



An Introduction to Communication Systems for Medical Facilities

By

J. Paul Guyer, P.E., R.A.

PDHLibrary Course No 0005451
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Guyer Partners
44240 Clubhouse Drive
El Macero, CA 95618
(530)758-6637
jpguyer@pacbell.net

J. Paul Guyer, P.E., R.A.

Paul Guyer is a registered civil engineer, mechanical engineer, fire protection engineer, and architect with over 35 years experience in the design of buildings and related infrastructure. For an additional 9 years he was a senior-level advisor to the California Legislature. He is a graduate of Stanford University and has held numerous national, state and local positions with the American Society of Civil Engineers and National Society of Professional Engineers.

CONTENTS

- 1. INTRODUCTION**
- 2. COMMUNICATION DISTRIBUTION FACILITIES**
- 3. TELEPHONE SYSTEM REQUIREMENTS**
- 4. TELECOMMUNICATIONS INFRASTRUCTURE SYSTEM (TIS)**
- 5. DEDICATED INTERCOM SYSTEM**
- 6. ENTERTAINMENT AND EDUCATIONAL TELEVISION (TV) SYSTEM**
- 7. RADIO FREQUENCY DISTRIBUTION SYSTEM**
- 8. NURSE CALL TONE VISUAL (NCTV) SYSTEMS**
- 9. NURSE CALL AUDIOVISUAL (NCAV) SYSTEMS**
- 10. PUBLIC ADDRESS (PA) AND PROGRAM DISTRIBUTION SYSTEM**
- 11. RADIO PAGING SYSTEMS**
- 12. EMERGENCY MEDICAL SERVICE (EMS) COMMUNICATIONS**
- 13. PHYSIOLOGICAL MONITORING**
- 14. SPECIAL MONITORING EQUIPMENT**
- 15. ELECTRONIC SECURITY SYSTEMS**
- 16. EMS RECORDER SYSTEM**

1. INTRODUCTION.

This is an introduction to communications systems for medical facilities such as hospitals and clinics. It is not a design manual and not a definitive treatise on the topic. It is intended to provide members of the building design and construction team to terminology, concepts, systems and practices only in a general way. For design of projects engineers must refer to applicable codes, standards and practices. Medical facilities use various integrated voice data, imaging, information, electronic security and telemedicine systems to provide quality healthcare, and those discussed here are for illustration purposes only.

1.1 Construction. All construction will require application of detailed communications engineering concepts, with consideration of system size, organization, function and cost.

1.2 Design Criteria. Communication systems, equipment and facilities will be designed in conformance with the Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines, NFPA 70, NFPA 99, NFPA 101, TIA/EIA 568, TIA/EIA 569, TIA/EIA 606, TIA/EIA 607, TIA/EIA 758 and applicable standards and criteria.

2. COMMUNICATION DISTRIBUTION FACILITIES. Communications systems distribution and support facilities will be provided as described herein:

2.1 Exterior. Design of the exterior cable system will be interfaced with the existing installation cable network and based on the requirements of the project. All exterior cable will be installed underground to the extent it is financially and physically feasible and not in conflict with the installation architecture. The primary route from the new facility to the Installation network will be a concrete encased duct bank to the nearest available service point.

2.1.1 Design Considerations. The number and size of conduits installed will provide for current needs and for reasonable future expansion. Design will be based on the forecasts for the telephone system line and trunk load and all other cable systems using the duct bank. The design analysis shall include the basis for conduit quantities used. Design of duct bank and manholes shall be based on ANSI/TIA/EIA 758.

2.2 Interior.

2.2.1 Cable Tray. Provide cable trays above the suspended ceilings in the corridors for all communications systems cables. Cable trays shall be located just above the ceiling and shall be designed and installed to insure ease of accessibility for future wiring changes. The cable tray system design and installation shall be in full compliance with ANSI/TIA/EIA 569.

2.2.2 Communications Rooms. The communications rooms will be sized and provided utility support in accordance with ANSI/TIA/EIA 569. Communications rooms shall be a minimum of 100 square feet each. In multistory facilities, communications rooms will be provided on each floor and vertically aligned to facilitate connection of all communication system riser conduits and wiring. Utility outlets will be on a dedicated circuit of the equipment branch of the emergency power system. Each equipment location will be provided with appropriate dedicated AC power. Insure that AC power from the appropriate emergency power branch is provided for each communication system. A penthouse equipment room, when required in hospitals and medical centers, shall be provided. The room is used to house radio equipment for the radio paging system, the television system and the ambulance emergency medical system (EMS). Also provide conduit penetrations to antennas for coaxial cables and emergency power for equipment in accordance with applicable standards and practices.

2.2.3 Communications Head End Equipment Room. A separate communications equipment room with sufficient space for personnel circulation and equipment maintenance will be provided in hospitals and medical centers for head end equipment such as television, public address and program distribution, radio, and data

communications equipment. This room will be located adjacent to the telephone system equipment room. This function will be supported by a communications room in clinics. Circuit breaker panels fed from the appropriate emergency system branches, as shown in Table 1, shall be installed in the room to serve the head end equipment. Design of the room including utility support shall be in accordance with ANSI/TIA/EIA 569.

2.2.4 Central Communication Room. A central communication room will be provided in hospitals and medical centers. The central communication room will be located as directed by the user. The central communication room size will be based on the quantity of wall mounted graphic displays, annunciator displays and other monitor and control equipment. Install monitors, annunciators, and control equipment in the room for any or all of the following systems per user direction:

- Engineered smoke control system (ESCS).
- Fire detection and alarm system.
- Generator monitor and alarm system.
- Medical gas monitors and alarms.
- Closed circuit TV (CCTV) for security (space designated for monitor and programmable system and control equipment and videocassette recorders).
- Refrigeration temperature monitor and alarm system (blood bank, food, pharmaceuticals (pharmacy and logistics) and morgue).
- Public address master microphone and paging zone selector panel.
- Radio paging console.
- Telephone attendant console.
- Security system console.
- Electronic Private Branch Exchange (EPABX) alarms.
- Pneumatic tube system control equipment

2.2.5 Main Computer Room. A separate main Information Systems computer room shall be provided when required by the user. The room shall be sized to accommodate the equipment planned for installation in the space. The designers will accommodate power distribution, HVAC with temperature and humidity controls, access control, fire detection and alarm, uninterruptable power supplies, voice and data equipment in addition to the basic computer equipment. The room will be equipped with sound dampening finishes. A raised floor will be provided if required by the user.

3. TELEPHONE SYSTEM REQUIREMENTS.

3.1 Central Telephone Equipment. The facility shall receive telephone service either from an internal Telephone Switching System (TSS) or served from other source as prescribed by the facility requirements and site specific information. An internal TSS is required in all hospitals, medical centers and other medical facilities as required by the user. The TSS may consist of a Private Branch Exchange (PBX) or Remote Switching Center (RSC) as directed by the user. The TSS will be capable of being upgraded to provide a national non proprietary ISDN service. If ISDN service is required by the user it shall be a national nonproprietary ISDN service.

3.1.1 Facilities. The following will be provided when a TSS is installed: service entrance conduits, a main distribution frame (MDF), a 5 ohm (maximum) signal grounding system in accordance with NFPA 70, power from the emergency life safety branch and a DC power supply consisting of dual rectifiers and sealed, low maintenance batteries. Batteries shall have a minimum capacity of two hours at full load. Each rectifier shall be sized to simultaneously operate the fully loaded TSS and charge the batteries. Multiple element surge protectors shall be installed on the AC input to the telephone system. These devices shall provide clamping to limit any transients and surges on the line to prevent damage to the rectifiers and the telephone system. In locations where the Installation AC system is known to have problems with high transients and voltage variations on the network, power conditioners shall be installed on the AC input to the telephone system. Heat detectors shall be provided in the TSS room. The heat

detectors shall be used to shut off both AC and DC power to the TSS equipment prior to sprinkler heads being activated. A sprinkler system will be provided in the telephone system equipment room, see section 12 for sprinkler system criteria. When the sprinkler system is activated the AC and DC power to the telephone system will be automatically disconnected. The room shall be designed in accordance with ANSI/TIA/EIA 569 and be large enough to accommodate the telephone system and all support equipment and have adequate equipment access, clearance and work space. The electrical and air conditioning services for the telephone system equipment room shall be sized to accommodate the worst case commercial system based on the telephone system maximum operational capacity. The complete air conditioning system for this room will be powered from the equipment branch of the emergency power system.

