



UKERNA

# Welsh Video Network

## **Advice and Guidance on Videoconferencing Rooms**

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## **0 PURPOSE OF THIS DOCUMENT**

This document has been adapted from the Videoconferencing Advisory Service's document titled 'Videoconferencing Rooms' (reference RT/VIDEO/VCAS/001). This document is intended to provide advice and guidance on the selection of rooms for videoconferencing activities for the Welsh Video Network

Equipment for the studios, provided as part of a central procurement, will include:

- A hybrid ISDN / IP videoconferencing CODEC
- A remote control CCD camera
- Microphones
- Document camera
- PC, projector and screen
- VCR
- Interactive electronic whiteboard

In order to provide help and support to institutions two support centres will be established at Swansea and Aberystwyth, using the same model as the current FE Support Centres.

In order to use the JANET Videoconferencing Service, studios must pass a Quality Assurance test. Detail of this test can be found in section eight of the local service manager's guide available from the JANET Videoconferencing Service. <http://www.jvcs.video.ja.net/docs/isdnmanguide.shtml>

As part of the Welsh Video Network project a contacts group will be established with representatives from all institutions across Wales. The group will meet on a bi-monthly basis. An e-mail list will be established which will facilitate the dissemination of information and provide site managers with an efficient way of highlighting problems or issues.

The project's web site is continually updated with progress on the project and links to useful information related to the project. The project's website is at <http://www.wvn.ja.net/>

## **1 INTRODUCTION**

### **1.1 Environment**

The environment for videoconferencing requires particular attention if the highest quality sound and vision signals are to be transmitted and received. This is equally true whether sophisticated, dedicated videoconferencing equipment or the simpler desktop plug in cards are being utilised.

The requirements for large group teaching are much more demanding than those for straightforward meetings but the basic principles remain the same. In the interests of simplicity, only videoconferencing rooms used for meetings will be

considered in detail here but where it is felt that points relevant to a teaching network are important these will be specifically mentioned.

Where a complete system e.g. a Rollabout has been purchased and installed then not all of the following will be applicable, some information has been included to assist those sites designing their own system around a separate CODEC.

To achieve good results certain room parameters need to be controlled quite tightly.

## **1.2 Health and Safety**

Before considering the technical requirements of a room for videoconferencing the health and safety issues need to be addressed.

The safety advice given in this document is offered in good faith but it is the responsibility of individuals/organisations following any or all of this advice to ensure that they comply with all of the relevant safety, legal and statutory regulations.

All electrical wiring and installation will need to comply with the IEE wiring regulations<sup>1</sup> and be carried out by qualified staff.

Air conditioning/handling equipment will also require installation by experienced staff to ensure the quality of air is adequate and the temperature, humidity, etc. are of an acceptable standard.

Acoustic treatment of rooms will need to be carried out with materials that satisfy the relevant building regulations, so it is essential that this work is supervised by qualified staff.

## **2. ROOM DESIGN**

### **2.1 Location of Room**

A quiet, convenient and central location is to be preferred. High levels of structural and air borne noise will be a problem so the room needs to be located away from sources of noise such as traffic, lifts, plumbing, workshops, plant rooms, air conditioning ducts, etc. Sounds that are a minor irritation to the ear can become unbearable when picked up by a microphone. Access should be suitable for persons with a physical disability i.e., a ground floor location is normally preferable.

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<sup>1</sup> The Institution of Electrical Engineers (IEE) Wiring Regulations 16th Edition (with amendments) available from: The IEE, P. O. Box 96, Stevenage, Hertfordshire, SG1 2SD.

## **2.2 Room Size**

This depends very much on the number of participants involved. From our experience most meetings will involve only 2-3 people although, on occasions, larger groups are involved and the room should be capable of seating a minimum of 12 people. For teaching seminar groups etc. accommodation for 20 students may be required whereas teaching involving 100 or more students is more likely to take place from a lecture theatre.

