HANDBOOK ON BEST PRACTICES FOR USING VIDEO TELECONFERENCING IN ADJUDICATORY HEARINGS

December 22, 2015

This handbook was prepared for the Administrative Conference of the United States. The opinions, views, and recommendations expressed are those of the authors and do not necessarily reflect those of the members of the Conference or its committees, except where formal recommendations of the Conference are cited.

ABOUT THE ADMINISTRATIVE CONFERENCE OF THE UNITED STATES

The Administrative Conference is an independent federal agency dedicated to improving the fairness, efficiency, and effectiveness of federal agency processes and practices through consensus-driven applied research. The Conference is a public-private partnership whose members include: the Chairman and 10 other presidential appointees, who comprise the Council; 50 senior government officials drawn from federal agencies, boards, and commissions; and 40 public members drawn from the private sector, including academia, who reflect a wide diversity of views and backgrounds. The work of the Conference is also supported by a small, full-time staff in the Office of the Chairman.

To fulfill its mission, the Conference and its staff perform a variety of functions. One of the chief activities of the Conference is conducting research that, in turn, serves as the foundation for identifying best practices and issuing formal recommendations to agencies, Congress, and the Judicial Conference. These recommendations have addressed a wide variety of administrative and regulatory issues, from the Conference's seminal work developing a practical framework to advance the use of alternative dispute resolution by federal agencies, to more recent efforts aimed at e-Rulemaking, video hearings, and other innovative agency practices. Since its inception in 1968, the Conference has issued over 200 such recommendations—several of which Congress has enacted into law, and numerous others of which have been followed by agencies and courts.

The Conference also serves as a central resource for agencies, as well as other federal officials, by providing nonpartisan, expert advice and publishing reference guides on administrative procedural or regulatory topics. Conference staff also engages in extensive outreach by, for example, appearing as speakers and conducting workshops and fora (often in collaboration with other federal agencies or private sector groups) to promote best practices or further the implementation of its recommendations.

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INTRODUCTION

The Administrative Conference of the United States ("Administrative Conference" or "Conference") has been involved in helping identify best practices in agency video hearings for several years. In 2011, the Conference issued a recommendation on video hearings.[1] The recommendation, among other things, provided a number of legal, administrative, and budgetary criteria that agencies should examine when determining whether to begin using or expanding their use of video telecommunications.[2]

In 2014, the Conference reexamined video conferencing for hearings in order to provide practical guidance to agencies that want to implement such technology.[3] *Recommendation 2014-7, Best Practices for Using Video Teleconferencing for Hearings*, concluded by tasking the Office of the Chairman with creation of a handbook for agencies on the use of video hearings. This handbook is the implementation of that recommendation. As such, it aims to provide guidance and advice through concrete and practical recommendations detailing how agencies may implement or improve their use of video teleconferencing in adjudicatory hearings.

The task of identifying and developing best practices is not an easy one. The plans and procedures that work for one agency may not work for another. To some agencies, a hearing is a meeting to discuss the undisputed facts of a situation and find an acceptable conclusion based on those facts. In other agencies, the facts are disputed and the hearing is adversarial. Procedures that are appropriate to a Social Security benefits hearing may be ineffective in a Department of Labor "black lung" hearing. Due to this variance, this handbook will both suggest best practices for particular situations and explain the foundation for these suggestions. We hope this style of presentation will allow agencies to better understand the recommendations and modify them to fit their individual needs. Of course, while we believe that video telecommunications brings great promise to administrative law, it is like any technology. Sometimes, the best use of any technology may be not to use it. This handbook can assist agencies in determining what is best for them and how to effectively use technologies they determine to be helpful in the appropriate contexts.

The Administrative Conference retained the services of the Center for Legal and Court Technology ("CLCT"/Courtroom 21), located at Marshall-Wythe Law School at the College of William and Mary, to prepare this Handbook. CLCT is an entrepreneurial public service initiative of the William and Mary Law School, dedicated to advancing the efficient use of technology in the administration of justice, and is actively engaged in worldwide consulting on the design and implementation of appropriate technology in courtrooms and hearing rooms.

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[1] *See* Admin. Conf. of the U.S., Recommendation 2011-4, *Agency Use of Video Hearings: Best Practices and Possibilities for Expansion*, 76 Fed. Reg. 48,795 (Aug. 9, 2011), *available at* http://www.acus.gov/recommendation/agency-use-video-hearings-best-practices-and-possibilities-expansion.

[2] The term video telecommunications is the technical term for what is commonly referred to as video conferencing or video hearings. The three terms are used interchangeably throughout this handbook.

[3] *See* Admin. Conf. of the U.S., Recommendation 2014-7, *Best Practices for Using Video Teleconferencing for Hearings*, 79 Fed. Reg. 75,119 (Dec. 17, 2014), *available at* https://www.acus.gov/recommendation/best-practices-using-video-teleconferencing-hearings.

MAKING THE PROJECT A SUCCESS

One of the realities of the world of adjudication is that too many technology projects fail to meet the need for which they were created. The major reason for this is that most technology projects are not planned well enough to fully identify the need, and therefore miss the mark. Albert Einstein is credited with saying, "If I had one hour to save the world, I would spend 59 minutes defining the problem and one minute fixing it."

How do we fully plan a technology project? It begins with a methodology called the "5 Whys." You first name the problem and then keep asking "Why" until you have an answer that technology can meet. An example might be:

- ✓ Why are our hearings so backed up? – It is difficult to schedule and get all parties together.
- ✓ Why is it so difficult? – Our adjudicators have to travel to the location and with travel time and delays, the number of cases they can hear is limited.
- ✓ Why do the adjudicators have to travel? – The adjudicator is in Washington, D.C., but the people they serve are not.
- ✓ Why can't we reduce or eliminate travel time and delays? – We can through use of video conferencing.
- ✓ Why don't we do that? – The answer to this is often because we never have or we are uncomfortable with it.

This example demonstrates the process and can be adapted for any problem solving exercise.

Is technology the answer? The answer is yes, no, or maybe. There are situations where technology is the answer. If the problem is traveling, then remote hearings via video can eliminate the problem. If the problem is sharing a case load with another office, then again remote hearings via video are an option. If distance and case sharing are not the issues and the people involved are all local, then video conferencing might not offer an advantage. Only the individual agency can evaluate the need and determine what will meet that need.

Once the need has been determined, the next step is to plan the project implementation. A number of questions need to be asked and answered before buying the technology, including:

- ✓ How will this effect existing work flow?
- ✓ What are our clear goals?
- ✓ What are the priorities for this project?

- ✓ What is the downside of this project?
- ✓ Who are all the stakeholders and have they been given the opportunity to voice their opinions?
- ✓ Have these opinions been taken into account in setting the project parameters and goals?
- ✓ Do we have all the resources to fully implement the project?
- ✓ Do we have a clear leadership plan for the project?
- ✓ How does this affect our 5-year / 10-year plans?
- ✓ How will we sustain and support the project?

Although there may be many other questions to be asked, these provide a sample of what needs to be determined before implementing a technological solution. Most of the work is setting the course by defining the need and planning the project.

The next step is to install the equipment and prepare to use it. During this phase, it is critical to communicate with all parties involved. It is normal to have to make adjustments to the scope of a project at this time. Any alterations should move toward the defined project result. Too many projects have had the final result changed by decisions made during installation. **It is imperative to keep the focus on the desired end result throughout installation in order to meet the goal and answer the need that started the project.**

TECHNOLOGICAL PLATFORMS

In order to better understand the benefits of video telecommunications, it is important to understand what video telecommunications are and how the technology works. The following is a brief description of the technology, the various components of a video telecommunications system, and several issues that arise with the use of these systems.

A. What is Video Conferencing?

The term "video conference" refers to the use of video and audio transmission devices which allow people in different physical locations to communicate by seeing and hearing each other. Since people communicate through their facial expressions and body language as well as through their words, video conferencing gives the user the ability to interact with another just as they would in person, while also taking advantage of the benefits of remote communication.

