device if that device has a telecoil built into it. The receivers may or may not have built-in headphones, and there are several kinds of coupling devices, such as induction neckloops, earbuds and headphones.



Types of Assistive Listening Systems

There are currently four types of assistive listening systems that use different signals:

Hardwire System

The hardwire system is a closed system in which the sound is never broadcast outside of the cables. Seats in the assembly area are hardwired and listeners must plug receivers into a built-in jack. This is similar to the type of system used in airplanes where headphones are plugged directly into the jack in the armrest of the seat. This booklet does not address hardwired systems, with one exception, noted on page 22.

Radio Frequency (RF) System

Radio frequency (RF) systems, sometimes called FM systems, operate like small radio stations. A transmitter broadcasts the sound on frequencies designated by the Federal Communications Commission (FCC) for use primarily by assistive listening systems. The receiver is "tuned" to the frequency broadcast in the auditorium or exhibition space so the listener hears the correct program.

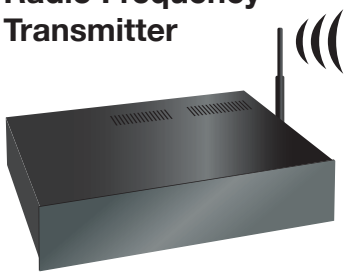
Infrared (IR) System

Infrared (IR) systems use invisible light on the infrared spectrum to transmit the sound signal to the receiver via radiator panels. These systems are sometimes referred to as "line of sight" systems because the receiver must be in view of the radiator panel without any obstacles between them, since infrared waves will not go through solid objects.

Induction Loop System

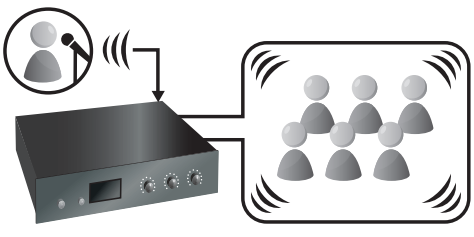
The induction loop system broadcasts electromagnetic current within an area encompassed by a cable antenna. To receive the signal, an individual must be within range of the magnetic field generated by the cable antenna, usually inside the looped area.

Radio Frequency Transmitter



Infrared Radiator Panel

Induction Loop



Types of Receivers

Receivers come in a variety of styles, shapes, and sizes. Regardless of the type of receiver, in order to accommodate the widest range of users with varying degrees of hearing loss and to be compatible with hearing aids and cochlear implants, the receiver must have a 1/8 inch (3.22mm) output jack. The jack allows the users to plug in a number of different coupling devices, including induction neckloops, to make the receiver compatible with the user's personal telecoil-equipped hearing aid or cochlear implant.

Monaural Headsets

Stethoscope Receiver

Receiver

Personal Hearing Aids

Some personal hearing aids and cochlear implants have built-in telecoils which can act as receivers where there is an induction loop system. Hearing aids with telecoils have switches that allow users to move between the aid's built-in microphone and the aid's telecoil. Once a personal device has been switched to the telecoil setting, the microphone is "off" and the user will only hear what is broadcast via the induction loop system. Users can also adjust the volume on their personal hearing devices.

Types of Coupling Devices

Coupling devices (like headphones) transmit sound from the user's receiver directly to the ear. Different people prefer and benefit from different types of coupling devices. A variety of coupling devices should be available so that visitors may choose the combination of receiver and coupling device that ensures maximum benefit from the ALS.

Monaural Earbuds

A single earbud that provides mono (one channel) sound. The earbud either covers or is inserted into one ear.

Binaural Earbuds/Headphones

Two earbuds that cover or are inserted into both ears. Binaural headphones can be mono (one channel) or stereo (two channels).

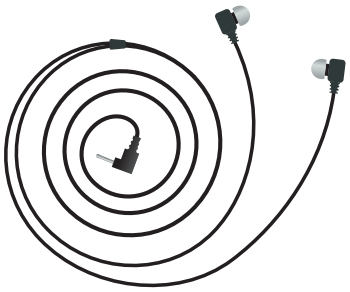
Induction Neckloops and Silhouettes

Induction neckloops or silhouettes are used only by a person whose hearing aid or cochlear implant speech processor has a built-in telecoil. When plugged into a receiver, these coupling devices generate a magnetic field that connects to the individual's hearing aid or speech processor via the telecoil. The neckloop is worn around the neck while the silhouette goes behind the person's ear, close to or touching the hearing aid or speech processor. In order to use the telecoil, most people will need to switch their hearing aid or speech processor from the microphone to the telecoil setting.

