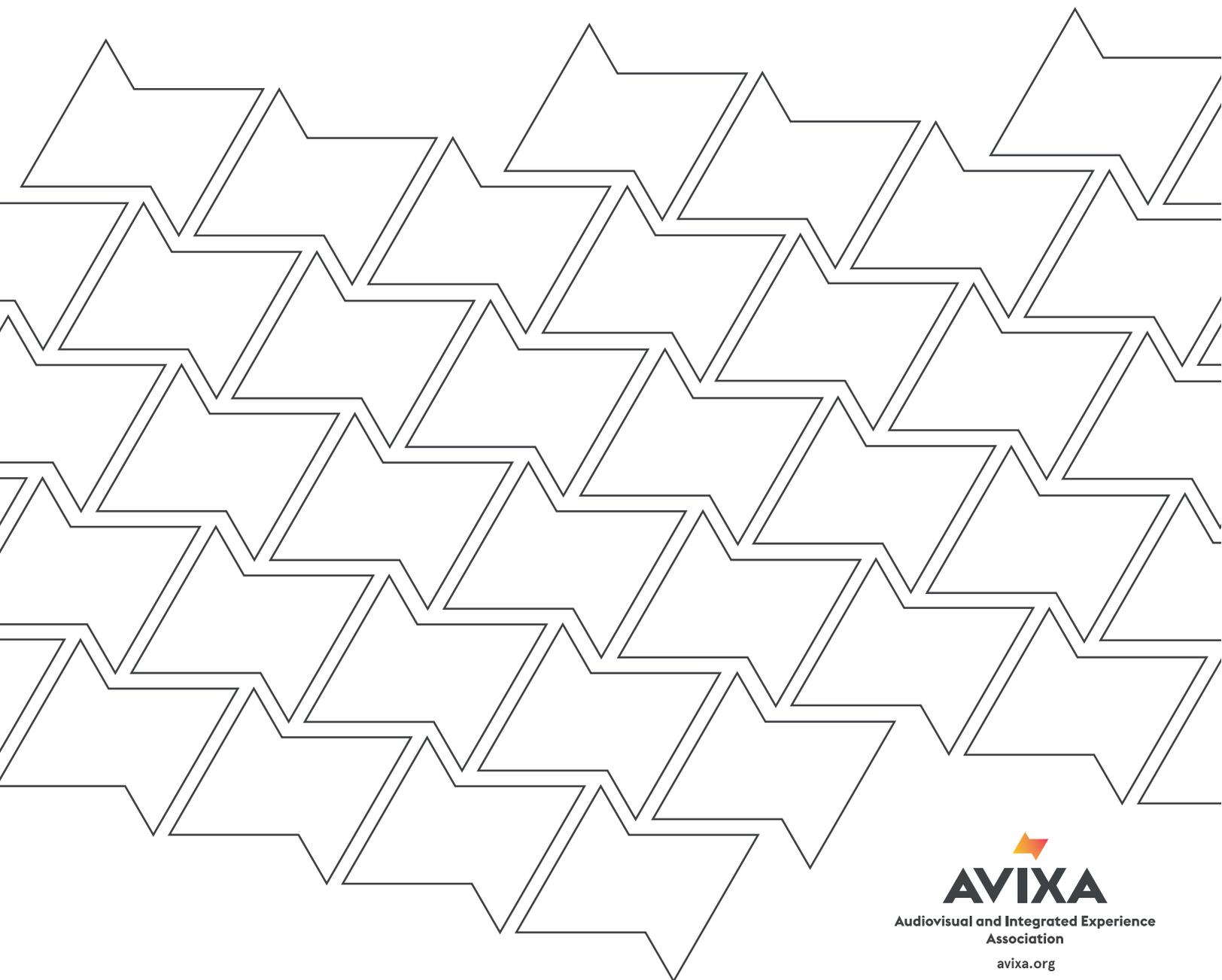


ANSI/INFOCOMM 2M-2010

Standard Guide for Audiovisual Systems Design and Coordination Processes



ANSI/INFOCOMM 2M-2010

Standard Guide for Audiovisual Systems Design and Coordination Processes

InfoComm International Standard

2010-12-05



11242 Waples Mill Road, Suite 200
Fairfax, VA 22030
www.infocomm.org

703.273.7200
800.659.7469
703.278.8082 FAX

Abstract

A successful professional audiovisual system installation depends on the clear definition and coordination of processes, resources, and responsibilities of the design and installation project teams. A properly documented audiovisual system provides the information necessary to understand and implement the system goals and project requirements in a logical and efficient manner. The documentation should complement and coordinate related architectural, engineering, and construction documentation. This standard outlines a consistent set of the standard tasks, responsibilities, and deliverables required for professional audiovisual systems design and construction.

Keywords

Audiovisual, AV system, AV design, AV documentation, AV infrastructure, MasterFormat™, construction documentation, best practice, AV installation, InfoComm

Disclaimer

The application of this standard is strictly voluntary. InfoComm International recommends its use but does not assume responsibility for misinterpretation or misapplication. InfoComm International does not assume liability for disputes resulting from the non-conformance to this standard. Conformance does not imply certification of a system. This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard.

Copyright

©2010 by InfoComm International®. This standard may not be reproduced in whole or in part in any form for sale, promotion, or any commercial purpose, or any purpose not falling within the provisions of the U.S. Copyright Act of 1976, without prior written permission of the publisher. For permission, address a request to the Director of Standards, InfoComm International.

Foreword

There are many types, sizes, and complexity levels of audiovisual systems. The user should apply this standard as appropriate to fit the particular project circumstances. Two common approaches are described here, although there are many possible variations in contractual agreements and relationships between the design and construction team. For example:

Consultant-led projects when the monetary value of the audiovisual systems is high, the building design and construction timeframe is long, or the installation work must be competitively bid. Independent consultants are persons or firms having neither financial interest in the products specified nor obligations or partnerships with equipment integrators, contractors, manufacturers, and their representatives.

Design-build projects (also known as turnkey projects) when the construction timeframe is accelerated, the installation systems are proprietary, and/or the project does not require competitive bidding. Professional AV integrator firms are in the business of selling, engineering, installing and providing ongoing service and support for a wide variety of audiovisual and related technologies, systems, and equipment. Equipment manufacturers may also provide turnkey systems design, installation, and service. In addition, owners may choose to have audiovisual systems designed and/or built by their in-house staff.

About InfoComm International

InfoComm International® is the leading non-profit association serving the professional AV communications industry worldwide. Founded in 1939, the association has 5,000 members, including manufacturers, systems integrators, dealers and distributors, independent consultants, programmers, rental and staging companies, end users, and multimedia professionals from more than 80 countries. InfoComm offers industry expertise and market research serving press and others seeking information about the industry. Through activities that include tradeshow, education, certification, government relations, outreach, and information services, InfoComm promotes the industry and enhances members' ability to conduct business successfully and competently. InfoComm International is the ANSI Accredited Standards Developer (ASD) dedicated to the dissemination of the knowledge of audiovisual systems performance parameters.