## **2.3 Room Shape**

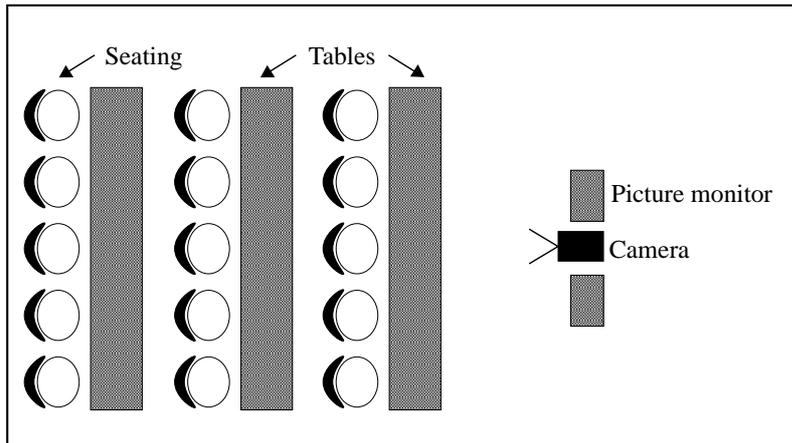
To reduce undesirable acoustic effects square rooms should be avoided if possible. An oblong or irregular shaped room, which will not encourage standing waves (and thus echoes), is better. Rooms with non parallel opposite walls are good acoustically but unlikely to be found in practice.

## **2.4 Room Layout**

Room layout will depend on the number of participants and the available space. Television cameras are positioned close to the viewing monitors so that participants are normally looking in the direction of the camera lens; this produces natural and expected images at the far site.

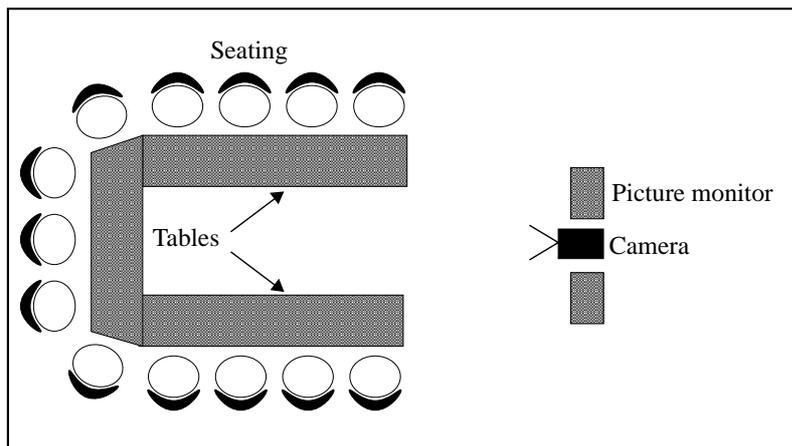
Figure 1 illustrates the horseshoe arrangement of seats, which permits a clear view of each participant but some panning of the camera will be necessary to optimise results; for small groups this layout can work very well. Double horseshoes (i.e. one behind the other) can accommodate medium sized groups and still permit a reasonable camera image.

Where space is very limited several parallel rows of tables (Figure 2) would house the maximum number of participants, but the camera will not be able to see everyone clearly. Another disadvantage of parallel tables or double horseshoes is that this tends to inhibit interaction at the local site as people have to turn around to talk to the participants in the rows behind.



**Figure 1: Conventional Layout**

During a conference local interaction can be just as important as interacting with the remote site. A single horseshoe of 20 people would, with a suitable camera, allow a clear view of everyone and allow efficient interaction but would need a large room.



**Figure 2: Horseshoe Layout**

Layout is thus a compromise between a clear view, interaction and the space available.

## 2.5 Room Decor

Television cameras have very limited contrast handling ability, so wall decoration should be neither too light nor too dark. Mid tones tending toward light (e.g. cream or magnolia) are to be preferred to give the room a bright atmosphere. If the walls are to be painted, a matt finish will minimise reflections. Grey walls can create a rather dull background and shades of red or any other fully saturated colours should be avoided.

