



National Park Service
U.S. Department of the Interior

Harpers Ferry Center

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NATIONAL PARK SERVICE STANDARD EXHIBIT FABRICATION SPECIFICATIONS

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National Park Service

Standard Exhibit Fabrication Specifications

Harpers Ferry Center
Harpers Ferry, West Virginia

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Division 1. PROJECT MANAGEMENT

1.1 Introduction

Schedule, coordinate, oversee, and manage work produced and installed under this contract.

1.2 Contacts

The Project Manager shall be the single point of contact between the contractor and the National Park Service (NPS) Contracting Officer's Representative (COR).

1.3 Specific Requirements

The contractor's Project Manager shall be in contact with the COR, Harpers Ferry Center, on no less than a weekly basis. The Project Manager shall perform the following work:

- A. **Quality Control** - Provide quality control to ensure that all elements of project work meet the requirements of the contract specifications and that all modifications are implemented. Provide routine inspections of shop-fabricated work and subcontracted work. Oversee quality of all work during installation. Ensure that all work not acceptable or compliant with the specifications is corrected prior to inspection or review by the COR.
- B. **Schedule** - Track work progress to ensure that the project is completed according to the schedule. Coordinate and confirm the dates for shipment, delivery, and installation of the work at the exhibit site with the COR.
- C. **Meetings** - Meet with the Contracting Officer and COR in accordance with this Division, 1.4, Meetings and Inspections, and as specified in individual task orders.
- D. **Travel** - In accordance with this Division, 1.5, Travel, and as specified in individual task orders.
- E. **Government-Furnished Materials** - Receive all government-furnished materials and inspect the materials to ensure that the quality is suitable for use in the exhibit. The Project Manager shall notify the COR immediately if government-furnished materials are not received in sufficient time to meet critical milestones, if damaged, or when use of the material would result in an unsatisfactory product.
- F. **Organize Resource Materials** - Identify and compile all resource material into a production package and ensure that this material is forwarded to the appropriate unit or person within the contractor's organization for use in the project.

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- G. **Submittals** - Coordinate all contractor's submittals and review them for legibility, accuracy, completeness, and compliance with contract requirements. Forward all submittals to the COR for review and approval. Receive all reviewed submittals and take appropriate action according to the approval or rejection by the COR.
1. **Approved Submittals** - Ensure that all changes, revisions, or additions are noted, and fabrication drawings and instructions are updated and forwarded to the COR.
 2. **Rejected Submittals** - When submittals are rejected, the COR will notify the Project Manager, in writing, identifying the reasons for rejection. The Project Manager shall revise and/or correct and resubmit, identifying changes.
- H. **Final Inspection** - Inspect completed work, including that of subcontractors, prior to final inspection by the COR and shipment to the site. Ensure that all elements of the project are complete and ready for the final inspection. The Project Manager shall notify the COR prior to the inspection if any elements will not be ready for final inspection as scheduled.
- I. **Delivery and Installation** - Ensure that all work is delivered and installed as scheduled. In the event that the COR reports problems during or after shipment, delivery, and/or installation, the Project Manager shall:
1. Determine the nature of the reported problem, damage, or production error and provide a proposal for resolution to the COR for review and approval; and
 2. Ensure that approved corrections or repairs are made in a satisfactory manner within the time scheduled by the COR.
- J. **Closeout Package** - Compile, prepare, and forward a closeout package to the COR in accordance with Division 9, Project Closeout.

1.4 Meetings and Inspections

The contractor's Project Manager shall meet with the Contracting Officer and COR as specified below and in individual task orders. After all scheduled meetings, the Project Manager shall prepare and provide written documentation to the COR enumerating all issues discussed and decisions made relative to the project.

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- A. **Postaward Conference** - The minimum agenda for this meeting includes the following:
1. General project review, including discussion of the following:
 - a. Contracting Officer and COR responsibilities;
 - b. Specifications and other work requirements;
 - c. Special contract requirements;
 - d. Correspondence procedures;
 - e. Subcontractors;
 - f. Delays and extensions;
 - g. Contract modifications;
 - h. Changes;
 - i. Submittals;
 - j. Project schedule;
 - k. Orientation to the park, including key personnel, location, and special conditions onsite; and
 - l. Billing and payment procedures.
 2. Provide government-furnished material to the contractor, including drawings, plan documents, reference and source materials, and other related materials.
 3. Review of exhibit plan and design.
 4. Review of government-furnished reference and source materials.
 5. Inspect and measure artifacts, verifying final dimensions.