3.1.2 Telephone system line/port count. Designer shall work with the user to determine the Total Line Count (TLC) required. Line and port have the same meaning. Since a TSS has a digital computer as a central control unit the point of connection for each external device (telephone instrument or trunk circuit) is called a port. Each single line telephone is connected to its own dedicated port which has a unique telephone number. There will be no multiple connections of single line instruments to a port. Each electronic feature phone is also connected to its own dedicated port, however, due to the type of line circuit cards required for these units, multiple telephone numbers can be assigned to each port. When determining the TLC each single line phone will be counted as one line and each multi-line electronic feature phone shall also be counted as one line regardless of the number of lines.

3.1.3 TSS Subscriber Line/Port Capacity. The TSS subscriber port capacity shall satisfy three different growth categories. The initially installed capacity (IIC) shall equal the TLC port count plus 15 percent (minimum). The IIC refers to a fully equipped telephone system requiring only the connection of telephone instruments to activate the port capacity specified. The fully wired capacity (FWC) provides for expansion of the port count beyond the IIC port size by requiring only the insertion of additional subscriber line cards and connecting telephone instruments. The FWC shall equal the

TLC port count plus 40 percent (minimum). The third category is the maximum operational capacity (MOC) of the telephone system. The MOC shall equal the IIC port count plus 100 percent (minimum). The MOC provides for long term expansion of the facility by the addition of cabinets, power supplies, processors, and other equipment to expand the telephone system within its design limits. The IIC, FWC, and MOC port counts shall be included in the telephone system specifications.

3.1.4 TSS Trunk Capacity. As a minimum, the number of trunk ports allotted for each category shall be 15 percent of the IIC, FWC, and MOC. The number of trunk circuits initially installed inside the telephone system on trunk circuit line cards shall be 15 percent (minimum) of the IIC.

3.1.5 Call Detail Recording (CDR). The TSS shall include software and hardware to provide a CDR function. The CDR shall enable the staff to establish accounting data for each station and trunk to include billing and traffic data. The CDR shall collect data on all calls made in the system, including all incoming and outgoing trunk calls. The CDR system shall provide software flexibility to enable the user to tailor the format of the reports produced on the CDR printer. As a minimum, the CDR system shall identify the station placing the call, telephone number dialed, date and time of day, call connect time, call duration, trunk type, cost, and either a cost center identification code or other code keyed to an organization or activity. The CDR will also enable the user to perform TSS traffic studies to show maximum busy hour calls and dial tone delay data.

3.1.6 System Features. The telephone system shall include an automatic diagnostic system with local and remote alarms, remote diagnostics hardware and software, local printouts of system reports and maintenance and alarm data and a power fail-auto-restart feature as well as any other features and functions required by the User.

3.1.7 Automatic Call Distribution (ACD) / Auto Attendant (AA). An ACD and/or AA, if required by the user, will be provided. Sufficient telephone lines to the ACD and/or AA as well as dedicated commercial circuits which bypass the DCO will be provided, when

required, for the efficient operation of the system. All incoming lines will be answered on a first-in first-answer basis. When all ACD operators are busy, incoming calls will be placed on hold after receiving a prerecorded message and will be served by the first available operator. When offices are closed (nights, weekends, holidays), all calls will be transferred to a recording device for accepting appointments and cancellations. The ACD shall provide a workload recording system. The workload recording system shall come equipped with a printer. The system shall record data and generate reports indicating the number of calls placed and received by each attendant, the number of uncompleted incoming calls due to a busy signal or hang-up, call answer time, call duration, calls waiting, calls completed by each attendant and the number of times all positions are busy and the duration of each busy period. Design shall include expansion capability to add additional operator stations and incoming lines.

3.2 Direct Telephone Service From the DCO. When telephone service is connected directly from the DCO to the medical facility telephone sets service entrance conduits, a Building Distribution Frame (BDF) and power from the equipment branch of the emergency power system, if available, shall be provided in the service entrance facility.

3.3 User Station (telephone) Features. The following features are the minimum to be furnished with the Telephone system software package and the telephone instruments:

Call Transfer/Consultation Hold/Three Party Conference.

- Camp-on.
- Progressive Conference.
- Abbreviated Dial/Speed Call.
- Executive Bridging
- Do Not Disturb.
- Call Forwarding.
- Call Forwarding-Busy.
- Call Forwarding-Don't Answer.
- Call Waiting.

- Call Intercept.

Alternate Routing.

Direct Inward Dialing.

- Direct Outward Dialing.
- Abbreviated Dial Ring Down Groups.
- Call Pick Up.
- Voice Mail.

Prerecorded Messages.

- Caller ID
- Caller ID Block
- Call Trace

3.4 Integrated Intercommunication (Intercom) System. Except for the dedicated intercom systems listed in other parts of this chapter, all intercom functions will be engineered into the telephone system. These intercom systems will be completely provided by the telephone system hardware and software with no external equipment. All intercom system calls will be private line (two subscribers) except when callers use three party conference or executive bridging. Each intradepartmental intercom system will be accessed via a separate function button on the subscriber electronic feature telephone. An abbreviated dial code shall be dialed to access stations.

3.4.1 Intradepartmental Intercom Systems. Subscribers within a dedicated group will be provided an efficient means of two-way voice communication. Intradepartmental intercom will be provided among department heads, secretaries, NCOICs and other staff members who converse on a frequent basis. The intradepartmental intercom groups will be identified on the TSRM by assigning an appropriate alpha numeric code to each station on the group.

3.4.2 Interdepartmental Intercom Systems. There will be no interdepartmental intercom networks on the telephone system. However, in order to assure that critical medical care areas can reach any office in the facility during an emergency, the

executive bridging feature shall be assigned to all telephones in those areas. A list of critical care areas is shown in Table 2. That table will be used during TSRM development to assure all critical medical care areas are assigned this service.

3.5 Service Class. Stations will be assigned service class dial access authorization as described in the following class categories:

- AA: Medical facility, on-installation, local commercial, DSN, and long distance commercial.
- A: Medical facility, on-installation, local commercial, and DSN.
- C: Medical facility, on-installation.
- H: Medical facility.
- P: Commercial pay telephone.

3.6 Telephone Instrument Types. The various types of instruments in a medical treatment facility are as follows:

- E* - Electronic feature phone set
- D - Single line desk/set
- ES* - Electronic feature phone set w/speaker/microphone
- DS** - Single line desk set w/speaker/microphone
- W - Single line wall set
- WS** - Single line wall set w/speaker/microphone
- P - Pay phone, local telephone company will provide and install set

* Electronic feature phones have a multi-line (multiple telephone numbers and features) capability. These phones are typically analog instruments, but may be a digital instrument.

** Non electronic speaker phones may require a power outlet for proper operation.

3.6.2 Patient Bedside Telephones. Telephones with dial pad in the handset or handset integrated into bedrail will be provided in patient bedrooms.

3.6.3 Public Pay Telephone. Pay telephone will be positioned to accommodate handicapped individuals and patients in wheelchairs in accordance with Uniform Federal Accessibility Standards and/or Americans with Disabilities Act. Pay station outlets will be placed in locations that are quiet and conveniently located near high traffic areas. Outlets will provide 0.25 meters of coiled telephone cable behind a blank cover plate and adjacent 120v ac outlet.

3.7 Elevator Premises Distribution System Outlet. Telephone connection shall be provided in elevator machinery rooms for each elevator car for the connection of elevator telephone sets. Telephone instrument should be furnished by the elevator supplier and be a direct ring down/hot line to a 24 hour staffed location.

3.7.1 Standard Room Outlets. Doctor's offices, exam room and other standard nominal offices in outpatient clinics will be provided with 2 desk Premises Distribution System (TIS) outlets, however, only one telephone instrument will be provided in each room.

3.7.2 Conference Room Outlets. Conference rooms may contain outlets to support video teleconferencing and emergency operations as required by the user.

4. TELECOMMUNICATIONS INFRASTRUCTURE SYSTEM (TIS). A TIS will be provided throughout the facility and will be designed and installed in accordance with the most current version of ANSI/TIA/EIA 568, ANSI/TIA/EIA 569, ANSI/TIA/EIA 606, and tested in accordance in accordance with the basic link test of ANSI/TIA/EIA 568 using level II accuracy. The TIS shall be a universal wiring network to serve all of the voice and data needs of the facility. The TIS will include both horizontal and backbone unshielded twisted pair (UTP) copper cables and fiber optic horizontal and backbone cables. The TIS will support voice, facsimile, data and other special services within the

facility. The TIS cables shall be installed in conduit and cable tray. All cables shall be terminated on both ends.

4.1 UTP Backbone Cable. A dedicated multi pair UTP copper cable to support voice applications shall be run from the building distribution frame (BDF) to each communications room. The cable shall be rated category 3 or higher per TIA/EIA 568. The backbone cables shall be sized to accommodate the initial installed capacity plus fifty percent spare capacity. In facilities with an installed TSS the associated main distribution frame (MDF) shall replace the BDF cited above.

