Defining and Implementing Standards for Lecture Room Services and Facilities

Keith Buckman,
Media Services Manager
Brunel University

Associate Author
Widad Oumaar

Contents

Disclaimer

The views expressed in this paper are those of the author and not necessarily of Brunel University.

Acknowledgements

1 Introduction

1.1   The aim of this Case Study is to document the process of researching and defining standards relating to lecture room services and facilities so that relevant data may be used to contribute to the process of determining national standards within the sector.

1.2   The Case Study is based on a current project being run by Brunel Media Services (BMS) to develop the University's lecture room AV presentation facilities by means of determining and implementing a set of operating standards. This activity has resulted from the merger of two AV service operations that existed prior to the incorporation of the West London Institute of HE within Brunel University. Although these service operations became integrated within one department about three years ago, local operating practices have largely been retained at the two service centres. Because of the relatively small size of the (new) Media Services (11 staff FTEs), it was decided at an early stage to consolidate the operation at one centre. This was delayed until certain influential factors had been finalised at institutional level, particularly in relation to structure and location of faculties.

1.3   The University is now entering a new phase that primarily concerns the transfer of the Faculty of Arts from Twickenham to Uxbridge Campus during 1998-99 and 1999-2000. Consolidation of the Media Services at Uxbridge will occur in synchronisation because of its strong link with the Faculty's Film & Television Studies programme.

1.4   AV services for lecture rooms are currently handled in quite different ways. At Uxbridge there is a purpose-built Lecture Centre (c.1966) where lectures are scheduled via the Timetabling Unit during weekdays 9.00am-6.00pm, term-time, and by the Conference Office for their users at other times. Timetable changes, and thus AV service events, occur on the hour and there are two BMS technicians that normally attend to booked events.

1.5   For Twickenham, Osterley and Runnymede campuses, BMS normally attends to AV requirements in support of departmental technicians who normally undertake routine AV set-ups and first line maintenance. There are however some departments without their own technicians and in such cases BMS provides a primary level of service. Timetabled sessions at Twickenham and Osterley are normally longer in duration than at Uxbridge. Differences also exist in terms of the level of equipment and facilities provided at these campuses and also in the diversity of physical spaces.

1.6   Current activity in relation to the local standards project essentially comprises: (i) the determination of working standards by means of available literature, historic levels of service, user expectations, comparison with similar service operations, etc.; (ii) audit of existing facilities and operations and matching against determined standards in order to identify priority planning tasks. The actual implementation of development of central lecture rooms is, in the author's opinion, a significant strategic planning issue involving multiple areas of responsibility.

1.7   An AV Survey was undertaken in July 1997 that provided useful information on aspects that users thought in need of priority attention (Appendix A). These included:

- Improved projection screens
- Improved lighting control
- Improved window blinds and curtains
- Improved whiteboards
- SVGA projection
- Network points
- Large screen for video display

It was concluded that BMS would be unable to implement significant improvements in terms of multimedia in lecture rooms without substantial commitment from other service departments, thus supporting the case for a strategic management approach.

1.8   Notwithstanding the need for this strategic approach, BMS has attempted to be proactive in at least auditing the problem and identifying areas where development work could be most effectively implemented. In terms of defining standards, the service has focused on two aspects: (i) physical and technical standards; (ii) service delivery standards.

1.9   The approach to examining standards was:

(i)   set up a project activity in BMS to determine and implement standards;

(ii)   search for literature and internet references that may be applicable;

(iii)   seek information from other service managers;

(iv)   discussion in local interest groups.

1.10   The local project was initiated at the BMS departmental meeting on 19th November 1997 with the aim of responding to the issues raised by users in the AV Survey. This was one of two key projects serving the next phase of integration, the second being the development of the Uxbridge BMS centre to accommodate media facilities being transferred from Twickenham.

1.11   Some searches were initiated to obtain literature and internet references on AV standards, and are described in more detail in paragraph 2.1.

1.12   An email message was circulated via mailbase to the membership of the Lecture Theatre Service Managers Group requesting any relevant material service managers had produced in other institutions that might offer contextual information to assist with the local project. The few replies received were at least helpful in seeing how other media service departments in HEIs were producing their own service statements, particularly in terms of service standards.

1.13   Local interest groups mainly consist of the Working Group on Performance Standards and the Media Service User Group (MSUG). The Working Group was set up by the Information Services Sub-Committee (ISSC) of Brunel's Strategic Planning and Resources Committee (SPARC) to examine the issue of performance standards for Information Services (i.e. library, academic and administrative computing and media services). The Working Group asked service managers to consult with their user groups and outline aims, objectives and performance criteria for a range of service operations. It was decided that a draft statement produced by the Computing Service in relation to call-out services should be adopted as a template by the other information services. BMS recently produced ones for AV and Off-Air Recording services and these were circulated and agreed by MS staff and the MSUG (Appendix B). At its most recent meeting, the ISSC requested service managers to include performance data in their regular reports and these are currently in the process of being sampled.

1.14   The local project has operated on the premise that in order to provide a solid basis for effective multimedia presentation in the multimedia age, it must first be established that the basic requirements for audio-visual presentation have been fully implemented. It has therefore been necessary to adopt an approach that re-examines first principles.

1.15   The local project ultimately supports the University's mission statement, that is 'to produce high quality graduates and research of use to the community'. The University has a good track record in terms of Teaching Quality Assessment, achieving scores of 20 or more points in all subjects assessed to date.

2 Physical and technical standards

2.1   The literature and internet search produced some texts and BSI/ISO standards that were used as a basis for examining the lecture room standards. A useful starting point was *The Complete Guide to Electronic Presentations* (Purdom, 1996). Though this was perceived as being produced for the corporate sector, a number of the basic principles adopted for the local project were based on this publication, unless otherwise stated. Another useful publication was *Effective Audio-Visual Presentation* (Simpson, 1987 - unfortunately at the time of writing the University's copy of the 1996 edition was unavailable). Certain BSI/ISO documents were also studied. While these were often specific to other environments and perhaps too detailed for the kind of general benchmarks being sought to examine standards for the local project, they were nevertheless invaluable. A range of manufacturers' brochures and manuals were also used containing technical data, tables, histograms, etc.. These were helpful in identifying significant physical and technical considerations. While it cannot be claimed that this literature search was particularly exhaustive, sufficient information was nevertheless obtained with which to assess some of the factors relating to lecture rooms at Brunel.

2.2   The range of presentation media likely to be used in lectures includes:

- spontaneous written information (whiteboard / flipchart / OHP / computer keyboard / mouse)
- OHP transparencies
- 35 mm transparencies
- audio playback and sound reinforcement (microphone and line sources)
- video display
- data display
- recording of lectures
- videoconferencing
- film projection

Inevitably, lecture rooms must have suitable facilities to offer projection of still and moving images, television screens, audio playback/sound reinforcement and writing boards.

2.3   Screen projection

2.3.1 There are well-established principles for determining size and type of projection screen and relationship to seating layout. An important consideration is the viewing in relation to the axis of the screen. This can vary considerably depending on the type of screen, higher gain screens tending to have a narrower viewing angle, often in the region of 30°, and decisions must be made in terms of trading-off gain against practical viewing angle. An important consideration here in the context of data projection is that brightness output from LCD projectors is still comparatively low, with the implication that a high gain screen should be used. However, this might not be compatible with a fixed seating layout with wider viewing angles and manufacturers are continually developing brighter projectors. So performance when using matt white screens, offering wider viewing angles, is likely to improve. Taking a simplistic approach so that viewing angles could be examined more practically, the following benchmark was therefore adopted:

For members of the audience to be able to view clearly, they should be seated within a 45° angle of the centre line of the screen.

This is assuming that the screen and seats are placed on a common central axis. A useful rule of thumb is that the ratio between the length of the front row and distance from front row to screen must not exceed 2:1.

2.3.2   It should be noted that if the angle of view is found to be excessive, the viewing angle can be optimised if the screen is mounted off-centre and tilted towards the seating axis. This also has the advantage of offering multiple aspect presentation, say if there is a requirement to make simultaneous use of projection, writing boards, television replay, etc..

2.3.3   It is accepted that back projection is an effective option but this was omitted from the Case Study as there are no lecture rooms in the University designed to offer back projection.

2.3.4   An acknowledged standard was also adopted relating to the fixing height of the screen to ensure good visibility and minimal disruption of the projection beam:

The bottom of the screen must be at least 1.2 metres above floor level.

2.3.5   There are also generally accepted standards for determining screen size in relation to seating:

(i)   the minimum distance of audience from the screen = 2.5 x screen height;

(ii)   the maximum distance of audience from the screen = 8 x screen height.

   For the purposes of the local project, it was assumed that a screen's normal aspect ratio is 1:1, allowing both landscape and portrait display in aspect ratios of 3:4. While there might be occasional requirement for 16:9 display, this has been regarded as a specialised application. As screens are available in incremental heights, some suggested sizes being given in Table 1, there is a choice between adopting height of the actual screen or the height of the projected image. It was decided to adopt the proportional calculation, i.e. $V/8$, where V is the distance between the screen and the back row of seats. It was also possible to attribute suitable proportions for a seating block based on V:

The minimum distance between the screen and front row is $V/4$.

The maximum length of the front row of seats is $V/2$.