Picture courtesy of Polycom

In the past, there were problems with different manufacturers' equipment communicating with outside equipment, but today, under current telecommunications standards, these diverse systems can now communicate with just each other. The International Telecommunications Union is responsible for generating worldwide "recommendations" for telecommunications. The H.3xx series are recommended for video conferencing and include the protocols for coding audio and video, multiplexing, signaling, and control.

Type	Description
H.320 Narrow-band V/C over circuit-switched network	This is an umbrella type recommendation for sending multimedia (audio/video/data) over Integrated Services Digital Network (ISDN) based networks.
H.321 Narrow-band V/C over Asynchronous Transfer Mode ("ATM")	An ATM network is designed to carry a complete range of telecommunications and computer data networks over a managed switch system. The network is designed to handle high data packets as well as voice and video data.
H.323 Narrow-band V/C over non-guaranteed quality-of-service packet networks (Internet)	A packet service network is a type of data network that groups all transmitted data (regardless of content, type, or structure) into blocks or data, called packets.
H.324 Very narrow-band V/C over the general (dial-up) telephone network	This type of communications uses regular analog telephone lines.

These standards make it possible to call any other system that has the ability to communicate on the same standard, thus making video conferencing simpler and more reliable. In many respects, a video conference call today is no harder to make than a telephone call.

In order to understand how a video conference system works, one must be able to recognize the parts of a video conference system and understand their respective functions. The parts of a video telecommunications system include:

- A **codec** is a device capable of encoding or decoding a digital data stream and is the "heart" of a video telecommunications system. The word codec is a combination of "compressor/de-compressor" and "coder-decoder." This device converts the audio and video signals into a digital signal, which is in turn transmitted to the far-end. For example, a codec converts the audio and video signals from an adjudicator's hearing room into a digital signal that is transmitted to a party's location (i.e., the far-end). The codec at the far-end converts that digital signal back into audio and video signals for display. Some video telecommunications systems use a piece of hardware for this function, while other systems use software on a computer. Both methods accomplish the same goal.

- A **camera** is a device that captures images in the room. The camera is the eye of the system. If it cannot see the object, the transmitted image is poor or non-existent. Cameras have a movable lens (zoom) and a sensor. This sensor, a charge-coupled device, measures a light panel of tiny light-sensitive diodes called photosites. Each photosite measures the amount of light (photons) that hits a particular point, and translates this information into electrons (electrical charges). A brighter image is represented by a higher electrical charge, and a darker image is represented by a lower electrical charge. The camera also includes a housing that is capable of moving, referred to as tilt and pan, for vertical and horizontal movement.

- The video conference system includes at least one **display**. This is a device that shows the video image from the far-end of a video conference. Some system designs call for two displays; one to show the person (or persons) at the far-end and the second display to show video data or evidence that is being presented.

- **Microphones** are devices that capture the sound from either end during a conference. As the camera is the eye, the microphone is the ear; what the microphone cannot hear will not be transmitted.

- **Speakers** are the devices that project the sound from the other end of a conference. They can either be mounted on the displays or located in another form in the room.

It is important to remember that the video product is only as good as its weakest link. Having quality components and sufficient bandwidth (a measure of the rate of data transfer measured in bits per second) is the only way to guarantee a good video conference signal.

B. Methods of Transmission

The two most common methods of communication are through Integrated Services Digital Network ("ISDN") and Internet Protocol ("IP"). ISDN was the initial method of transmission and is essentially a telephone call type of connection. IP has become the universal standard for video conference and modern telephone communications due to ready availability of high bandwidth internet connections and low cost.

1. Integrated Services Digital Network

ISDN is a digital communications network providing transmission rates in multiples of 64kbits per second. Typically described as 2B + D, Basic Rate ISDN ("BRI") logically uses two 64kbits/sec data channels (B channels) and one 16kbits/sec signaling channel ("D channel"). ISDN is not the single global standard. Within Europe, EURO-ISDN is used almost exclusively. Some countries even have their own types of ISDN, all of which are based, to a varying degree, on ISDN. This is important because differences with various forms of ISDN communication cause many video telecommunication problems and should be kept in mind if conducting a video hearing with someone in another country.

ISDN cabling usually connects to the system using an 8-core straight-through cable which is terminated with an RJ–45 jack at each end. The cable is terminated so pins 1, 2, 7, and 8 are used by ISDN to provide a power source for ISDN devices such as ISDN telephones; pins 3, 4, 5, and 6 carry the transmit ("Tx"), and receive ("Rx") balanced pairs required for data communications.

2. Internet Protocol

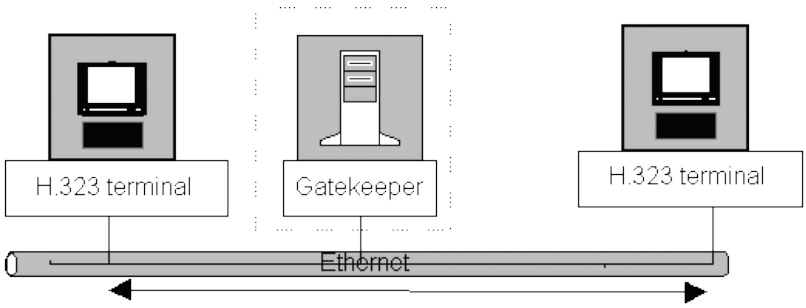
IP is the video transmission carried over normal internet infrastructure. The difference is the parts of the system that allow it to function. This standard is universal, allowing any device to easily communicate with other devices. The parts of an IP-based system are terminals, gatekeepers, gateways, and multipoint control units.

a. Terminals

The terminal is the transmitting and receiving component of a video conference system that supports video and audio. The transmitter includes a digital imaging and processing device (coder) and the receiving unit includes a data processing unit and a display generator (decoder). This is the codec's main function.

b. Gatekeepers

A gatekeeper is a component of H.323 that is responsible for managing other parts of an H.323 network. Gatekeepers are typically software products that reside on a server in the network. Their responsibilities include bandwidth management of incoming or outgoing calls, call admission to accept or deny calls, and zone management. The H.323 terminal must make use of the gatekeeper's services if the gatekeeper is present on the network.



c. Gateways

An H.323 gateway is required to perform the translation if there is a need for an H.323 terminal to communicate with another terminal on an H.320, H.324, or analog network. These components typically have ISDN and IP network connections and support the translation between these two networks. Typically, codecs have built-in gateways with minimal features.

d. Multipoint Control Units

The multiple control unit ("MCU") controls conferences between 3 or more terminals. The H.323 MCU may be a separate component or may be incorporated into a terminal.

C. Standard Definition vs. High Definition Video

Standard definition ("SD") video is the term for low resolution video. This is normally a resolution of 480 lines and produces a 4:3 aspect ratio. In simple terms, this is the television video we grew up watching.

High definition ("HD") video is a higher resolution than standard video and normally has a current resolution of 720 to 1080 lines of resolution and a 16:9 aspect ratio (wide screen). Again in simple terms, this is the television of today.

This difference is important because most current video conference systems are designed for high definition. The increased resolution provides much improved visual content and quality and so requires more bandwidth than a standard video conference.

D. Video Conference vs. TelePresence

Video conference equipment manufacturers have revamped their equipment lines and moved to HD video conferencing as a standard. The base models are referred to as HD video conference while the higher-end equipment is considered TelePresence. HD video conferencing uses high quality camera optics and digital audio/video to greatly enhance the quality of the picture and sound of the call. TelePresence refers to a set of technologies that are designed to make all participants feel as if they are present in the same room. TelePresence provides the users' senses with stimuli to simulate the feeling of presence in that other location through position, movements, actions, voice, and other stimuli. For example, if a adjudicator, representative, and party are in one room and a witness is at another location, the camera will move in order to focus on whoever is talking—the adjudicator, representative, or party—just as one would move one's head toward the speaker in person. The witness, though participating remotely, will have an experience similar to one he or she would have in person.