About ANSI

The American National Standards Institute, Inc. (ANSI) is the national coordinator of voluntary standards development and the clearinghouse in the United States for information on national and international standards. An American National Standard implies a consensus of those substantially concerned with its scope and provisions. Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered and that a concerted effort be made toward their resolution. The use of an American National Standard is completely voluntary. Its existence does not in any respect preclude anyone, whether he or she has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard.

InfoComm International Standards Development

InfoComm International maintains a Standards Steering Committee, which provides oversight to the standards development task groups responsible for specific standards. The Steering Committee reports to the InfoComm International Board of Directors, whose approval is required before standards may be submitted to ANSI.

InfoComm International Standards Program Developers

STANDARD GUIDE FOR AUDIOVISUAL SYSTEMS DESIGN AND COORDINATION PROCESSES STANDARD TASK GROUP

Brian E. Huff, MBA, CTS-D, LEED® AP, ISF-C (Moderator)
Joy Caspar, CTS
Matthew Jackson, CTS-D
Ratnesh Javeri, CTS-D
John O'Brien
Howard Quinton, CTS-D
Brad Weber, PE, CTS

INFOCOMM INTERNATIONAL STANDARDS PLANNING COMMITTEE

Richard Derbyshire (Chair)
Scott Walker, CTS-D, LEED® AP (Past Chair)
Frederick J. Ampel
Michael Carter, CTS
Joy Caspar, CTS
Barry Goldin, CTS
Gary Hall, CTS-D, CTS-I
Brian E. Huff, MBA, CTS-D, LEED® AP, ISF-C
Matthew Kosel, CTS-D, CTS-I
Greg Jeffreys
Brian R. Pipe
Peter Swanson, CTS

INFOCOMM STANDARDS STAFF

Joseph Bocchiaro III, Ph.D., AStd, CTS-D, CTS-I, ISF-C (Vice President of Standards and Best Practices)
Randal A. Lemke, Ph.D. (Executive Director and CEO)
Alex Damico (Chief Operating Officer)
Melissa Taggart (Sr. Vice President of Education and Certification)
Ann Brigida, CTS (Director of Standards)

Table of Contents

Abstract	i
Keywords	i
Disclaimer	i
Copyright	i
Foreword	ii
About InfoComm International	ii
About ANSI	ii
InfoComm International Standards Development	ii
InfoComm International Standards Program Developers	iii
Table of Contents	iv
1. Scope, Purpose, and Application	1
2. Referenced Publications	1
3. Definitions	3
4. Requirements.....	4
5. Verification.....	14
6. Appendix 1: Optional Services	25

1. Scope, Purpose, and Application

Purpose

The purpose of this standard is to provide a description of the methods, procedures, tasks, and deliverables typically recommended or applied by professionals in audiovisual (AV) systems design and integration projects. The intention of the structure outlined in this Standard is to enable clients and other design and construction team members to assess confidently whether the responsible parties are providing the expected services.

Modern AV systems have become increasingly complex and interconnected to other building systems such as network, electrical, HVAC and building automation/energy conservation. In many instances, AV systems provide critical operational functions for the owner, warranting a thoughtful and well-organized approach to commonly accepted planning, design, and integration procedures.

In addition, the AV systems design and integration process may span and parallel a lengthy design and construction cycle, including input and review by many key personnel from divergent disciplines, trades, and backgrounds. This standard provides a practical guideline for defining the audiovisual system requirements and a clear accountability structure for the development and execution of the system design components. It provides a consistent reference for the project team from the initial design phase through construction, project completion, and building occupancy.

Exceptions

This document is a Standard Practice Guide outlining design considerations and accepted procedures for accomplishing the task of integrating audiovisual systems into the design and construction of facilities in the built environment. This guide outlines a comprehensive set of procedures for the design and construction of professional audiovisual systems, and does not suggest a specific course of action. Qualified, experienced professionals are required to interpret, judge, and modify this guide to suit the project needs. Some of the tasks and deliverables described in this guide may not be applicable in all circumstances. The intent of this guide is not to represent or replace the due diligence of qualified audiovisual professionals, and cannot be applied without considering each project's individual parameters and circumstances.

2. Referenced Publications

Normative References

The following standards contain provisions that, through reference in this text, constitute provisions of this document. At the time of approval, the editions indicated below were valid. Because standards are periodically revised, users should consult the latest revision approved by the sponsoring Standards Developer Organizations:

- a. American National Standards Institute (ANSI)

- b. The Construction Specifications Institute (CSI)

For the purposes of this document, the use of the latest revision of a referenced standard is not mandatory. However, parties to agreements based on this document are encouraged to apply the most recent editions of the standards and publications listed. Information on recent editions is available from the InfoComm Director of Standards, and ANSI.

- a. BICSI and InfoComm International, *AV Design Reference Manual*, First Edition, 2006, Tampa, FL and Fairfax, VA
- b. InfoComm International, 2005, *Audiovisual Best Practices*, First Edition, Fairfax, VA

Informative References

The following publications contain information that supports the design and application of this standard, but are not required provisions of the standard:

- a. The American Institute of Architects, various dates, *Contract Documents*, Washington, DC
- b. The Associated General Contractors of America, 2004, *Project Delivery Systems for Construction*, Alexandria, VA
- c. The Construction Specifications Institute, 2004, *MasterFormat™ 2004 Edition*, Alexandria, VA
- d. Heinz, John A., PE, and Casault, Richard B., PE, *The Building Commissioning Handbook*, Second Edition, Building Commissioning Association, 2004, APPA, BCA
- e. InfoComm International (formerly International Communications Industries Association Inc.), 2003, *The Basics of Audio and Visual Systems Design*, Revised Edition, Fairfax, VA
- f. InfoComm International, *Audiovisual Systems Project Documentation Sample*, 2009, Fairfax, VA
- g. InfoComm International, 2009, *AV Installation Handbook*, Second Edition, Fairfax, VA
- h. InfoComm International, 2006, *Dashboard for Controls Design Guide for the Creation of Touchpanel Control Interfaces*, Fairfax, VA
- i. National Institute of Building Sciences, 2008, *United States National CAD Standard*, Washington, DC
- j. National Society of Professional Engineers, various dates, *Contract Documents*, Alexandria, VA