2.3.6   It also stands to reason that there must be no obstructions to projection from any ceiling suspensions so the following standard was included:

Maximum height of the screen depends on the height of the ceiling, seating area and the position of any suspended structures that may obstruct viewing or projection.

2.3.7   Perhaps an obvious but essential statement is 'lighting control is fundamental to a good presentation' (Purdom, 1996). In order to ensure optimum projection quality, there must be sufficient and flexible control of lighting to enable a high percentage of exclusion in the immediate vicinity of the screen and an appropriate and even level for the audience to be able to take notes. Simpson indicates that lighting must be under push-button dimmer control. Whatever form of lighting control is offered it must be easy to use and clearly labelled. Curtains or blinds must be able to exclude the majority of daylight. It was considered that the ambient light level should be quantified as a standard both as a maximum for the immediate space around the screen and as a minimum for the seating area. It is intended that experiments are made in the near future to arrive at suitable levels. In summary, the following standards were therefore adopted:

There must be separate control of lighting for the audience and the screen spaces.

Lighting controls must be convenient and simple to operate.

It should be possible to achieve almost total exclusion of daylight.

2.3.8   There are several ways in which seating can be configured to offer different teaching modes but for the purposes of this exercise the important issue was thought to be whether or not the seating is fixed to the floor. If so, then services can deal with more certainties in terms of screen position, size, etc.. Unfixed seating, while offering greater flexibility for optional teaching methods, requires a similar level of flexibility to be accommodated in the installation, occasionally to the extent that more than one side of the room can be used for projection. In such situations, rail systems offer a useful means of achieving such flexibility. Suitably wide gangways must be provided for the purposes of emergency exit.

2.3.9   The quality of seating must be suitable for sustained periods of use, particularly if long sessions are the norm. Suitable platforms must also be provided for note taking. This aspect was not surveyed as part of the local project and but its importance should not be underestimated.

2.3.10 Where a lecture room has no projection booth, space must be provided for projection equipment either in front of the audience, or suspended above the seating area where appropriate. Once a suitable screen size has been determined in relation to distance *V*, appropriate formulae and tables given in BS ISO 11314 : 1995 may be used to determine the required location and lens specification for the projection equipment. Ideally, any projection equipment located in front of the audience should be positioned and configured to present the optimum screen size for the room. However, there may be cases where the only possible location is within the seating block. In this case adequate measures must be taken to provide a secure operating platform for the equipment, suitably managed cable runs for power supply and signal cables, and freedom from obstruction within the projection aperture.

2.3.11 Screens should be tilted to the optimum angle for the type of projection equipment being used in order to eliminate image distortions such as keystone. This requires adjustable screens when projecting from multiple locations.

2.3.12 It was necessary to categorise lecture rooms simply and conveniently for the purposes of examining lecture room installations. The following were thought to be the most useful:

Category 1   Room with fixed seating and projection booth

Category 2   Room with fixed seating an no projection booth

Category 3   Room with unfixed seating

2.4   Television screens

2.4.1   The requirements for display of moving images are different to those for data display. The Sony guide indicates that the distance between the screen and audience for video is between five and ten times the screen diagonal whereas for data it is more specifically expressed as six times the screen diagonal (Purdom, 1996). Working on the basis of minimum requirements, and assuming that the provision of screens is normally more controllable than seating distances, the following standards were adopted:

The minimum diagonal screen size for video display is *V*/10.

The minimum diagonal screen size for data display is *V*/6.

2.4.2   It follows that in situations where display requirements are determined by maximum seating distance, television screens are more likely to be used for video in smaller lecture rooms, whereas most rooms are likely to require some form of projection for data.

2.4.3   Table 1 presents a summary of the above calculations for practical application of the aforementioned principles, both in relation to minimum sizes for projection and television

screens. This table enabled one to determine the minimum screen size requirements for a room given distance *V*.

2.5   Audio Playback and Sound Reinforcement

2.5.1   These audio aspects were examined together because a common system is likely to be required for both.

2.5.2   Before examining audio systems, it was decided to determine prerequisite standards for effective sound reproduction, i.e. appropriate room acoustics. There were two important considerations here: (i) ambient noise levels; (ii) reverberation time. Ambient noise in a room may be caused by a wide variety of sources including audience movement and chatter, equipment fans, environmental control systems, noise from adjacent areas, external noise from road and air traffic, and even lawnmowers! Clearly, the general level of ambient noise in any room must be kept to a minimum so that lectures can be clearly heard by the audience. ISO 9568:1993 *Cinematography - Background noise levels in theatres, review rooms and dubbing rooms* was thought to provide a useful basis for adoption for lecture rooms, although its scope is limited to steady noise within the theatre. A significant statement is that 'Levels beyond NC-45 will result in poor audio reproduction', i.e. a noise curve ranging between 75dB at 31.5 Hz, through about 46dB at 1 kHz to about 42 dB at 16 kHz. It also suggests that a certain level of steady background noise is helpful in masking distracting intermittent noises. For comparative purposes, normal speech has a level of about 60 - 65 dBA and suggested isolation levels for lecture rooms range from 35 - 45 dBA (Talbot-Smith, 1995). It was difficult to produce a working benchmark here and the proposed action was to undertake measurements along ISO 9568 lines in those rooms that were perceived as having significantly intrusive ambient noise.

2.5.3   Excessive reverberation can severely affect the clarity of audio signals. Conversely, a room with excessive absorption is likely to require sound reinforcement, even in a small space, so a compromise has to be achieved. Using a suggested duration of 0.6 - 1.2 T_{60} for reproduced sound in lecture rooms, the following was adopted as a working benchmark (Talbot-Smith, 1995):

Reverberation time experienced in a lecture room should be in the region of one second.

It was thought that a simple clap test would be sufficient though this has yet to be applied locally. It was anticipated that results would vary depending on the number of people in the room and by variable surface area of furnishings such as curtains. Tests should therefore be made under typical operating conditions for multimedia presentation.

2.5.4   Once suitable room acoustics had been achieved would be necessary to determine what power the audio system should have and how many speakers should be provided in the room. For smaller rooms, when using LCD projectors or television monitors, internal loudspeakers are probably sufficient. For larger rooms, a separate amplification system will be required, preferably offering a mixer with sufficient channels to facilitate a suitable range of sound sources that may be used. In such cases, the following standard was adopted:

High quality separate audio amplification should be used in lecture rooms seating 40 or more people with sufficient power rating to deliver undistorted sound at a typical operating level appropriate to the room.

The range of available products and environments makes it difficult to specify a power rating but Purdom suggests that for medium sized presentations, and amplifier of 60 watts capacity will be needed. The number of loudspeakers required is related to audience size, a suggested principle being that 4 speakers will be need in rooms with a seating capacity of 50 and 8 speakers for rooms with a capacity of 100 (Purdom, 1996). Ideally, loudspeakers should enable

even distribution of amplified sound throughout the seating area at a similar height to the screen. In larger rooms, it may be necessary to install an electronic delay device to maintain a perception of synchronisation for viewers seated towards the back of the room.

2.5.6   As larger rooms would require sound reinforcement and suitable microphone systems it was decided that all installations requiring separate audio amplification systems should provide sound reinforcement for the lecturer. For the multimedia age it is desirable to build in a level of audience interactivity by offering some facility to enable students to use microphone systems in addition to the lecturer. Radio microphone systems offer the greatest flexibility in terms of giving the lecturer unrestricted use of space and for the audience to pass round hand-held units. In practice, the limited availability of operating frequencies imposes a severe restriction on the number of systems that can be used simultaneously within an operating radius that effectively covers an entire site. Cable systems were thought most suitable for widespread adoption, saving radio microphones for more specialised purposes, particularly where members of the audience were involved. Also, it was thought that lecturers should be given the option to use either lectern microphones or to wear tie-clip types, depending on their needs, and cable runs should be suitably managed for safety and convenience.

Separate audio amplification systems must include a multiple microphone facility, normally via a cable, offering a suitable choice of operating modes.

2.5.7   To offer additional functionality, it was considered that:

Any lecture room audio system should include a suitable line level output facility for the purposes of recording lectures or onward transmission.

2.5.8   To provide optimum facilities for hearing-aid users, it was decided that:

All audio installations should include an induction loop system so that hearing aid users can receive the entire range of audio sources available on the system via their 'T' setting.

2.6   Spontaneous written, drawn or typed information

All lecture rooms must provide basic facilities for lectures to write or draw spontaneously during their presentations. For the multimedia age there were thought to be two applicable principles:

(i)   that the media used are IT friendly in terms of minimising dust;

(ii)   that a suitable range of electronic interfaces are available, including mouse keyboard.

2.6.1   By default therefore:

Chalk boards must not be used where there is also use and storage of any equipment containing electronic circuits, lenses or viewing screens.

2.6.2   As whiteboards and flipcharts would continue to be used in the foreseeable future, it was determined that such provision should be flexibly incorporated within an installation so that projection screens and television can be used simultaneously.

2.6.3   Inevitably, lectures and students would need to interact spontaneously with multimedia displays via electronic interfaces.

Data displays must incorporate suitable electronic interfaces to enable spontaneous enhancement of and interaction with any multimedia display.