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- B. **Progress Meetings and Inspections** - The COR will schedule progress meetings to coincide with project work inspections at the contractor's facility. The minimum agenda for the progress meetings includes the following:
1. Inspection of work in progress and completed work;
 2. Identification of problem areas and discussion of proposed solutions;
 3. Review of schedule;
 4. Discussion of planned progress during succeeding work period; and
 5. Discussion of work standards and practices to maintain quality.
- C. **Pre-installation Meeting** - The COR will meet with the Project Manager, Installation Team, and others of the contractor's staff, at the contractor's facility, prior to shipping and installation of the exhibits. The minimum agenda for the Pre-Installation Meeting includes the following:
1. Inspection of the fully setup staged exhibits as specified in Division 8, Setup and Installation.
 2. Review of existing conditions at the installation site, identifying potential problems and proposed solutions.
 3. Review of installation schedule, including:
 - a. Sequence in which work will be shipped, unloaded, setup, and installed; and
 - b. Projected work schedule onsite, including working days and hours.
 4. Review of preliminary maintenance manual in accordance with Division 9, Project Closeout.

1.5 Travel

The Project Manager shall travel to Harpers Ferry Center, Harpers Ferry, West Virginia, to the park site, or to other locations as specified in individual task orders in order to attend meetings and perform other duties required under the contract.

Division 1. PROJECT MANAGEMENT

- A. **Postaward Conference** - The Project Manager shall travel to Harpers Ferry Center, Harpers Ferry, West Virginia, to the park site, or to other locations in order to attend the postaward conference. The location will be specified in individual task orders.
- B. **Site Visits** - The Project Manager shall travel to the park to review existing conditions prior to fabrication of the exhibits. The Project Manager shall make additional trips to the site as specified in individual task orders in order to review conditions that have changed or to examine artifacts not available to be viewed previously. At a minimum, the Project Manager shall perform the following:
1. Assess existing conditions for onsite work. Take detailed measurements of the exhibit space to ensure proper fit of all exhibit elements. The contractor shall assess locations of heating and ventilation ducts, doors, windows, lighting fixtures, wall switches and controls, security system alarms and sensors, changes in floor level, floor finishes, ceiling beams, building structures and finishes, and other elements which impact on proper fit and operation of the exhibits;
 2. Assess existing conditions which impact on the installation of the exhibits, including: unloading areas, doorway clearances, curbs, stairs, elevators, available storage areas, available areas for setup of power tool work stations, offsite facilities for disposal of debris, parking, and local availability of food, gas, hardware, and other supplies and services;
 3. Assess existing electrical and lighting systems for determination of their impact on installation and operation of all exhibit elements;
 4. Inspect and measure artifacts, verifying final dimensions; and
 5. Meet with the general contractor, as specified in individual task orders, to exchange contact information for future coordination of work and to review and inspect the ongoing progress of the general contractor's work as it relates to the exhibits.
- C. **Installation** - Travel to the park to oversee installation of exhibits at the site by the Installation Team, and to submit the Final Maintenance Manuals to the COR, in accordance with Division 8, Setup and Installation, 8.4, G.

Division 2. FABRICATION DRAWINGS

2.1 Introduction

Provide drawings for review and approval detailing proposed fabrication of all structures indicated in the government-furnished exhibit design drawings and other elements as specified in individual task orders. Provide drawings documenting fabrication of the completed exhibits, including illustrations describing operational and maintenance procedures.