3. Definitions

- a. AHJ: Authority having jurisdiction
- b. AV infrastructure: The physical building components that make up the pathways, supports, and architectural elements required for audiovisual technical equipment installations
- c. BOM or BOQ: Bill of Materials or Bill of Quantities
- d. BREEAM (BRE Environmental Assessment Method) is the international environmental assessment method for buildings. It sets the standard for best practice in sustainable design and has become the de facto measure used to describe a building's environmental performance.
- e. CSI: The Construction Specifications Institute
- f. Environmental sustainability: The effort to create and maintain conditions under which humans and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of current and future generations
- g. Equipment rack: A centralized housing unit that protects and organizes electronic equipment
- h. LEED[®] AP: Accreditation from the USGBC (U. S. Green Building Council) for green building professionals who have demonstrated competence in green building practices
- i. OFE: Owner furnished equipment, sometimes known as owner supplied contractor installed (OSCI) (OFICI) or "Free Issue"
- j. Raceway: An enclosed channel of metal or nonmetallic materials designed expressly for holding wires, cables, or busbars, with additional functions as permitted in applicable code. Raceways include, but are not limited to, rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquid-tight flexible conduit, flexible metallic tubing, flexible metal conduit, electrical nonmetallic tubing, electrical metallic tubing, under floor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, wireways, duct, and busways (adapted as example from NEC 2008 Handbook).
- k. Cable tray: An unenclosed channel of metal or nonmetallic materials designed expressly for holding wires, cables, or busbars, with additional functions as permitted by local or national codes. Cable trays and raceways may also be referred to as trunking.
- l. Owner: The designated responsible party with the authority to make final decisions on contract and technical issues, and final acceptance in the client's interests.
- m. RCDD: Registered Communications Distribution Designer: Certification from BICSI (an association that supports the information transport systems industry) identifying candidates who have demonstrated their knowledge in the design, integration, and implementation of information transport systems and related infrastructure components.
- n. Technical power: A term used in the audiovisual industry for lines power that exclusively serves an audiovisual system. The exact definition is country and project-dependent.

4. Requirements

Professional AV Infrastructure, System Design, and Construction Documentation Components

Criteria

Designers should analyze and define the system budget, performance needs, and functional requirements prior to ordering and installing equipment to clearly and formally document the owner's needs and expectations.

Following approval of the functional concept and overall budget, system design may commence. Subsequently, after designers have completed and fully reconciled the design with the documented functional requirements, system engineering, labor deployment, and construction can begin.

The following sections outline the tasks that may be included in this process.

I. Project Planning and Coordination Meetings

The project contract documents will typically specify the number, length, and location of meetings required throughout the design effort. Meetings can include face-to-face sessions as well as audio-, video-, or web-based sessions. The type, timing, and quantity of the meetings should be adjusted to reflect the project requirements.

II. Program Phase (alternatively, Briefing Phase or Concept Design Phase)

The purpose of the program phase is to discuss, clarify, and document the owner's needs, concerns, expectations, and constraints to guide the design team in its approach to the functionality and cost of the AV systems.

- A. Needs Analysis: This activity addresses the owner's business processes to assess specific requirements and expectations. This may include discussions regarding available technologies to meet the owner's needs and a review of systems and infrastructure proposed to support the project goals. Components of this analysis may include:
 - 1. Interviews with end users, facilities managers, etc.
 - 2. Surveys of existing facilities
 - 3. Inventories of existing equipment
 - 4. Discovery of additional project requirements, such as sustainable building guidelines

- B. Program Report: Also known as the AV Narrative or Discovery Phase Report, the Return Brief, or the Concept Design Report, this document describes the client's specific needs, system purpose and functionality, and the designer's best estimate of probable cost, in a non-technical format for review and approval by the owner. The report follows a Needs Analysis phase addressing the owner's business processes, which assesses specific requirements and expectations. This may include discussions regarding available technologies to meet the owner's needs and a review of systems and infrastructure proposed to support the project goals. User reviews and comments on the AV program may warrant revisions and updates to the program report. Components include:
 - 1. Executive Summary: This section provides an overview of the project, project programming process, systems, special issues, and overall budget.

2. **Space Planning:** This section provides advice to the design team, where necessary, as to any special requirements of the audiovisual systems. This may include equipment closets, projection rooms, observation rooms, dressing rooms, head end rooms, etc.
3. **Systems Descriptions:** This section is a non-technical description of the owner's desired functionality for each system. This section may include AV sketches, drawings, diagrams, photos, product data, and other graphics to exemplify the capabilities of the proposed systems.
4. **Infrastructure Considerations:** This section includes a description of the electrical, voice, data, mechanical, lighting, acoustic, structural, and architectural infrastructure needed to support the audiovisual systems.
5. **Audiovisual Budgets:** This section outlines the *Probable Costs* to procure, install and commission the proposed AV systems, as well as any *Additional Costs* such as taxes, markups, service, support, and contingencies.

III. Design Phase

The purpose of these activities and their associated documents is to identify the functional requirements and design intent for the audiovisual systems. These documents should reference any work required by other trades to complete the AV design. Coordination of these documents with those of other trades is essential.

- A. **Architectural and Infrastructure Requirements:** These documents illustrate the coordination of various aspects of the core, shell, and interior design of the space. Millwork, casework, and furniture, as well as supporting electrical and physical protection systems required to support the audiovisual systems are included.
 1. **Architectural and Interior Design:** This work involves planning for the integration of AV systems in the designated spaces within the project. Items covered may include space planning issues such as, but not limited to:
 - a) Projection and viewing sightlines and distances
 - b) Lectern locations and presenter ergonomics
 - c) Custom or integrated millwork, furniture, and casework
 - d) Disability access recommendations and codes
 - e) Finishes
 - f) Wall and ceiling height recommendations
 - g) Stage sizes and heights
 - h) Seating tiers and row-to-row distances
 - i) Equipment booths, central control and equipment rooms, service, and access
 - j) Ancillary spaces (breakout rooms, green rooms, dressing rooms, etc.)
 - k) Equipment cooling and ventilation
 - l) Structural and fire rating impacts
 - m) Lighting plan, zones, and control
 - n) Delivery and installation of oversize products (large crated displays, projection screens, and mirrors)
 2. **Electrical:** This work involves coordinating the following AV-related requirements with the project electrical engineer or electrical contractor:
 - a) National and local codes for high and low voltage installations
 - b) Electrical power panel (and subpanel) locations, layouts, and labeling for AV supplies
 - c) Anticipated AV related electrical loads, power factor correction requirements, and circuit breaker requirements
 - d) Surge suppression, clean power, and back-up power requirements for AV loads