2.7   Computers

2.7.1   It was thought unrealistic to adopt lasting technical standards for using computers in lecture rooms so certain operational considerations were summarised as a check list:

(i)   What network facilities are available in the lecture room?

(ii)   What operating system and software applications are available on the network?

(iii)   Are any specialised multimedia operating platforms, operating systems, software applications and hardware required for multimedia display and if so how are they provided?

(iv)   Who supplies and supports the actual computer?

(v)   What display equipment will be used and what are the interface and configuration requirements?

(vi)   How will user files be managed?

(vii)   Are any peripheral devices required?

2.7.2   It was thought that computer network points should be conveniently provided, both for table-top access in front of the lecturer and for connection to lecture room systems. There should also be a telephone connection point available, capable of independent use when the network points are being used. This would enable reporting and 'talk-down' dialogue relating to any problems encountered during set-up, both with internal and external service providers, as well as offering other communication facilities.

2.7.3   Also, optimum display size, brightness and uncompressed resolutions should be sought at all times when projecting computer data.

2.7.4   Furthermore, the general level of LAN performance must be sufficient to handle increasing levels of demand long term.

2.8   General

2.8.1   It was thought that much of the operating equipment should be contained in a suitable secure cabinet to enable convenient interconnection, multiple power supply, etc..

2.8.2   Also, most controls and temporary connecting points should be readily to the lecturer as s/he faces the audience.

2.8.3   The floor must be free of any cable runs and similar hazards.

2.8.4   Adequate furniture must also be provided, not only for operating a range of equipment, but leaving sufficient table space for equipment and materials being used during the lecture.

3 Local application of physical and technical standards

3.1   A room survey is currently being undertaken by BMS to collect data on relevant aspects of each room to enable an examination of the local application of the standards described in Section 2. This is proving to be a major task and work is still in progress. However, the data collected so far, while not exhaustive, at least supply some useful indications of the sorts of issues being faced. The Uxbridge Lecture Centre provided the main focus of this activity, particularly as many rooms are replicated, and examples exist of all three categories described in 2.3.12. Table 2 shows examples of some of the Lecture Centre rooms. However, certain other rooms at Uxbridge and other campuses are also cited to exemplify certain points.

3.2   Proportions, fixtures and services

3.2.1 Most screens are of the matt surface type, and are mostly wall-mounted. Lecture rooms in Categories 1 and 2 generally have fixed or electric roller screens and Category 3 rooms have manual roller screens.

3.2.2 Typical viewing angles were found to be excessive in comparison to the 45° standard. For example, 50 seat Category 1 rooms offer viewing angles in the region of 60°. While the seating is unfixed, the number of seats and tables generally provided in these rooms make it difficult to adopt more favourable viewing positions. In fixed-seating rooms, typical viewing angles are in the region of 53%. One explanation for this is that in a number of cases the rooms have in recent years had additional seating installed in front of the existing rows to maximise seating capacity. As well as being detrimental to optimum viewing conditions, this resulted in difficulties with positioning projection equipment. Accepting that alternative lenses may rectify the problem in certain cases, the cost implications of this had apparently not been allowed for within the seating extension project. Most of the 70-80 seat tiered lecture rooms have additional angled screens (1.5 m x 1.5 m) which assist with overcoming this difficulty and offer multiple display modes.

3.2.3 In terms of physical proportions, Table 2 also illustrates a number of points, both positive and negative:

(i)   Typical floor to screen heights are about 30 cm lower than the standard 1.2 metres.

(ii)   Typical screen sizes measured in relation distance *V* were found to compare favourably to adopted standards.

(iii)   The distances between the screen and the front row of the are often significantly shorter than the adopted standard.

(iv)   The typical distance from the top of the screen to the ceiling is 30 cm. Consideration of this together with the typical bottom of screen height suggests that ceiling heights in the Lecture Centre offer extremely limited margin for error.

The AV survey conducted by BMS in 1997 indicated a significant amount of dissatisfaction with the lighting control facilities. This was both in relation to control of electric lighting and daylight exclusion and was a general rather than room specific problem. While not within BMS's remit, it is nevertheless important for the Service to be proactive in improving these facilities as it is currently unable to offer optimum projection quality, no matter how good or up to date the equipment.

3.2.5   Room acoustics have yet to be systematically examined, though there were a small number of comments in the 1997 AV Survey indicating improvements were required. There are however some anecdotal observations worth recording:

(i)   Most Category 3 rooms tend to have polished floors rather than carpets. While carpets would reduce noise caused by moving chairs, footsteps, etc., there is a resistance to fitting them in such rooms because of cleaning and replacement costs.

(ii)   While some purpose built rooms appear to have reasonably good isolation, external noise from air and road traffic is a significant problem for one campus in particular, especially in the Summer when windows need to be open for ventilation.

(iii)   There are a number of older buildings that have been converted to provide additional lecture rooms. For example, about 10 years ago a chapel was converted into a 160 seat Category 2 lecture room. The ceiling was parabolic in section and produced a delay of several seconds from a single clap test. As students could not hear the lecturers, pressure was imposed to install a PA system. This, if anything, exacerbated the problem. Ultimately a suspended ceiling was installed and this greatly improved both the acoustics and the efficiency of the PA system.

3.3   Equipment

3.3.1   Most lecture rooms have a resident overhead projector (OHP) and efforts have been made to limit the range of models. A replacement project has recently been completed in the Lecture Centre to offer high quality 400 watt and 250 watt projectors with dual lamp facility and built-in mains socket for using additional equipment such as LCD panels. A limited number have roll attachments fitted where there is a known ongoing expectation for this provision. The new projectors offer colour fringe correction and also have relatively quite cooling fans. The typical focal length is 315 mm giving projection distances ranging between 1.6 m and 2.9 m for the rooms in Table 2. In these specific cases, when aiming to achieve the minimum screen size appropriate to a room's distance V, the space in front of the seating has been just sufficient to allow appropriate positioning of the OHP when using centrally mounted screens.

3.3.2   There is a good stock of 35mm slide projectors, either permanently installed or available for loan or delivery from the local BMS Centre. Both cable and infra-red remote control facilities are available. A number of rooms, particularly the Lecture Centre theatres, have front-to-back cable links for remote control. Loan stock projectors have zoom lenses so that they can be readily used in a wide range of situations. Multiple projection requirement is rare.

3.3.3   There are a range of television screens in use. In recent years it has been practice to purchase Supercreens on trolley bases incorporating a video cabinet. These offer good quality images up to 46" (117 cm) diagonal. In addition to standard PAL VHS replay these are sometimes used for NTSC video display and for data display via a VGA to video converter. A practical consideration is that they just about fit though doorways so that in certain buildings the same unit can service a number of lecture rooms. Using Table 1 it is been possible to determine that these systems are suitable for video display in rooms where distance V is 11.5 metres or less and for data display in rooms where distance V is 7 metres or less. Applied to the Lecture Centre, this is effectively all Category 3 rooms and extends to Category 2 rooms for video display. These trolley Supercreen systems have a floor to bottom screen height of 117 cm, which is slightly lower than the standard height. Typical screen sizes for conventional TV screens range from 14" (34 cm) for portable VHS presenters to 28" (66 cm) monitors on trolleys. Effectively this means that the former is only really suitable for seminars and the latter for video display in rooms where V is 7 metres or less. Existing TV installations will therefore be reviewed to ensure suitability. Most stands for these screens conform to the 1.2 m height standard.

3.3.4   There are a relatively small number of LCD projectors and LCD panels in use. However, the projectors are mostly current models offering uncompressed SVGA and reasonable brightness levels (up to 700 lumens). Demand is such that current expenditure priority is to increase stock levels of LCD projectors. LCD panels have largely been consigned to a back-up role. Two LCD projectors have been installed ceiling-mounted in Category 3 rooms, largely due to the front row seating problem described in 3.2.2. These are operated from the front rather than the projection booth and cabinets have been installed containing the interface unit, VHS playback, sound amplification and microphone equipment.

3.3.5   Some rooms have CRT projection installations, all over 5 years old and some having limited scanning frequencies. It is notable that with one exception these installations have been made as part of a building project, either a new extension or an adaptation. Most are in the larger of the University's lecture rooms and the level of associated installation work means that these are normally the best equipped rooms. Effectively, only one is capable of SVGA projection and this is located in a specialist PC laboratory. Inevitably, these will require replacement during the next 5 years or so, probably with suitable LCD projectors. In view of the level of associated installation, it is likely that the replacements will also be ceiling- mounted. It is perhaps useful to note that the projector in the University's Howell Theatre (400 seats), is mounted on an elevator assembly as it would otherwise interfere with the beam projected from the booth at the back of the room.

3.3.6   VHS video playback machines are widely available for use in lecture rooms, some offering extended facilities such as NTSC playback, Long Play or S-VHS. There are no immediate plans to replace this provision, although equipment stock is being extended to provide more specialised applications such laserdisc playback. Central copying services are provided enabling copying to and from other video formats. There is a good stock of portable VHS and S-VHS camcorder equipment that is occasionally used for recording lectures, in addition to central television and sound recording facilities. BMS also operates an extensive off-air recording service for the University.