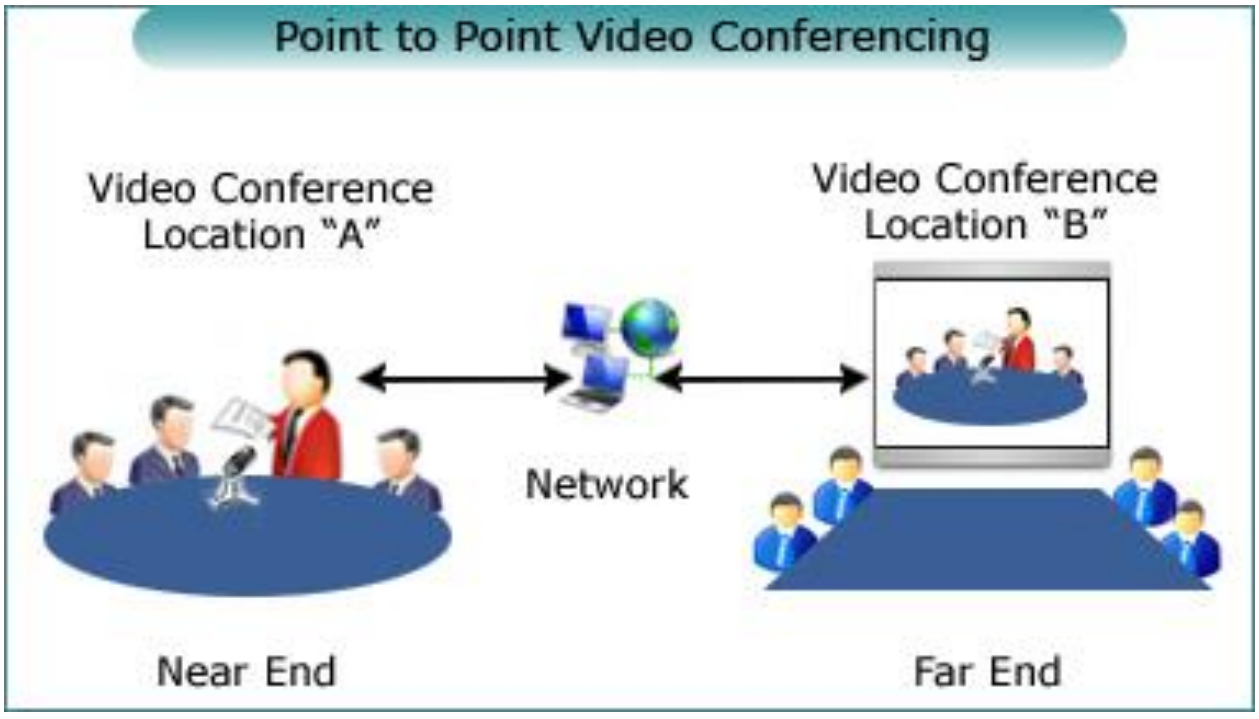
The major difference between HD video conference and TelePresence, is the technology involved within each method. With both video conference and TelePresence, the cameras have greatly improved in quality and performance, allowing the user to see the objects even more closely than if they were physically in the room. The audio electronics have also improved with better acoustic echo cancellation methods, vastly enhancing the sound quality on both ends of the conference. With TelePresence, multiple cameras in the room and highly advanced digital electronics provide the visual and audio stimuli that mimic actual presence within the room. If a person on the left speaks, the other images "turn" toward the speaker and the sound comes from the "left," just as if the person was in the same room. The room designs are developed to contribute to the experience.

Current generation video conference equipment is also less expensive than previous generations. The real cost increase is found in bandwidth. Basic HD video conference equipment requires a minimum of 1.2 megabits per second (Mbps) for a single point-to-point conference. To provide for a decentralized multi-point between four end-points (the normal capability for most systems) the bandwidth requirement would be four times greater than the bandwidth required for the "host" system (5 Mbps). This is quite a capacity

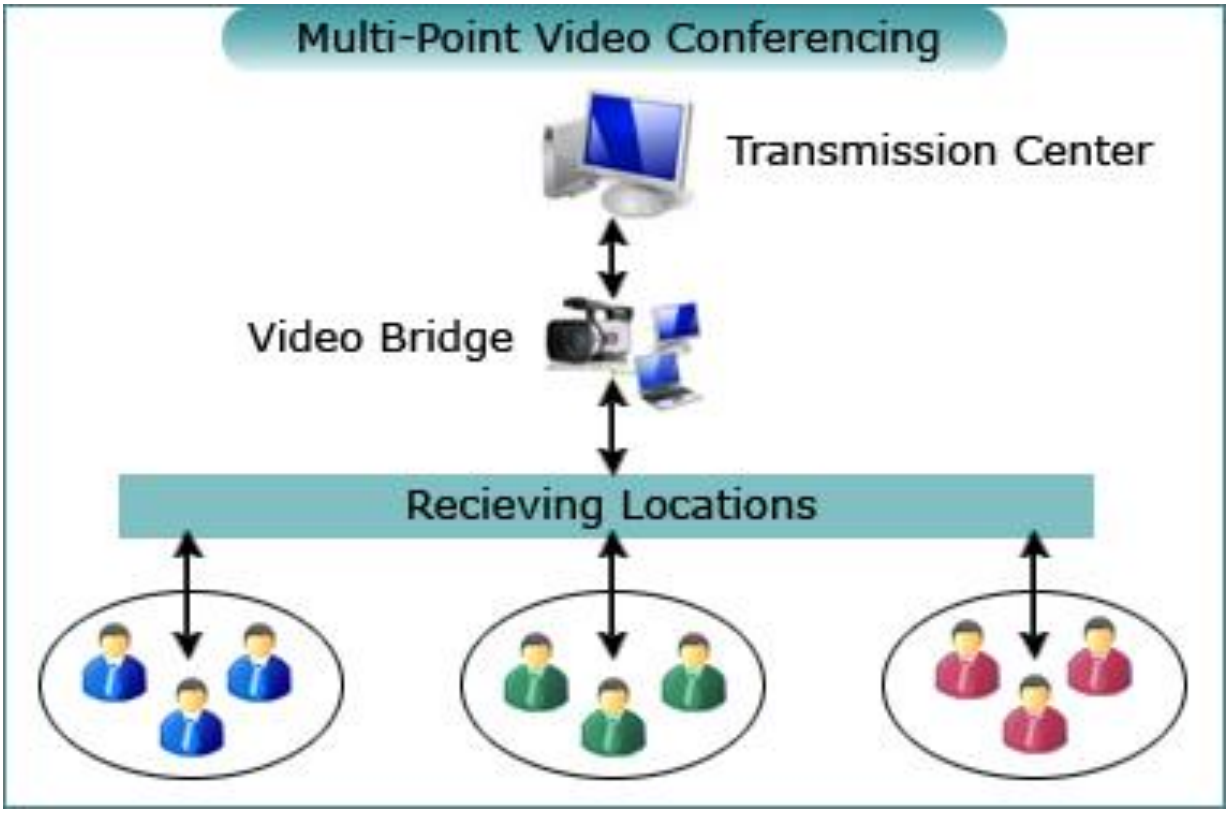
increase from the current 384 kilobit per second (Kbps) or 768 Kbps currently used by many government agencies, but it is critical to provide the quality of service needed in hearing rooms.

E. Point-to-Point vs. Multi-Point Calls

A point-to-point video call goes from one location to another location. It involves just two video conference systems. A multi-point video call is a call involving several locations and video systems. Most current video conference codecs can call three other locations using the MCU built into the codec. In order to connect to more locations, an outside bridge must be used. A bridge is simply a larger MCU that can connect multiple locations and networks.



Multi-point calls also require more bandwidth. If a point-to-point call requires 1.2 Mbps, then a four-point call requires a bandwidth of 5 Mbps to maintain the same quality.



Some federal agencies require all calls to go through their bridge. This is mainly for security purposes. While security is important, this method can cause quality issues and transmission delays. It can also create scheduling issues and delays if there is too much traffic on the bridge.

F. Choosing the Correct Equipment

There is a wide variety of video telecommunications equipment available today. Systems range from tablets to complex multi-camera installed TelePresence systems with multiple screens. When selecting the appropriate equipment, one must first think about the type of proceeding the technology is meant to serve, as well as the desired result.