- e) Receptacle types and locations
 - f) Electrical requirements for isolated ground, same phase, or other project-specific grounding techniques such as technical grounding
 - g) Pathways and capacity for high and low voltage cabling (copper, optical, and other) related to AV equipment including interconnects to other building systems
 - h) Project specific requirements for separation of high and low voltage cable types
 - i) Specifications, locations, and mounting heights for AV-related cable boxes and stubs including floor, wall, ceiling, pull, exterior, millwork, and casework
 - j) Equipment rack isolation and bonding requirements
 - k) Coordination of AV safety grounds with building safety grounds
 - l) Other AV-electrical related notes and diagrams
 - m) Local and national review and certification requirements for drawings. Local or national codes may require a registered electrical engineer to review and stamp the AV-related electrical drawings.
3. Workmanship and Technique: Some jurisdictions require the use of licensed electricians, licensed low voltage cable installers, members of labor organizations, and/or certified professionals for some of the tasks included in an AV contractor's scope. The level of coordination in these circumstances escalates to include many items beyond purely power and related infrastructure concerns. These include but are not limited to:
- a) Verification of licensing, permits and/or affiliations with labor organizations
 - b) Expectations for workmanship, e.g., field wiring methods and techniques such as separation of signals
 - c) Cable termination standards , e.g., wiring of balanced vs. unbalanced audio
4. Acoustical: This work involves the coordination of acoustical design criteria for the project and conditions that could directly impact the audio systems designs. The project's acoustical consultant or designated member of the design team defines the acoustical requirements for the project. The audiovisual systems designer may provide input. The acoustical criteria may include:
- a) Architectural acoustics recommendations, e.g., design criteria for ambient/background noise levels, reverberation time
 - b) Mechanical systems noise and vibration control recommendations, e.g., isolation from other noise sources
5. Information Technology (IT): This work involves the coordination of AV-specific requirements for voice or data services to equipment and equipment rooms. The audiovisual systems designer may provide input to the project team as to the specific location and type of data endpoints, special patching requirements for specialized "hybrid" equipment (non-data use of IT infrastructure), bandwidth requirements, and data prioritization, among other parameters.
- B. AV System Documents: These documents detail the qualifications, items, and performance requirements necessary to complete the scope of work for the audiovisual systems.
1. Bid Specifications: Competitive bidding requires written specifications of the audiovisual systems equipment and installation. This standard recommends the insertion of audiovisual specifications into the project construction documents. These documents should conform to the owner's requirements and/or CSI MasterFormat™ standards organized as follows:

Part 1 – General: This section communicates to the bidder the basic

project structure and relationships between the work covered under the AV specification division(s) and related trade sections. Part 1 – General identifies the technical scope and administrative requirements of the project and typically includes a summary of the project requirements, definitions, a list or references to related documents, as well as bid and project submittal requirements. In addition, this section outlines requirements for:

- General conditions
- Project schedules
- Communications procedures
- Incentives and penalty clauses
- Terms and payment schedules
- Deposits and mobilization fees
- Quality assurance
- Company qualifications
- Technical certifications or other relevant professional qualifications, and specific product training certificates
- Materials handling, e.g., site clean up, disposal, recycling
- Subcontractor/prime contractor relationships
- Substitutions
- Submittals electronic format, e.g., PDF, CAD, BIM, etc.
- Submittals physical format, e.g., paper sizes, disks, or other storage medium
- Product and finish samples
- Job conditions
- Environmental sustainability, energy efficiency, and recycling
Note: *Part 1-General* should include a suggested or required approach to the design of AV systems with the project's overall environmental sustainability (LEED, BREEAM) goals, if applicable. This section outlines the redeployment of existing or pre-owned equipment, low-power designations such as ENERGY STAR[®], international hazardous substance restrictions such as RoHS and WEEE, AV system or facility power management, and the handling of AV-related packing materials and construction debris. Power offsets, reductions, and savings should be expressed in kilowatt hours (kWh), kilojoules per second (kJ/s), or British thermal units per hour (Btu/h) as well as tons of carbon dioxide (CO₂), and other common raw and hazardous material standard reduction measurements.
- Test reports
- Warranty requirements
- Service contracts
- Training
- Inspections
- Drawings of record (As-built drawings)

Part 2 – Products: This section includes a detailed itemization and description of all equipment to be provided as part of the project. The designer may also list the equipment quantities to clarify the project requirements; particularly a product that is not intended to be installed but is indicated on drawings.

Part 3 – Execution: This section describes the installation and performance expectations of the specified equipment. Key elements addressed are the physical installation of equipment, system

performance, system testing, and user training.

Specific subjects that require attention may include but are not limited to:

- Quality of workmanship (e.g., fit and finish tolerances, cleanliness, cable dressing)
- Verification of existing conditions and work by others
- Installation standards
 - Equipment, plate and panel labeling, and labeling techniques
 - Wiring and labeling practices
- Safety
- System preassembly and operational staging
- Materials handling, packing for shipment and delivery to site, e.g.:
 - Base build items (e.g., screens, speakers, mounts, floor boxes, custom back boxes)
 - Equipment racks
 - Large equipment
 - Small shipments
 - Storage of equipment on site
 - Proof of performance
- Performance Standards, e.g.:
 - Audio Coverage Uniformity (ACU™)
 - Audio quality, e.g., speech intelligibility, frequency response, sound pressure level, freedom from hum, noise and oscillation, signal-to-noise ratio
 - Video quality, e.g., text legibility, resolution, system contrast ratio, brightness, freedom from distortion
 - Control system operation, e.g., ease of use, graphical appearance, security interface and levels, response time, network connectivity protocols, etc.
- Sustainability requirements, e.g.:
 - LEED®
 - ENERGY STAR®
 - BSR/ASHRAE/USGBC/IESNA Standard 189.1P
 - Recycling, disposal of packaging materials, and hazardous substance restrictions such as RoHS and WEEE
- Testing methods and tools
- System adjustments
- System commissioning
- Testing and commissioning reports
- Punch list process (defects resolution, snag list, etc.)
- Definition of “Substantial Completion”
- Training: Owner, user, administrator, maintenance
- Warranty Requirements, e.g.:
 - Preventive maintenance
 - Equipment replacement and repair terms
 - Start date and duration of contract
 - Days and hours of access
 - Technician response time
 - Contact information and protocol
 - Remote access troubleshooting
 - Warranty extensions and enhanced service terms
 - Exceptions and limitations such as abuse, misuse, theft or unauthorized system modifications