3.3.7   The CRT and LCD projection installations have normally required a good level of audio equipment installation and such rooms normally offer a good quality amplifier and speaker installation for video playback and microphone input. The microphones used have normally been tie-clip radio types and Brunel is currently operating at full capacity on some campuses in terms of radio operating frequencies. While the power rating of the amplifiers is perceived to be fit-for- purpose, evidently most installations would benefit from additional speakers. Only the Howell Theatre has a PA installation that includes a sufficient number of ceiling mounted speakers to provide an even distribution. For rooms having no systems, portable combination amplifiers are available for loan, some incorporating audiocassette playback, for use in rooms with no installed reproduction or PA facilities. The Howell Theatre also has an induction loop installation. Induction loop systems have also been installed retrospectively in some lecture rooms at Twickenham and Osterley campuses as part of a special project. Similar installations are being planned for the main theatres at Uxbridge but here there are significant problems arising from their close proximity and consequent need to eliminate possibility of overlapping induction fields. Some portable neck-loop systems are available for loan to students to use in other lecture rooms.

3.3.8   Computing facilities in lecture rooms have been given relatively low priority in comparison to providing a good level of student access to PCs and systems infrastructure for the academic departments. Details of Brunel's computer network can be found at URL *http://www.brunel.ac.uk/depts/cc/network* . Few lecture rooms currently have Class 5 UTP network points, though it is understood that the Computing Service is planning to extend network provision in this area. BMS has therefore had to adopt a largely non-networked approach to using PCs in lecture rooms. For the Lecture Centre a single PC on a trolley has normally been provided but more recently notebook PCs have been purchased offering

portability and higher level of multimedia capability. There is also a case being examined to offer portable Macs in addition facility. BMS is tackling the issue of supporting multimedia notebooks in the context of skills development (see 4.5.5).

3.3.9 While film projection has largely been superseded by video, there are some rooms offering 16 mm projection facilities and these are likely to continue to be required for specialised subjects such as film studies.

3.3.10 There is at least one lecture room with an internal telephone installed so that a lecturer can call for help. This has worked most effectively on a number of occasions but there are no immediate plans to extend this to other rooms.

3.3.11 There is no central lecture room videoconferencing service as such and most activity at Brunel has been initiated within academic departments. BMS is currently examining the feasibility of offering a service as an extension to its television recording service.

4 Service performance standards

4.1   BMS has attempted in the past to apply principles described in ISO 9004:1991 Part 8 *Guide to the Quality Management and Quality Systems for Services* in delivering high quality AV services in Brunel lecture rooms. This has proven difficult in practice mainly because of the complexity of the service-client provider relationship in our situation. Who is the client? Is it the lecturer who is requesting the service of the AV department or is it the student whose experience is ultimately affected by the quality of service delivery? It is easy for AV departments to perceive lecturing staff to be their clients as it is these people that request the services, specify their needs, expect delivery at the requested level of service, and so on. Where academic departments believe they are subsidising central services, such perceptions are reinforced. This can lead to an oppositional attitude being adopted where blame is attributed to the service, or the client, for any failure in delivery. An alternative view is to define the student as the client, with lecturing and AV staff working in collaboration to deliver high quality teaching. This in my view is the preferred model, but it does require a very high level of communication between the numerous parties involved in service provision. While not rejecting ISO principles altogether, a more pragmatic approach might be to examine aspects of operational practice that can at least be measured in order to determine certain benchmarks.

4.2   The framework proposed here for determining operational standards comprises the following inter-related aspects:
- Space
- Time
- People
- Equipment
- Finance

4.3   Space

4.3.1   The physical layout of lecture rooms required for effective AV presentations has already been examined in detail. Other factors that need to be considered are:
- The total number of lecture rooms serviced
- Who is responsible for providing which services in which rooms
- The proximity of service points in relation to individual lecture rooms
- Suitability of specific rooms for specific modes of presentation
- Extent of standardisation of room types for multiple and simultaneous occupancy

4.3.2   At Brunel, particularly since incorporating the two campuses of the former West London Institute, BMS is currently in the process of defining its service territory. While AV equipment in rooms in the Uxbridge Lecture Centre is clearly the responsibility of BMS, rooms at other campuses have become 'adopted' by departments making most frequent use. BMS is formalising the existing practice of servicing lecture rooms at two levels:

(i)   Primary level - where media requirements are booked and serviced via the AV staff;

(ii)   Secondary level - where requirements are booked and serviced via departmental technicians, but Media Services is responsible for repairing faulty equipment, supervising new installations, setting up special events, etc..

So the first service standard defined here is:

Each lecture room must have a clearly defined and widely published and understood support system.

4.3.3 Once a published central table has been produced, containing information on responsibility, contacts, level of service, etc., each service organisation must set up and manage its own support system accordingly. The scale of this task is dependent on the number of rooms to be serviced, the level of service to be delivered, the proximity to service centres (assuming there is one in a fixed location). These of course have to be resourced from the other contributing factors, i.e. time, people, equipment, finance.

4.3.4 Brunel Media Services' territory currently comprises 70 rooms at Primary level and 130 at Secondary level. Apart from the Uxbridge Lecture Centre, where the AV staff are located in the same building as the lecture rooms, most rooms require travel to other buildings and indeed other campuses. Current practice is to service Twickenham, Osterley and Runnymede lecture rooms from the Twickenham Media Centre, outbound travel distances of 2 miles and 18 miles respectively. Evidently, there is a need for suitable transport arrangements to be made and the level of local equipment provision (including suitable storage, security and access arrangements) to be sufficient to keep actual equipment transportation to a minimum.

4.3.5 An additional space complexity is the number of floor levels in any building and the extent to which these are serviced by elevators. At Brunel, there are a number of buildings with staircases only or restricted-size elevators necessitating each floor to be considered as if it were a separate building.

4.4 Time

4.4.1 Time is a factor that is often subject to performance measurement in any service organisation and there are several aspects that need to be taken into account when determining standards:

- supporting services are required for specific pre-arranged events;
- lecture rooms are subject to timetabling;
- frequency of changeover between sessions;
- the number service events likely to occur simultaneously;
- the time taken to set up, test and dismantle equipment;
- hours that support staff are available;
- minimum notice period required for booking equipment.

4.4.2 In terms of service delivery, most operations inevitably work on the basis of supporting specific events that have been booked in advance. There is effectively no margin of error here, providing certain other conditions have been agreed and met, such as sufficient booking notice. Students have a right to expect a performance target of 100%. This depends on effective management of the remaining variables and compliance with clearly stated service conditions. Furthermore, staff and students will rapidly lose confidence in newer technologies if they are seen to fail, even if statistically there is only a small percentage of delivery failure. This target is fundamental and provides the basis for all management strategies planned in relation to the delivery of lecture room services. It is hereafter referred to as the 100% delivery standard. Furthermore, it is necessary to ensure that any failure to deliver is examined thoroughly to avoid recurrence.

The benchmark for achieving delivery of support services for prearranged events is 100% and this has priority when planning service management strategies. A clear statement must be produced specifying conditions under which this target is to be met and performance monitoring must record information on level of compliance by all parties.

At Brunel, this target was actually quantified by the working group on performance standards and readily accepted by BMS (Appendix B). Performance is measured by expressing delivery failures as a percentage against bookings where the conditions of booking have been fully met by all parties.

4.4.3 Lecture rooms are inevitably subject to timetabling and at Brunel this is the responsibility of the Timetabling Unit in Academic Registry during teaching hours and the Conference Office for the remaining time. There are a number of complex issues here but in short it is vital that there is effective communication between those responsible for delivering lecture room services and those who timetable the rooms. While the level of interpersonal communication may be good (at Brunel both the Timetabling Unit and the Conference Office are represented on the Media Services User Group), there must also be effective systems, databases, etc., to ensure that lectures are scheduled in appropriately equipped rooms. Ideally, this should be provided as a one-stop service to the lecturer. While, it is not reasonable for the timetablers to have the specialist expertise in running multimedia facilities, it is desirable for them to be reasonably conversant with the technology and this may have certain training implications. So as a standard, it can be stated that:

There must be a high level of communication between those scheduling events and those delivering lecture room services with shared access by all service providers to a comprehensive lecture room database.

4.4.4 Another important time factor is the length of the changeover interval between sessions. For Brunel, sessions in the Uxbridge Lecture Centre are timetabled in hourly slots so there is very limited time between sessions to set up and test equipment. However, at the other campuses, the timetable slots tend to be longer, so for example a slot might last a whole morning or afternoon. This means that Uxbridge AV technicians have intensive periods of activity on the hour while Twickenham technicians primarily have service tasks first thing in the morning, at lunch times and during mid-session breaks. With the transfer of a whole faculty to Uxbridge it is probable that there will be an increase in the number of service events taking place on an hourly basis, assuming that the Lecture Centre timetable maintains its existing structure.

4.4.5 It is obvious that the number of events that can be serviced simultaneously is finite and dependent on staffing levels, equipment provision, optimum changeover time, etc..

4.4.6 In a situation where there is extremely limited changeover time, procedures need to be in place to ensure that set-up and testing time is minimised. This requires staff to be adequately trained, equipment and systems to be very reliable, effective task scheduling, procedures to ensure that kits are complete, and effective reserve measures available when things go wrong. It is likely that the complexity of multimedia equipment and frequent dependence on remote services will introduce additional problems with maintaining existing levels of performance for set-ups. Indicative BMS equipment set-up performances are:

- 98% of set-ups are completed in 10 minutes or less;
- 82% of set-ups are completed in 5 minutes or less;
- 12% of set-ups are completed in 3 minutes or less.