Strongly patterned wallpaper or 'busy' curtains will only distract the viewers; mid tones and plain textures are much more suitable. Plain, mid to light blue curtains can produce a most pleasing backdrop (Appendix A). Curtains should be loosely gathered otherwise camera auto focus systems may focus on the vertical edges of the curtain folds rather than on the participants.

A college crest hung behind the participants against a plain wall can add interest to the image although during multipoint conferences most crests can look very similar and some additional identification will be necessary.

Videoconferencing equipment, and in particular the vision Coder-Decoder (CODEC), compresses the vision signal considerably (over 1000:1 for ISDN 2) to send the signals over the ISDN network. Patterned backgrounds contain more information and thus more detail than plain walls and so force the CODEC to work much harder; plain backgrounds allow the CODEC to concentrate on more important picture areas, e.g. the participants' faces.

## **2.6 Furniture**

Individual sites will have their own preferences for the type of furniture to be installed. Try to avoid bright, reflective surfaces that may cause unwanted highlights in the picture and distract the viewer from the main subject matter.

Control desks/tables will need to accommodate the likely number of participants but also provide space for: the CODEC remote control unit; the microphones or audio units; a visualiser to permit the display of diagrams, x-rays, overhead transparencies, etc.

In more complex installations space will also be needed for: a vision mixer/switcher to select vision sources and remote controls for the cameras if required.

## **2.7 Conference Equipment**

If picture monitors displaying local and remote pictures are built in to cabinets then allowance must be made for adequate ventilation and for easy access for maintenance, etc. A comfortable viewing distance from eye to picture monitor is 5-6 times the picture diagonal.

A telephone is essential; this could be fitted with a flashing light instead of the conventional ringing tone to avoid disturbance during conferences. An accurate clock, easily read but not in shot, will also prove very useful.

The audio mixer (used to set microphone levels) is best located away from the desk to discourage adjustments to the audio levels during transmission. Echo cancellers will not operate correctly if audio levels are altered after line up has been achieved. This is also the case with loudspeaker volume, which should be altered only during the echo canceller alignment.

A desk mounted microphone mute facility is necessary to kill the local sound during a conference so that the participants may talk discreetly without disturbing the remote site.

## **2.8 Windows**

Windows always cause problems for television cameras due to the changing lighting levels. A room without windows is to be preferred. If windows are inevitable (perhaps in a multi purpose room) then adequate blackout must be provided to exclude all natural light. Roller or vertical blinds are seldom successful and heavy curtains or drapes are much better. These will also assist in improving the acoustics (and the decor).

## **2.9 Lighting**

Modern television cameras are very sensitive and will operate in quite low levels of illumination, but a much better picture will be produced by providing high lighting levels.

Tungsten/Halogen lighting is normally preferred for television, but in the videoconferencing environment it is unsuitable due to the amount of heat it generates. Fluorescent lighting is the only realistic choice: it is energy efficient, dissipates little heat and is relatively inexpensive.

Normal office lighting levels will be adequate, i.e. 500 Lux, and an intermediate or warm fluorescent tube colour (equivalent colour temperature 3200-4000 Kelvin) will give acceptable pictures and emit a fairly comfortable light for the participants.

Fittings should be arranged so that a higher level of illumination is produced in front of the participants than either above or behind them so as to prevent shadows on faces. Fluorescent lighting, though not ideal, will give good, even, energy efficient illumination. Care needs to be taken to avoid glare from the fluorescent tubes on the picture monitors; one solution is to use visual display unit (VDU) lighting which is fitted with diffusing shades (i.e. category 2 or 3 lighting). It is also helpful if lights in the vicinity of the picture monitors can be switched off independently of the general lighting.