1. Video Screen

The first and perhaps most fundamental factor is the video screen. The screen must be large enough to see the video image clearly. If a single adjudicator needs to view a single video image, a small desktop display should be sufficient for this use. For example, one adjudicator had an issue with his display, complaining that the images were hard to see and he could not clearly see the party. Upon further discussion, it was learned that the image was a multi-view of four sites, which meant the adjudicator only had the party on a quarter of a 17" screen. While a multi-view image was inadequate, the adjudicator could see the image clearly on the full screen.

If a multi-view image is needed, then a larger screen is required. A basic rule of thumb is that the image should be close to life size. This would mean that, in a 300-500 square foot hearing room, a 50”-60” display would be required, to create the same size image as if the adjudicator were physically present in the room. Therefore, the agency should consider the video image and the room size before purchasing the displays or video systems.

2. Location

The second factor to consider is the location of people in the room. This determination is necessary to establish the camera sight-line and to ascertain the number of cameras required. When placing a camera in a room, the camera needs to face the person who is speaking. This set-up is imperative to promote good communication. When one person speaks to another in person, they make eye contact. With video, the camera must be placed where it will achieve the same result, which is why most manufacturers of video telecommunication systems place the camera on the monitor. This set-up becomes potentially tricky in a hearing room because many of the positions are at opposing angles. For example, a hearing room had recently installed a video system. The system was placed on a side wall so all people in the well could easily see the displays. The unit had a single camera which was aimed down the center of the room. When the adjudicator or attorney spoke, it appeared as if he were not looking directly at the person on the far-end. To address this kind of issue, the agency could add a second camera to provide for multiple angles. The agency could also have connected the camera control to the audio system to allow the camera to respond to whoever is speaking and pan between angles accordingly. Although the details may vary, the best practice is to analyze the room and the video camera shots before purchasing a system.

3. Audio System

A good audio system is also imperative. Concerns involving audio arise more frequently than any other concern. While all video telecommunications systems come with some form of microphone and speaker system, most are designed for a limited area. If working from one’s desk, the built-in system should be sufficient. However, in a hearing room, where multiple people sit in different locations and at different distances from the unit, the built-in system is insufficient. With the exception of a small room or office, most agency hearing rooms will require an audio system connected to the video telecommunications equipment.

Again, the best practice for audio is to analyze the room and provide microphones for each participant’s speaking location in the hearing room. Each microphone should be connected to an audio processing device that provides echo-cancellation to reduce echo and improve sound quality. The room should also provide sufficient speaker coverage so that all participants can clearly hear the person on the far-end of the video call. Normally, the speakers on the display are insufficient to cover any but a small room.

4. Recording System

When purchasing a video telecommunications system, it is also important to consider how the record is captured. Not all systems allow for audio output to a recording system. If the

agency uses an electronic form of record capture, the equipment must be designed to work with the room's audio system or, at minimum, to connect to the recording system. If the agency uses a court reporter (either stenographic or voice-writing) the video system must be configured so the reporter can clearly hear and see the video conference.

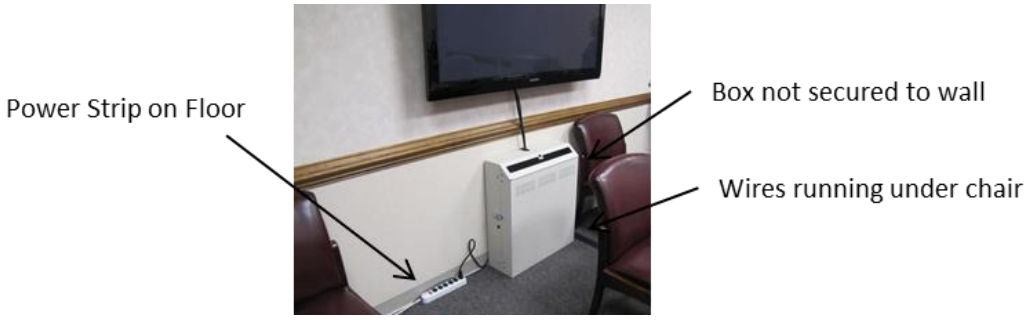
5. Codec

The "heart" of the video conference system is the codec. Most current codecs are designed for HD video transmission, which means they are capable of providing high quality video image when connected to a HD camera and display. Given the current video telecommunications industry standards, virtually any recently produced video conference codec can provide a more than sufficient video image. For example, many agency adjudicators spoke of poor quality video and fuzzy pictures. This is most likely not the codec's fault, but is attributable to another factor in the video transmission chain, such as low amounts of bandwidth. When selecting a system, usually the codec is matched to the other components. Deciding which codec to purchase will depend on how many other locations will be connected at one time (bridging), and whether the connection will involve ISDN and/or IP-based communications.

G. Implementation

Having the best equipment in the world does not guarantee success. How the equipment is installed and the bandwidth on which it will run are mission critical elements of making a useful and problem-free video telecommunications system. Installation of video telecommunications equipment involves correctly placing the equipment in the room and connecting it to the other audio and video systems (if any). Installation quality is both a performance and a safety issue.

Over the years, some installations have created problems for agencies. The installers failed to secure wiring or, in some cases, even equipment, to walls and other room structures. Wires were put in plastic cable covers and placed under parties' chairs. In one reported case, a person tripped on these wires, fell, and was injured. Obviously, loose wires that may be easily broken or disconnected can lead to technical failure. The lack of effort to secure the wires demonstrates poor quality installation practices. In the past, too many vendors used a "drop-and-run" installation method. Equipment was brought in and placed as quickly as possible with no standardization. For example, wall-mounted equipment was not secured to the wall, wires were placed on the floor in haphazard ways, and displays were placed or mounted in locations that did not allow proper personnel movement and passage space.



In order to prevent this, agencies should adopt installation standards requiring that all equipment and cabling be secured properly. Here is an example of such a standard provided by the Social Security Administration ("SSA"):

> Normal New Installation and Renovation Installation Standard:
>
> All wires and cables must be secured to millwork, tables, walls or other non-movable support materials. Under tables, they must be secured to the bottom of the table in a "cabled" manner that will not allow wires to hang down. If wiring has to cross a floor area, it must be routed to a low traffic area and covered with appropriate floor cable molding that is secured to the floor.
>
> All VTC cables will go up the wall, above the ceiling, and down the wall to the mixer. Under no circumstances shall any wiring cross under the client, representative, or expert area of the table(s).
>
> An Alternate Installation Standard**:**
>
> All wires and cables must be secured to millwork, tables, walls or other non-movable support materials. Under tables they must be secured to the bottom of the table in a "cabled" manner that will not allow wires to hang down. If wiring has to cross a floor area, it must be routed to a low traffic area and covered with appropriate floor cable molding that is secured to the floor.
>
> If all VTC cables cannot go up the wall, above the ceiling, and down the wall to the mixer, an alternate path is to follow the wall to the raised platform face and then follow that face to the Reporter area and then on to the mixing device. If this is done, the cables must be secured to the floor molding (or placed behind it) so that it is secure. Stick-on cable mounts are not acceptable; mounts must be secured to the wall. Again, under no circumstances shall any wiring cross under the client, representative, or expert area of the table(s).

H. Bandwidth

Bandwidth is an issue for many agencies. Complaints about long delays, poor quality images, weak audio, and many others can be traced to low bandwidth. The codecs of today are capable of HD video, but that capability requires sufficient bandwidth to transmit HD video.

A simple way to understand what bandwidth means to video conferencing is to compare bandwidth to a garden hose. If a garden hose is connected to one sprinkler, a certain amount of water is produced from that one sprinkler. If three more sprinklers are added to the first, a bigger

hose is required to produce the same level of water out of each sprinkler. If the size of the hose does not increase, each sprinkler will only dispense one quarter of the amount of water that would be dispensed with only one sprinkler.

There are some who object to adding additional bandwidth, claiming that it would cost too much. They indicated that the past usage did not warrant the additional cost. That observation sounds logical, especially in these times when budgets are restricted. However, if the agency plans to increase its use of video in the future and fails to increase the bandwidth, that decision could lead to a system crash in a very short time. If there is one predictable factor, it is that network requirements and the need for increased bandwidth will be necessary for all agencies in the next several years.