4.4.7 Ideally, support must be available throughout the hours of lecture room usage and this introduces certain issues with service levels, particularly where arrangements need to be made of supporting events during evenings, weekends and recesses. At Brunel, if AV services are required beyond office hours, special arrangements can be made for specific events, these being represented in the Service Level Agreement produced for the Conference Office (Appendix C).

An adequate system must be in place for ensuring lectures can be effectively supported throughout lecture room usage hours.

4.4.8 Sufficient preparation time must be allowed in order to fully service an event. At Brunel, the minimum booking notice period is 5 working days.

4.5 People

4.5.1 The range of issues concerning people are:
  - Competencies
  - Staffing levels
  - Special needs

4.5.2 There are two levels at which competencies can be viewed: initial training and qualification; continual development. There are a number of courses and qualifications appropriate to the field and a seemingly infinite number of routes media service staff can actually enter university lecture room servicing. This is effectively illustrated by the AV team at Brunel who have a diverse range of qualifications and experience including graduate and postgraduate level. This aspect is further complicated by the diversity of activity a department may service. So for example, where AV events are relatively infrequent, staff service other areas, such as student project support (advisory, equipment loan, post-production), production of teaching materials, off-air recording, training, etc.. Perhaps the only standard than can really be applied here is that staff should possess an appropriate level and qualifications for the job and this is determined at local level via the relevant job evaluation scheme.

4.5.3 Whatever the level of initial qualification and experience, rapid technological development requires a continual process of training and retraining both for lecturing and support staff. A suitable framework for lecture room competencies might look like this:

	Minimum level required	
	Lecturing staff	Support Staff
Software		
Current network operating system	Operational	Op and diagnostic
Presentation software	Operational	Op and diagnostic
Web browser	Operational	Op and diagnostic
General applications (local network)	Operational	Op and diagnostic
Course specific applications	Op and diagnostic	Operational
Production processes		
Presentation software	Basic	Advanced
Graphic design skills	Basic	Advanced
Image and sound recording	Basic	Advanced
Photocopying	Basic	Advanced
Video production	Basic	Advanced
Hardware		
Power supply	Room specific	Comprehensive
Operating modes	Room specific	Comprehensive
Adjust image and sound controls	Room specific	Comprehensive
for optimum clarity		

Evidently support staff have to manage a wide range of eventualities, and are consequently expected to have a thorough and wide-ranging knowledge of relevant software, hardware, processes and local lecture room environments.

4.5.4 Such essential competencies depend on an institution having a comprehensive staff development programme, on support staff to provide a role in implementing training, and on priority time to be given for developing new skills, for example in relation to software upgrades. Furthermore, this demands a significant knowledge of new products and so there is an increasing reliance on the availability of objective information. This is where the sharing of experiences via such groups as the Lecture Theatre Managers Group is proving to be particularly useful, but it really needs to be organised as a national / regional activity where centres can test products for their suitably for use in HEIs.

4.5.5 BMS staff are currently having their annual appraisal and this has provided a timely reminder of the need for a more systematic approach to sharing knowledge and developing the core skills listed above. All support staff should participate in this process, both as trainees and trainers. This requires a significant level of planning and ongoing commitment but this must not deter activity from being undertaken, even at a minimum level.

Lecture room support staff are required to have a comprehensive and continually developing range of competencies. Effective systems must be implemented to ensure support staff can fully participate in this process both as trainees and trainers.

4.5.6 In order to achieve the 100% service delivery target identified earlier, it is essential that there is an adequate number of staff available to deliver the service. A number of complexities have already been cited that can assist with determining an optimum number, and this needs to be offset against other factors, in particular cost. While one could examine staffing numbers as a comparison with student FTEs, this is perhaps less helpful in this case than factors such as the actual number of rooms serviced, the number of events to be serviced per day, the peak requirement for simultaneous bookings, and the times staff are expected to be available to attend events.

4.5.7 An additional servicing factor is that a central contact point must be maintained for bookings, responding to emergencies, operating equipment loan services, etc.. If the intensity of room service demands is high, sufficient provision must be made for staff presence to be maintained in a central service point with suitable cover for lunch times, etc.. However, such staff should be operationally familiar with service provision and so this is perhaps best handled by roster rather than employing full-time receptionists.

4.5.8 While it is perhaps a standard that should go without saying, the value of good interpersonal skills, professional and helpful attitude, appearance, etc., should not be underestimated.

4.5.9 Adequate provision must be made for lecturers, students and support staff with special needs and this should be manifest in arrangements for access to lecture rooms, channels of communication, and special installations such as induction loops. It is notable that effective access arrangements for wheelchairs also facilitate convenient access for equipment trolleys. Some Uxbridge Lecture Centre rooms are Category 2 theatres with tiered floors and have only one doorway at the higher level making access to the front impracticable for wheelchairs or equipment trolleys.

4.6 Equipment

4.6.1 Some technical considerations have already been considered in relation to equipment, but there are a number of management considerations that need to be discussed:

- range of equipment types to be made available;
- portable and installed equipment;
- longevity;
- ease of use;
- user information;
- formats;
- security;
- maintenance.

4.6.2 BMS endeavours to ensure that a good range of equipment is available for use and classes these as core and specialist equipment. Core equipment currently comprises:

- Projection Screens
- OHPs
- 35mm slide projectors
- LCD projectors (up to SVGA for data and video)
- VHS replay + TV monitors
- VHS camcorders
- PA equipment
- Portable cassette amplifiers

Specialist equipment is that which is infrequently requested but is kept in limited stock numbers. It also includes items that may not be held in stock and need to be hired in or in some cases purchased especially.

4.6.3 While some items of core equipment are permanently installed in selected lecture rooms, or at least kept on a trolley that serves a local cluster, certain portable items are kept in central store and are available for delivery or loan for events. There are a number of practical and financial considerations that determine when equipment needs to be permanently installed. Whatever the case, there must be sufficient stock levels to ensure maintenance of the 100% delivery standard. It is also important to ensure that any portable equipment held in stock is genuinely portable and so a realistic all-up weight restriction may be considered appropriate. Weight is not the only factor determining portability and consideration must also be given to fitness-for-purpose in relation to carrying cases and their straps and handles, the need in certain situations to carry bundles of equipment, and the problem that some lightweight equipment may actually be large or have awkward protrusions.

4.6.4 Generally speaking, audio-visual equipment has experienced a high level of longevity in comparison with IT hardware and at Brunel there are countless examples of items of equipment that are continuing to provide effective service delivery beyond ten years. More recently, there has been a move to renew some of this older core equipment at Brunel, but it is expected that the new equipment will last at least as long as the replaced equipment. However, certain items, such as LCD projectors, are developing very rapidly and at the moment it is unrealistic to expect the quality of current models to be unsurpassed in three years time, or even less. Inevitably, the increasing demand for this facility will impose a strain on finances during the next few years, though future products will inevitably offer greater value for money in terms of improving levels of brightness and resolution. Such equipment also tends to have a high depreciation rate.

4.6.5 While the ability to make effective use of equipment can be tackled by staff development, it is important to minimise the level of problems that might occur when using unfamiliar

equipment. It is perhaps better for staff development sessions to concentrate on transferable rather than machine-specific operating skills in this respect. Ease of use can be supported by offering consistent models of equipment from stock, minimising the use of equipment with excessive operational features, making use of a standard universal remote control unit, etc.. Perhaps the most useful measure that can be adopted as a standard is a consistent labelling system for all equipment, and indeed other important operational controls such as lighting. This should contain a brief critical operating path for the item of equipment and contact information for seeking help. It might also contain information for the service provider but this must be kept to a minimum, say by use of a bar-code label. The critical operating path should provide information on:

1. Activating power supply

2. Selection of operating mode

3. Essential presentation adjustments

4. Closing down and switching off

Brunel lecture room equipment is currently labelled in a somewhat ad-hoc way and the need for a more consistent labelling system has been included in the AV Service Performance statement (Appendix B). It is intended to label equipment along the aforementioned lines.

4.6.6 Just as important as equipment labelling is the actual provision of information about the service. This is recognised as a key issue at Brunel throughout the Information Services. Media Services created a revised post in 1997, Recordings and Information Officer, whose responsibilities comprise the off-air recording service and relevant licensing compliance arrangements, and provision of service information. This person is responsible for updating the service's website, for producing relevant literature and circulars, and ensuring that news items, however small, are frequently included in the University newsletter. Bulletins are also circulated by email to members of Media Services User Group and these are certainly forwarded in some cases to entire departments by representatives. Service reports are also made by managers at each Information Services Sub-Committee. The value of informal networking cannot be underestimated as an additional measure. Evidently the provision of service information must be made in a co-ordinated way via the widest range of possible channels. Furthermore, it is vital that communication within the service department is operating at optimum level, both formally and informally, so that consistent information is provided to the user community.