2. Design Drawings: These documents conform to the overall project document format and include standard keys, schedules, tables, and notes pertaining to the audiovisual systems.
 - a) Title Block
 - (1) Project title/location/scope
 - (2) Firm contact information
 - (3) Engineer and draft person's initials
 - (4) Submission and revision notes with dates
 - (5) Drawing numbering coordinated with architectural plans, if applicable
 - (6) CAD file location
 - b) Cover Page
 - (1) Project title/location/scope
 - (2) Drawing schedule (conforming to the individual sheet order, numbering, dates and title block text)
 - (a) Drawing number
 - (b) Drawing title
 - (c) Issue date
 - (d) Revision date(s)
 - c) Standard Details
 - (1) Drawing key
 - (2) Schedules
 - (a) Audio and video matrix routing
 - (b) Multi-pin connector wiring
 - (c) Floor, wall and ceiling boxes
 - (d) Plates and panels
 - (e) Cables and connectors
 - (f) Conduits and raceways
 - (g) System test points
 - (3) Division of labor
This subsection describes the scope of work and manner in which the various responsible contractors will carry out the work.
3. Facilities Drawings: These documents detail the layout and location of the audiovisual system equipment within the project facility or grounds.
 - a) Device and Equipment Plans, Sections, and Elevations: These drawings identify the locations, physical requirements and relationships of audiovisual equipment within the facility, including, but not limited to:
 - (1) Projection beam path and camera field of view
 - (2) Viewing sightlines and legibility limits
 - (3) Device aiming, coverage and orientation
 - (4) Schematic layouts for AV equipment integrated into furniture
 - b) Equipment Mounting Details: These drawings provide specific details for the mounting of AV devices to the floors, walls and ceilings of a facility for each device requiring mounting, rigging or other suspension. The details include, but are not limited to:
 - (1) Details of the mounting hardware and devices
 - (2) Blocking or other structural supports required to support the devices
 - (3) Cable routing to the device
 - (4) Special notes for safe and secure installation of the devices or the mounts as may be provided by the manufacturer or required by code

- (5) Note: For special mounting situations and where required by local code, drawings may be developed by or reviewed by a structural engineer. This may require approval by a licensed engineer according to local codes.
- c) Miscellaneous Details: These drawings include any details, drawings or information necessary for coordination with other building systems and elements to effectively convey the project requirements and design intent for the audiovisual systems. They include, but are not limited to:
 - (1) Equipment racks and enclosures
 - (2) Connection plates and receptacles
 - (3) Projection screens, switches, and controllers
 - (4) Antennas, repeaters, wireless nodes, etc.
 - (5) Specialized, floor, wall, and ceiling boxes
 - (6) Other items that are attached to or impact the building design or construction
- 4. System Drawings: These documents detail the audio, video, and control signal switching and routing, and other details necessary to convey the complete audiovisual system design.
 - a) Functional Diagrams: These drawings are commonly known as "Block," "Flow," or "Schematic" diagrams. They indicate an overview of the system signal flow in its entirety and illustrate the interconnection of the audio, video, and control subsystems. Functional diagrams also include references to related subsystems and provide the reader with a clarification of the boundaries of the AV scope of work. The diagrams include contractor-provided and owner-furnished equipment, as well as equipment supplied by others. These drawings include compiled or separate drawings for:
 - (1) Audio subsystems
 - (2) Antenna distribution systems
 - (3) Digital signal processing
 - (4) Video subsystems
 - (5) Special video subsystems with any interconnect to the main video subsystem, e.g., matrix routing, CCTV, camera automation, editing
 - (6) Control equipment
 - (7) Voice/data systems interface components
 - (8) Other diagrams and notes provided for another audiovisual subsystem, e.g., lighting, drapes, shades, HVAC, security interfaces
 - b) Equipment Rack Elevations: These drawings confirm that proper space allocation, ergonomics, accessibility requirements, thermal management, weight distribution, and cable management have been considered. For bid and engineering purposes, equipment rack elevations provide a means to estimate the quantities of required patch panels, bulkheads, interconnect cables, patch cables, equipment rack accessories, and other hardware necessary for a professional installation.
 - c) Specialized Plates and Panels: These drawings detail the information for all plates and panels, including size, connector arrangements, types of signals, labeling requirements, and any special integration or installation requirements for that connector.
 - d) Specialty Connector and Miscellaneous Wiring Diagrams: These drawings illustrate connectors, pin-outs and wiring used in special circumstances. The majority of connectors, pins and wires in an AV system follow industry standards

for termination. Where a connector configuration is used atypically, details for the termination of that connector are provided in the drawing set. The details include an illustration of the connector and its pins as well as a numbering schedule or other labeling of the pins and specific coordination of the pins to individual wires.

- e) Custom Configurations and Modifications: Some elements of the AV system design may require internal modification or special configuration of devices to achieve the intended function in the system. This may include the setting of DIP switches, installation of internal jumpers, and similar. In all of these cases, details of the special requirements and settings are provided in the drawings to ensure readers understand the requirements and their impact on functionality.
 - f) Patch Panel Layouts and Labeling: These details serve to clarify the number and types of panels (by signal) as well as the number of connections per panel. The patch panel layout should be consistent and labeled with the signal type.
5. Custom Application Documentation: These documents convey information necessary to illustrate additional requirements for the configuration of software, hardware, and other programmable equipment and subsystems.
- a) Digital Signal Processors, Consoles, and Work Surfaces (DSP): This documentation describes in detail the necessary software-configurable audio and video routing, processing, and user presets necessary to meet the system functional requirements.
 - b) User Interface: The section includes a visual or written description illustrating the logical sequence of the user interface. This may include a Graphical User Interface (GUI) layout and/or button-by-button description. The documentation may also outline the requirements and best practices to ensure that programmers have a firm understanding of the AV control system design and scope requirements. These requirements generally include:
 - (1) Contractual guidelines such as payment terms and warranty, definition of scope, support and documentation, license agreements, and intellectual property rights
 - (2) Project management guidelines designed to establish a list of tasks and deliverables such as process flow, scheduling, testing and debugging, code installation, onsite and remote support, and system commissioning
 - (3) Data storage, including the requirements for provider backup and archiving to protect the integrity and availability of files for future use
 - c) Asset Management and Scheduling Systems: This documentation includes information regarding the management or scheduling of the AV system via a data network. It may include a network diagram, software requirements, administrative assets, and other system components. This section also includes details about inter-system connectivity, user interface layouts, timing, sequencing, or automation of the AV systems.

IV. Construction Phase

- A. Construction Drawings: Construction drawings, provided in PDF or other unalterable document format, should include sufficient detail to convey the physical configuration of the AV systems to the installation team. These drawings are also known as "Submittal Drawings," "Workshop Drawings," or "Shop Drawings" when provided for review as part of a consultant-led project. Suggested components include, but are not limited to:

1. Title Block
 - a) Project title/location/scope
 - b) Firm contact information
 - c) Engineer and draft person's initials
 - d) Submission and revision notes with dates
 - e) Drawing numbering coordinated with architectural plans, if applicable
 - f) CAD file location

2. Cover Page
 - a) Project title/location/scope
 - b) Drawing schedule (conforming to the individual sheet order and information)
 - (1) Drawing number
 - (2) Drawing title
 - (3) Issue date
 - (4) Revision date(s)

3. Standard Details
 - a) Drawing key
 - b) Schedules
 - (1) Audio and video matrix routing
 - (2) Multi-pin connector wiring
 - (3) Floor, wall, and ceiling boxes
 - (4) Plates and panels
 - (5) Cables and connectors
 - (6) Conduits, ducts, and raceways
 - (7) System test points
 - c) Division of Labor
This subsection describes the scope of work and manner in which the various responsible contractors will carry out the work.