All videoconference manufacturers are moving toward HD, and while the systems will allow connections at lesser bandwidth, most new equipment is designed for HD. The current bandwidth requirement for HD is 1.2 – 1.5 Mbps. Even Skype has an HD version requiring 1 Mbps. In a video conference study for a Texas court system to allow adjudicators and doctors to evaluate incarcerated defendants, the participants used 5 Mbps at each location to provide the quality and performance required to clearly see and connect the detention center, hospital, and courthouse on the same video call.

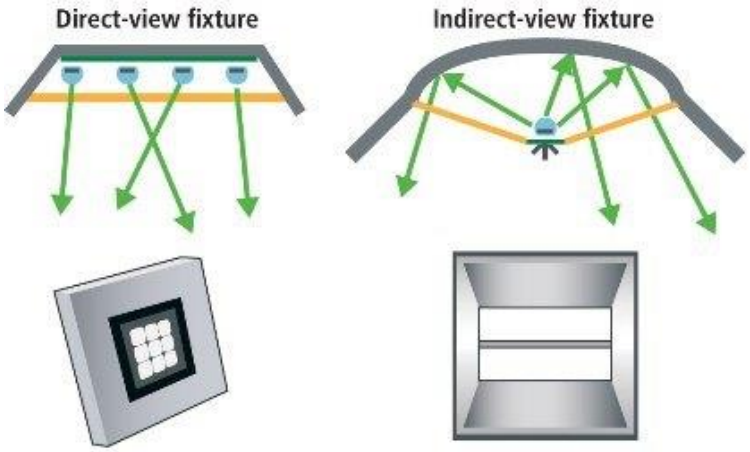
Dedicating large amounts of bandwidth may require increasing the size of the network, which unquestionably presents significant costs. However, the cost of failing to provide enough bandwidth is poor quality performance from the video conference equipment. This provokes complaints about poor quality video. One adjudicator told us that he could clearly see a scar on a person's arm in person but could not via video. The picture was fuzzy because of insufficient bandwidth.

HEARING ROOM ENVIRONMENT FOR OPTIMAL VIDEO

The room environment in which the video telecommunications system is installed is as important as the equipment itself. A wide variety of issues can be addressed with proper lighting, acoustics, room colors, and air handling systems. The video conference industry has conducted many studies on how to use this environment to enhance video experience and performance. The high-end TelePresence rooms exemplify this research. The following are short explanations of industry recommendations:

A. Lighting

The lighting design used for rooms that involve video telecommunications is critical for several reasons. Participants in the room must be able to see written documents, video monitors, and each other clearly without glare. The lighting, which is the most critical factor for color and temperature, must also provide proper illumination for the video camera used in video conferencing. Indirect lighting should be used exclusively to ensure that there is even disbursement of light without "hot-spots."



Unfortunately, the vast majority of hearing rooms do not have proper lighting for video camera use. This lighting situation causes poor visual quality at the other end of the video conference. Perhaps the main issue is that these rooms were designed for an office environment rather than a video conference environment. In his article "Lighting for Teleconferencing Spaces," James Robert Benya states,

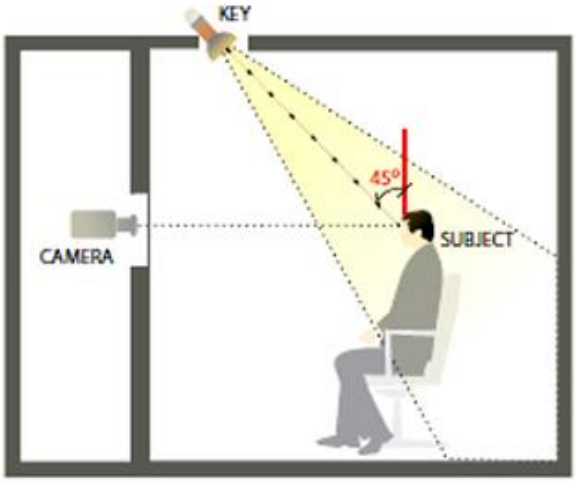
> Video teleconference rooms are among the most difficult spaces for which to design lighting. They combine the bright illumination requirements found in TV studios with the need for a darkened environment to allow viewing a video display screen. Making both possible at the same time is why special lighting systems and techniques must be used.[4]

[4] James Robert Benya, *Lighting for Teleconferencing Spaces*, LUTRON ELECTRONICS, INC., 1998, *available at* http://asia.lutron.com/grafikeye/casestdy/366657Teleconferencing3.pdf.

Design is critical to providing adequate lighting. Fortunately, many design requirements can be adapted from normal video conference rooms, such as those used in the corporate world.

Fluorescent overhead lighting is normally found in hearing rooms, and while it was designed to illuminate documents and materials on work surfaces, they can cause shadows to appear on a person's face. Lighting placement is important so that it does not create glare on computer monitors. Lighting should be placed to achieve a well dispersed, horizontal, ambient light throughout the room and provide even coverage throughout the room. The lighting fixtures should be reflective and provide indirect lighting to ensure that there is even disbursement with no "hot-spots," such as those that may be caused by mixing direct and indirect lighting.

Light cast on a face should be at a 45 to 60 degree angle and originate from multiple locations to minimize shadowing around the eyes and chin. There should be 400 to 500 lux on the faces of the participants on a vertical plane. The usual color temperature of the lighting used for video should be between 3,000 to 3,800 degrees Kelvin. (Indoor light setting for broadcast cameras is 3,200 degrees Kelvin.) A color of 3,500 degrees Kelvin is considered necessary to enhance skin tones.



Incandescent quartz halogen light sources are the most popular for video production lighting. Agencies should not use low energy florescent lights that operate between 30 and 50 kHz. These can create flickering that is visible to the camera. High frequency electronic ballasts are required for video room lighting. When used, there will be no light flicker to interact with a video camera.

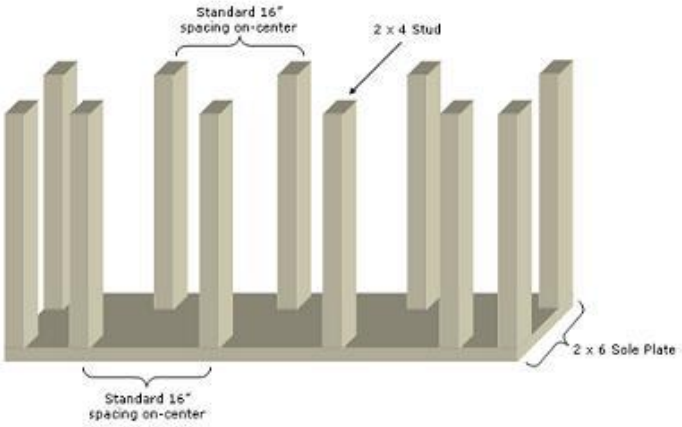
To improve screen contrast and image sharpness, room surfaces around the screen should be dark and shaped to shield the screen from ambient light. The dark finish on adjacent surfaces prevents the screen's own light from being diffusely reflected onto itself. In other words, even coloring and architectural design are essential in achieving good screen image quality.

B. Noise Transference

The spaces for hearings vary by design and agency needs, but all have certain similar requirements. Sounds within the room must be confined to that space in order to ensure confidentiality. Sounds outside of the space must be kept out so that they do not detract or interfere with the proceedings.

When possible, the rooms should be located in the inner area of the office space and not along exterior walls or windows. This will reduce outside noise transference. The room should not be located adjacent to any noise or vibration producing elements, such as elevators (shafts or machine rooms), mechanical rooms, restroom plumbing walls, or high traffic doors or corridors.