4.6.7 A range of new media formats is now on the market, some in competition with others, giving a lot of potential for confusion and incompatibility. However, the basis for any standardisation must be consensus, and with inevitable exceptions, it is suggested that a useful standard to adopt is that of widespread availability and familiarity to the consumer. This has indeed been the case in the past for VHS video, and there is currently little motive for BMS to change to a different video format for lecture room presentation. However, it is important that convenient services are locally provided to enable transfer of media from a wide range of formats for use on the common one adopted within the institution. This must include analogue to digital forms and BMS has recently invested in two current multimedia computers (PC and Mac) to enhance the level of service in this area, particularly for converting analogue video to MPEG files (and vice versa). A similar principle applies for multimedia codecs in that it is better to adopt those widely available to the consumer. In summary:

Presentation formats and digital codecs must be widely available to the consumer before adopting them in HEIs.

There must be an effective and convenient service operation that provides a core range of format and file conversion operations.

4.6.8   Working on the principle that by virtue of the subject it is better to devise unique local measures for ensuring effective levels of security, there are still certain operational standards that can be adopted. An important factor is that if one adopts the previous standard of consumer availability this also 'sale' value and consequent risk in relation to items of equipment. A good basis for effective equipment security is effective premises security and it is vital that there is an appropriate level of communication between those responsible respectively for security and lecture room services. A second principle is that the service implements effective measures for attributing responsibility for certain items of equipment to users while it is in their care. It is particularly important to ensure there is no gap occurring in any handover period between the service and the user during which equipment is exposed to an increased level of risk. This also applies to keys that might be loaned to users for unlocking equipment cupboards, etc.. Procedures and liability must be clearly understood by all parties concerned. Inevitably, equipment will go missing or be damaged but it is often difficult to claim on insurance when levels of excess charge are already high and this inevitably puts the burden of replacement cost on the service or the user.

4.6.9   In order to achieve the 100% delivery target, equipment must be fully operational at the required delivery time. This must be supported by an effective programme of routine inspection, which necessarily includes cleaning and checking for electrical safety, and suitable measures for undertaking remedial maintenance. With the increasing level of digital systems incorporated in today's devices, it is inevitable that the majority of remedial work must be undertaken by manufacturers and appointed dealers. Measures must be taken to provide replacement from stock, both for an immediate session if something breaks down and in the medium term if equipment has to be sent away for repair. So suggested standards are:

There must be a system for routine cleaning and inspection that includes checking for electrical safety.

There must be effective liaison with reputable contractors, normally recommended by regional purchasing consortia, to ensure effective delivery of remedial services.

Stock levels must be sufficient to offer reserve equipment in case of failure to a level that is fit for purpose.

BMS currently aspires to these standards, but the level is somewhat inconsistent. The AV Service Performance Statement (Appendix B) incorporates a line on routine inspection and the service is currently seeking ways of approaching this more rigorously for all campuses than at present. Testing for electrical safety has been subcontracted on an annual basis but the service is currently seeking to undertake this in-house and incorporate a more comprehensive record system via computer database and bar-coding for a collection of routine inspection tasks. The service makes regular use of a selection of contractors for remedial servicing, some recommended via the SUPC AV Commodities Group. The level of reserve equipment for data projection is more limited than is ideal but priority is in any case being given to increasing overall stock levels of LCD projectors.

4.7 Finance

4.7.1   The range of issues concerning funding of lecture room services include:

- scope;
- cost recovery;
- replacement as well as additional;
- lease or hire;
- peripherals and furniture.

4.7.2   One of the difficulties thought to be prevalent at Brunel is that the funding of lecture room services is managed by a variety of service operations, both within the academic and administrative areas of the University. This is complicated by the fact that most services are multifunctional and it is only recently that BMS has been required to identify its costs in relation to specific service operations rather than more general categories of expenditure. Consequently, individual service managers may have a limited view of the total expenditure on lecture room services within the University. The most variable budget on a year-to-year basis has hitherto been the equipment budget, partly because of variability of capital funding of installation projects, and partly due to this being a more flexible recurrent expenditure category than pay, licence fees, etc..

4.7.3   BMS is funded primarily by means of a cost recovery mechanism, whereby academic departments have a levy deducted from their resource allocation by means of a distribution model that takes into account service usage and departmental 'size'. The Computing Service is funded in a similar way, but there is also an infrastructure allocation primarily used for networking projects. BMS also receives an annual fee from the Conference Office in relation to AV support, this being recovered by the CO by means of equipment hire charges made to conference organisers. Administrative departments, including some services with interests in lecture rooms, are funded separately to the academic resource allocation. While this is a somewhat complicated arrangement, BMS has attempted to ensure a balanced delivery of service in relation to the cost recovery mechanism, so that the proportion of expenditure in a particular service area such as AV support for lecture rooms is matched to the cost recovery model weightings.

4.7.4   When devising budget strategies, BMS has attempted to ensure that a reasonable level of funding is provided for replacement equipment. Ideally, this would be formulated as a percentage of existing assets, but this has proven difficult in practice owing to the limited level of equipment funding and the extreme range of replacement times for specific equipment items.

4.7.5   There must be a highly efficient means of procuring multimedia resources in order to limit the financial burden imposed by growth, frequent replacement and high depreciation rate. This requires a high level of collaboration by means of central institutional purchasing strategies and national or regional interest groups and consortia.

4.7.6   The majority of BMS equipment has been purchased rather than leased or rented.

4.7.7   Budgets relating to equipment must incorporate adequate provision for related items such as cases, stands, trolleys, lockers, connecting cables, ongoing maintenance, training, etc..

5 Conclusions

5.1   The determination of standards in relation to the local project at Brunel University is proving to be an extremely useful exercise. The main benefits at a local level have been:

   (i)   an improvement in the level of knowledge on the fundamental principles of AV presentation;

   (ii)   the opportunity to review service delivery by more objective means;

   (iii)   the facility to adopt a systematic approach to analysing the quality of existing facilities and services;

   (iv)   the means of identifying major issues that are relevant to planning the future delivery of lecture room services;

   (v)   the collection of evidence to support arguments for resource allocation in identifiable areas;

   (vi)   the summary of a range of relevant technical and service standards within a single document.

5.2   The time scale of the Case Study effectively provides a snapshot of ongoing activity that may itself be used as a benchmark to examine progress at future intervals. Inevitably, there are certain issues where it has only been possible to scratch the surface.

5.3   The initial research into suitable standards, while arguably limited in depth, has nevertheless yielded a useful range of quantitative standards, operational guidelines, etc., that have enabled an extensive range of issues to be examined. There has been a subconscious process of excluding matters that were not thought to have a wider relevance, or were perhaps too complicated for general application. It is hoped that this Case Study is perceived to have fulfilled its declared aim and that the standards suggested indeed form the basis for a more extensive examination at national level within HEIs. It is therefore proposed that these standards are examined in a number of sample institutions for the purposes of determining their appropriateness and to consider any additional standards thought to have been omitted.

5.4   A primary concern is that of physical space. It is evident that while improvements can be implemented with relative ease to equipment installations and networking infrastructure, more fundamental aspects, such as physical proportions of rooms, accessibility, etc., are extremely difficult to change. Brunel University has a range of lecture rooms that includes adaptations of buildings on historical sites to modern purpose-built lecture theatres. A large number of HEIs probably have similar kinds of provision. While compromises must inevitably be made with existing rooms it is vital that new building projects, including adaptations, fully adopt appropriate standards relating to the physical space, seating layout, acoustics, etc., as a prerequisite to equipping lecture rooms for AV and multimedia.

5.5   It is significant that the standards relating to facilities have tended to be physical rather than technical. This is primarily due to the fact that acceptable technical standards, i.e. those pertaining to product performance and interconnectivity, are constantly changing. This may be to such an extent that several changes can be expected within the timescale likely to be achieved by any national standards review process. To this extent, technical standards will inevitably be culturally driven by manufacturers, suppliers, and local service operators. It is therefore vital that a high level of ongoing cultural exchange exists between service deliverers by means of national interest groups, mailbase groups, purchasing consortia, etc.. Furthermore, such exchange should focus on the specialist needs of HEIs and national organisations need to be proactive in alerting manufacturers to expectations in relation to product development.

5.6   The most important standard in relation to supporting lecture room services is the 100% delivery standard. This is the prerequisite benchmark both for strategic and operational planning in relation to the delivery of lecture room services and must be supported by a highly effective organisational structure and highly efficient resource management. By necessity this must be implemented at institutional level rather than by individual service departments. However, service departments can be proactive in ensuring that their specialist knowledge is fully incorporated into the strategic management processes of the institution.

5.7   Furthermore, certain models of service delivery are believed to create oppositional attitudes between academic and service departments. It is vital that a suitable model is implemented that encourages more collaborative approaches to providing multimedia in lecture rooms to the ultimate benefit of the student.

6 Bibliography

British Standards Institution, BS 5550 : Part 7 : Subsection 7.2.6 : 1991 *Cinematography - Screen luminance for the projection of motion picture prints in indoor theatres and review rooms.*

British Standards Institution, BS ISO 9004-2 : Part 8 : 1991 *Guide to the Quality Management and Quality Systems for Services*

British Standards Institution, BS ISO 9568 : 1993 *Cinematography - Background acoustic noise levels in the theatres, review rooms and dubbing rooms.*

British Standards Institution, BS ISO 11314 : 1995 *Photography - projectors - image size/projection distance calculations.*

Purdom, Nick, *The Complete Guide to Electronic Presentations*, Sony Broadcast & Professional UK, 1996.