Personal Audio Cables and Cochlear Patch Cords

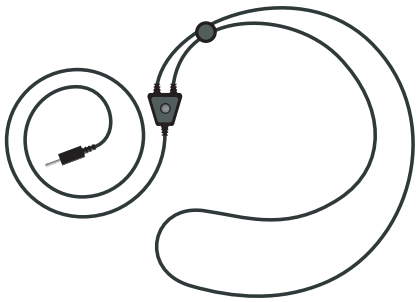
Some cochlear implants require the use of a personal audio cable or a cochlear patch cord to connect the receiver to a visitor's speech processor. This technology is not very common. Many cochlear implant users now have speech processors with built-in telecoils and can utilize the induction neckloop. If a visitor does bring his or her own personal audio cable, the cable should plug into a receiver via the 1/8-inch jack. Earbuds from other devices (e.g. phones and iPods) may also work. Individuals should be given the choice to use their own personal coupling devices whenever possible.

Earbuds



Headphones

Induction Neckloop



Part IV:
Assistive Listening Systems in Museums: Setting, Space and Program Considerations

In order to meet the ADA's obligations for effective communication and its Standards' requirements, various museum settings and programs may need different types of assistive listening systems. For example, a permanently installed infrared (IR) system may work best for a planetarium, while a portable radio frequency (RF) system may better suit a docent-led tour.

General Space and Program Considerations

Each type of assistive listening system has its pros and cons. In order to determine which system will work best for a particular space or program venue, the following questions should be considered:

- Does the space have many physical obstructions?
- Are there materials or other technologies in the space that might interfere with the ALS?
- How large is the assembly area?
- What is the expected capacity?
- How many performance spaces, theaters, and/or auditoriums are in the venue?
- How close together are the spaces, and what's the distance between exhibit elements with audio components?
- How many audio programs are within exhibits?
- Is the exhibit permanent or temporary?
- Is the program accessed through a handset?

- Does the program start when the visitor makes the selection or does the program loop continuously?
- Does the system need to be portable?
- Will the system need to work outdoors?
- Should the ALS have more than one channel so it can also serve other purposes (e.g., transmit audio description for visitors who are blind or have low vision?)

Before the final purchase of an assistive listening system, organizations may wish to invite the manufacturer to provide a demonstration in the space where the system will be used. Whenever possible, the system should be tested during a live event or in an existing exhibition where feedback can be solicited from people who use assistive listening services.

Location of the Transmitters or Radiator Panels and Physical Obstructions

When placing transmitters or panels for assistive listening systems, installers should consider the exhibit's sound design as well as any potential obstructions. Many exhibits employ sound in specific focused areas and receivers must be able to pick up signals in these areas. Building and/or exhibit materials and obstructions such as support pillars, walls, deeply recessed areas, or balcony overhangs can reduce the quality of system signals or block them entirely.

- **Radio Frequency (RF)** signals can travel in all directions and through physical obstructions, but the more objects that the signal has to pass through to reach the receiver, the more potential for distortion (much like the interference a tunnel can cause to the reception on a car radio). Positioning the transmitter or its antenna in front of the exhibit facing the user, can maximize reception. The use of additional transmitters or antennae can also improve signal quality in areas with large obstructions.
- **Infrared (IR)** radiator panels transmit the infrared light signal in one direction. Though IR signals can "bounce" off solid objects and walls, this diminishes the strength of the signal. Additional panels will minimize areas of poor reception in irregularly shaped spaces or spaces with lots of obstructed areas. A sound technician/contractor experienced with infrared systems can maximize the coverage by a panel and determine exactly how many will be needed to cover a specific area.
- **Induction Loop** systems generate a magnetic field using cables that circle the space. Loops can be installed during construction; mounted overhead or under a flooring surface (like carpet). Signals can be directed and controlled, depending on the installation and strength of the system. The system's magnetic field is subject to spillover and interference from other objects that create electromagnetic fields as well as certain building materials. Many issues can be mitigated with the help of a knowledgeable, professional, and experienced technician/contractor.