4.2 Fiber Optic Backbone Cable. Fiber optic cables shall connect all of the communications rooms with the fiber building distribution frame (FBDF). The FBDF shall be located as directed by the user. The type and quantity of fiber cables shall be coordinated with the user. Patch panels shall be used to terminate all backbone fiber optic cables.

4.3 Horizontal Copper Cable. The horizontal cable shall consist of 4 pair UTP cable rated category 6 or higher. The cable shall be installed between the communications rooms and the user outlets. The horizontal UTP cable shall support the voice and data needs of the user. The use of horizontal UTP rated higher than category 6 shall be permitted when standards become available for cable performance and testing.

4.4 Horizontal Fiber Optic Cable. Horizontal fiber optic cable shall be installed on an as needed basis, or as required by the user.

4.5 TIS Outlets. TIS outlets shall be located to support user work stations throughout the facility. A standard outlet shall consist of 12 centimeter square backbox with a dual 1.6 centimeter plaster ring. The cover plate shall include a minimum of 6 available positions for jacks. All UTP jacks shall be 8 pin modular rated at category 6 or higher per ANSI/TIA/EIA 568. Standard outlets shall as a minimum contain one jack for voice service and two marked for data service. The user shall provide input on the outlet

density and number of jacks required at each work station and each faceplate based upon known current needs at the time of facility opening. The facility shall not be wired to support uncertain future possible changes. Desk outlets shall be mounted 0.45 meters (18 inches) AFF.

4.5.1 Wall Telephone Outlets. Telephone outlets designed to support wall mounted telephone sets shall be ADA compliant. Faceplates for wall height telephone outlets shall have one ANSI/TIA/EIA category 6 rated jack and studs for mounting a wall type telephone set. Where restricted by casework, outlets shall be adjusted and appropriately noted on the floor plan and elevation.

4.5.2 Modular Furniture Outlets. Modular Furniture Outlets may be accommodated by the use of consolidation points or standard wall outlets as allowed by ANSI/TIA/EIA 568. The Intermediate Termination Point (ITP) may be located either above the ceiling, in the IBS located below the floor or on the wall with connecting conduit to the modular furniture connection point. The use of “power poles” is permitted if approved by the user.

5. DEDICATED INTERCOM SYSTEM. Dedicated intercom systems shall be provided in play therapy mirror rooms and group therapy mirror rooms if required by the user. In these areas, speaker-microphones will be installed in the therapy rooms for two way sound communication with the adjoining mirror room.

6. ENTERTAINMENT AND EDUCATIONAL TELEVISION (TV) SYSTEM. A complete TV system consisting of a headend component and a distribution component shall be provided.

6.1 Television Signal Source. Source of the TV signal shall be from a Cable Antenna TV (CATV) provider, a Master Antenna TV (MATV) or a Satellite Master Antenna TV (SMATV) system. While CATV is the preferred source, the recurring cost of this option,

based on the installation contract with the supplier, may make it prohibitive. The choice shall be based on an economic analysis of the three options.

6.1.1 Headend. For hospitals and medical centers, the headend shall be installed in the penthouse equipment room when an MATV or SMATV system is used. When a CATV source is used for these facilities, the headend shall be installed in the communications head end equipment room. For stand alone clinics, the headend shall be installed in one of the communications rooms.

6.1.2 Headend Equipment. All equipment required to acquire, process, filter and condition the TV signals for distribution, shall be provided. This shall include antennas, converters, amplifiers, filters, combiners, test ports, attenuators, and any other equipment required by the TV signal source selected. Provisions for an interface, if required by the user, to the hospital patient information system shall be provided. For hospitals and medical centers the system will provide for computer control of individual television sets, on demand viewing from individual television sets in patient rooms as well as on demand internet service from individual television sets patient rooms. The system will be capable of providing billing information for each on demand service chosen by a patient.

6.1.3 Distribution System. The distribution system shall consist of coaxial cable, amplifiers, splitters, directional couplers, multi-taps, and outlets to provide radio frequency TV signals to the television sets throughout the facility. The amplifiers shall be installed in communications rooms throughout the facility. Multi-taps are typically installed along the outside edge of the cable tray to facilitate distribution to the outlets.

6.2 Television Outlet Location. Television outlets will be provided in the following manner in the following types of rooms.

6.2.1 Nonpatient Rooms. A television outlet will be provided in each day room, patient lounge, waiting room, classroom, conference room, auditorium, staff lounge, staff sleep

room, group therapy, play therapy, administrative office and in each department chief's office. In rooms larger than 14 net square meters (NSM) the outlet(s) will be located 0.3 meters below the ceiling. For smaller rooms, the outlet will be located 0.45 meters AFF allowing ready access for manual control. In conference rooms, lounges and classrooms, larger than 14 NSM, the television outlet may be connected through a coaxial switch. The coaxial switch will be required if portable video programming sources are to be used by the facility and will be mounted 1.2 meters AFF and will include an input jack for a video cassette recorder. Switch will be two position type marked for central TV and Video Program Source (VPS) selections. The TV outlets will be mounted per user requirements and a remote control unit will be provided.

6.2.2 Patient Rooms. Television outlets will be located on the wall opposite the bed and out of the circulation path. Remote channel selection from the nurse call pillow speaker or patient bedrail system will be provided.

6.2.3 Psychiatric Patient Rooms. Television outlets will not be provided in psychiatric seclusion rooms. The user shall determine the requirement for television outlets in all other psychiatric patient rooms.

6.3 Television Outlet Configurations. Television outlets will be configured as follows:

6.3.1 Standard Wall TV Outlets. Outlets will consist of a 100 millimeter square box with a metal barrier and a 2-gang flush metal device plate. The device plate will have a built in 75 ohm female type F coaxial connector on one side, and a NEMA 5-20R AC power receptacle on the other side.

6.3.2 Patient Room TV Outlets. Outlets will consist of a 100 by 150-mm 3-gang box with a metal barrier and a 3-gang flush metal device plate. The device plate will have a built-in 75 ohm female type F coaxial cable connector on one side, a bushed opening in the middle section to receive the television control cable, and a NEMA 5-20R, AC power receptacle on the other side. The audio output of the television receiver and the TV

control cable will be connected to the associated nurse call bedside station by a shielded cable in a 20 mm conduit.

7. RADIO FREQUENCY DISTRIBUTION SYSTEM. A Radio Frequency Distribution System shall be provided to receive and distribute both simplex and duplex radio frequency communications throughout the facility. The system will be capable of receiving and distributing radio frequencies between 150 MHz and 5800 MHz. The signal sources may be either external or internal to the facility. The exact frequencies to be used shall be coordinated with the user. The system will be capable of supporting IEE 802.X wireless network communications, radio page communications, trunked radio Communications, cellular communications and RF tracking communications simultaneously.

8. NURSE CALL TONE VISUAL (NCTV) SYSTEM. Tone/visual nurse call systems provide simultaneous light and tone signaling of patient and staff calls for emergency assistance. NCTV systems are typically installed in stand alone clinics and in clinics in hospitals and medical centers as directed by the user. TVNC Systems shall comply with UL 1069 and be UL 1069 listed.

8.1 Station Location. Provide emergency call stations in each patient toilet room, public toilet inside the clinic, patient shower, recovery room, hydrotherapy/whirlpool tub area, clinic treatment room, specimen drawing, blood donor area, selected PT treatment cubicles, clinic procedure room, pulmonary function lab, immunization room, dialysis rooms, Treadmill Room, Allergy Injection Room, EEG Testing Room, radioisotope lab, patient dressing areas (EG/Radiology/PT etc.) and other treatment areas in which a patient might be left alone.

8.2 Electrical Power. Tone visual systems will be on the critical branch.

8.3 System Components and Operations. The system will be composed of the following components and operate in the manner described.

8.3.1 Emergency Call Station. An emergency call cord station will be provided adjacent to the patients head in recovery areas and treatment rooms, beside each toilet, adjacent to each whirlpool, beside the chair in each specimen donor area and above the shower head. Waterproof stations will be provided in showers and at whirlpool. An emergency nurse call is initiated by pulling a cord or pushing a button at an emergency nurse call push button station. This will cause the following events to occur until the call is cancelled at the originating station.

8.3.2 Room Dome Light. Dome light with chime outside room or cubicle will illuminate and a chime will sound. The dome light color will be coordinated with all other systems to provide a unique annunciation.

8.3.3 Zone Dome Light. Zone dome light with chime at intersection of corridor where the patient care room is located will illuminate with a light and sound an audible tone also. The color and audible tone pattern of the light shall be coordinated with the user to provide a unique annunciation identical to that provided by the dome lights.