The construction of the space is different from most conventional office spaces in order to maintain confidentiality and minimize noise transference. The design of a room for optimal acoustics is a science unto itself and requires significant engineering using the specifics of a given space. Walls should extend from floor slab to ceiling slab and should be sealed with caulking on both the top and bottom, leaving no gaps from the concrete of one floor to the concrete of the next. Wall construction for hearing rooms should use staggered studs with wall cover material connected to only one set of studs. This "offset" of the studs will eliminate mechanical coupling (vibration) between hearing rooms. Wall construction should provide a gypsum board thickness of 5/8 inch, at minimum, with a preferred thickness of 1 inch. A single layer of 1/2 inch gypsum board bonded to another layer of 1/2 inch gypsum board creates an ideal surface to subdue mechanical coupling between the layers of the wall. Wall space may be filled with an absorption layer, such as fiberglass dense batting or mineral rock wool of 4 to 6 inches (the equivalent of R-11 to R-13). This absorption layer should be placed in the wall and should not be compacted to improve efficiency. This should increase the minimum sound transmission class ("STC") rating of 55 to 65, which is better for the control of re-reinforced sound. Walls should, at minimum, have an STC rating of 45. Duct, pipe, or other penetrations should be properly sealed. Duct silencers should be used as required to ensure the required minimum STC of 40. Recognizing that we do not live in a perfect world, attention should be given to achieving these standards as closely as possible within the constraints of available facilities. These standards should be incorporated in any new construction.



Staggered Stud Wall

Carpets absorb sound. When possible, use carpets made of natural fibers, which are more absorbent than synthetic fibers.

The ceiling is a critical plane for sound control. Acoustical ceiling tiles help to absorb and diffuse sound within the room. Ideally, a 1-inch thick compressed dense-core fiberglass tile should be used. A blanket of at least 6 inches of un-faced dense fiberglass batting or mineral rock wool (the equivalent of R-15 to R-19) should be installed above this tile. Where hard ceilings are used, such as gypsum board or plaster, the final surface should be treated with an acoustic coating.

Ideally, about 50% of the surface area of the walls should be covered by sound absorption panels. It is recommended that at least one of the two opposing parallel walls should have absorption panels. Furthermore, dispersing the absorption panels throughout the face of the wall is generally more effective than clustering them together. This practice will reduce the ambient room noise and echo that may otherwise detract from the video conferencing and audio record.

The doors should be solid core without louvered openings in order to provide a minimum STC rating of 40 to 55. The door should include a door sweep and gaskets surrounding the door closure area to help maintain the STC requirement.

C. Room Décor

The décor of a hearing room can greatly affect the video conference and hearing experience. The electronics and optics of a video conference system "build" the image from a blue/gray reference image; certain colors, textures, and decorations can have a negative effect on the video product even though they look esthetically pleasing in person. Wall finishes, artwork, furniture, and other fixtures in the camera's field of view should be neutral in color. When there is a minimum difference between the room background and the reference image color, the codec has an easier time converting the images into a digital format, which ultimately results in better video quality at the far-end. In general, light shades of gray or blue work best with cameras. White paint should be avoided because it creates too much contrast. White paint can also literally erase the faces of participants with darker skin tones from the camera's view. This phenomenon, mixed with poor lighting may cause problems in some hearing rooms. Wall finish should be semi-flat or eggshell for low reflection. The floor usually isn't seen by the camera, but it is best to keep the floor covering relatively dark, to reduce glare.

The furniture should not include dark colors, patterns, or bold woods, as these cause negative effects similar to those caused by dark wall colors. Dark walnut and dark cherry colors should be avoided, while medium tones both present a "judicial" appearance and do not adversely affect image capture. The table and furniture color should differ from the wall color in order to provide contrast, which better enables the camera to distinguish among the different room surfaces. Because glossy table surfaces can produce a glare, the table should have a non-glossy finish.

D. Sight-Lines & Viewing People

As already mentioned, the ability to clearly see parties in a video hearing is mission critical. One important method of improving a video hearing is to ensure all sight-lines are without obstacles. Monitors and other materials can block a person's view of another, just as they can in an in-person hearing. The room should be clear of any objects between the camera and the parties.

The camera positioning should also be adjusted so that the camera image covers the same image as though the party was physically in a hearing room. That means if you can see the person from the waist up in a witness stand, the far-end camera should be adjusted to provide the same view. Even if an adjudicator uses a desktop video system, the unit should be placed so the image appears the same as the in-person hearing room. In other words, a desktop video system should be placed close to the adjudicator, not across the room.

There are a number of reasons why an image may be unclear, including:

- The lens of the camera is dirty. Normal maintenance of a system includes cleaning the lens of the camera. If the lens is not regularly cleaned, the image quality will suffer, just as if your glasses were not clean.

- The lighting in the room is insufficient. By adding proper lighting, and in some cases additional special lighting, it will be possible to distinguish the facial features of all participants regardless of skin tone.

- The bandwidth is insufficient. By increasing bandwidth, video images will change from being fuzzy or pixelated to clear and crisp.

E. Audio Issues

Good audio is essential to communication. The video can fail during a video hearing and communication can still proceed to some degree. If audio fails, the session has to stop. The first best practice with audio is to have each person speak directly into a microphone. Think of the microphones as the "ears" of the system, only what they hear can be transmitted. Too many hearings have been unsuccessful because a party moved the microphone too far away and the participant's voice could not be picked up by it.

A good practice is to always test the call before the hearing. Even if the site has been called many times, quality can vary from call to call. Sometimes establishing a quality connection requires disconnecting and recalling the site. This is true for video as well as audio.

Agencies should be aware that individuals with a hearing impediment may not be able to understand the audio. While it is true that the video conference equipment cannot correct this problem, a hearing assistance system can. Many courtrooms have American with Disability Act compliant hearing assistant systems already installed and connecting the video system to it is just a matter of connecting into the room audio system. For rooms without the hearing assistance equipment, such equipment can easily be added to an audio output on the video conference system.

TRAINING

The educational, business, and medical worlds have been using video conferencing for a long time as a proven method of enhancing communication and reducing costs. There have been many studies conducted in an effort to improve quality and performance. The most common issue that causes poor quality video conference experiences is operator knowledge. "Operator error" occurs when the user makes a mistake, often because they do not understand the way the video system works.

For example, an adjudicator complained about a person monitoring their video hearing. Upon visiting the hearing room, it was found that the screen was showing a picture-in-picture split screen ("PIP"). The near-end camera zoom was pulled back ("zoomed out") so far that the image seen by the far-end contained only a small head in the back of the room. The "person on the screen who was monitoring" was actually the adjudicator's own image on the screen. This also explained why the people at the far-end of the video telecommunication could not clearly see to whom they were talking. When we mentioned this to the adjudicator, he responded that he had no idea what that screen was or how it got that way. He also did not know how to work the camera. When we explained what it was and how to adjust the camera, he was delighted, and the people at the other end could then see the adjudicator clearly. This is presented not to imply a failing on the part of the adjudicator, but to show an obvious need for basic understanding and training that must be considered if video conference equipment is to be used successfully.

Support for video conference equipment is crucial to successful long term use. Support can include simple operator training, normal maintenance, problem trouble-shooting, network management, and even equipment repair. This does not necessarily mean that a user agency must hire professional electronic engineers, but the agency does need to balance the number of video systems used with the amount of normal support required. Most corporations, depending on size, use a combination of inside support personnel and vendor support.

Agencies seldom have trained, dedicated support personnel for the video conference equipment. The technology support personnel are normally required to support IT, telephones, copiers, and other office equipment, as well as the video equipment. This varied type support is perfectly acceptable. Depending on the size of the agency and the number of video systems deployed, there are a number of options for employing and using support personnel. Some larger agencies, such as SSA, have support personnel dedicated to supporting the technology because of the large number of video systems the agency uses.

All video conference users require training and technical support. The root of most video equipment problems stems from the absence of these two key things. Being familiar with the

operation of video conference equipment and how to basically maintain and support it eliminates most operator-related issues.

Each agency should ensure they have adequate training models. If they don't, they should develop, supplement, or replace current materials. Materials should include basic information for normal users and advanced information for support personnel.

A. User Support

The basic training model should include an introduction to video conferencing and how it works. For example, the topics to be covered could include:

- What is a Video Conference?

- What is the Value of Video to Your Hearing?

- Video Conference Etiquette
  - Use the picture-in-picture "near side" view function to see how you will appear to those on the far-end.
  - Ensure you are looking at the monitor when you talk.
  - Speak into the microphone so you can be heard clearly.
  - Use visual signals to improve communications.