- B. Facilities Drawings: The Construction Facilities Drawings reflect the details provided in the Design Phase Drawings and include any new, additional, or construction details for the project.
 1. Device and Equipment Plans, Sections, and Elevations: These drawings identify the locations, physical requirements, and relationships of audiovisual equipment within the facility, to scale where applicable, including exact:
 - a) Projector and camera locations
 - b) Device aiming, coverage, and orientation
 - c) Integration of AV equipment into furniture
 - d) Labeling of device type, manufacturer, and model

- C. System Drawings: Systems Drawings for Construction/Fabrication include all of the information in the design documents with additional information required to complete fabrication and installation of the audiovisual system.
 1. Functional Diagrams: These drawings include all of the information in the design documents with the following additions:
 - a) Each device block/symbol labeled by manufacturer and model number
 - b) Labeling or graphics indicating the gender, and exact connector type used on each device
 - c) Each connector and wire clearly labeled indicating type and/or manufacturer part number
 - d) Wire numbers corresponding to the schedules and adhesive labels attached to each end of all wires including power cords, proprietary cables, etc.
 - e) Any additional information required to instruct the field technicians in the proper installation, wiring, and configuration of the systems equipment
 - f) Other diagrams and notes as appropriate

2. Equipment Rack Elevation Diagrams: These drawings and documentation include and clearly indicate the following (as applicable):
 - a) Front view with the location of each piece of front mounted equipment indicated in Rack Units (RUs). The count is illustrated from the bottom of the equipment rack with the slot count on the left side.
 - b) Manufacturer and model number of each piece of equipment
 - c) Identification for each piece of equipment in the equipment rack drawing matching the identification physically attached to all equipment
 - d) Side views for locations of internal mounted equipment, e.g., power strips, power supplies, RF splitters, satellite multi-switches, and power sequencers
 - e) Cable entrance location notes

3. Other Details: These drawings and documentation include the following (as applicable):
 - a) Verification of loudspeaker, projector, and other equipment mounting and aiming details
 - b) Specialized plate, panel, and connector details, including dimensioned engraving and punching instructions
 - c) Exact patch panel layouts and labeling strip text
 - d) Connector and miscellaneous wiring diagrams, as applicable
 - e) Custom remote control and keypad labeling text

- D. Reference Documentation: This documentation clarifies details and settings of each device that requires specific programming or configuration for its functionality in the system. Examples include:
 - a) Matrix routing and preset configuration tables
 - b) Digital signal processing configuration details including virtual devices deployed, matrix schedules, settings, levels, and presets
 - c) Wireless microphone transmission frequencies
 - d) Control equipment
 - e) IT integration information including MAC address/IP address schedules, patchbay schedules as applicable

- E. Testing and Acceptance: These procedures and their results are carried out and documented in reports.
 - a) Test procedures are carried out
 - b) Test report(s)

- F. Project Closeout: The project closeout documentation is submitted to the owner at the conclusion of the construction phase.
 - a) Drawings of record ("As-built" drawings)
 - b) Final software code
 - c) Final graphics files
 - d) User operations manuals
 - e) Equipment owner's manuals, warranty cards, etc.
 - f) Warranty Support Statement for system

5. Verification

- I. Verification of conformance to this standard must include the delivery of the *Audiovisual System Design and Coordination Components Checklist* (below). This serves to verify the following:
 - A. Documentation of Applicability – An outline that indicates which sections of the standard are applicable to the project according to contractual agreements, as well as any services not applicable (indicated as N/A).
 - B. Consideration – Written verification that the service provider(s) have read and understand this standard, and agree to be referred to as the Responsible Party for the applicable sections.
 - C. Completion – Written verification that the service provider(s) have completed the approved services, indicated by the party authorized to sign as Accepted By.
- II. *The Audiovisual System Design and Coordination Components Checklist* includes three checkboxes for each item for the project team to address:
 - A. The Activity Code identifies the type of item:
 1. D Deliverable: A specific document
 2. C Coordination: A method for ensuring that the item is fully integrated into the plans
 3. T Task: A specific work activity that needs to be carried out
 4. M Meeting: A specific agenda-oriented gathering of the affected parties
 5. O Other: An activity not defined in the above four items
 6. NA Not Applicable: This element is unnecessary or undesired for this project
 - B. Responsible Party: The designer, contractor, or integrator that is delegated and contracted to perform the activity. This may be more than one party and should be identified as such. Examples of project participants include, but are not limited to:
 - a) Acoustician
 - b) IT Designer
 - c) Electrical Engineer
 - d) Control System Programmer
 - e) General Contractor
 - f) Audiovisual Integrator
 - g) Audiovisual Consultant
 - h) Architect
 - i) Electrical Contractor
 - j) Theatre Consultant
 - k) Owner
 - l) Structural Engineer
 - m) MEP Engineer
 - n) Facility Manager

C. Accepted By: The client, designer, contractor, or integrator that is authorized and contracted to verify that the activity has been performed. This may be more than one party and should be identified as such. Project participants from the Responsible Party list, above are examples of eligible accepting parties.

D. Following is an example of how a checklist line item can be filled:

EXAMPLE: Verification Checklist			
Date	Activity Code	Responsible Party	Accepted By
I. Project Planning and Coordination Meetings			
<u>4/9/2010</u>	<u>M,C,D</u>	<u>Integrator</u>	<u>Consultant</u> 1. Schedule and agreement for meetings

Standard Guide for Audiovisual Systems Design and Coordination Processes Checklist

Project Title _____ **Description** _____

Location _____ **Architect** _____

Designer _____ **Date** _____

Integrator _____ **Client** _____

Activity Codes: Meeting – M Coordination – C Task – T Deliverable – D Other – O NA – Not Applicable
Note: There may be more than one activity code on each line

Date	Activity Code	Responsible Party	Accepted By
------	---------------	-------------------	-------------

I. Project Planning and Coordination Meetings

_____	_____	_____	_____	1. Schedule and agreement for meetings
-------	-------	-------	-------	--

II. Program Phase

_____	_____	_____	_____	Program Phase startup meeting
_____	_____	_____	_____	A 1. Interviews with end users, facilities managers, etc.
_____	_____	_____	_____	A 2. Surveys of existing facilities
_____	_____	_____	_____	A 3. Inventories of existing equipment
_____	_____	_____	_____	A 4. Discovery of additional project requirements
_____	_____	_____	_____	B. Program Report