8.3.4 Annunciator Panel. The wall mounted annunciator panel display at the nearest nursing station or reception desk will illuminate and indicate the call origination point and sound an intermittent signal. The light and signal can only be canceled at the call originating station. The capability to silence the intermittent audible signal shall be provided at the annunciator panel. This will only silence the audible tone of the current call on the system. The visual signal shall remain until canceled at the originating station. The audible signal silence capability shall automatically reset and generate an audible signal upon receiving any new calls. Swing capability shall be provided between clinics when required by the user.

8.3.5 Central Equipment. Central equipment panel will be located in a communications room nearest the area served.

9. NURSE CALL AUDIO/VISUAL (NCAV) SYSTEMS. Communication of patient and staff calls for assistance will be provided from patient care locations through combinations of tone and light signals, full duplex intercom, digital display, and radio page. All NCAV system shall comply with UL 1069. The system shall utilize an independent, dedicate industry standard local area network with industry standard protocols, equipment and cabling.

9.1 NCAV System locations. NCAV systems are typically provided in inpatient wards and emergency rooms. Dedicated NCAV networks allow each patient care unit to operate from a local master station or transfer all nurse call functions to any other master station on the network. Prime NCAV capabilities include the following:

9.1.1 NCAV System Features. NCAV system networks will have the same basic feature package for standardization and to simplify maintenance problems. Features that are not required on a particular patient care unit will not be activated on the system installed in the unit.

9.1.2 Call Annunciation. Light, tone, master station display and alphanumeric radio page annunciation of patient and staff calls for assistance will be identified by classification, priority and origination point. Annunciation is simultaneously provided on various AVNC equipment devices and or directly to the assigned Nursing Staff via radio page to assure an appropriate and timely staff response over the most direct route to the call origination point.

9.1.3 Hands Free Operation. Hands-free voice intercom from patient care areas and staff work stations to the master station serving the unit shall be provided once a call is established.

9.1.4 Device Alarms. The NCAV system shall have the capability to transmit the signaling of alarms from an attached medical device such as an IV pump.

9.1.5 Television Control. The nurse call patient station shall provide for remote control and sound audio reception from patient TV set that is mounted on the patient room footwall or ceiling.

9.1.6 Lighting Control. The patient station pillow speaker or bed rail system shall provide control of the over bed reading and general lights.

9.1.7 Call Statistics. If required by the User, the system shall maintain a data base of all call data and provide for the viewing and printing of call data on a work station and generation of statistical management reports of operating statistics including call type, call volume and call response time data.

9.1.8 Access Control Interface. If required by the user, an interface with the access control system to provide annunciation on the local nurse call system if there is an attempt to make an unauthorized entry/exit from the unit shall be provided. This particularly applies to the pediatric and psychiatric nursing units, nursery, and surgical suite.

9.1.9 Telephone System Interface. If required by the user, interconnection with the telephone system to provide for remote answering of patient nurse calls by use of any telephone in the facility.

9.1.10 Patient Information Interface. Provisions shall be provided, if required by the user, to interface to the facility information system hospital patient information system.

9.2 Station Locations. Local master stations will be provided on each inpatient nursing unit, labor and delivery suite, surgical suite, surgical recovery, nursery, and emergency department. Master stations will also be provided, as required by the user, in hemodialysis unit, cystoscopy suite, cardiac catheterization suite, Oral Surgery Clinic, and radiology special procedure (Angiography, CT Scan, MRI, Nuclear Medicine) suites and other areas as required by the user.

9.3 Electrical Power. NCAV systems will be on the critical branch. All separately powered equipment such as monitors shall have separate uninterruptable power supplies.

9.4 System components. The following paragraphs describe the many components that comprise the NCAV system.

9.4.1 Patient Station Locations. Patient station locations will be as follows:

ROOM TYPE	MOBILIZATION BEDROOMS	NON-MOBILIZATION BEDROOMS
1 Bedroom:	1 Dual Bed Patient Station	1 Single Bed Patient Station
2 Bedroom:	1 Single Bed Patient Station & 1 Dual Bed Patient Station	1 Dual Bed Patient Station
4 Bedroom:	On each of two walls: Install 1 Single Bed Patient Station & 1 Dual Bed Patient Station.	On each of two Walls: Install 1 Dual Bed Patient Station.

In areas served by an NCAV system a single patient station will also be located in each recovery room bed module, OR patient prep/hold bed module, psychiatric bedroom (except isolation room) treatment rooms and labor/birthing room.

9.4.2 Cord Sets. A minimum of one cord set with entertainment controls, pillow speaker and lighting controls will be provided per patient station. The user will determine the number and types of cord sets to be provided for each facility. Psychiatric patient bedrooms will be provided with push buttons in lieu of pillow/speaker controls.

9.4.3 Psychiatric Seclusion Rooms. Audio patient stations will consist of a speaker and microphone and will be mounted in the seclusion room ceiling. All components will be tamperproof.

9.4.4 Psychiatric Push Button Stations. Psychiatric push button stations will be provided in each seclusion room and will be provided in lieu of emergency call cords at all psychiatric toilet, shower and tub fixtures. All components will be tamperproof.

9.4.5 Psychiatric Key Switch. Psychiatric key switches will be provided outside the seclusion room door. This switch will activate the emergency call switch inside the seclusion room.

9.4.6 Emergency Pull Cord Stations. Emergency pull cord stations will be provided in each public toilet, patient toilet, shower, tub, and at each CCU and ICU toilet/lavatory location, except in psychiatric patient areas.

9.4.7 Emergency Push Button Stations. Emergency push button stations will be provided at each nursery intensive, continuing care, and isolation bassinet location; in each normal, admission, and observation nursery; and each parent feeding space.

9.4.8 O R Stations. Staff Stations with an emergency call button will be provided in each operating room, cystoscopy room, cardiac catheterization, Angiography procedure room and nursery procedure room. Two emergency call stations will be provided in the delivery and birthing room, one to support the mother and one to support infant resuscitation.

9.4.9 Auxiliary Medical Device Alarm Jack. Auxiliary medical device alarm jack will be provided on each patient station or on a separate panel adjacent to each bed, one per bed, except in CCU and ICU. Two, one on each side of the bed, will be provided in CCU and ICU.

9.4.10 Duty Stations. Duty stations provide an audio intercom capability plus visual and audible annunciation of calls on the system. Duty stations will be provided in the staff lounges, patient/prep hold, clean core, decontamination, equipment cleanup and storage, and anesthesia clean and soiled workrooms; linen, equipment, and supply storage rooms; trash rooms; treatment rooms; nourishment pantry; mediprep; staff work rooms; tub/shower rooms; and nurseries.

9.4.11 Staff Stations. Staff stations provide an audio intercom capability and will be provided in nurse, and ward master offices; dayrooms; conference, waiting, interview, pediatric play, operating, delivery, emergency procedure and trauma, cystoscopy, cardiac catheterization, and Angiography rooms; isolation and seclusion room anterooms; and nursery parent teaching/feeding and procedure rooms.

9.4.12 Dome Lights. Dome lights without a tone device will be provided outside the entrance to each room which has a patient station, psychiatric push button station, emergency pullcord, emergency push button, and elbow switch for emergency calls.

9.4.13 Zone Dome Lights. Zone dome lights will be provided at corridor intersections to direct traffic to the call origination point.

9.4.14 Central Equipment Panels. Central equipment panels will be located in communications rooms nearest the area served.

9.4.15 Central Printer. Central printer, if required by the user, will be located as directed by the user.

9.4.16 Patient Bed Devices. The designer shall coordinate with the user to determine if beds with integral devices are to be provided. The appropriate connections, coordinated with the equipment shall be provided for connection of nurse call and telephone system to the bed equipment.

9.5 System Features.

9.5.1 Network Operation Modes. Each equipped unit will be an operating zone of the network of a floor level network. Operating zones and network modes will function as follows:

9.5.2 Operating Zone Mode. Each unit can operate as an independent zone with all calls from within the unit routed to the local zone master station in the unit. When in operating zone mode, the local zone master station has full dedicated use of all system features and intercom channel. No system busy signals will be allowed.

9.5.3 Network Mode. All functions and programmed patient data from any local zone master station can be captured by and combined with the functions and patient data of any other master station in the network. Any one master station can handle all calls from any combination of operating zones or an entire network.

9.6 Call Types. The following are the types of calls signaled.

9.6.1 Patient Call. Patient call for routine or priority assistance from a patient bed.

9.6.2 Patient Call Cord Set Disconnect. Patient call cord set has been disconnected from the patient bedside station (will signal an emergency call).

9.6.3 Emergency Patient or Staff Call. Patient or staff call for emergency assistance from any patient or emergency call station.