Size of the Assembly Area

Systems should suit the size of the assembly area.

- Small RF transmitters are adequate for use in classrooms and small meeting rooms if the receiver is never more than 25 to 30 feet from the transmitter. Large RF transmitters can cover anywhere from 200 to 500 feet and the signal strength can be increased with the use of a more powerful antenna.
- Infrared radiator panels come in several sizes. A knowledgeable person can determine the size and quantity of radiators necessary to cover a performance space adequately.
- A single small room may be easily covered by one loop, but larger spaces will require multiple or a phased array of loops in order to ensure adequate coverage. The placement of induction loop cables can be very complex, therefore installation must be done by a professional.

Possible Interference

All three systems—RF, IR and induction loop—may experience interference from materials or objects built into or used in the space:

- RF systems can pick up other RF transmissions if the channels or frequencies are close to one another on the spectrum of potential channels and frequencies.
- IR systems are subject to interference from other devices that generate infrared signals, and are less effective in environments that are brightly lit with natural or fluorescent light, although newer systems are being designed to overcome this problem.
- Induction loop signals experience interference from objects made of metal such as supports in reinforced concrete, mesh, metal frames, or suspended ceilings, as well as the presence of other magnetic fields such as those found in electric motors, electric generators and transformers, electric musical instruments, sound boards, and TV/video cable.

Multiple Spaces

When multiple spaces within the same building require assistive listening systems, the proximity of those spaces and the possibility of sound bleed must be considered.

- RF signals will go through walls and other obstructions, so ALS users could find themselves listening to the wrong program. That scenario can be avoided with the use of a multi-channel RF system where each space is assigned a different frequency or channel. If privacy is an issue, RF systems are not recommended.
- IR signals will not go through walls, so there will be no interference between adjacent spaces using the same system.
- Induction loop signals used in close proximity of one another in the same space or venue can overlap and bleed into one another, causing visitors to hear multiple signals simultaneously. Proper installation can minimize sound bleed. Installing loops on several different floors can be challenging, depending on the venue's construction materials (e.g. reinforced concrete floors), and other spatial considerations, like floor-to-floor separation (i.e. the room height). Proper installation by an experienced technician can mitigate most issues.

Portability

Some systems are designed to move easily between spaces, while others are typically designed for permanent installation but can potentially be repositioned in other venues.

- RF systems are the most portable and are easily carried by tour leaders or docents.
- IR systems may be moved* to different venues, but a technician must verify that panels are positioned correctly in the new spaces.
- Loop systems, like IR systems, may be moved* by a professional who will ensure proper placement of the loops in the new space.

* Though technically portable, IR and loop systems must be installed, i.e. tour leaders cannot carry them from space to space.

As technology advances, other portable assistive listening devices become available. As of this date, potentially helpful personal devices include "Pocket Talkers" and clipboards with built-in induction loops. Organizations considering portable systems should thoroughly investigate all options. Manufacturers of assistive technology can offer consultations.

Multi-Channel Usage

Multi-channel systems allow one system to be used simultaneously for more than one purpose. Organizations that offer services such as audio description or simultaneous translation should consider investing in a multi-channel system. While these systems tend to be more expensive and require receivers with switches for channel changing, a multi-channel system may cost less than two completely separate systems. Both RF and IR systems are available as single- or multi-channel systems. Induction loops are single channel only.

When using multi-channel systems in exhibit environments, organizations must assign different channels to different programs (regardless of whether the programs are in the same room). In this situation, visitors must change channels between programs, and that information needs to be conveyed to the users, either verbally or through signage.