2.2 Specifications

- A. **Review all measurements** relating to the fabrication and installation of work required under this contract.
- B. **Prepare Fabrication Drawings and Revised Fabrication Drawings.** Incorporate all changes required into fabrication drawings and all additional elements specified in individual task orders that were not included in the exhibit design drawings. Fabrication drawings shall include the following that are changed from, or in addition to, the government-furnished exhibit design drawings:
 - 1. **Plan, Elevation, and Section View Drawings** indicating final dimensions and layouts;
 - 2. **Materials, Finishes, Colors, and Hardware** identified, including manufacturer's name and associated color, finish, or product identification number. Provide up-to-date information on all colors, finishes, and products; and
 - 3. **Exhibit Elements in Drawings Identified and Numbered** in accordance with original government-furnished exhibit design drawings and in accordance with Attachment B, Exhibit Numbering System Guidelines.
- C. **Provide catalog cuts for all equipment and hardware**, as specified in Division 3, Samples/Mockups/Prototypes, 3.2.A.
- D. **Execute Isometric Drawings** to illustrate access into the exhibits for maintenance and repairs by the park staff. Drawings shall include, but are not limited to, access into all exhibit artifact cases, audiovisual equipment, lighting equipment, and storage areas inside the exhibits. The isometric drawings shall be incorporated into all copies of the maintenance manual.
- E. **Prepare Artifact Mount Drawings**, in accordance with Division 7, Conservation Guidelines, 7.7,B.
- F. **Prepare a Preliminary Maintenance Manual** in accordance with this Division, 2.4.F.

Division 2. FABRICATION DRAWINGS

- G. **Prepare As-Built Drawings** in accordance with this Division, 2.4, G.

2.3 Materials

The contractor shall provide all materials for the production of work included in this Division.

2.4 Execution

A. **Drawing Technique - General**

Drawing sheet size shall match the government-furnished exhibit design drawings, since the contractor's fabrication drawings will be incorporated with the exhibit design drawings by the NPS upon completion of the project. Because completed drawings are entered into the government microfilm system, the contractor shall prepare them so they can be reproduced as clear and legible half-size prints. The contractor shall use American National Standards symbols. Each drawing shall be identified with the park name, project name, exhibit number, sheet number, and date of submittal.

B. **Fabrication Drawings**

The contractor shall prepare and submit, for review and approval by the COR, fabrication drawings in quantities of copies as specified in individual task orders.

C. **Revised Fabrication Drawings**

As specified in individual task orders, the contractor shall prepare and submit revised fabrication drawings incorporating all corrections or revisions required by the COR. If revised fabrication drawings are not specified in individual task orders, all corrections and revisions shall be incorporated into the as-built drawings.

D. **Isometric Drawings**

The contractor shall prepare isometric drawings for inclusion into the maintenance manual in accordance with Division 9, Project Closeout. The isometric drawings shall illustrate access into exhibit artifact cases, audiovisual equipment, lighting equipment, storage areas within the exhibits, and any other maintenance and operation procedures which require illustrations to supplement the written instructions.

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The drawings shall be prepared for an 8-1/2" x 11" format and shall be punched for a three-ring binder. The drawings shall include notations to clearly communicate the step-by-step procedures for operating locking mechanisms, opening access doors, removing silica gel, replacing lamps, and all other relevant maintenance procedures. The contractor shall be responsible for making the instructions accurate and clear for the park staff. The alternative use of photographic images to illustrate the instructions instead of drawings is acceptable with prior approval by the COR, if the images provide equal or greater clarity of information.

E. **Artifact Mount Drawings**

In task orders in which artifact mounting is included in the scope of work, the contractor shall provide artifact mount drawings for review and approval by the COR. The drawings shall illustrate all custom hardware to be used to mount artifacts in the exhibit, identifying relevant artifact number, dimensions, materials, and finishes. Where identical mounts are to be used for multiple artifacts, the contractor may submit a typical drawing that identifies the artifacts referred to by number. Materials and finishes shall be in accordance with Attachment E, Summary of Exhibit Conservation Guidelines, and Division 7, Conservation Guidelines, of these Specifications.

F. **Preliminary Maintenance Manual**

Maintenance manuals shall be prepared and submitted to the COR on the following schedule: a preliminary draft of the maintenance manual shall be submitted with the fabrication drawings and catalog cuts; completed maintenance manuals shall be submitted at the installation of the exhibits; and one copy of the completed maintenance manual shall be submitted with the closeout package.

Prepare a preliminary maintenance manual for review and approval by the COR. The preliminary maintenance manual shall be assembled into a three-ring binder and shall include, at a minimum, a table of contents, tabbed and labeled page dividers for each section including those sections for which no content is available at this time, and all content information that is appropriate for development at this phase of the project such as catalog cuts, maintenance instructions, list of vendors, suppliers, and subcontractors.

1. **Assembly of Maintenance Manual**

Pages shall be 8-1/2" x 11" sheets and shall be punched and inserted into three-ring binders. Insert a full-length sheet of card stock into the sleeve along the spine of the binder labeled "Maintenance manual," the name of the project, site, and month/year of installation.