9.6.4 Medical Device Alarm. Alarm signal from a patient bedroom indicating that an attached medical device needs service.

9.6.5 Staff Intercom Call. Staff intercom call from a staff or duty station location.

9.6.6 Reminder Call. Master station attendant call/signal to dispatch and remind staff that assistance is needed at a patient location as a result of a patient or staff call.

9.7 Tone and Light Call Signal.

9.7.1 Call Annunciation. Each call will annunciate throughout a unit by various combinations of illuminated lights and tones.

9.7.2 Annunciator Lights. Light colors, with steady or flashing illumination, will allow adequate distinction between call types and priorities.

9.7.3 Tone Annunciation. Calls on the NCAV system will cause tone signals will sound at the master, and duty stations only. Tone signals will sound at different intermittent pulse rates to allow adequate distinction between call types and priorities. Code blue calls will cause a tone signal on the central code blue annunciation panel.

9.7.4 Annunciation Coordination. Tone and light signals for each call type and priority will be consistent for all tone/visual and NCAV systems.

9.8 Call Priorities.

9.8.1 Call Prioritization. Processing of calls will be sequenced in a 4 level priority rank order, from a high of number 1 to a low of number 4, as listed below.

<u>Priority Number</u>	<u>Call Category</u>
1	Code Blue, Infant Code Blue, Infant Security Alarm, Wandering Patient
2	Emergency, Bed Exit, Failure Alarm, Emergency Medical Device Alarm
3	Priority, Patient Priority, Cord or Bed Disconnect
4	Routine, Routine Patient, Routine Medical Device, voice Intercom

9.8.2 Multiple Call Priorities. When more than one call is present on the system at any one time, the highest priority call will take precedence.

9.9 Radio Page Capability. NCAV system networks will be provided radio page capability so that calls registered on a network can be relayed to radio pagers carried by staff. Radio pages can also be originated from master stations and the telephone attendant consoles. NCAV radio page system may be combined with the wide area radio page system.

9.9.1 Message Types. Pagers will be able to receive the following types of messages:

9.9.2 Priority Alert Tones. At least three distinct alert tones to indicate the priority of the digital display or voice message being paged.

9.9.3 Alpha Numeric Message. An alphanumeric digital display message, including room/bed number and type of call.

9.9.4 Pager Assignment. Duty assignment data will be programmable from any master station. The data will correlate the address number of the pager assigned to a staff member with their duty assignment by room/bed, level of care and work shift.

9.9.5 Call Transfer To Pager. Any patient, staff or medical device service call from a patient care location can be relayed directly to the individual or group of pagers carried by the staff assigned to the call origination point and level of care on each shift. The system will automatically perform this direct relay function to the appropriate pager by cross-referencing duty assignment and absence indication data with pager assignment and address data.

9.9.6 Call Transfer Function. Call relay function can be initiated in any one of the following three ways:

9.9.7 Attended, Semiautomatic Mode. When calls are being handled at a master station the attendant can relay a call to the appropriate pager by activating a radio page function key on the station keyboard while the call is still registered on the system.

9.9.8 Unattended, Automatic Mode. When a master station is unattended, the station can be switched to an automatic radio page mode where by all calls coming to the master station will automatically be relayed to the appropriate pagers.

9.9.9 Preprogrammed, Automatic Mode. Specific call types can be programmed for automatic relay to the appropriate pager even if the master station that normally handles the call is unattended. This will include emergency and auxiliary medical alarm service calls. Additionally, each patient station can be individually programmed for patient priority call status whereby all patient calls will be automatically relayed to the appropriate pager.

9.9.10 Page Origination. A radio page can be originated from any master station. A tone alert and alphanumeric digital display message can be originated by use of the station keyboard. The message may be either a preprogrammed message or a free text message. The page can be routed via duty assignments by keying in the room/bed number or directly to an individual or group by keying in their pager address number.

9.9.11 Master Stations. Master stations that have transferred control of the operational zone to another master station will retain the capability to originate radio pages.

9.10 Code Blue. Code Blue is a generic phrase which is used to indicate a critical situation brought on by a cardiac arrest or similar type of immediate life threatening event. Depending on the type of health care facility and the user criteria there can be a number of variations on Code Blue which identify different types of patients to which the code applies. The number and type of signals shall be determined by the user. These may include, but not limited to, a code for adult patients, pediatric patients, and infants each of which will have a separate label. For the purposes of this document all such

calls shall be referred to as Code Blue. The NCAV shall provide for all types of Code Blue calls to be implemented by the user in the facility. All Code Blue calls shall share the highest priority on the NCAV system.

9.10.1 Code Blue Call Locations. The user shall decide where Code Blue signaling devices are required. It is strongly recommended that Code Blue signaling be provided in all areas covered by the NCAV system. A neonatal code signaling system is highly recommended in all baby care areas such as LDRP rooms and the nursery. A pediatrics code signaling system is highly recommended in the pediatrics ward and the emergency department. It is also recommended that code buttons be installed as separate, stand alone buttons in a single gang faceplate. Code Blue stations should be installed on each side of the patient service console to facilitate easy access by the attending staff. The following locations are strongly recommended for Code Blue stations: each inpatient bed; each OR; each delivery room; each cystoscopy room; each bronchoscopy room; each oral surgery operator; each LDRP room; each nursery; each baby care area; each emergency exam treatment room bed; each trauma room bed; each pre-op and post-op surgery patient hold cubicle; each inpatient exam treatment room; each stress test/treadmill room; each blood draw room; renal dialysis room; each immunization room; each x-ray room; each MRI room; each CT Scan room; each angiography room; each cardiac cath. room and each chemotherapy room.

9.10.2 Code Blue System Operation. The system shall be capable of activating the NCAV radio page interface in the event of a Code Blue call. The system shall transmit to the radio page encoder the type of call and the location by room and bed number in the facility. The radio page shall be sent to a specific group of pagers carried by the response team. The system shall also send the type of code call, room and bed number to the NCAV Code Blue annunciator panel which shall display all active Code Blue Calls on the system. The Code Blue annunciator panel(s) shall be in a location which is staffed 24 hours a day such as the main reception desk, information desk or emergency room nurses station. The NCAV system shall also annunciate Code Blue calls with

unique audible and visual signals on the Master Stations, duty stations, unique color and flash sequence on NCAV dome lights.

9.11 Service Dispatch Reminder. If during a patient call the master station attendant determines that a patient needs staff assistance the attendant can signal this need. If service is not rendered within a specified time period, the system alerts the attendant by appropriate signaling at the master station.

9.12 Patient Station Privacy Mode. Any patient station can be switched to operate in a privacy mode. When a patient station is in the privacy mode, the attendant at the master station cannot monitor sound from the patient room. While in this privacy mode, the patient can still receive or originate a call. When the call is complete, the patient station will return to the privacy mode.

9.13 Master Station Features. Master stations shall be PC based with large touch screen flat panel color monitors unless otherwise directed. Master stations will include the following features in addition to those specified above:

9.13.1 Call Sequencing. Calls can be sequenced for answer in accordance with call priority rank order and time of placement. This normal sequence can be bypassed and calls answered in any order.

9.13.2 Priority Programming. Capability to program and review priority rating of patient station.

9.13.3 Voice Intercom Calls. Place full duplex voice intercom calls to patient stations, staff and duty stations by touching the appropriate control on the touch screen monitor or dialing the stations number. If the called patient station is in the privacy mode, the patient has to activate the nurse call push button/pad before answering the call.

9.13.4 Audio Monitoring. Audio monitor of any one patient station that is not in the privacy mode.

9.13.5 Handsfree Mode. Calls are placed and answered in a handsfree mode. A handset is provided privacy when placing or answering calls.

9.13.6 Call Display. Capability to display a minimum of 3 incoming calls, holding all other calls in memory until answered. Patient data shall be displayed on the monitor when a room or call is selected.

9.13.7 Feature Programming. Capabilities to initialize review and update all programmable system features, variable data, radio pager duty assignment, and patient data.

9.14 Patient Station Controls. Patient entertainment and light control:

9.14.1 Light Controls. Reading and general lights can be controlled by activating light control switches on the cord set connected to the patient station, except in psychiatric patient bedrooms and seclusion rooms.

9.14.2 Television Controls. In patient bedrooms where the TV set is mounted on the footwall or ceiling, the patient can also control/listen to TV channels through use of a pillow speaker type cord set connected to the patient station. TV controls include TV set on/off, channel selection and volume.

9.14.3 Alternate Cord Sets Types. A push button or pressure pad cord set can be used in conjunction with a pillow speaker/light control cord set.

