**Video Conference Room Design and Layout Recommendations**

**Room Requirements**

The total floor space required for Videoconferencing is much smaller than departments on campus have become used to for general local presentation and meeting. In architectural terms, it is not uncommon to find an approximation of 15 square feet of floor space per participant in a traditional presentation or meeting room. If there is a front-of-room presenter position at a podium, and if there is some use of in-room technology (projection devices, whiteboards, etc.) then this figure may show real value as these elements require less space in a videoconferencing-only scenario.

What should be scrutinized during room selection for videoconferencing is the viewing perspectives of both the local and remote audiences. Often times, a large classroom with a 50-70 person capacity will be deployed with videoconferencing equipment. This may seem like a good idea, however it really stretches the intended scope of the equipment. In such a scenario, without a full-time camera operator the entire local audience (the 50-70 in the classroom) must be removed from view. A zoomed out shot of such a crowd serves no purpose in such an event. One logistic workaround might be to setup a table in the front of the room where local participants may re-locate to in order to speak with any far-end participants.

It videoconferencing, we on campus have to consider not only the issues related to local viewing and hearing but also the issues of being seen and heard by people at the far-end of the connection. This means that we must consider sight lines and angles of participant interaction that go beyond traditional presentation environments. As a rule, more space is required for videoconferencing. This allowance ensures that participants at the far-end will see and hear everyone arriving at their location via the connection, and that all will see and hear at a level of quality that does not detract and, in the best deployment, even enhances the communications.

Having determined the required size of the space, we can move on to the actual renovation or construction of the space itself. Again, the requirements here are generally less forgiving than those applied in meeting-only spaces. In the most basic sense this is because, by sheer definition, at least some of the participants in a conference-based meeting are not actually in the room. As such, customers cannot count on the typical human mechanisms (the human ears and brain and our ability to locate sound in three dimensional space) to manage any acoustic anomalies.

If the solution is, for example, in a room that is adjacent to a double-door entry to the building, then knowing this, folks can take the inevitable doorway noise into account as customers filter the sounds folks hear both inside the meeting room and coming from that adjacent entryway. Within our own physical and local environment customers have the ability to isolate local unwanted noise from local “sound of interest” (voice of other people, etc.) and place the unwanted noise in an inferior position in our conscious though pattern. Folks are able to do this because they know where the noise is coming from and (usually) what is causing it. We may be annoyed by the noise, but we generally are able to ignore it. As soon as we add conferencing to the meeting equation, however, we add the element of electronic pickup and reproduction of all sounds. For the people at the far-end, the unwanted noise is much more difficult (if not impossible) to ignore. They do not have the ability to isolate it in three-dimensional space (the microphones eliminate the spatial reference) and they often do not know what is making the noise. The brain of the far-end participant will devote more and more conscious observation and though energy to trying to work out these elements, in an attempt to isolate and finally “ignore” the unwanted sound. It has already been stated that they cannot do this, however, due to the
electronic separation between the locations. Thus they are left with an impossible task that takes up more and more thought energy, eroding the perceived quality of the spoken communications over time. Frustration and exasperation quickly set in, and the communication flow quickly falls apart.

This then, is one reason folks on Campus must pay even greater attention to the acoustic and visual issues for any presentation space that will be connected via conference to another. Minor, seeming insignificant anomalies we often ignore in the local environment become significant impediments to smooth communication with people at the far-end of any connection. In short, we must always ask ourselves, “What does this look like and sound like to the folks at the far-end?”

**Windows**

Windows usually present the equivalent of an acoustic nightmare (as well as altering the way the camera renders colors and brightness). They not only transmit room sound, but also allow unwanted outside noise to intrude on the conference space. In the event that windows cannot be avoided, it becomes essential that window treatment of some sort be used. This treatment should match the interior look and feel of the space, while providing a high level of sound and light block. Typically, a heavyweight drape (>24 ounces) of heavy fullness (>6” fullness on >8” centers per fold) is preferred. In all cases, the use of sheer draperies or standard vertical or horizontal blinds should be avoided, due to their inherent inefficiency in blocking sound and light, and the fine lines they create within the camera field of view.

**Ceiling Tiles**

These should be high-quality acoustic tiles, ideally 1” thick compressed dense core fiberglass. An added benefit of this kind of ceiling tile is that it works well with indirect lighting as specified later in this document. To reduce any extraneous noise from leaving or entering the room via the ceiling space, the ceiling tiles can be blanketed completely from the plenum side, with a minimum of 6” thick unfaced dense fiberglass batting or mineral rock wool (~R-15 to R-19). Here again, a barrier layer will improve the performance, but all Campus building codes must be followed for allowable materials in the various aspects of room acoustic modifications. To make entry and exit from the ceiling space easier, the blanket and barrier do not need to rest on the ceiling tiles, but may be suspended above it.