Resources:

Large Area Assistive Listening Systems: Review and Recommendations, The US Access Board, http://www.access-board.gov/research/completed-research/large-area-assistive-listening-systems

Demystifying Hearing Assistance Technology: A guide for service providers and consumers (2007). PEPNet West, National Center on Deafness, California State University, Northridge, www.pepnet.org/resources/demystifying

Different Types of Assistive Listening Systems: A Comparison

Radio Frequency (RF) System/FM System

Space Considerations

Signal travels through walls?	Yes. Can be resolved with a multi-channel system with different frequencies assigned to different spaces.
Physical obstructions?	Signal can go through physical obstructions, but proper placement of transmitters is important.
Size of space?	Small RF transmitters: 25 to 30 feet. Large transmitters: 200 to 500 feet, further with more powerful antenna.
Interference?	Radio signals

Usage Considerations

Portable?	Yes.
Outdoor Use?	Yes.
Additional Use/Multi Channels?	Yes.

Infrared (IR) System

Space Considerations

Signal travels through walls?	No.
Physical obstructions?	Signal is blocked by physical obstructions.
Size of space?	The larger the venue, the more panels required.
Interference?	Infrared signals, bright light (natural and fluorescent)

Usage Considerations

Portable?	No. The equipment can be moved from one location to another, but a technician will need to make sure the system works properly. It is not designed to be used on a tour.
Outdoor Use?	Yes.
Additional Use/Multi Channels?	No.

Induction Loop System

Space Considerations

Signal travels through walls?	Yes, but minimized with proper installation.
Physical obstructions?	Though building materials can interfere with reception, proper installation by a professional can mitigate most issues.
Size of space?	Large spaces require a phased array of loops.
Interference?	Other magnetic fields, objects made of metal.

Usage Considerations

Portable?	No. Though the equipment can be moved from one location to another, it is often installed under carpeting or in the ceiling. If moved, a technician will need to make sure the system works properly. It is not generally designed to be used for tours.
Outdoor Use?	Yes.
Additional Use/Multi Channels?	No.

ALS Use and Considerations in:

Auditoriums, Classrooms, Lecture Halls, and Theaters

Like other museum spaces, auditoriums and theaters must also be accessible to visitors with hearing loss. Specific requirements pertaining to assistive listening systems in theaters, auditoriums and assembly areas can be found in Legal Obligations, page 5, and are covered in detail in *Assistive Listening Devices for People with Hearing Loss: A Guide to Performing Arts Settings*.

Meeting Rooms

In addition to fulfilling visitor needs, museums should also ensure effective communication for staff and for individuals attending meetings. A portable RF system can be easily transported to any meeting location. Organizations could also permanently install an induction loop, infrared or RF system in an oft-used meeting room.

Best Practice: When purchasing assistive listening systems for meetings, consider buying additional wireless microphones. Extra microphones can make it easier for attendees to participate in meetings and can also enhance community engagement during interactive programs such as Q&A sessions.

Outdoor Programs and Festivals

When choosing the type of assistive listening system for an outdoor event, consider the following:

- Infrared systems are usually ineffective outside due to interference from sunlight, but both loop and RF systems can be used outdoors.
- Loop systems can be installed under a floor mat or temporary audience platform, or above a seating area.
- In larger spaces or difficult-to-loop areas, it may be easier to use a radio frequency system.
- Radio frequency systems are the most portable, as the entire system (receivers, microphones and transmitter) can be easily moved.

As always, proper installation is key to the effectiveness of any assistive listening system. Regardless of the type of system, organizations should ensure that no other features of the space (e.g. physical barriers) or technologies being used (e.g. other RF signals) will cause interference.

Guidelines for assembly areas, page 7, can be used when determining the number of receivers for outdoor events.

Best Practice: Check assistive listening systems daily during outdoor events to ensure that they are in proper working order.

Docent-led Tours

Small, convenient, and easy to use, portable RF systems are the best choice for tours that lead visitors from space to space. When using an RF system, a docent speaks into a microphone attached to a small transmitter, while visitors use headsets or neckloops attached to receivers, usually worn around the neck or carried in a pocket.

In large and noisy exhibition spaces (including outdoor areas), RF systems may be helpful to all visitors, not only those who have hearing loss. Visitors using the assistive listening system will hear the docent over any ambient or background noises and docents will not have to shout to be heard.

If a tour stays within a single space, loop and infrared systems may also be effective.

Exhibition Spaces

Many exhibits include ambient soundtracks, voiceovers, videos, interactive activities, and demonstrations. These auditory aspects are not only integral to the exhibits, but to the entire museum experience, and should be accessible to all.