The light intensity emitted from fluorescent fittings is not equal in all directions, i.e. it is greater parallel to the tubes and lower from each end. When planning room lighting, care must be taken to ensure the participants are lit adequately.

Dimming systems, especially the less expensive systems, can cause interference to microphone circuits due to radio frequency radiation. Unless suppliers can guarantee their equipment will not cause problems, it is wise to avoid dimming and to arrange for the lights to be switched in rows. High frequency fluorescent systems provide quiet and flicker free illumination but they also have the potential to interfere with the audio circuits.

To warn others that a videoconference is taking place an "On Air" light outside the room is a useful addition.

## **2.10 Acoustics**

It has already been mentioned that the room needs to be situated in a quiet part of the building away from lifts, noisy plumbing, traffic and the like, as this structure borne noise is very difficult to eradicate.

Noise levels may be measured with suitable sound pressure level (SPL) meters but the results need to be interpreted very carefully. The suitability of a room for conferencing is a decision best entrusted to an experienced person as the acceptable level of intrusive noise is dependent upon the nature, as well as the level, of the noise. As a guide for videoconferencing an SPL reading of less than 35dBA is required. The “A” refers to the weighting used during the measurement, and takes in to account the response of the human ear to sounds of different frequency. The SPL makes a single measurement. A more accurate assessment of intrusive noise is achieved by plotting a “Noise Rating” (NR) curve. This requires an instrument that measures the noise at a number of spot frequencies. Noise Rating curves are familiar to architects who use them in the design of buildings. For videoconferencing an NR of 25 or lower is required.

Attention must also be paid to the internal acoustic characteristics of the room. Too many echoes will present problems. The room should not be too absorbent, however, as this will present an unnatural and uncomfortable environment for the participants.

Carpets will improve the acoustics effectively and will generally be more cost effective than acoustic ceiling tiles. Hard, blank walls can be deadened by heavy curtains, which also improve the decor. Upholstered chairs will also help.

Where a room suffers badly with echoes it is far better to treat adjacent walls than two opposing ones: thus standing waves will be reduced in two dimensions (length wise and width wise) instead of just one.

## **2.11 Heating and Ventilation**

Participants may be videoconferencing for considerable periods, so it is essential that they are comfortable. Normal office temperature levels (i.e. 16-21<sup>0</sup>C) and comfortable humidity levels (40-50%) should be maintained.

Microphones are extremely sensitive to moving air so, although normal air conditioning and heating systems may operate unnoticed by the participants, the microphone can amplify the effect and cause unacceptable interference during a videoconference.

Broadcasting studios use very specialised air conditioning systems that move a large volume of air very slowly through large ventilation ducts and so create very low levels of background noise.

Conventional heating/air conditioning systems use low volume/high velocity systems through small ducts: these are inherently noisy, but also much less expensive to install. It is unlikely that a low velocity system will be installed because of the cost.

What is important is the ability to control the system independently if necessary during conferences. The integrated air conditioning systems that heat/condition whole floors or groups of rooms cannot usually be controlled adequately in individual rooms and will inevitably introduce unacceptable background noise that will be uncontrollable.

## **2.12 Electrical Power**

### **(a) Safety Issues**

All electrical installations will need to comply with the IEE wiring regulations and be carried out by competent and qualified staff.

A master switch fitted with an earth leakage breaker is a convenient way to isolate all videoconferencing equipment.

The vision and sound equipment, together with the CODEC/echo canceller, have fairly modest power ratings and 13 amp domestic sockets will be adequate provided the earthing and clean supply stipulations outlined in 2.12 (b) are met.

Signal cables should not normally be run in the same cable duct as 240 volt a/c mains supply cables (see IEE regulations).

### **(b) Electrical/Electromagnetic Interference**

The equipment used for videoconferencing should be powered from a clean mains supply to avoid electrical interference. It should not be on the same line as that feeding large electrical loads such as plant motors, lifts, workshops, etc.