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Organize the manual in sections in accordance with 2.4, F.2, and separate each section with labeled and tabbed dividers. Organize content of the maintenance manual to facilitate easy use as a reference document. Include page numbers or headers, and organize information in a logical manner.

When audiovisual equipment is installed as part of the exhibit, the maintenance manual shall consist of two volumes, the second of which shall be dedicated to the operation and maintenance of the audiovisual equipment.

2. Content of Maintenance Manual

- a. **Title Page** - Provide a title page with the name of the exhibit, the site, and installation date.
- b. **Table of Contents** - Provide a list of contents.
- c. **Contract Information** - Provide name, address, and telephone number for all contractors and suppliers who produced work for the exhibit, identifying the portion of the work which they provided.
- d. **Cleaning Instructions** - Provide instructions for cleaning all exhibit structures, finishes, graphic panels, tactile models, and screen printed material. Include brand names of recommended cleaning materials. Provide the name, address, telephone number, and website (if applicable) of the manufacturers or distributors of the cleaning products. Listed cleaning products shall correspond with supplies included in the maintenance kit furnished by the contractor. "Not to be used" materials and techniques shall be identified.
- e. **Repair Instructions** - Describe specific techniques for repairing damage to exhibit surface materials such as: wood and painted finishes, screen printed areas, plastic laminates, faux finishes, fabric, metal, acrylic, polycarbonate, and glass.
- f. **Artifact Care and Handling** - Provide information or direction for care, maintenance, and cleaning of the artifact mounts, including how to detach the object from the mount. Provide copies of all final artifact mount drawings.
- g. **Product List and Catalog Cuts** - List brand names of off-the-shelf products purchased for use in the exhibit and the name, address, telephone number, and website address (if applicable).

Division 2. FABRICATION DRAWINGS

Provide legible machine copies of catalog cuts for all products listed. However, if copy of original cannot be produced without loss of readability, original catalog cuts shall be provided. Include at least one original copy of the manufacturer's information packed with contractor purchased off-the-shelf equipment, inserted into 8-1/2" x 11" clear plastic sleeves, punched for three-ring binders.

- h. **Warranties** - Provide manufacturer's warranties for all off-the-shelf equipment purchased by the contractor.

- i. **Access Instructions** - Provide visuals clearly and sufficiently illustrating access to artifacts, desiccant, lighting equipment, mechanical devices, and audiovisual equipment within the exhibits. The illustrations shall include the exhibit number(s), step-by-step instructions, and any other information relevant to opening or dismantling the structures. The illustrations shall be accomplished in one or both of the following ways:
 - 1) Isometric or exploded view drawings, as specified in this Division, 2.4, D.

 - 2) Photographs combined with text, showing a person following the step-by-step instructions. Include close-up views of specialized locks or hardware, identified by captions.

- j. **Electrical and Mechanical Instructions** - Provide maintenance and operation instructions for all lighting, electrical, and mechanical equipment as follows:
 - 1) **As-Built Lighting Plan**
 - (a) As-built drawings of the exhibit lighting plan which shows final fixture placement, orientation, and the lamp specifications for each fixture.

 - (b) Identification of the manufacturer and model number of all fixtures, including any specialized equipment such as gels, diffusers, and louvers.

 - (c) Specific instructions for re-lamping.

 - 2) **Wiring Diagrams** - Include as-built wiring diagrams for all lighting and equipment installed by the contractor. Include a copy of government-furnished instructions for repair or replacement of audiovisual equipment.

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- 3) **Catalog Cuts** - Catalog cuts and manufacturer's printed instructions for all ceiling lighting fixtures, lighting tracks, lighting track fixtures, lamps, connectors, transformers, adapters, power strips, clocks, sensors, timers, ventilation fans, thermostats, motors, switches, pushbuttons, fibers, lenses, illuminators, dimmer controls, or other electrical, mechanical, or lighting equipment.
 - k. **Color and Finish Samples** -
 - 1) Provide actual samples of all materials used in the exhibit such as: woods, veneers, masonry, metal trim, laminates, fabrics, carpets, paints, and inks. Material shall be mounted on 8-1/2" x 11" white illustration board, clearly labeled with the color name and number, the manufacturer's brand name, and other pertinent product identification, keyed to the drawings for location.
 - 2) One 8-1/2" x 11" mounted sample shall be provided for each type of digital output print and for each screen printing ink color and substrate combination used in the exhibit.
 - 3) Samples of specialized techniques such as sandblasted or etched graphics or finishes shall also be provided.
 - l. **As-Built Exhibit Plan** – The contractor shall update the government-furnished planning database to reflect all changes that occur during fabrication, and provide a hard copy and electronic version of the resulting as-built schedules and facsimiles. All revisions and updated information shall be clearly noted.
 - m. **As-Built Exhibit Drawings** - Include one copy of as-built exhibit drawings printed onto 11" x 17" sheets as specified in this Division, 2.4, G.
3. **Volume 2, Audiovisual Operations Manual**