It is essential (and cost-effective) to incorporate accessibility into the exhibition design process. When deciding upon placement and use of assistive listening devices within an exhibit, designers must consider the number, type, and location of audio experiences. Spaces with many competing sounds can distract and confuse visitors, even those without hearing loss. Multiple channel systems may be useful in exhibits with competing audio experiences, but care must be taken to ensure visitors know which channel to use as they move through the space.

Options for:

- **Exhibits with separate audio experiences in several different rooms:**

  Infrared systems require either a separation between the rooms or walls between exhibits that can block the signals. Radio frequency systems need to be multi-channel, with separate channels used for each room, and notices posted for visitors as to which channel is in use. Loops need to be focused or far enough apart that signals do not interfere with each other.

- **Exhibits with multiple audio experiences within the same space:**

  - Infrared systems need narrowly targeted emitters that send very localized signals.
  - Loop systems must be properly spaced to prevent sound interference and overlap. The space between loops should be at least twice the longest side of each loop. For example, if there are two loops, each measuring four feet by four feet, there should be at least eight feet between the two loops.
  - Visitors accessing a multi-channel system may be able to change channels between exhibits, but the ease of switching channels will vary depending on the brand and style of the receiver. Venues must tell visitors which channels to use in the different spaces or at each exhibit element.
  - When audio experiences are close to one another, hardwired systems may prove a good way to deliver audio content to all visitors while controlling sound bleed, since handsets or headphones used with the system can provide a direct feed from the sound source. If used, each handset/headphone must have built-in volume control, hearing aid compatibility, and the capability for the user to reset volume at the beginning of the program.
  - Museums may use assistive listening systems, captions, exhibit text descriptions*, or scripts to provide effective communication.

* Exhibit text descriptions may help to provide information about ambient sounds (e.g. bird calls) within an exhibit.

Best Practice: Provide assistive listening for all audio programs. Depending on the nature of the program, also consider providing scripts or captions for people who prefer to read the information.

Resource

Accessible Temporary Events, A Planning Guide (2002)* contains a wealth of information regarding the logistics of accessibility at temporary events, as well as general accessibility-related information. The booklet was produced by The Center for Universal Design, College of Design, North Carolina State University for the Southeast Disability and Business Technical Assistance Center under a grant from the National Institute on Disability and Rehabilitation Research. It is available online at http://dhs.sd.gov/accessibility/documents/Accessible Temporary Events Planning Guide.pdf

* New regulations have been issued since publication of Accessible Temporary Events. Users should check any specific requirements against the 2010 Standards for Accessible Design or contact the Department of Justice ADA Information Line or the U.S. Access Board with any questions.

Part V:
Maintaining, Distributing and Administering an ALS Program

Assistive listening systems are only effective when visitors can easily access well-maintained receivers. Organizations need to maintain quality and effectiveness by planning for maintenance, establishing an effective distribution system, and training staff on a regular basis.

Quality and Effectiveness

Assistive Listening Systems work by reducing or eliminating ambient noise and negating the effect of distance. The way sound is fed into the system has a significant impact on the quality and effectiveness of the ALS. The farther the microphone is from the sound source, the more distorted the sound becomes. Microphones pick up ambient noise like the sound of heating and cooling fans, the rustling of audience members, and the hum of lighting equipment—all of which can be transmitted to the ALS. For best sound quality, organizations should invest in a top-quality directional microphone and/or place the microphones on or as close to the audio source as possible. For videos or exhibitions, the assistive listening system should be connected directly to the sound source, as microphones in the environment will pick up ambient noise.

Maintenance

Cleaning the Equipment

Keeping the earphones and earbuds (the parts that go in or over the ears) clean is important for health and safety. Many earbuds are made of hard plastic that can be carefully sanitized, or have disposable rubber or foam covers that can simply be replaced after each use. Proper cleaning instructions are typically available from the devices' manufacturer.

For hygiene reasons, some visitors may prefer to use their own earphones and earbuds. This should pose no difficulty as long as the plug on the visitor's earphones fits the receiver.

Storage

Equipment should be kept in a dry, temperate, protected, and dust-free place. Receivers and coupling devices should be stored in such a way that wires do not get twisted and mangled. Some receivers can be purchased with storage cases, some of which double as chargers.