- Video Conference Equipment Parts and Functions

- How To
  - Place a video call
  - Receive a call
  - Adjust the camera (both near and far-end)
  - Adjust the audio
  - End a call

- Basic User Level Trouble-Shooting Techniques and the Support Resources Available to the User

Much of the training will be equipment-specific, so several versions may have to be provided based on the various models of video conference equipment used in the field.

Another way to eliminate operator issues would be to create reference charts. These short, two to four page "cheat-sheets" could be kept with each video conference system and provide basic system operation directions. Topics could include:

- Placing a video call

- Receiving a call

- Adjusting the camera (both near and far-end)
- Adjusting the audio
- Ending a call
- Other normal operational issues
- Trouble-shooting techniques in the event the equipment is not working

B. Support Training

The support personnel training should include more advanced material including:

- Normal equipment maintenance
- Advanced trouble-shooting
- How to record issues and address recurring problems

For support personnel, it is advised that the following training be developed by each agency:

- Send support personnel to manufacturer's training for the specific equipment installed.
- Have technical manuals available for each location's specific equipment.
- If the agency has internal support, devise a procedure for placing a trouble call.
- If the agency does not have internal support, have a method in place for getting outside technical support.

FEEDBACK FROM PARTICIPANTS

As use of video telecommunications grows and changes, it is important to make procedural and operational improvements constantly. As with everything in life, there is always room for improvement. Each agency should develop a method of feedback, by which users and participants can communicate recommendations, issues, and concerns.

The simplest method might be to assign one person in the technology group to collect this information. This person could in turn bring this information to the appropriate groups or persons in his or her agency. Technology support personnel should handle technical issues. Procedural or functional recommendations should be presented to the chief adjudicator or administrator, as decided by the particular agency.

Additionally, this feedback should be periodically shared with the Office of the Chairman of the Administrative Conference so that it can make changes to this handbook and communicate best practices to other agencies.

GLOSSARY OF TERMS

CLCT would like to acknowledge the assistance of Biamp Products, Beldon Cable, Extron Electronics, Shure Brothers, The Light Brigade, and West Penn Wire for their assistance in compiling this list of terms.

A

Acoustics - The characteristics of a physical space (room) and how it affects the sound within it.

Adjudicator – One—either an administrative law judge or a non-administrative law judge—who makes a decision in an administrative adjudicative proceeding.

Audio Visual (A/V) - Industry term for audio/visual, or audio/video.

Air Handling System - This is a formal term for air conditioning, heating and ventilation systems used in buildings.

Ambient - Conditions that exist in the environment of the cable; conditions existing at a test or operating location prior to energizing equipment (e.g., ambient temperature, ambient light).

Analog - A continuously varying action, or movement, that takes time to change from one position to another; standard audio and video signals are analog; an analog signal has an infinite number of levels between its highest and lowest value. (Not like digital, where changes are by steps.)

Aspect Ratio - The relationship of the horizontal dimension to the vertical dimension of a rectangle; in viewing screens, standard TV is 4:3, or 1.33:1; HDTV is 16:9, or 1.78:1; sometimes the ":1" is implicit making TV = 1.33 and HDTV = 1.78.

Audio - 1) A term used to describe sounds within the range of human hearing (20 Hz to 20 kHz). 2) Also used to describe devices which are designed to operate within this range. 3) Of or concerning sound, specifically the electrical currents representing a sound program or the sound portion of an A/V program.

B

Bandwidth - A frequency range, or "band" of frequencies between the limits defined by the "half power points," where the signal loss is -3dB; in audio and video, this band of frequencies that can pass through a device without significant loss or distortion; the wider the bandwidth, the better the quality that results, such as sharper picture, better sound, etc.; the higher the bandwidth number, the better the performance (300 MHz is better than 250 MHz; when a signal passes through a path with more than one device (including cables) the limiting factor (bottleneck) in that path is the device with the narrowest bandwidth.

Black - The darkest visible surface; created by the absorption of all incident light and color; in video, the transmission of horizontal and vertical sync signals without picture information.

Black and White - Monochrome (one color) or luma information; in the color television system, the black and white portion of the picture has to be one "color": gray, D6500, 6500 K as defined by x and y values in the 1939 CIE color coordinate system.

Basic Rate Interface (BRI) - Basic Rate Interface ISDN.

Bridge (or Multipoint Bridge) - A device that allows multiple systems to dial in and participate in a single videoconference; A data communications device that connects two or more network segments and forwards packets between them.

Brightness - Usually refers to the amount or intensity of video light produced on a screen without regard to color; sometimes called "black level."

C

Cable Modem - A device that enables you to hook up a personal computer to a local cable TV line and receive data at much faster rates than telephone modems and ISDN lines.

Circuit - A system of conducting media designed to pass an electric current.

Codec (Coder/Decoder) - 1) A device that converts analog video and audio signals into a digital format for transmission over telecommunications facilities and also converts received digital signals back into analog format. It may also dial up the connection (like a modem for teleconferencing). 2) Compressor/decompressor; codecs can be implemented in software, hardware, or a combination of both.

Color Temperature - The color quality, expressed in degrees Kelvin (K), of a light source: the higher the color temperature, the bluer the light; the lower the temperature, the redder the light.

Composite Video - An all-in-one video signal comprised of the luma (black and white), chroma (color), blanking pulses, sync pulses and color burst.

Connector - A device designed to allow electrical flow from one wire or cable to a device on another cable; will allow interruption of the circuit or the transfer to another circuit without any cutting of wire or cable or other preparation.

Contrast - The range of light and dark values in a picture, or the ratio between the maximum and the minimum brightness values: low contrast is shown mainly as shades of gray, while high contrast is shown as blacks and whites with very little gray; also the name of a TV monitor adjustment, which increases or decreases the level of contrast of a displayed picture; also called "white level."

D

Decoder - 1) A device used to separate the RGBS (red, green, blue and sync) signals from a composite video signal. Also called an NTSC decoder. 2) The device in a synchronizer or programmer that reads the encoded signal and turns it into some form of control.

Definition - The fidelity with which a video picture is reproduced: the clearer the picture, the higher the definition; influenced by resolution.

Digital - A system of data or image values in the form of discrete, non-continuous codes, such as binary; when data is in a digital format, it can be processed, stored (recorded) and reproduced easily while maintaining its original integrity.

Digital Signal - 1) An electrical signal which possesses two distinct states (on/off, positive/negative). 2) Digital signals, such as TTL signals, have only two levels: high/low or on/off.

Display Device - Any output device for presenting information visually; examples include: CRT (cathode ray tube), LED (light emitting diode), LCD panel (liquid crystal display), or gas plasma; a general term for a projector or monitor.

Distortion - Any undesired change in a wave form or signal.

E

Encoding - Converting to a code; in video, the combination of electronic elements into one signal.

Ethernet - Institute of Electrical and Electronic Engineers standard network protocol that specifies how data is placed on and retrieved from a common transmission medium; ethernet has a transfer rate of 10 Mbps forms the underlying transport vehicle used by several upper-level protocols, including TCP/IP and XNS.

F

Far-end - In videoconferencing, the party or group you are connecting to at the distant site.

Focus - The act of adjusting a lens to make the image appear sharp and well defined; the best possible resolution of an image, showing the image to be sharp and well defined.

Frequency - The number times a particular event happens per a given time; in A/V, the number of complete cycles per second of a musical tone or electronic signal, expressed in Hertz (Hz).

G

Gateway - A device that interconnects networks with different, incompatible communications protocols.

H

H.320 - ITU-T H.320 is a family of standards developed for video teleconferencing systems using ISDN; references H.261 (for video); G.711, G.722, and G.728 (for audio); H.221, H.230, H.231, H.233, H.234, H.242, and H.243 (for control); allows a system from one manufacturer to "talk" to a system from another manufacturer, just as two different brands of FAX machines can "talk" to each other.

H.323 - ITU standard allowing audio, video and data to be transmitted by way of the Internet Protocol (LAN/WAN); the umbrella standard defining multiple codes, call control, and channel setup specifications; basically, videoconferencing over IP.

Hardware - Physical equipment.

High Definition Television (HDTV) - HDTV refers to a complete product/system with the following minimum performance attributes: a receiver that receives ATSC terrestrial digital transmissions and decodes all ATSC Table 3 video formats; a display scanning format with active vertical scanning lines of 720 progressive (720p), 1080 interlaced (1080i), or higher; aspect ratio capabilities for displaying a 16:9 image; receives and reproduces, and/or outputs Dolby Digital audio.