**Air Conditioning**

It is critical that all air-handling equipment (blowers, heat exchangers, solenoid valves, etc.) be located outside the physical meeting room space. The will prevent the noise burden associated with such equipment from affecting the participants of any meetings held in the room. Location of air-handling equipment within the ceiling space of a conference room often renders that room unusable for video or audio-only conferencing.

The air vents should be of open construction to eliminate “wind noise” while the system is running. These vents normally are specified as “low-velocity” diffusers. The number of air vents within the room should be sufficient to maintain a consistent temperature throughout the space. All HVAC ducts and diffusers should be over sized for the general application in the space, with minimum 2’ diameter insulated flexible ducts and matching 2’ noise dampening diffusers generally best. All ducts should be installed with gradual bends and curves rather than rigid 90-degree corners. This will minimize
“thunder” sounds as the initial air pushes through the ductwork and into the room.

There should be a thermostat to control this specific room system independently of the rest of the building, and that control should be located within the room.

Important: Allow an additional 5,000 BTU of cooling capacity for a standard “roll-about” single monitor VC system with extended in-room peripherals (PC, document camera, scan converter, etc.) and a minimum of 10,000 BTU for a dual display multimedia presentation system with large screen displays. For the comfort of the participants, the room must accommodate these heat loads, plus the heat load of a room full of people, with minimal temperature rise.

**Interior Design and Finishes**

Wall colors within the field of view of the camera have a significant impact on the far-end perception of the room video quality. Certain colors are better suited to video rooms than others. The electronics and software of the videoconferencing room “builds” the images at the far-end from a gray/blue reference image. When there is a minimal difference between the room background and the reference image color, the codec has an easier time turning the image into numbers, with the result that the far-end will see a much higher quality video presentation. In general, *light gray with just a touch of blue seems to work best*. For rooms that have marginal lighting, slightly darker colors are quite useful.

**Furniture**

As we have noted, VC rooms should be slightly on the large side for the typical number of attendees. The placement of furniture should present a natural rapport with the videoconference system, but shouldn't preclude the local interaction of conference participants. Doorways used for access to the space usually should be within the view of one of the camera presets to prevent the perception from the far-end that people could come into their meeting unseen. Doorways should not, however, be in constant, direct view of the camera system, as this may cause unwanted distractions and movement of people in the picture field.

Any tables within the conference environment should have a light top surface. Glossy tops should be avoided, as should strong colors or any bold wood grain. If glossy or saturated color surfaces are unavoidable, then proper lighting can help reduce (but not necessarily eliminate) their ill effects. The best table surface color is a flat satin finish, in neutral gray. In cases where the worst possible surfaces are present, the proper surface color effect can be achieved by using a table covering, put in place only when the room is being used for videoconferencing. This will, create problems related to the use of access ports in the tables or movement of end-user items across the surface.

**Room Lighting**

The brightness of the lighting in a videoconference room plays an important role in determining the far-end view of the meeting. When there are low to moderate amounts of light, the distance of “in focus” objects (depth-of-field) usually is only 2’ or 3’ from nearest in-focus to furthest in-focus. With bright light the range of in-focus objects can more than double. Participants at the far-end will see more people in sharp focus, and the codec will have an easier time encoding the image.
Bright standard direct fluorescent lighting has the undesirable side effect of being harsh for the local participants. In addition, the direct down lighting casts significant “drop shadows”. The result is undue stress among participants.

The best plan for videoconferencing is to use indirect lighting for 80 to 85 percent of the light, and evenly distributed direct lighting for the remaining 15 to 20 percent. The indirect light will help minimize shadows on the faces of the participants, and make the room more comfortable for viewing the far-end on the TV monitor. The direct light can be used to create backlight separation between foreground and background objects or surfaces.

There should be not less than 55fc (foot-candles) and ideally as much as 75fc of light (770lux) on the faces of the participants in the facial field as viewed by the camera in the conference space. The light should be completely even across the field of measure or view, and of one consistent color temperature.

To best meet these requirements, indirect fluorescent lighting most often is recommended. This type of lighting works by using the upper walls and ceiling as diffuse reflectors for the light. The usual recommended color temperature for these is 3,000 to 3,800 degrees Kelvin. If there is a significant quantity of outdoor light entering the room, the lamps should be more than 5,5000 degrees Kelvin.

**Room Preparation Conclusion**

When we follow the above guidelines we dramatically improve the odds for success in the deployment of live bi-directional conference-based human communications. An added benefit is that this approach dramatically enhances the effectiveness of the room as it operates for more traditional meetings and presentations. The environment is more comfortable and flexible, and less dependent on specialized electronics for “fixing” deficiencies in the environment.