Activity Codes: Meeting – M Coordination – C Task – T Deliverable – D Other – O NA – Not Applicable

Date Activity Responsible Accepted
Code Party By

III. Design Phase

A. Architectural and Infrastructure Requirements

1. Architectural and Interior Design

_____	_____	_____	_____	Design Phase startup meeting
_____	_____	_____	_____	a. Projection and viewing sightlines and distances
_____	_____	_____	_____	b. Lectern locations and presenter ergonomics
_____	_____	_____	_____	c. Custom or integrated millwork, furniture, and casework
_____	_____	_____	_____	d. Disability access recommendations and codes
_____	_____	_____	_____	e. Finishes
_____	_____	_____	_____	f. Wall and ceiling height recommendations
_____	_____	_____	_____	g. Stage sizes and heights
_____	_____	_____	_____	h. Seating tiers and row-to-row distances
_____	_____	_____	_____	i. Equipment booths, central control and equipment rooms, service and access
_____	_____	_____	_____	j. Ancillary spaces (breakout rooms, green rooms, dressing rooms, etc.)
_____	_____	_____	_____	k. Equipment cooling and ventilation
_____	_____	_____	_____	l. Structural and fire rating impacts
_____	_____	_____	_____	m. Lighting plan, zones, and control
_____	_____	_____	_____	n. Delivery and installation of oversize products

Activity Codes: Meeting – M Coordination – C Task – T Deliverable – D Other – O NA – Not Applicable

Date Activity Code Responsible Party Accepted By

2. Electrical

_____	_____	_____	_____	a. National and local codes for high and low voltage installations
_____	_____	_____	_____	b. Electrical power panel (and subpanel) locations, layouts, and labeling for AV supplies
_____	_____	_____	_____	c. Anticipated AV-related electrical loads and circuit breaker requirements
_____	_____	_____	_____	d. Surge suppression, clean power, and back-up power requirements for AV loads (UPS, generators)
_____	_____	_____	_____	e. Receptacles types and locations
_____	_____	_____	_____	f. Requirements for isolated ground or same phase or other project specific grounding requirements
_____	_____	_____	_____	g. Pathways and capacity for high and low voltage cabling related to AV equipment
_____	_____	_____	_____	h. Project specific requirements for separation of high and low voltage cable types
_____	_____	_____	_____	i. Specifications, locations, and mounting heights for AV related cable boxes, stubs
_____	_____	_____	_____	j. Equipment rack isolation and bonding requirements
_____	_____	_____	_____	k. Coordination of AV safety grounds with building safety grounds
_____	_____	_____	_____	l. Other AV-electrical related notes and diagrams
_____	_____	_____	_____	m. Local and national review and certification requirements for drawings

3. Workmanship and Technique

_____	_____	_____	_____	a. Verification of licensing, permits, and/or affiliations with labor organizations
_____	_____	_____	_____	b. Expectations for workmanship
_____	_____	_____	_____	c. Cable termination standards (i.e., wiring of balanced vs. unbalanced audio)

Activity Codes:	Meeting – M	Coordination – C	Task – T	Deliverable – D	Other – O	NA – Not Applicable
------------------------	--------------------	-------------------------	-----------------	------------------------	------------------	----------------------------

Date	Activity Code	Responsible Party	Accepted By	
	4.	Acoustical		
_____	_____	_____	_____	a. Architectural acoustics recommendations
_____	_____	_____	_____	b. Mechanical systems noise and vibration control recommendations
	5.	Information Technology (IT)		
_____	_____	_____	_____	Information Technology (IT) Recommendations AV System Documents
	B. AV System Documents			
	1.	Bid Specifications		
_____	_____	_____	_____	Part 1 – General
_____	_____	_____	_____	Part 2 – Products
_____	_____	_____	_____	Part 3 – Execution
	2.	Design Drawings		
_____	_____	_____	_____	a. Title Block
_____	_____	_____	_____	b. Cover Page
_____	_____	_____	_____	c. Standard Details

Activity Codes: Meeting – M Coordination – C Task – T Deliverable – D Other – O NA – Not Applicable

Date	Activity Code	Responsible Party	Accepted By	
	3.	Facilities Drawings		
_____	_____	_____	_____	a. Device and Equipment Plans, Sections, and Elevations
_____	_____	_____	_____	b. Equipment Mounting Details
_____	_____	_____	_____	c. Miscellaneous Details
	4.	System Drawings		
	a)	Functional Diagrams		
_____	_____	_____	_____	1. Audio Subsystems
_____	_____	_____	_____	2. Antenna Distribution Systems
_____	_____	_____	_____	3. Digital Signal Processing
_____	_____	_____	_____	4. Video Subsystems
_____	_____	_____	_____	5. Special Video Subsystems with Interconnects to the Main Video subsystem
_____	_____	_____	_____	6. Control Equipment
_____	_____	_____	_____	7. Voice/data Systems Interface Components
_____	_____	_____	_____	8. Other Diagrams and Notes Provided for any Other Audiovisual subsystem
	b)	Equipment Rack Elevations		
_____	_____	_____	_____	Equipment Rack Elevations

Activity Codes: Meeting – M Coordination – C Task – T Deliverable – D Other – O NA – Not Applicable

**Date Activity Responsible Accepted
Code Party By**

c) Specialized Plates and Panels

_____ _____ _____ _____ Specialized Plates and Panels

d) Specialty Connector and Miscellaneous Wiring Diagrams

_____ _____ _____ _____ Specialty Connector and Miscellaneous Wiring Diagrams

e) Custom Configurations and Modifications

_____ _____ _____ _____ Custom Configurations and Modifications

f) Patch Panel Layouts and Labeling

_____ _____ _____ _____ Patch Panel Layouts and Labeling

5. Custom Application Documentation

_____ _____ _____ _____ a. Digital Signal Processor, Consoles, and Work Surfaces (DSP)

_____ _____ _____ _____ b. User Interface

_____ _____ _____ _____ c. Asset Management and Scheduling Systems

Activity Codes:	Meeting – M	Coordination – C	Task – T	Deliverable – D	Other – O	NA – Not Applicable
------------------------	--------------------	-------------------------	-----------------	------------------------	------------------	----------------------------

Date	Activity Code	Responsible Party	Accepted By
-------------	----------------------	--------------------------	--------------------

IV. Construction Phase

_____	_____	_____	_____	Construction Phase startup meeting
-------	-------	-------	-------	------------------------------------