Hertz (Hz) - 1) The international term for cycles per second. 2) Unit of frequency equal to one cycle per second.

High Frequency (HF) - International Telecommunication Union designation for the 3-30 MHz band of frequencies.

I

I/O (Input/output) - Refers to the flow of information or signals (in or out) with respect to a particular device.

Image - A reproduction or imitation of a person or thing displayed by any type of visual media.

Integrated Services Digital Network (ISDN) - A digital network available to business or home users for transmission of voice, video, or data up to 1.5 Mb/s.

Internet protocol (IP) - A set of rules for how data is transmitted from place to place on the Internet. IP is a connectionless protocol in which data is broken down into small bundles known as packets. Each packet is transmitted separately, possibly along a different route than other packets from the same message.

J K L

LCD (Liquid crystal display) - A panel that utilizes two transparent sheets of polarizing material with a liquid containing rod-shaped crystals between; when a current is applied to specific pixel-like areas, those crystals align to create dark images; the dark areas are combined with light areas to create text and images on the panel; LCD panels do not emit light but are often back-lit or side-lit for better viewing.

Level - 1) The relative intensity of an audio or video source. 2) A measure of the difference between a quantity or value and an established reference.

Local Area Network (LAN) - A group of computers and associated devices that share a common communications line and typically share the resources of a single processor or server within a small geographic area (for example, within an office building).

Lumen (LM) - A unit of measure for the amount of light emitted by a source; 0.98 Ft-c (foot-candles) of light covering a surface of 1 square foot.

Lux - The amount of light per square meter, incident on a surface; metric measurement of light intensity taken at the illuminated surface; one foot-candle (FT-c) = 10.76 lux, or 1 lux = 1 lumen/square meter = 0.093 foot-candles.

M

Mbps (Megabits per Second) - One million bits per second; a unit of measurement for data transmission.

Microphone - A device that converts sounds to electrical signals by means of a vibrating diaphragm—the signals can then be amplified, transmitted for broadcasting, or used for recording the sounds; a late 17th century term originally denoting a device for making faint sounds louder.

Modem (Modulator/Demodulator) - A device that puts information on a carrier signal and transmits it over a (phone) network; the same device receives such signals and demodulates, or separates the information from the carrier; connects computers with other communications devices through ordinary phone lines.

Monitor - 1) A TV that receives a video signal directly from an external source, such as a VCR, camera or separate TV tuner to produce a high-quality picture. 2) A video display used with closed circuit TV equipment. 3) A device used to display computer text and graphics.

Multiplexing - A video conference term for connecting to multiple locations at the same time.

Multipoint - When more than two locations are connected for a videoconference using a bridge; usually multipoint switching is done by video-follow-audio, such that the person speaking is automatically seen by the other conference site(s).

N

Network - A network is a method of data communications between computers.

Noise - Any unwanted signal, such as in audio and video that adversely affects the quality of the picture or sound.

O

Output - A product or operation which goes to some external destination, such as another device, a video screen, image or hard copy; the signal derived from any audio or video device; the physical connection that delivers the result of what the device does, such as an output connector carries the output signal.

P

Packet - A collection of network data sent at once from one network node to another. A data unit of variable length used in communications protocols such as Ethernet and IP. Packets allow some flexibility by allowing more data to be sent without breaking it up into pieces and then re-assembling it at the receiver, in turn reducing overhead.

Pan-Tilt-Zoom (PTZ) - The capability of a camera to move and scan the field of view. Pan refers to side-to-side movement, tilt refers to up/down movement, and zoom refers to the camera's ability to zoom in or out on objects.

Picture-In-Picture (PIP) - Displaying a small picture within a larger picture by scaling down one of the images to make it smaller—each picture requires a video source such as a camera, VCR, or channel selector; consumer TV can use PIP for viewing two channels at the same time, for viewing taped video and a channel, etc.; videoconferencing uses PIP to display pictures from video sources at each participating site on each screen at the same time.

Pixel (Picture Element) - A pixel is a single point in a graphic image or screen; arranged on rows and columns.

Point-to-Point - A videoconference between two locations, like a telephone call.

Protocol - A set of agreed-upon standards that define the format, order, timing, "handshaking," and error checking method for data transfer between two pieces of equipment.

Q R

Receiver - An electronic package that converts light energy to electrical energy in a fiber optic system; also refers to a unit that converts an RF signal to another type of signal (e.g., radio, television).

Resolution - The density of lines or dots for a given area that make up an image; determines the detail and quality in the image; a measure of the ability of a camera or video system to reproduce detail, or the amount of detail that can be seen in an image; often expressed as a number of pixels, but more correctly it is the bandwidth.

S

Sharpness - The definition of the edges of an image.

Signal - Any visible or audible indication that can convey information; the information conveyed through a communication system.

Signal Loss - A video problem that shows up as a faint picture for lack of video information.

Sound - are the elements that create the mechanical wave. They are the speed, at which it travels, the period, the wavelength, the frequency of the sound created, the bandwidth and the amplitude.

Source - 1) A device or sound that starts the signal flow. 2) The device (usually LED or laser) used to convert an electrical information-carrying signal into a corresponding optical signal for transmission by an optical wave guide.

Speaker - A device for converting signals into sound: an electronic or electromagnetic device used to convert electrical energy into sound energy, providing the audible sound in equipment such as televisions, radios, CD players, and public-address systems.

Split Screen - A video effect where portions of images from two sources divide the screen.

Stereo - In audio, a process of using separate signals on separate channels for the left and right audio, thereby giving depth, or dimension, to the sound.

T

Transmission Control Protocol/Internet Protocol (TCP/IP) - Based on the IETF standard RFC793; TCP is a reliable, connection-oriented protocol that first establishes a connection between the two systems that will exchange data; when an application sends a message via TCP for transmission, TCP breaks the message into packets, sized appropriately for the network; TCP provides the flow control (to prevent overrunning the receiver) and congestion control (to prevent overwhelming the capacity of the network); for Ethernet networks, the maximum packet size is 1518 bytes; TCP uses the IP protocol to address and

send the packets—the IP protocol uses three key parameters: the IP address, subnet mask, and default gateway.

Telecommunications - An electronic method of transmitting information from one location to another over a telephone network.

Teleconferencing - A meeting between people, at two or more locations, who can communicate by audio and/or visual devices (often via telephone and/or closed-circuit television).

Terminal - A device typically having a keyboard and display that is capable of sending text to and receiving text from another device, a network, etc.

Termination - A load, or impedance, at the end of a cable or signal line used to match the impedance of the equipment that generated the signal; the impedance absorbs signal energy to prevent signal reflections from going back toward the source; for video signals, termination impedance is typically 75 ohms; for sync signals it is usually 510 ohms.

Transmitter - The electronic package that converts electrical energy to light energy in a fiber optic system; also refers to equipment that generates RF or electrical signals for transmission through the air or space or over a transmissions line.

U V

Video - Refers generally to any method using video tape or television technology to produce an image.

Videoconferencing - Conducting a conference between two or more locations using video cameras, microphones and video monitors; the participants can be seen, as well as heard.

Video Telecommunications - Another term for videoconferencing.

W

Wide Area Network (WAN) - Long-distance networks using various transmission technologies, such as the Internet, frame relay/atm, fiber, or ISDN.

Wavelength - The distance from one peak to the next (between identical points) in adjacent waves of electromagnetic signals, propagated in space or along a wire; usually specified in meters, centimeters, or millimeters; in the case of infrared, visible light, ultraviolet, and gamma radiation, the wavelength is usually specified in nanometers (10-9 meter) or Angstroms (10-10 meter); inversely related to frequency: the higher the frequency of the signal, the shorter the wavelength.

White - The lightest visible surface created by a reflection of all colored light.

White Level - In television, the signal level that corresponds to the maximum picture brightness; set by the contrast control.

X Y Z

Zoom - A term used with cameras and video displays related to the ability to change the view anywhere between near and far. Definitions for near and far vary from one device to another.