Robertson, Ian, *Audio-Visual Equipment: a technician's and user's handbook*, Butterworth-Heinemann Ltd., 1991.

Simpson, Robert E., *Effective Audio-Visual: a user's handbook*, Focal Press, 1987 and 1996.

Talbot-Smith, Michael (Ed.), *Sound Engineer's Pocket Book*, Focal Press, 1995.

Various manufacturers' and suppliers' catalogues, brochures and manuals.

Websites:

http://www.agocg.ac.uk/AV/standards.html

http://www.bsi.org.uk/

http://www.brunel.ac.uk/depts/cc/network

http://www.brunel.ac.uk/depts/media/

7 Tables

Table 1 Proportional sizes in relation to distance *V* (Screen to back row of seats)

All dimensions expressed in metres.

V	Screen Height (*V*/8)	Minimum Front Row Distance (*V*/4)	Minimum Video Display Diagonal (*V*/10)	Minimum Data Display Diagonal (*V*/6)	Minimum Top of Screen Height	Suggested Screen
5	0.62	1.25	0.50	0.83	1.82	1.5 x 1.5
6	0.75	1.50	0.60	1.00	1.95	1.5 x 1.5
7	0.87	1.75	0.70	1.17	2.07	1.5 x 1.5
8	1.00	2.00	0.80	1.33	2.20	1.5 x 1.5
9	1.12	2.25	0.90	1.50	2.32	1.5 x 1.5
10	1.25	2.5	1.00	1.67	2.45	1.5 x 1.5
11	1.37	2.75	1.10	1.83	2.57	1.5 x 1.5
12	1.50	3.00	1.20	2.00	2.70	1.8 x 1.8
13	1.62	3.25	1.30	2.17	2.82	1.8 x 1.8
14	1.75	3.5	1.40	2.33	2.95	2.0 x 2.0
15	1.87	3.75	1.50	2.50	3.07	2.0 x 2.0
16	2.00	4.00	1.70	2.67	3.20	2.5 x 2.5
17	2.12	4.25	1.70	2.83	3.32	2.5 x 2.5
18	2.25	4.50	1.80	3.00	3.45	2.5 x 2.5
19	2.37	4.75	1.90	3.17	3.57	3.0 x 3.0
20	2.50	5.00	2.00	3.33	3.70	3.0 x 3.0
21	2.62	5.25	2.10	3.50	3.82	3.0 x 3.0
22	2.75	5.50	2.20	3.67	3.95	3.0 x 3.0
23	2.87	5.75	2.30	3.83	4.07	4.0 x 3.0
24	3.00	6.00	2.40	4.00	4.20	4.0 x 3.0
25	3.12	6.25	2.50	4.17	4.32	4.0 x 3.0
26	3.25	6.50	2.60	4.33	4.45	4.0 x 3.0
27	3.37	6.75	2.70	4.50	4.57	4.0 x 3.0
28	3.50	7.00	2.80	4.67	4.70	4.0 x 3.0
29	3.62	7.25	2.90	4.83	4.82	4.0 x 3.0
30	3.75	7.50	3.00	5.00	4.95	4.0 x 3.0

Table 2 Example Lecture Centre Rooms at Brunel University

Category	No. of Seats	Distance of First Row to Screen (Metres)	Distance V (Back Row to Screen)	Rolled Screen Size in cm	Angled Screen	Length of First Row (Metres)	Screen Bottom to Floor (Metres)	Screen Top to Ceiling (cm)	Audience angle of the Screen Axis
3	20	board rm	5.30	155x155	No	5.00	0.92	30	25º
3	50	2.00	6.40	150x150	No	7.00	0.90	30	60º
2	70/80	2.80	9.00	180x180	150x150	6.10	0.90	30	51.3º
2	70/80	2.00	9.76	180x180	150x150	5.48	0.90	30	53.8º
1	160	2.60	11.70	235x235	No	7.14	sliding screens	30	53.9º
1	210	2.80	15.53	235x235	No	7.66	sliding screens	30	53.8º
1	400	5.60	21.60	400w x 300h	No	15.4	1 & variable	0	53.9º

8 Appendices

Appendix A:

Brunel Media Services - Audio Visual Facilities Survey

Summer 1997

A Summary of Findings

1.   *Aim* - The aim of the survey was to identify priorities for developing AV facilities in public lecture rooms throughout the University during the current strategic planning period.

2.   *Distribution by Campus*

Location	Number Distributed	Number Returned	%age Distribution	%age Returned
Uxbridge	292	58	52.5	54.7
Osterley	129	23	23.2	21.7
Twickenham	121	21	21.8	19.8
Runnymede	14	4	2.5	3.8
Totals	556	106	100%	100%

3.   *Current Usage of AV Facilities* - Almost every department was represented in the response.

Facility	Number of Users	Facility	Number of Users
Overhead Projector	84	VHS Replay	47
Whiteboard	27	35mm Projector	22
SVGA/PC projection	14	Tape Recorder	4
None	4	Flipchart	3
Microphone	2	Unspecified	2
Mac Presentation	2	Camcorders	2
Laserdisc	1	CD Rom	1

4.   The following is a list of required improvements expressed in the responses to the survey. Also indicated is the number of times each improvement has been listed among the top 3 priorities.

Required Improvement Expressed	Number of Times Expressed in Survey Responses	Number of Times Expressed as a Top 3 Priority

Improved projection screens	49	28
Improved lighting control	46	23
Improved window blinds or curtains	41	21
Improved whiteboard	39	17
SVGA projection	29	19
Network point	28	16
Large screen for video display	27	11
Hi-lumen OHP	25	13
Radio microphone (tie-clip for lecturer)	23	12
Improved access and facilities for disabled students	20	8
Provision to display Mac	16	7
Provision to display Unix	11	6
Videoconferencing	9	3
Laser disc playback	8	3
Radio mic. (hand held for audience circulation)	8	3
Playback in video formats other than VHS	7	3
PA System	7	4
16:9 video display	4	1

Appendix B: Information Services Sub-Committee - Working Group on Performance Standards

Draft statement

Media Services

[NB Working Group Comments have been included in square brackets and these are currently under discussion with the Media Services User Group]

AV service

STATUS

Core

DESCRIPTION

The aim of this service is to provide an extensive range of AV equipment and supporting services for teaching applications in central lecture rooms. Equipment is provided either by permanent installation in lecture rooms, by setting up for specific events or by issuing to users from central service points. Bookings for events and equipment loans can be made by personal visit, telephone, email or internal mail and arrangements for delivery collection are agreed with the user. There is a central email address and internal telephone line for bookings and enquiries. Stock is maintained at a level determined to be appropriate to satisfy prevailing operational requirements. Equipment is serviced by routine inspection and by attending to reported faults, subject to convenient access times. A certain level of support is given for departmental lecture rooms where there are no technical staff within the department. This service is also provided to conference organisers by agreement with the Conference Office.

Further details at URL: http://www.brunel.ac.uk/depts/media/services.htm

AUTHORITY

[Authority needs to be agreed. It was proposed that this should be the Information Services Sub-Committee.]

FUNDING

Media Services budget and Conference Office annual fee.

SECTION

AV team

OBJECTIVES

- [99]% of users will be able to use existing AV installations without referral to Media Services
- [100]% of requests will have the required equipment set-up and collected for a specific event [on any of the four campuses, subject to advanced notice from the user of 5 working days]
- n% of applications to borrow equipment will be satisfied [within 15 working days]

- MEASUREMENT

- [All AV equipment to be labelled with contact number for immediate response]
- [Introduction whereby all equipment is checked on a random basis to be functioning properly]
- [A user evaluation sheet for all clients at least once a year.]
- a log kept of any matters referred to Media Services in relation to installed equipment and matched as a percentage against room bookings for given periods
- a log kept of complaints in relation to set-ups and collections and matched as a percentage against booked events for given periods
- a log kept of booking requests where alternative arrangements became necessary, matched as a percentage against number of AV equipment loan agreements for given periods
-

DEPENDENT ON

- Specification by the University of groups of rooms to be centrally serviced
- Suitability of a lecture room for the required mode of AV presentation
- Accessibility to lecture room prior to an event or for service inspection [Delete]
- Prior user training and experience in operating specific equipment [Delete]
- Prior booking in accordance with standing notification periods
- Availability of equipment in particular spaces at particular times [Delete]
- Notification of faults by users [Delete]
- Satisfactory return of loan equipment by previous borrower [Delete]

COMPONENTS

- Service information, training and advisory support
- Enquiries and booking
- Equipment set-up and breakdown
- Stock control
- Equipment issue and retrieval from service point
- Installation
- Equipment maintenance
- Administration

CHANGE OBJECTIVES

Based on demands. Current trend towards increasing use of LCD projectors for data presentation. Service will increasingly be provided from the Uxbridge centre.

[It was suggested that there should be some mention of the service continuing to keep apace with its stock of state of the art equipment, and of the service introducing a mechanism to ensure that users return equipment after they have finished with it. Also it was acknowledged that adequate user training should be an important development target.]

HIGHEST RISK ASSESSMENT CATEGORY

Availability of appropriate AV equipment at required place and time.