The contractor shall provide a separate notebook that contains the audiovisual operations manual. This manual shall describe the operation and simple troubleshooting of the audiovisual systems specified in individual task orders. Each copy shall include the owner's operating/service manuals for each item of equipment used in the specified system. The manual content minimum shall be:

Division 2. FABRICATION DRAWINGS

- a. **Title Page** - Provide a title page with the name of the exhibit, the site, and installation date
- b. **Table of Contents** - Provide a list of contents
- c. Systems Block diagram(s), 11"x17"
- d. Systems Overview description(s)
- e. Daily System Startup and Shutdown Procedures
- f. System Adjustments
 - 1) Audio
 - 2) Video
- g. Troubleshooting Guide
 - 1) Video
 - 2) Audio
 - 3) Controls
- h. Maintenance Procedures
 - 1) Describe routine procedures required with time intervals. This includes audiovisual programs, lighting equipment, computer interactive displays, mechanical interactive displays, and other electrical, electronic or mechanical equipment provided and/or installed by the contractor.
 - 2) For each audiovisual display, provide a list of parts needed for routine maintenance with make, model, time frequency needed, quantity per year, and price as of what date.
 - 3) Provide a written proposal at installation for an optional service contract for audiovisual equipment or audiovisual systems as specified in individual task orders. Include proposed pricing for service at scheduled intervals as well as for fixed labor rates for individual service calls. Provide the contractor's contact information including name, address, telephone numbers, and names of the project manager, sales representative, and service manager.

Division 2. FABRICATION DRAWINGS

- i. As-built wiring diagrams for each audiovisual system. Provide hard copies as well as the electronic files in PDF format.
- j. A hard copy and electronic version of the final control program(s).
- k. The manufacturer's installation, maintenance, and user instruction manuals for all components of the system. When electronic versions are available, they shall be included.
- l. Provide manufacturer's warranties for all off-the-shelf equipment purchased by the contractor. Include documentation for date of purchase of the equipment.

G. **As-Built Drawings**

The contractor shall prepare a completed set of as-built drawings containing all approved revisions and additions to the fabrication drawings and any subsequent changes to the original plan. The as-built drawings shall be submitted in the maintenance manuals in accordance with this Division. All original drawings produced under this contract will be the property of the government.

Division 3. SAMPLES/MOCK-UPS/PROTOTYPES

3.1 Introduction

Provide samples for all materials, colors, and finishes specified for the exhibits. Fabricate mock-ups and prototypes as specified in individual task orders.

3.2 Specifications

A. **Catalog Cuts** - Catalog cuts shall be provided for all specialized hardware and off-the-shelf items provided by the contractor, including:

1. Lighting fixtures and associated hardware;
2. Electronic and electrical equipment and hardware, including audiovisual equipment, computer systems, control systems, cables, pushbuttons, and ventilation fans;
3. Security hardware and locks;
4. Specialized cabinet hardware, including hinges, casters, drawer pulls, door handles, levelers, etc.; and
5. Specialized fasteners, including cable hanging systems, wall or floor anchors, and other fasteners specified for anchoring or supporting exhibit structures in place.

Catalog cuts shall be legible originals or copies. When more than one product is shown on a page, highlight, circle, or otherwise identify the specific product, including all appropriate specifications such as model or part number, color, size, etc.

B. **Materials and Finishes Samples** - All samples shall be identified with the brand name, number, color name and number, and the manufacturer's name, address, and telephone number. Sample sizes shall be a minimum of 12" x 12" or as specified in individual task orders.