9.14.4 Pressure Pad Cord Sets. It is also possible to use a dual pressure pad cord set to control two functions, nurse call and footwall TV set control, or nurse call one light

control. It is not possible to use a push button or a geriatric pressure pad cord set to control TV volume on footwall mounted TV sets.

9.14.5 Cord Set Holder. A wall bracket will be provided to hold the cord sets when not in use.

9.15 Operational Statistics Printer. Printout of operational statistics. A printer, if required by the User, will be located in the central communications room. The system shall be capable of providing printouts of real time call data by room and bed. This data shall include the time each call is placed, answered at the master station, set on service reminder, and canceled.

9.16 Access Control System Interface. Remote access control alarm: By interfacing the nurse call system with the access control system, it is possible to locally annunciate any unauthorized entry/exit from the pediatric and psychiatric nursing unit, surgery, mother-baby unit and the nursery.

9.17 Telephone System Remote Answer Interface. An interface between the nurse call system and the telephone system, if required by the user, shall be provided. The interface shall allow the use of any telephone on the unit to remotely answer any call from a patient station, staff or duty station when the nurse call master station is unattended.

10. PUBLIC ADDRESS (PA) AND PROGRAM DISTRIBUTION SYSTEM.

10.1 System Components. The system will consist of the following components.

10.2 Headend Equipment. The headend will contain the following equipment:

10.2.1 Background Music Sources. Compact disc player/changer shall be provided if desired by the user to supply background music to the system.

10.2.2 Auxiliary Inputs. Rack space and preamplifier input ports for two auxiliary inputs shall be furnished to support user provided devices.

10.2.3 Preamplifiers and Power Amplifiers. Preamplifiers and power amplifiers shall be provided.

10.2.4 Monitor Panel and Selector Switches. Monitor panel with selector switch and speaker to check each zone output shall be provided.

10.2.5 Voice Input and Zone Selection. Microphone, zone selector switch and telephone interface module for paging shall be provided. The number of telephone trunk or subscriber lines provided will be based on the system configuration. One trunk or subscriber line per zone shall be provided. Telephone system interface equipment shall be provided as part of the PA system. Control functions such as call answer, tone announcement before the page, and automatic preset time-out will be accomplished by the telephone interface module.

10.2.6 Input Selection Switch. Input selection switches for connecting program inputs to the distribution system.

10.3 Loudspeaker System. Low power speakers will be used to provide uniform sound distribution at low volume levels. For maximum coverage, corridor speakers will be spaced at a maximum of twice the ceiling height apart. Speakers located in individual rooms will be provided with separate volume controls. Paging speakers in designated areas such as a pediatrics clinic will be provided with a volume control and bypass relay for override during paging. Table 3 provides guidance for speaker functions to be provided in each area.

10.4 System Configuration. The system shall be configured in accordance with the following.

10.4.1 All Call. An all zone paging capability, which shall have priority over all other paging will be provided in every facility. All-call may be accessed via a microphone in the central communication room or via telephone. The microphone access has priority over the telephone access.

10.4.2 Wide Area Zone. Each hospital will be zoned by functional areas - nursing tower, outpatient clinics, energy plant, and ancillary areas. Wide area paging will have priority over all local paging. Microphone access has priority over the telephone access. These zones may be accessed via a microphone in the central communication room or via telephone.

10.4.3 Local Zones. For each ancillary or administrative department or outpatient clinic where patients are seen for diagnosis or treatment, such as radiology or physical therapy, paging zones will be established for both patient and staff areas. Local zones will be accessed using the telephone system. In ancillary areas which only provide support, such as central material services, only a staff zone will exist. The microphone access for the areas will be at the department secretary or NCOIC office. Local zone paging may be overridden by wide area zone or all zone paging. A music volume control with bypass relay for paging will be provided at the same location as the microphone.

10.4.4 Music Only Speakers. Music only speakers will be provided at locations where staff or patient paging is not required but music is desired. A volume control will be provided in each music only area.

10.4.5 Functional Area Zones. See Table 3 for zones provided in functional areas.

10.4.6 Speaker Locations. Speakers will never be provided in the following: private or multi-occupancy offices; recovery rooms; exam rooms; libraries; patient bedrooms and staff sleeping rooms.

10.4.7 Sound Reinforcement Systems. Local sound systems, to include microphones, speakers, and amplifiers, not connected to the program distribution system, will be provided in chapels, auditoriums, and large conference rooms.

10.4.8 Medical/Dental Clinic Zoning. A separate zone for medical and a separate zone for dental will be provided in combined Medical Dental clinics. An all call for the entire facility will be maintained.

10.4.9 Microphone Quantities. The installation of microphones will be limited. The user will provide guidance on the number and location of microphone stations. Telephone system input is the preferred method.

11. RADIO PAGING SYSTEMS.

11.1 Radio Paging. One ultra high frequency (UHF) paging systems will be provided for 100 percent coverage within the health facility. The recommended method is to furnish the system as part of the construction contract. Leasing radio paging service is an option from a local provider. An economic analyses shall be performed to determine the most advantageous solution. A written agreement assuring that any leased service provider will provide priority service for medical facility generated pages will be required. A system to ensure 100% coverage inside the medical facility will need to be provided if a leased service provider is selected.

11.2 Pager Distribution. Pagers will be provided for all professional and support personnel who frequently work away from their primary areas.

11.3 System Function. The system will utilize tone and vibration alert paging receivers that display an alpha numeric message. Each pager will be accessible by dialing a discrete set of digits via the telephone system. Access will also be possible through a central control console within the health facility or through the audio visual nurse call

system. Facility design shall include space in penthouse area, AC power and conduit for control and coaxial cables. The radio page system shall interface with the nurse call system if required by the user.

11.4 Emergency Response Team Pagers. Pagers assigned to members of the code and other emergency response teams will provide at least 3 separate and distinct annunciations; one for routine calls and one for emergency calls. These pagers will have two separate access codes, one for routine and one for group alerting. The group alerting code will signal all units simultaneously.

11.5 Antennae Type and Mounting. Antenna type and mounting height will be selected to provide complete facility coverage. Conduit must be provided from the encoder to the transmitter location and from there to the antenna.

11.6 Power Requirements. All radio paging equipment will be connected to the life safety branch of the emergency power system and rated for continuous duty.

12. EMERGENCY MEDICAL SERVICE (EMS) COMMUNICATIONS. The EMS system consists primarily of radio equipment which is used for voice and telemetry communications with ground and air ambulances. Multiple radios are used at each location and the basic task for the designer is to provide site support for the equipment. Remote control units for the radio transceivers are included with the radios and these will usually be installed in ambulance dispatch or in the emergency room nurse's station for receiving voice and telemetry. The radio transceivers are normally installed in the penthouse equipment room although some transceivers have no remote control unit and will be installed in ambulance dispatch. Information must be obtained on the equipment to provide the required site support.

12.1 Electrical Power. Power will be provided for all radios and remote control units from the life safety branch of the emergency system when available.

12.2 Empty Conduit and Boxes. Junction boxes and empty conduits will be provided with pull wires to install cables. Provide conduits from the penthouse to the antennas mounted on the roof and when required, conduits for coax and control cables from ambulance dispatch to the penthouse equipment.

12.3 Structural Support. Structural support and sufficient mounting space will be provided for the antennas.

13. PHYSIOLOGICAL MONITORING. An empty conduit system with pull wires will be provided for installation of equipment and cable for the monitoring system. All equipment including monitors, computers, and printers will be connected to the critical branch of the emergency power system. An uninterruptible power supply (UPS) will be provided by the user.

13.1 Cardio-Pulmonary Respiratory Monitoring. Data entry points will be monitored by a central computer. A minimum of one 12 CM square back box and one 25mm (1 inch) conduit with pull wires will be provided from each data entry point to the communication system cable tray. Conduits with pull wire will be provided from the central physiological monitor computer room to the communication system cable tray. As a minimum data entry/monitor points will be provided as follows:

13.1.1 Emergency Room. Each trauma room, treatment room, treatment cubicle, and the nurses station. At the nurses station provide conduit to both the printer and monitor locations.

13.1.2 Surgical Suite. Each operating room, with outlet located in ceiling service console; Each recovery bed including the isolation rooms; recovery area nurses station; and the anesthesia work room. At the recovery area nurses station provide conduit to both the printer and monitor locations.

13.1.3 Urology. Each cystoscopy room.

13.1.4 ICU/CCU. Each bed and nurses station. At the nurses station provide conduit to both the printer and all monitor locations.

13.1.5 Step-down Units. At the nurses station provide conduit to both the printer and all monitor locations.

13.1.6 Labor And Delivery. Each delivery room, with outlet located in ceiling service console; Each labor room; each recovery bed, and nurses station. At the nurses station provide conduit to both the printer and all monitor locations.