A. Construction Drawings

_____	_____	_____	_____	1. Title Block
_____	_____	_____	_____	2. Cover Page
_____	_____	_____	_____	3. Standard Details

B. Facilities Drawings

1. Device and Equipment Plans, Sections and Elevations

_____	_____	_____	_____	a. Projector and Camera Locations
_____	_____	_____	_____	b. Device and Equipment Plans, Sections and Elevations: Device Aiming, Coverage, and Orientation
_____	_____	_____	_____	c. Device and Equipment Plans, Sections and Elevations: Integration of AV Equipment into Furniture
_____	_____	_____	_____	d. Device and Equipment Plans, Sections and Elevations: Labeling of Type, Manufacturer, and Model

Activity Codes:	Meeting – M	Coordination – C	Task – T	Deliverable – D	Other – O	NA – Not Applicable
------------------------	--------------------	-------------------------	-----------------	------------------------	------------------	----------------------------

Date	Activity Code	Responsible Party	Accepted By	
	C.	System Drawings		
_____	_____	_____	_____	1. Functional Diagrams
_____	_____	_____	_____	2. Equipment Rack Elevation Diagrams
_____	_____	_____	_____	3. Other details
	D.	Reference Documentation		
_____	_____	_____	_____	a. Matrix routing and preset configuration tables
_____	_____	_____	_____	b. Digital signal processing configuration details
_____	_____	_____	_____	c. Wireless microphone transmission frequencies
_____	_____	_____	_____	d. Control equipment
_____	_____	_____	_____	e. IT integration information
	E.	Testing and Acceptance		
_____	_____	_____	_____	a. Test procedures are carried out
_____	_____	_____	_____	b. Test report(s) submitted
	F.	Project Closeout		
_____	_____	_____	_____	a. Drawings of Record (As-built Drawings)
_____	_____	_____	_____	b. Final software code
_____	_____	_____	_____	c. Final graphics files
_____	_____	_____	_____	d. User operations manuals

Activity Codes:	Meeting – M	Coordination – C	Task – T	Deliverable – D	Other – O	NA – Not Applicable
------------------------	--------------------	-------------------------	-----------------	------------------------	------------------	----------------------------

Date	Activity Code	Responsible Party	Accepted By	
_____	_____	_____	_____	e. Equipment owner's manuals, warranty cards, etc.
_____	_____	_____	_____	f. Warranty support statement for system

OPTIONAL SERVICES

_____	_____	_____	_____	Optional Services startup meeting
-------	-------	-------	-------	-----------------------------------

I. Pre-Design Phase

_____	_____	_____	_____	A. Benchmark Facilities Tours and Presentations
_____	_____	_____	_____	B. Best Practices and AV Technology Seminars
_____	_____	_____	_____	C. Mock-ups of Audiovisual Systems

II. Design Phases

_____	_____	_____	_____	A. Control System Design and Programming
_____	_____	_____	_____	B. Custom Software Programming

III. Post-Construction Services

_____	_____	_____	_____	A. Maintenance Agreement
_____	_____	_____	_____	B. First-use Monitoring and Support
_____	_____	_____	_____	C. Ongoing Technology Management Services
_____	_____	_____	_____	D. Full Technology Management Outsourcing

6. Appendix 1: Optional Services

I. Pre-Design Phase

- A. **Benchmark Facilities Tours and Presentations:** The owner and the project design team may decide to benchmark peer facilities prior to beginning a design engagement. This exercise allows project stakeholders to evaluate recently completed facilities similar in scale and scope to their proposed facility. Often two or three facilities will be toured after which the design team may be asked to assemble and present findings from these tours and assess the lessons learned from owners of these peer facilities.
- B. **Best Practices and AV Technology Seminars:** Similar to the peer facility tours noted above, an AV designer may be asked to facilitate general AV technology seminars to apprise project stakeholders of the newest technology solutions and industry best practices.
- C. **Mock-ups of Audiovisual Systems:** The owner and the project design team may decide to create a “mock-up” room that simulates the essential ergonomic, lighting, and acoustic properties of the architectural design. An audiovisual system, whether real or simulated, may be incorporated into this space to verify sightlines, ergonomic features, and other considerations.

II. Design Phases

- A. **Control System Design and Programming:** Control systems represent uniquely challenging aspect to an integrated AV system design. Today's control solutions involve both hardware designs (typically identified in the AV designer's hardware drawings) and custom programming to automate and simplify system usage as well as related environmental system control, e.g., lights, shades, HVAC systems.
- B. **Custom software programming is performed during construction by the systems integrator, independent programmer, manufacturer, owner's technical staff, or consultant, and typically includes the following deliverables:**
 - 1. **Logic flow diagrams:** Designers may opt to communicate the control system's functional requirements through flow diagrams to indicate the sequence of events and logic paths a system should follow.
 - 2. **Touch panel layouts:** Designers may choose to define the user interface design as part of the system design documentation. These user interface (UI) designs may take the form of simple button panel layouts or may include full iconography and button-by-button descriptions of logic flows.
 - 3. **Control Code:** Customized programming code is required to display the touch panel layouts in the proper sequence, make the buttons function as required and instruct the control system to activate the various devices in the AV system and environment behave as desired. Control code is typically created during the system integration phase; however, some projects may require prototypical control code for system mock ups during the design phase or early in the systems integration phase to allow an owner to sign off on the user interface.

III. Post-Construction Services

- A. Maintenance Agreement: For some systems and clients, maintenance services may be desirable to ensure the continuous quality operation of the system. Under contract, a systems integrator may provide inspection, adjustment, cleaning of equipment and systems, etc. Inspectors may identify worn parts, updates, or enhancements that may require additional compensation.
- B. First-use monitoring and support: For some systems and clients, it is advantageous to have the systems integrator or design consultant present at the first or early events in the venue to operate the equipment and/or advise the operator. This may be desirable for a variety of reasons, such as the inability to train operators fully due to time constraints, temporary equipment in an unfinished system, the necessity to instill confidence in the system, etc.
- C. Ongoing Technology Management Services: In some cases, an owner requires additional technical support in the post-construction phase that does not fit the traditional service model. Examples of ongoing support needs could include:
 - 1. Post-construction commissioning services not just at project completion but many months after occupancy
 - 2. Additional training sessions for new users and technicians over time
 - 3. Consultative services related to enterprise-level rollouts of new technology
 - 4. Software/firmware upgrades over time
 - 5. Other initiatives related to adapting/connecting a new project to other facilities or groups
- D. Full Technology Management Outsourcing: For some clients it may make sense, both financially and organizationally, to pursue a full outsourcing arrangement for day-to-day AV operations. Similar to an IT outsourcing solution, this arrangement allows an owner to focus on its core business while outsourcing services that are not core. Duties could include in-room AV services, videoconference/bridge monitoring, video production/post-production services, and other related duties.