Best Practice: During any renovation (including carpet or seat replacement), make sure all parties involved are aware of the placement of ALS systems, so that contractors don't inadvertently cut wires or cables or damage panels.

Maintaining Batteries

Batteries, the power supply for all receivers and some small portable ALS transmitters, are a commonly ignored but essential component of a well-functioning assistive listening system. In order to keep the system functioning smoothly, staff should understand how different types of batteries work.

- **Non-Rechargeable Batteries**

  This type of battery, also known as an alkaline battery, is often used for household items like flashlights and toys. Though these batteries are readily available, they normally cannot be recharged. They are useless once discharged and must be disposed of. Not all ALSs can use non-rechargeable batteries.

- **Rechargeable Batteries**

  Nickel-cadmium batteries (NiCad or Ni-Cd.) are commonly used to power receivers and small portable ALS transmitters. These rechargeable batteries cost more than alkaline batteries and require specialized recharging units, but do not need to be replaced as frequently.

Tips for Handling and Maintaining Rechargeable Batteries:

- **Know what type of battery your devices use.** Rechargeable batteries may be NiCad, NiMH or Li-Ion, all of which have different charging needs. Refer to your owner's manual for charging tips, and don't switch types of batteries unless your device is especially configured to accept more than one type of battery.
- **Don't store different types of batteries together.** Don't mix rechargeable with single charge batteries, or store old ones with new ones. Improper use could cause leakage or rupture.
- **Make sure to buy a charger that's compatible with the type of batteries you plan to use.**
- **Handle the batteries carefully, and keep away from fire or extreme heat.**
- **Remember that rechargeable batteries may self-discharge during storage.** Check batteries to ensure they are sufficiently charged before use.
- **Extend battery life by:**
  - Storing and charging batteries at room temperature (a cool dry place is best).
  - Removing batteries from the charger as soon as they are fully charged.
  - Charging batteries at least every 6-9 months.
  - Keeping battery contact surfaces clean. Rub a clean pencil eraser, cloth, or rubbing alcohol across the surface of batteries to clean them.

Developing a Distribution System

An effective distribution system is an essential element of any ALS program. Organizations can create a simple, efficient system by using the following checklist:

Decide where receivers will be kept and who will distribute them.

Are receivers kept and distributed at the ticketing window? Do volunteers or staff hand them out from an information booth? Are docents in charge of distributing portable receivers for tours? Think about where your visitors use receivers and choose a distribution location that is convenient and clearly designated with signage. If you have a large facility or use receivers for different purposes (i.e. a permanent system for a theater and a portable one for walking tours), you may want to consider distributing receivers from more than one location.

Consider developing a system to track the devices.

Some organizations place discreet numbered labels or other identifying markers on each receiver, enabling staff to identify which receiver is given to which visitor. This can greatly simplify the process of locating equipment should it go missing, and can also serve as a means to track technical problems, maintenance, and repairs. Organizations should be sure to designate a staff person to be responsible for tracking the equipment.

Decide whether to collect collateral from visitors.

Though organizations are never allowed to charge visitors to use the receivers, they can collect some form of collateral in an effort to ensure that equipment is returned. Many require visitors to leave some form of valid identification (such as a driver's license or other ID with the visitor's name on it) in exchange for the receiver. If IDs or other collateral are collected, every precaution should be taken to ensure that these are secured and not vulnerable to theft.

Some museums do not want the responsibility of holding IDs and instead collect visitors' names and phone numbers. In the event that a receiver is not returned, museum staff can then contact the responsible party.

Determine specific steps for distributing equipment.

Figure out step by step how the equipment is to be distributed. Write simple instructions and troubleshooting tips for the staff and/or volunteers who are responsible for distributing the equipment. The process should include the following:

1. **Turn the system on.**

   Make sure the assistive listening system is turned on at its source.

2. **Set up the receivers.**

   Insert batteries and, if necessary, plug a headphone or earbud into the receiver. If using a multichannel system, check that each receiver is set to the appropriate channel.