1. **Finish Samples** -

- a. **Paint** - Paint colors mixed to match the specified exhibit color, applied to substrate of same material to be used in the exhibit. All samples shall be identified with exhibit color number.
- b. **Plastic laminate**

Division 3. SAMPLES/MOCK-UPS/PROTOTYPES

- c. **Wood** - Solid wood or wood veneer finish in specified species of wood and thickness and with specified finish, such as stain, sealant, or oil finish.
 - d. **Metal** - Finish and metal specified, including but not limited to, paint, powder coating, patina, and anodized finish.
 - 2. **Glazing** - Glass or acrylic glazing, in specified type and thickness.
 - 3. **Gasketing for Artifact Cases** - One-foot long sample of each type of gasketing to be used.
 - 4. **Models** - Including topographic models, natural history models/dioramas - as specified in individual task orders. Samples of models shall represent the actual materials, finishes, and colors from which the model will be made.
 - 5. **Custom Life-size Figures** - Cast from live models (real people), samples shall include photographs of the people from whom the castings are to be made. Samples of finishes and colors for custom figures shall be provided in the same materials from which the custom figure surface will be fabricated.
- C. **Graphics** - Graphic media, including but not limited to, samples of digital and photographic prints, mounting and overlaminating, screen printing, porcelain enamel, etched glass, vinyl cutouts, and fiberglass embedments. Graphic media samples shall represent typical images, colors, and typography specified in the exhibit.
 - 1. **Digital Output Graphic Proofs** -
 - a. **Paper Proofs**
 - 1) Provide full-size (100%) paper proofs for all graphic images and layouts in quantities as specified in individual task orders. Proofs shall be full-color and include final, high-resolution scanned images.
 - 2) Proofs that have been reviewed by the COR and require changes shall be corrected and resubmitted as revised proofs.

Division 3. SAMPLES/MOCK-UPS/PROTOTYPES

a) Each sheet shall be identified with the following minimum information:

- Project Name (SHEN-BYRD VC)
- Exhibit label number(s)
- Font(s)
- Type size(s)
- Date of submittal

b) For large murals, it is acceptable for the contractor to submit the proof in sections. For reference in assembling the sections, the contractor shall submit a reduced-scale print of the entire mural on one sheet, with the seams marked.

b. **Production Samples**

- 1) Provide full-size (100%), full-color graphic samples of images and layouts. The samples shall be produced using the final output media specified (i.e.: inkjet, Lambda, screen print), with final colors and resolution.
- 2) Production samples shall represent all combinations of colors, typography, and types of images as they will appear in the final panels.
- 3) Quantities of each sample shall be as specified in individual task orders. When no quantity is specified, one copy of each sample shall be submitted.
- 4) The individual task order may also specify particular areas of exhibit graphic panels, at full size, which the COR requires in addition to the production samples. Dimensions of these sections shall be a minimum of 12" by 12", or as specified in individual task orders.

2. **Mounting and Overlaminating** - Provide one 8" by 10" sample of a mounted and laminated print for each type of mounting substrate and overlaminate specified on the drawings or in individual task orders.

3. **Screen Printing** – Provide samples of all screen inks printed on the exact finished substrate specified on the drawings or in the individual task order. Samples of type shall use the smallest and lightest version of each typeface specified on the drawings, but no smaller than 24 point. Samples will be reviewed by the COR for color accuracy, and to evaluate contrast and readability.

Division 3. SAMPLES/MOCK-UPS/PROTOTYPES

4. **Other Graphic Samples** – Provide samples of porcelain enamel, etched glass, vinyl cutouts, fiberglass embedments, graphics on fabrics, dimensional letters, and all other graphic elements specified for the project.

- D. **Mock-ups** - Mock-ups are full-scale representations of portions of an exhibit for the purpose of review and testing of exhibit elements that are undeveloped and need further evaluation. Mock-ups shall be fabricated as specified in individual task orders. Mock-ups are for review only, and shall not be incorporated into the final exhibit.

- E. **Prototypes** - Prototypes are portions of an exhibit such as an artifact case or an interactive mechanism that has a particular need to be reviewed and tested prior to fabrication of more elements of the same design. Unless otherwise specified in individual task orders, prototypes shall be corrected, in accordance with the review and approval by the COR, and incorporated into the final exhibit along with the other elements of the same design.

Division 4. EXHIBIT STRUCTURES

4.1 Introduction

Provide fabrication of all exhibit elements including cabinetry, panels, platforms, artifact cases, cabinets or kiosks containing computer equipment, vitrines, or other elements that constitute the basic structural elements of the exhibits.