Local mains interference filters (e.g. on socket outlets) can help in some cases, but it is far better to start with a clean supply than to attempt to correct a dirty one.

The signal earthing ideally should be separate from the normal electrical earth, i.e. a clean technical earth. (It is imperative to comply with IEE regulations.)

All equipment should normally be powered from the same electrical power phase. If this is not possible (e.g. where equipment is located in different rooms or buildings) then precautions will need to be taken to isolate the audio and video signals to avoid mains hum interference.

To minimise hum pickup, signal cables (i.e. sound and vision) should not be run parallel to mains supply cables; this is especially important for microphone cables.

### **2.13 Cable Ducting**

Several cables will need to be run from the control desk to the picture monitors and loudspeaker/audio mixer and also to the CODEC/echo canceller wherever these are situated. Some provision must be made for small ducting or conduit to protect these cables.

When cable runs across floor spaces cannot be avoided, then some form of protection must be provided. Special rubber cable protectors are available that protect the cables and minimise the risk of tripping. At the very least the cables should be secured with marker tape.

## **3. OPERATIONAL FACTORS**

### **3.1 Location of CODEC and Echo Canceller**

When a videoconference room is being installed it is very desirable to install the CODEC/echo canceller either within or very close to that room to simplify the send and receive circuits.

Where multiple conferencing rooms are being considered then the location of the CODEC/echo canceller should be carefully planned to minimise cable/fibre runs (or radio links). If cable lengths exceed 15 metres then analogue colour television signals will degrade; the longer the runs the more correction will be needed to compensate for these cable losses.

### **3.2 Site Identification**

To enable other sites to recognise the videoconference room some form of identification is necessary; this is particularly important when several sites are working simultaneously.

An institution's crest on the wall behind the participants can form an effective identifier provided only a few sites are conferencing. When several sites are involved then the institution's name will also be necessary to avoid confusion. College crests can add interest but should not form a significant part of the image (see 2.5 above).

Electronic character generators may be used to superimpose the name of the site over the picture. Inexpensive units can, however, cause problems by also generating distortions to both pictures and sound: for this reason they should be used with caution.

### 3.3 Links to Teaching/Equipment Rooms

The sound and vision signals may need to be sent to and received from rooms some distance from the videoconferencing equipment (e.g. to provide signals to an overflow audience in a large lecture theatre).

A variety of methods can be used to transmit the signals:

- Fibre optics
- Copper cables
- Microwave links

The signals can be transmitted digitally or as baseband audio/video.

The use of fibre optics to transfer digital information is well tried and tested but problems have been experienced in transmitting analogue signals over fibre, especially where audio and video signals are multiplexed over a single fibre. For this reason analogue fibre drivers should be chosen with caution.

Where long signal paths are involved (up to 64 km), microwave wireless links can be very cost effective; they are also appropriate for building to building links where roads, etc. need to be bridged. A licence is essential for the operation of any radio link. Information is available from the Radiocommunications Agency<sup>2</sup>.

Where analogue signals runs are shorter than 400 metres, copper (e.g. coaxial cable for the video signals or twisted pair for the audio ) can be very cost effective. This option is often overlooked with the vogue for fibre but, if cost is paramount, it can be a good choice.

For very short runs (<50 metres) within a building, copper is the best option.

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<sup>2</sup> Radiocommunications Agency (radio link licensing authority)  
Fixed Links, Floor 10 South, New Kingsbeam House, 22 Upper Ground, London, SE1 9SA

**PANTONE REFERENCE COLOURS**

Pantone reference samples are normally used by graphics designers/printers and may be borrowed for comparison when purchasing curtains.

These reference colours are intended for use on uncoated paper in the printing industry so, while they are a useful guide, it must be borne in mind that the surface texture of curtain material is very different from that of uncoated paper.

With this caveat, the light to mid blue colours recommended for background curtains are:

- 279U
- 285U
- 292U
- 2925U
- 299U
- 2995U