3. Test the receivers.

Always make sure each receiver is working before it is given to a visitor! There are several ways to test the equipment:

Play a recording in the auditorium over the assistive listening system. Bring the receivers into the space and listen to each to be sure that they are working properly.

Purchase a small induction loop system, IR radiator panel, or RF transmitter on the same frequency as the radiators and transmitter in the auditorium and connect it to a radio or other audio feed where the receivers are distributed. This is useful if the distribution site is at a distance from the space where the receiver will be used, as it will allow the visitor to test the receiver before using it.

Troubleshooting:

If the receiver is not working, check the following:

- Make sure the coupling device is plugged firmly into the receiver by pushing the jack in until it clicks.
- Turn up the volume on the receiver.
- Make sure the battery is firmly in place.
- Replace the battery.
- Replace the coupling device (headphone, earbud, neckloop) or receiver.
- If using a multi-channel system, make sure the device is tuned to the correct channel.

If the device still is not functioning after all of the above, or if none of the receivers seem to work, confirm that the system has been turned on at its source.

4. Distribute the receivers.

Ask each visitor what type of headphone or coupling device is preferred. Hand the receivers out to visitors, collecting collateral or taking down information as determined by your tracking system.

5. Explain how to use the receiver.

Go over everything the visitor needs to know, including what should not be touched or changed.

- The headphone, earbud or neckloop must be firmly plugged into the receiver.
- The receiver must be turned on and the volume adjusted to the level the visitor finds comfortable. If an induction loop system is in place and the visitor is using his or her own personal hearing device with a telecoil as the receiver, the visitor must control the volume using his or her personal hearing device.
- When distributing a multichannel receiver, instruct visitors not to change the channel. Tell them the correct setting in case they inadvertently do so.
- Give visitors tips on how to maintain the best reception:
  - For RF receivers, the wire leading from the receiver to the earpiece acts as the antenna. The straighter and less tangled this is, the better the reception.
  - For IR receivers, the glass "eye" must be facing the sound source; not turned around towards the visitor's chest, or blocked by clothing, hair, hands or printed materials, such as programs.
  - When using induction loops, individuals may be able to make adjustments on their personal hearing devices.
- Ask visitors to avoid jiggling, squeezing, or dropping the receivers. Tell them to make sure that all connections are tight for best reception.
- Tell visitors who to contact in the event of problems, and how and where to return the equipment at the end of their visit.

6. Be available to provide assistance.

Make sure that visitors know who to contact in case there are any issues with their receivers. Exchange any faulty receivers for ones that have been carefully checked. Make a note and tell appropriate staff what was reported to be wrong with the receiver.

7. Collect equipment, take inventory and follow up on missing or malfunctioning equipment.

Make sure someone is available at the distribution area to collect receivers and headphones or other coupling devices. In the event that receivers are not returned, provide a means for the distributor to inform the staff person responsible for tracking down wayward receivers and coupling devices. Provide forms for reporting faulty and/or missing equipment.

As visitors return receivers, ask if there were any problems. If there were, note the specific problem and be sure this information gets to the appropriate staff. Tracking this information can help staff identify whether there is a problem with the individual receiver or with the system. Staff will then know to check, repair or replace the receiver, or to check, realign or repair the system's radiator panels, cables or transmitters. Consistent complaints from a specific area may indicate a problem with transmitters: e.g. an IR radiator panel may be knocked out of focus, the RF signal may be blocked, or the induction loop cable may be disconnected.

Staff Training

Once a distribution plan has been created, staff must be trained to follow the procedures. Training should include all staff and volunteers who work with the assistive listening system, distribute receivers, or answer questions from the general public. Organizations should offer training on a regular basis to keep staff and volunteers familiar with the system.

Best Practice: Create pictograms that help staff and volunteers see how parts of an assistive listening system fit together. For example, a picture may show a headphone and a receiver, with an arrow illustrating how the two connect. Keep pictograms in cases for receivers and portable systems.

Technical Staff

Technical staff needs to understand how the system works. They need to know how to turn the system on, how to feed the sound into the system, how to mix the sound appropriately, and where the transmitter, cables, or radiators are located. When using a multichannel system for different purposes simultaneously, such as assistive listening and audio description, technical staff must know how to operate the system so that the correct audio feed is broadcast on the correct channel.