4.2 Quality Assurance

Refer to the Architectural Woodwork's Institute (AWI) quality standards for cabinetry and laminate work. All manufacturer's printed recommendations for materials, coatings, and adhesives are a part of these specifications. Copies of the publication, **AWI Quality Standards**, are available from:

Architectural Woodwork Institute
46179 Westlake Drive, Suite 120
Potomac Falls, Virginia 20165
571-323-3636
www.awinet.org

All materials and fabrication methods for artifact cases, including all structures to be installed inside artifact cases, shall be in accordance with Attachment E, Summary of Exhibit Conservation Guidelines.

4.3 Product Handling

Store lumber and millwork in a dry location. Do not expose wood to extreme changes in temperature or humidity. Protect panels, cases, and other structures from damage during handling, production, storage, shipping, and installation.

4.4 Materials

A. Wood Products - As specified on the drawings and in accordance with the following.

1. **Plywood** - For exhibit finish substrate and structure use American Plywood Association (APA) Grade B or better, birch veneer plywood, sanded and touch-sanded, 3/4" thick. In areas where moisture is a factor, use marine grade birch plywood. Bending plywood shall be used for curved surfaces.
2. **Medium Density Fiberboard (MDF)** - Artifact case structures and pedestals or platforms for use inside artifact cases shall be fabricated using Medite II, industrial grade medium density fiberboard (MDF) manufactured with a formaldehyde-free binder which meets the requirements of ANSI A208.2-2002.

Division 4. EXHIBIT STRUCTURES

Medite II, as manufactured by:

Sierrapine, Ltd.
Lava Ridge Court, Suite 220
Roseville, California 95661
800-676-3339
www.sierrapine.com

3. **Framing Lumber** - Number 2 Grade Poplar, Douglas Fir, or Number 1 Grade Southern Pine.

B. Plastics - As specified on the drawings and in accordance with the following.

1. **Artifact Vitrines** - Plastic glazing for artifact cases or vitrines shall be clear, UV-filtering cast acrylic sheet, as specified below.

Plexiglas, UF-3, as manufactured by:

Altuglas International
c/o Arkema, Inc.
2000 Market Street
Philadelphia, Pennsylvania 19103
215-419-7000
<http://www.altuglasint.com>

Acrylite OP-2, as manufactured by:

Cyro Industries
100 Enterprise Drive
P. O. Box 5055
Rockaway, New Jersey 07866
800-223-2976
www.cyro.com

2. **Subsurface Laminated Graphics** -

- a. Exhibit graphics which are output as paper prints and exposed to higher than normal wear from visitor use shall be subsurface laminated to clear, non-glare cast acrylic or polycarbonate sheet, in accordance with Division 6, Graphics, 6.10, and then mounted to a rigid substrate.

Examples of exhibit graphics which are considered as receiving higher than normal wear include the following:

- Panels mounted with a mainly horizontal orientation;

Division 4. EXHIBIT STRUCTURES

- Instructional label panels adjacent to push buttons, interactive devices, models, and maps.
- Cut-out graphics, as an alternative to the standard for fabrication of cut-out graphics as a phenolic resin graphic panel, in accordance with Division 6, Graphics, 6.10, E.

- b. Non-glare cast acrylic sheet shall be as manufactured by Altuglas International or Cyro Industries. Non-glare polycarbonate sheet, as manufactured by:

GE Plastics
One Plastics Avenue
Pittsfield, Massachusetts 01201
413-448-7110
www.geplastics.com

3. **Moderately Expanded PVC Sheet** - Moderately expanded PVC sheet **shall not** be used for fabrication of any elements which are to be installed in the interior of an artifact case, including panels, pedestals, or graphic substrates.

C. Metals - As specified on the drawings and in accordance with the following.

1. **Steel** - Steel for fabrication of exhibit structures shall be as recommended by the American Society for Testing and Materials (ASTM) for the application specified.

American Society For Testing and Materials
100 Barr Harbor Drive
West Conshohocken, Pennsylvania 19428-2959
610-832-9585
www.astm.org

2. **Aluminum** - Flat plate shall be anodized. Extrusions for structural supports shall be 6060-T or 6063-T52 alloy and anodized or painted.

3. **Miscellaneous** - Railings and ornamental metalwork shall be in accordance with recommendations of the National Ornamental & Miscellaneous Metals Association (NOMMA).