13.2 Fetal Monitoring. A conduit with pull wire will be provided from each delivery room, labor room, stress test room, exam/prep room and birthing room to a pull box above the ceiling at the labor and delivery nurses station. A minimum of one conduit with pull wire will be provided from the pull box to the nurse station for the monitors.

13.3 Neonatal Monitoring. A conduit with pull wire will be provided from each intensive and continuing care bassinet location, LDR, LDRP and each isolation room to a pull box above the ceiling at the nursery nurses station.

13.4 Anesthesia And Respiratory Gas Analysis System. Conduit with pull wire will be provided from each operating room ceiling column, from 25 percent of the patient service consoles in the surgical suite recovery area, to include the isolation rooms; each cystoscopy room at the head of the table; each delivery room ceiling column, and one delivery recovery bed patient service console. Conduits with pull wires will be provided to the anesthesia workroom where the analyzer and central processing unit are to be located. Conduit will be provided to the anesthesia office suite and the blood gas lab for printer or cathode ray tube units.

14. SPECIAL MONITORING EQUIPMENT. Monitor panels for hospitals and medical centers will be provided in a 24 hour staffed location to monitor the operation of critical hospital systems and equipment per NFPA 70. If an Energy Monitoring System is

furnished for the facility, the alarm points may be made part of that system and a separate monitor need not be installed. The exceptions are medical gas and the emergency generator monitors, which must be a dedicated system.

14.1 Refrigerator Unit. A signal circuit will be provided from the blood bank, food service, autopsy, allergy injection, immunization and pharmaceutical (pharmacy and logistics) units to indicate loss of electric power or excessive temperature or each refrigerator.

14.2 Medical Gas Alarms. Alarms for each piped medical gas system will be provided.

14.3 Power System Monitor/Annunciator. Key functions of normal and emergency electrical power system will be monitored and will include status indicators and alarms as listed in NFPA 70 and NFPA 99.

14.4 Stand Alone Clinic Refrigerator Alarms. Refrigerator alarms for stand alone clinics shall be connected to a remote staffed location. Connection of the alarms to an Energy Monitoring system, if available, will accomplish this requirement.

15. ELECTRONIC SECURITY SYSTEMS. Security within a medical treatment facility may be accomplished with an intrusion detection system, door access systems, infant protection system and CCTV surveillance or a combination of the above.

15.1 Intrusion Detection Systems (IDS). Empty conduit raceways and outlet boxes with blank covers will be provided for the future installation of an IDS system. The site preparation for this system will include allocation of space in a protected area for a control unit, monitor station and signal processing equipment as well as remote sensors. Intrusion detection system locations and sensor types to be provided for are as follows:

Location	Balanced Magnetic Switch	Ultrasonic Motion Detector	Duress Alarms
Inpatient and outpatient Pharmacy	X	X	
Inpatient and Outpatient Pharmacy dispensing Window(s)	X	X	X
Emergency Department			X
Pharmacy Vault	X	X	
Cashier office	X	X	X
Logistics vault	X	X	
Logistics warehouse	X	X	
Silver recovery central Collection point	X	X	
Mental Health			X

A magnetic switch shall be placed on each door or window that could provide access. The motion detector shall cover the entire area. Video monitoring and recording will be activated by the intrusion detection and duress alarms (See paragraph CCTV surveillance). Intrusion detection system design will follow the established industry guidelines.

15.2 CCTV Surveillance. Provisions will be made for GFGI CCTV surveillance equipment. Conduits with pull wires, outlet boxes, and electrical power will be provided for the following suggested locations: cashier office, cashiers in food service and installation exchange, vaults, stairwell exits on pediatric and psychiatric nursing units and nursery, computer room, emergency and acute minor illness waiting and reception areas, corridors connecting buildings, pharmacy dispensing windows, building entrances and exists, elevator lobbies, loading docks, parking lots, and ground floor mechanical rooms. The system will be designed such that a camera will be activated by an intrusion detection alarm or an attempt at unauthorized access at a card reader. Monitors will be located in a staffed location.

15.3 Door Access Systems. An electronic door access system will be provided where required by the user. The system will be complete and will include all monitor and control equipment and equipment to produce cards to discontinue access authorization

for issued cards, maintain and provide a listing of current authorized access by individual, location, and time. An interface will be provided between the CCTV system and the Door Access System to initiate video monitoring and recording anytime these doors are opened unless an authorized access card has been read by the card reader. This is further defined in paragraph, "CCTV Surveillance." An electronic door access system will be provided at the following locations:

- Selected building entrances.
- Each exterior door to the 1st floor mechanical equipment rooms.
- Each storage room entrance door
- Each Pharmacy Door
- Each Pharmacy vault door
- Each computer room door
- Each cashier office door
- Each Psychiatric Nursing Unit entrance door

15.4 Infant Protection System. This system will provide a method where by any unauthorized individual who attempts to transport an infant through a protected doorway shall create an alarm condition. In an alarm condition the doorway shall be locked to prevent the individual and or infant from being able to leave. The system shall be supervised to detect any tampering or removal of a monitoring device. Any detected unauthorized tampering with or unauthorized removal of equipment shall generate an alarm condition.

16. EMS RECORDER SYSTEM. A multichannel recorder system will be provided as required by the user in hospitals and medical centers. The system will include the following functions and features:

16.1 EMS Recorder Function and Features. The EMS recorder will typically be installed in the Ambulance dispatch area. The system will be used to record voice

communications on selected telephone lines and all EMS radios. The telephone lines recorded shall include but not be limited to the Emergency room Nurses Station and the Ambulance Dispatch telephones. The actual lines to be recorded shall be determined by the using military service. Two way audio from each of the EMS radios shall be recorded. The recorder shall as a minimum have the following characteristics:

- Record media shall have a minimum of 24 hours of recording capacity.
- A minimum of 10 channels plus one channel which records time in hours, minutes and seconds for record retrieval.
- A microprocessor based control system which provides both system control and diagnostics.
- A rapid search system which enables fast retrieval of time dated information
- Search and playback from digital memory while the system continues to record the prescribed channels.

16.2 System Inputs and Mounting. The system will accommodate multiple input impedances to allow recording from the varied media identified. The system shall be rack mounted in a free standing cabinet.

REFERENCES

Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines” United States Access Board, latest edition.

NFPA 70, “National Electric Code”

NFPA 99, “HealthCare Facilities”

NFPA 101, “Safety to Life from fire in Buildings and Structures”

ANSI/TIA/EIA 568, “Commercial Building Telecommunications Cabling Standard”

ANSI/TIA/EIA 569, “Commercial Building Standard for Telecommunications Pathways and Spaces”

ANSI/TIA/EIA 606, “Administration Standard for the Telecommunications Infrastructure of Commercial Buildings”

ANSI/TIA/EIA 607, “Commercial Building Grounding and Bonding Requirements for Telecommunications”

ANSI/TIA/EIA 758, “Customer–Owned Outside Plant Telecommunications Cabling Standard”

EMERGENCY POWER BRANCH ASSIGNMENT FOR COMMUNICATION SYSTEMS	
COMMUNICATIONS SYSTEMS	BRANCH ASSIGNMENT
TSS Telephone	Life Safety
Public Address and Program Distribution	Life Safety
Radio Paging	Life Safety
Physiological Monitoring	Critical
Emergency Medical Service (EMS) Radios	Life Safety
LAN Electronic Equipment **	Critical
Nurse Call	Critical
ELECTRONIC SECURITY	
IDS	Equipment
CCTV	Equipment
SPECIAL ALARM MONITORING EQUIPMENT	
Medical Gas	Critical
Blood Bank	Critical
Morgue Refrigerators	Equipment
Food Service Refrigerators	Equipment

** For the purposes of this document LAN electronic equipment does not include any individual computer workstations. Individual computer workstations will need to be addressed on a case by case basis with the using military service.