Media Services

18 March 1998

Appendix C:

Brunel University

Media Services

Service Level Agreement for Conference Office

1. This document constitutes a service level agreement between the Media Services   and Conference Office of Brunel University and applies to provision of AV services in relation to all conferences and courses arranged through the   Conference Office taking place on the Uxbridge Campus.

2. The Service Level Agreement lasts for a period not exceeding 12 months from the date of signature to 31st July of the subsequent year.

3. Media Services undertakes to provide the Conference Office with relevant information on the AV services and facilities available for use by external clients, by means of a published Schedule giving details of rooms equipped with AV installations, portable AV equipment and indicative hire rates.

4. Subject to the relevant clauses contained within this Agreement, Media Services is obliged to make available to the conference or course organisers, hereafter referred to as the Client, the required AV equipment and facilities selected from the current Schedule at the requested dates and times specified in the written booking confirmation.

5. The Conference Office is responsible for communication with the Client in relation to AV Services by providing information on services available, confirming booking arrangements with Media Services and collecting any payments due from the Client.

6. The Conference Office will require the Client to sign a declaration to the effect that s/he will indemnify and hold harmless Brunel University's employees, and its assigns, against any infringement of the Copyright, Designs and Patents Act 1988 in relation to the unauthorised performance and recording of works.

7. Media Services must be informed as soon as possible of any events booked which are likely to require AV services. The Conference Office will provide Media Services with written confirmation by Thursday no less than one week before the event and is obliged to ensure accuracy with the Client. This will be regarded as the definitive statement of the Client's requirements.

8. While variations to a confirmed booking may subsequently be negotiated, Media Services reserves the right to refuse any such request which cannot reasonably be fulfilled with the available time and resources. A specific charge will be made for the provision of services in respect of any such variations, including any staff and hire costs, by means of an internal transfer demand issued to the Conference Office. Media Services will advise the Conference Office of the full cost of the   special arrangement prior to issue of demand.

9. The Conference Office will ensure that AV facilities are operated by competent persons and will indemnify Media Services in respect of any loss or damage to the equipment occurring during the booking period.

10. The Conference Office will not permit the Client to connect his/her own equipment to any AV facilities without the prior agreement of Media Services staff.

11.   AV Services are normally provided weekdays between 9.00am and 5.00pm throughout the year. Media Services does not normally provide attended service at weekends but can provide support for a specific event in one of the following ways:

(i)   by demonstrating the equipment to a suitable representative of the Client prior to the event at a mutually agreed time, the cost of this service being absorbed within the Annual Fee;

(ii)   by inviting members of its technical staff to work on specific events for overtime payment at the appropriate rate, this being charged to the   Conference Office;

(iii)   by approaching up to three successive sub-contractors in the event that alternative arrangements are not possible. The Conference Office will be charged the full cost of the subcontracted service but any Media Services administration costs will be absorbed within the Annual Fee.

12.   (i)   The Conference Office will agree in advance with the Client the arrangements for attended AV support for specific events, consistent with the specific arrangements for evening and weekend cover agreed for the event in relation to Clause 11.

(ii)   In the event of the equipment breaking down during operation, the Client should   contact the Conference Office immediately who will implement the emergency back-up procedures agreed for the event.

(iii)   In the event that any equipment failure cannot be rectified within a reasonable time scale, Media Services is obliged to provide substitute equipment of a similar standard, which may be left in the care of the   Conference Office in advance of the event. If the replacement equipment is of a lower specification, the relevant hire fee for the item will be waived. If no replacement equipment is available, Media Services will   offer compensation to the Client, via the Conference Office, not exceeding the relevant equipment item hire fee. In such cases, the Conference Office will issue Media Services with a specific departmental transfer instruction.

(iv)   In the absence of technician support, the Conference Office is responsible for ensuring that any equipment provided is secure and disconnected from the power supply when not in use.

13.   For any booked service event, Media Services staff will install the requested equipment to a level which is ready for the client to use, i.e.:

- the equipment will be placed in an appropriate location on a suitable stand or trolley and any screens required made ready;
- the equipment will be plugged into a suitable power supply and all signal connections made good and checked;
- any lenses will be adjusted for focus consistent with its set-up location;
- the equipment will normally be left switched-off at its operating panel unless it is likely to result in inconvenient loss of functionality or data;
- the equipment will be ready to use no less than fifteen minutes before the starting time of the conference or course detailed in the booking confirmation.

The Client is responsible for resetting the equipment if s/he chooses to relocate it   or alter the default settings and should be asked to switch it off and disconnected from the power supply after use.

14.   The Conference Office will pay Media Services an Annual Fee, less a 5% royalty, by 1 July preceding the end of the agreement period. The Annual Fee is decided by mutual agreement at the start of the agreement period and is based on the previous year's Annual Fee plus inflation as of the date of signature, taking account of any agreed variation in relation to Clause 15.

15.   Media Services will keep a record of the number of events serviced during the financial year to assist in determining any variation to the previous year's fee. Any consequent variation to the Annual Fee will not exceed 5% more or less than the previous year's Annual Fee.

16.   The Annual Fee includes the hire of equipment and facilities described in the Schedule, and staff time during normal service opening hours. It excludes overtime payments, consumables, and the cost of providing services varying from any booking confirmation.

17.   In the event of any failure of either party to fulfil their obligations during the agreement period, the injured party will notify the other in writing giving details of the incident so that both parties may agree an appropriate course of action.

Agreement period from _____ to 31 July_____

Annual fee £_____, less 5% royalty.

Signed _____   _____

           Media Services Manager   Conference Manager

Appendix D: Summary List of Standards

<u>Physical and technical standards</u>

1.   The essential distinguishing characteristics of lecture rooms are summarised in the following categories:

Category 1   Room with fixed seating and projection booth

Category 2   Room with fixed seating without a projection booth

Category 3   Room with unfixed seating [2.3.12]

2.   For members of the audience to be able to view clearly, they should be seated within a 45° angle of the centre line of the screen. [2.3.1]

3.   The bottom of the screen must be at least 1.2 metres above floor level. [2.3.4]

4.   Maximum height of the screen depends on the height of the ceiling, seating area and the position of any suspended structures that may obstruct viewing or projection. [2.3.6]

5.   Proportional distances and screen sizes in relation to distance V, i.e. the screen to the back row, are:

(I)   The minimum distance between the screen and front row is $V/4$. [2.3.5]

(ii)   The maximum length of the front row of seats is $V/2$. [2.3.5]

(iii)   The minimum diagonal screen size for video display is $V/10$. [2.4.1]

(iv)   The minimum diagonal screen size for data display is $V/6$. [2.4.1]

6.   There must be separate control of lighting for the audience and the screen [2.3.7] spaces.

7.   Lighting controls must be convenient and simple to operate. [2.3.7]

8.   It should be possible to achieve almost total exclusion of daylight. [2.3.7]

9.   Reverberation time experienced in a lecture room should be in the region of one second. [2.5.3]

10.   High quality separate audio amplification should be used in lecture rooms seating 40 or more people with sufficient power rating to deliver undistorted sound at a typical operating level appropriate to the room. [2.5.4]

11.   Separate audio amplification systems must include a multiple microphone facility, normally via a cable, offering a suitable choice of operating modes. [2.5.6]

12.   Any lecture room audio system should include a suitable line level output facility for the purposes of recording lectures or onward transmission. [2.5.7]

13.   All audio installations should include an induction loop system so that hearing aid users can receive the entire range of audio sources available on the system via their 'T' setting. [2.5.8]

14.   Chalk boards must not be used where there is also use and storage of any equipment containing electronic circuits, lenses or viewing screens. [2.6.1]

15.   Data displays must incorporate suitable electronic interfaces to enable spontaneous enhancement of and interaction with any multimedia display. [2.6.3]

Service standards

16.   The benchmark for achieving delivery of support services for prearranged events is 100% and this has priority when planning service management strategies. A clear statement must be produced specifying conditions under which this target is to be met and performance monitoring must record information on level of compliance by all parties. [4.4.2]

17.   Each lecture room must have a clearly defined and widely published and understood support system. [4.3.2]

18.   There must be a high level of communication between those scheduling events and those delivering lecture room services with shared access by all service providers to a comprehensive lecture room database. [4.4.3]

19.   An adequate system must be in place for ensuring lectures can be effectively supported throughout lecture room usage hours. An adequate system must be in place for ensuring lectures can be effectively supported throughout lecture room usage hours. [4.4.7]

20.   Lecture room support staff are required to have a comprehensive and continually developing range of competencies. Effective systems must be implemented to ensure support staff can fully participate in this process both as trainees and trainers. [4.5.5]

21.   Presentation formats and digital codecs must be widely available to the consumer before adopting them in HEIs. [4.6.7]

22.   There must be an effective and convenient service operation that provides a core range of format and file conversion operations. [4.6.7]

23.   There must be a system for routine cleaning and inspection that includes checking for electrical safety. [4.6.9]

24.   There must be effective liaison with reputable contractors, normally recommended by regional purchasing consortia, to ensure effective delivery of remedial services. [4.6.9]

25.   Stock levels must be sufficient to offer reserve equipment in case of failure to a level that is fit for purpose. [4.6.9]

Keith Buckman

23 April 1998