Staff or Volunteers Who Work with Visitors

All staff and volunteers who deal directly with the public should receive training. Everyone needs to know enough to answer a few basic questions, including the fact that the facility does have an assistive listening system, what type of system (RF, IR, or Induction loop) is installed, where visitors can pick up receivers, and which staff member(s) can answer more specific questions.

Staff or Volunteers Distributing the Equipment

Staff or volunteers responsible for distributing the receivers need more intensive training so they can directly assist visitors. They need to know how the system works, what receivers and coupling devices will work best given a visitor's personal hearing device, how to explain the equipment to the visitor, and the procedures for distributing and maintaining the equipment. If using a multichannel system, staff must know which channel is used for assistive listening and which is used for other programs, as well as when those other programs are offered. Staff should also receive training on basic courtesy and disability etiquette.

Tips for Interacting with Visitors who are Deaf or Have Hearing Loss:)*

- People who are deaf or have hearing loss are visitors first! Treat them with a smile and the good customer service you extend to every one of your visitors.
- Speak clearly in a comfortable tone of voice. Don't exaggerate or shout.
- Get a person's attention before speaking by waving your hand, tapping his or her shoulder, or flashing the lights.
- Keep sentences short and be flexible with language. If the person is having difficulty understanding you, rephrase your sentence or write it down.
- Provide a clear view of your face and keep the light source on it. Don't hide your mouth with your hands, turn your head away or down, or turn your back to the person.
- Be a lively speaker. Use facial expressions that match your tone of voice, and use gestures and body movement to communicate.

* This list is compiled from several sources.

The VSA and Accessibility Office at the John F. Kennedy Center for the Performing Arts offers tipsheets and other resources that may aid in staff training. Check out www.kennedy-center.org/accessibility/education/lead/resources.html for the latest offerings and updates. Resources are also available at www.ada.gov/reachingout/intro1.htm.

Part VI:
Directory of Manufacturers

The following is a list of manufacturers who make assistive listening systems that are used in facilities and venues like classrooms, museums, or theaters. Manufacturers have lists of local vendors who can sell, install, and help maintain the equipment. Knowledgeable sound engineers or other professionals familiar with ALSs should always be involved in installation or consultation. Poor or improper installation of the equipment can render it useless.

Disclaimer: This is not a comprehensive list nor does inclusion on this list imply any kind of endorsement of the company or product.

Audex (IR)
710 Standard Street
Longview, TX 75604
(800) 237-0716
www.audex.com

Comtek (RF)
357 West 2700 South
Salt Lake City, UT 84115
(800) 496-3463
sales@comtek.com
www.comtek.com

Listen Technologies Corporation (RF and IR)
14912 Heritagecrest Way
Bluffdale, UT 84070
(800) 330-0891
info@listentech.com
www.listentech.com

Oval Window Audio (IL)
33 Wildflower Court
Nederland, CO 80466
(303) 447-3607 Voice/TTY
info@ovalwindowaudio.com
www.ovalwindowaudio.com

Sennheiser Electronic Corp. (RF and IR)
1 Enterprise Drive
Old Lyme, CT 06371
(877) 736-6434
www.sennheiserusa.com

Telex Communications, Inc. (RF)
12000 Portland Avenue South
Burnsville, MN 55337
(800) 392-3497
www.telex.com

USL, Inc. (IR)
181 Bonetti Drive
San Luis Obispo, CA 93401
(805) 549-0161
usl@uslinc.com
www.uslinc.com

Williams Sound Corp. (RF and IR)
10300 Valley View Road
Eden Prairie, MN 55344
(800) 328-6190
info@williamssound.com
www.williamssound.com

Credits

This booklet was produced in 2016 by the John F. Kennedy Center for the Performing Arts, Office of VSA and Accessibility under the direction of:

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Special thanks to Darcylen Darling and Avery Burns

Funding for Access and Accommodation Programs at the Kennedy Center is provided by the U.S. Department of Education.

Kennedy Center education and related artistic programming is made possible through the generosity of the National Committee for the Performing Arts and the President's Advisory Committee on the Arts.

The Office of VSA and Accessibility is a
Jean Kennedy Smith Arts and Disability Program

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