Table 1

CRITICAL CARE AREAS THAT REQUIRE EXECUTIVE BRIDGING FEATURE
Each Nurse's Station
Each Operating Room and control station
Emergency Room Reception / Nursing Station
Pharmacy: Intravenous (IV) Additive and Unit Dose
Pathology: Reception, Blood Bank, frozen section and Stat Lab
Radiology Reception
Cardiology Clinic Reception
Respiratory Therapy Blood Gas Lab
Each Delivery Room, suite and recovery room
Obstetrics/Gynecology Clinic Reception
Cardiac Cath
Angiograph Rooms
Obstetrical, Medical/ Surgical, OD and Pediatrician Sleep Rooms
Linear Accelerator Control Station
Magnetic Resonance Imagery Control Station
Contamination Control Area
Hyperbaric Medicine

Table 2

PUBLIC ADDRESS AND PROGRAM DISTRIBUTION ZONES						
Area	Zone*	Page Only	Page & Music	Music Only	Location of Music Vol.Ctrl**	Microphone Location
Interdepartmental Corridor	All-Call		X		Head end	Central commo rm
NURSING UNITS SURGERY, OBSTETRICS:						
Corridor	All-Call	X			Head end	Central commo rm
Dayroom				X	Nurses Station	Not Applicable
Family Wait				X	Nurses Station	Not Applicable
Staff Lounge				X	Lounge	Not Applicable
Operating & delivery rooms				X	Each room	Not Applicable
Nursery	All-Call		X		Each room	Central commo rm
Snack bar, Vending area, Px, Barber shop	All-Call		X		Head end	Central commo rm
OUTPATIENT CLINICS (MEDICAL & DENTAL):						
Patient waiting, Toilets, and Corridors	Local-patient		X		Reception	Reception
Staff Corridors	Local-staff		X		Reception	Reception
Staff lounge	Local-staff		X		Lounge	Reception
Treatment room				X	Each tretmt rm	Not applicable
Dental treatment Rooms & areas				X	Each room or area	Not applicable
OCCUPATIONAL AND PHYSICAL THERAPY:						
Patient waiting & Toilets	Local-patient		X		Reception	Reception
Corridor	Local-staff		X		Reception	Reception
Hydrotherapy				X	Each room	Not applicable
Activities of daily Living				X	Suite	Not applicable
Exercise & rehab				X	Each room	Not applicable
Treatment cubicles				X	Each room	Not applicable
Staff lounge	Local-staff		X		Lounge	Reception
RADIOLOGY, RADIATION THERAPY, NUCLEAR MEDICINE						
Patient waiting,	Local-		X		Reception	Reception

Table 3 (part 1)

PUBLIC ADDRESS AND PROGRAM DISTRIBUTION ZONES						
Area	Zone*	Page Only	Page & Music	Music Only	Location of Music Vol.Ctrl**	Microphone Location
Corridors, toilet (Multioccupancy) Diagnostic & therapy rooms	patient			X	Each room	Not Applicable
Staff Corridors	Local-staff		X		Reception	Reception
Staff Lounge	Local-staff		X		Lounge	Reception
PATHOLOGY:						
Patient waiting and toilets	Local-patient		X		Reception	Reception
Blood drawing				X	Each room	Not Applicable
Laboratories except blood bank	Local-staff		X		Each room	Reception
Blood bank			X		Each room	Not Applicable
Corridors	Local-staff		X		Reception	Reception
Staff lounge	Local-staff		X		Lounge	Reception
FOOD SERVICE:						
Dining room	Local		X		Dept. Secretary	Dept. Secretary
Kitchen	Local		X		Dept. Secretary	Dept. Secretary
Staff lounge	Local		X		Lounge	Dept. Secretary
Corridors	Local		X		Dept. Secretary	Dept. Secretary
LOGISTICS:						
Warehouse	Local		X		Each area	Dept. Secretary
CP&D	Local		X		Each area	Dept. Secretary
Staff lounge	Local		X		Lounge	Dept. Secretary
Corridor	Local		X		Dept. Secretary	Dept. Secretary
ADMINISTRATIVE DEPARTMENTS:						
Corridors	All call		X		Local amplifier	Not applicable
CENTRAL MATERIAL SERVICES:						
Work areas	Local		X		Each room	Sec or NCOIC office

Table 3 (part 2)

PUBLIC ADDRESS AND PROGRAM DISTRIBUTION ZONES						
Area	Zone*	Page Only	Page & Music	Music Only	Location of Music Vol.Ctrl**	Microphone Location
Corridors	Local		X		Sec or NCOIC office	Sec or NCOIC office
Staff lounge	Local		X		Each room	Sec or NCOIC office

The above table is provided for guidance only the actual configuration of the PA system will be coordinated with the using service.

** Volume control for music only. All page only and page & music speakers with a local volume control will have a bypass relay for paging.

*Areas indicated for all call and local staff zones will also be included in wide area zones in the facility.

Table 3 (part 3)

QUIZ

AN INTRODUCTION TO COMMUNICATION SYSTEMS FOR MEDICAL FACILITIES

1. Communications rooms shall be a minimum of _____ square feet each.
 - a. 200
 - b. 150
 - c. 100
 - d. 75

2. The Communications Head End Equipment Room will be located adjacent to the _____ equipment room.
 - a. emergency medical services
 - b. telephone system
 - c. public address system
 - d. physiological monitoring

3. Displays and equipment for a/an _____ system will not normally be installed in a Central Communication Room.
 - a. engineered smoke control
 - b. fire detection and alarm
 - c. generator monitor and alarm
 - d. educational program

4. A/an _____ will not normally be provided when an internal Telephone Switching System is installed.
 - a. impressed current cathodic protection system
 - b. service entrance conduits
 - c. main distribution frame
 - d. signal grounding system

5. _____ is not normally a user station feature for telephone system software/hardware packages:

- a. Camp-on
- b. Progressive Conference
- c. Executive Bridging
- d. Non-exclusive Bridging

6. _____ services will not normally be supported by the Telecommunications Infrastructure System.

- a. Facsimile
- b. Voice
- c. Data
- d. Video

7. Wall Telephone Outlets designed to support wall mounted telephone sets shall be _____ compliant.

- a. FM
- b. NFPA
- c. ADA
- d. ASTM

8. _____ is not normally a television signal source for an Entertainment and Educational Television System

- a. Cable Antenna Television (CATV) provider
- b. Master Antenna Television (MATV) system
- c. Satellite Master Antenna Television (SMATV) system
- d. Dedicated Set Antenna Television (DSAT) system

9. For hospitals and medical centers, the headend for a MATV or SMATV shall be installed in the _____ equipment room.

- a. penthouse
- b. telemetry
- c. communications
- d. EMS

10. Television outlets _____ be provided in psychiatric seclusion rooms.

- a. may
- b. will
- c. will not
- d. shall

11. A Radio Frequency Distribution System shall be provided to receive and distribute both simplex and _____ radio frequency communications throughout the facility.

- a. monaural
- b. compressed
- c. short wave
- d. duplex

12. A Radio Frequency Distribution System shall be provided capable of receiving and distributing radio frequencies between 150 MHz and _____ MHz.

- a. 3800
- b. 4800
- c. 5800
- d. 6800

13. Tone/visual nurse call systems provide simultaneous _____ and tone signaling of patient and staff calls for emergency assistance.

- a. light
- b. audio
- c. video
- d. data

14. Nurse Call Audio/Visual (NCAV) systems shall be provided from patient care locations through combinations of _____ .

- a. tone and light signals
- b. full duplex intercom
- c. digital display
- d. all of the above

15. Nurse Call Audio/Visual (NCAV) systems shall be on the _____ branch of the emergency power system.

- a. control
- b. life safety
- c. equipment
- d. critical

16. A minimum of one _____ set with entertainment controls, pillow speaker and lighting controls will be provided per patient station.

- a. cord
- b. DSL
- c. dial-up
- d. ethernet

17. The radio paging communications system shall be connected to the _____ branch of the emergency electrical power system.

- a. critical
- b. life safety
- c. equipment
- d. single-phase

18. Physiological monitoring equipment shall be connected to the _____ branch of the emergency electrical power system.

- a. critical
- b. life safety
- c. equipment
- d. single-phase

19. Food service refrigerators shall be connected to the _____ branch of the emergency electrical power system.

- a. critical
- b. life safety
- c. equipment
- d. single-phase

20. _____ is/are not an area(s) that requires an Executive Bridging feature.

- a. Nurses stations
- b. Day rooms
- c. Operating rooms
- d. Emergency Room Reception

21. _____ is not a Priority 1 category for Nurse Call Audio/Visual systems.

- a. Code Red
- b. Code Blue
- c. Infant Security Alarm
- d. Wandering Patient

22. Nurse Call Audio/Video (NCAV) system networks will be provided _____ page capability so that calls registered on a network can be relayed to radio pagers carried by staff.

- a. video
- b. visual
- c. radio
- d. data

23. One _____ paging system will be provided for 100 percent coverage within the health facility.

- a. short wave (SW)
- b. low frequency (LF)
- c. very high frequency (VHF)
- d. ultra high frequency (UHF)

24. Pagers assigned to members of the code and other emergency response teams will provide at least _____ separate and distinct annunciations.

- a. 4
- b. 3
- c. 2
- d. 1

25. The Emergency Medical Service (EMS) system consists primarily of _____ equipment which is used for voice and telemetry communications with ground and air ambulances.

- a. video
- b. radio
- c. telephone
- d. satellite