National Ornamental & Miscellaneous Metals Association
1535 Pennsylvania Avenue
McDonough, Georgia 30253
888-516-8585
www.nomma.org

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D. Glass - As specified on the drawings and in accordance with the following. All glass shall be either tempered or laminated safety glass.

1. **Laminated Glass** - Polyvinyl butyral (PVB) UV-filtering layer between two laminations. All glass to be used as glazing for artifact cases shall be clear, UV-filtering laminated glass.
2. **Tempered Glass** - Fully-tempered glass which breaks into small cubes if broken.
3. **Anti-Reflective Glass** - AMIRAN anti-reflective glass, in thickness as specified on the drawings. AMIRAN used for artifact case glazing shall be laminated. AMIRAN is manufactured by:

SCHOTT North American, Inc.
555 Taxter Road
Elmsford, New York 10523
914-831-2200
www.us.schott.com

E. Gasketing - The contractor shall use only silicone gasketing as specified in Attachment E, Summary of Exhibit Conservation Guidelines, Section 3, "Sealing of Exhibit Cases." Manufacturers of silicone gasket materials include the following:

Rogers Corporation
BISCO™ Silicones
One Technology Drive
P.O. Box 188
Rogers, Connecticut 06263-0188
860-744-9605
www.rogers-corp.com/bmu/info.htm

Clean Seal, Inc.
21900 West Ireland Road
South Bend, Indiana 46614
800-366-3682
www.cleansal.com

Delta Designs, Ltd.
P.O. Box 1733
Topeka, Kansas 66601
785-234-2244
800-656-7426
www.deltadesignsltd.com

Netherland Rubber Company

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2931 Exon Avenue
Cincinnati, Ohio 45241
800-733-6107
www.netherlandrubber.com

- F. Adhesives and Sealants** - As specified on the drawings or as recommended in the manufacturer's specifications for installation of materials. All adhesives and sealants to be used on the internal surfaces of artifact cases or for case furnishings such as platforms, pedestals, or panels shall be in accordance with Attachment E, Summary of Exhibit Conservation Guidelines, Section 3, "Sealing of Exhibit Cases."
1. **High Pressure Laminate Adhesive** -
 - a. **Laminate-to-Substrate** - Use a nonpigmented contact cement or the manufacturer's recommended adhesive.
 - b. **Laminate-to-Laminate** - Use a nonpigmented two-part epoxy or the manufacturer's recommended adhesive.
 2. **Glass** - Silicone SCS1201 clear, white or black, as manufactured by:

General Electric Company
GE Silicones
260 Hudson River Road
Waterford, New York 12188
518-237-3330
800-332-3390
www.gesilicones.com
 3. **Artifact Case Wood Sealant** - Seal all exposed wood inside artifact cases which shares the same air space with the artifacts and desiccant chamber so that artifacts will not be harmed by volatile chemicals outgassing into the air inside the case. Exposed wood inside case furnishings such as platforms, pedestals, or panels shall also be sealed. Surfaces already finished with high-pressure laminate do not need additional sealant. Sealants shall be in accordance with Attachment E, Summary of Exhibit Conservation Guidelines, Section 5, "Exhibit Case Construction Materials." Follow manufacturer's specifications for application of the finish.

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Camger 1-175 Series Poly Preserve Aliphatic Urethane Barrier, as manufactured by:

Camger Chemical Systems, Inc.
364 Main Street
Norfolk, Massachusetts 02056
508-528-5787
www.camger.com

4. **Artifact Case Crack and Gap Sealant** - To ensure a tight seal, fill all seams which could allow air exchange with outside air using silicone, acrylic latex, or acrylic latex silicone caulk which is neutral curing, does not emit acetic acid during curing, and has low volatile organic compounds (VOC's). Examples of some acceptable neutral curing caulks, and caulks with low VOC's, include the following:

- a. Dow Corning neutral-curing silicone glass sealant, as manufactured by:

The Dow Chemical Company
2030 Dow Center
Midland, Michigan 48674
989-636-1000
www.dowcorning.com

- b. OSI Pro-Series VP-275™ multi-purpose silicone sealant, neutral-curing, as manufactured by:

Henkel Consumer Adhesives
7405 Production Drive
Mentor, Ohio 44060
800-321-0253
www.osiproseries.com

- c. Liquid nails super caulk, indoor-outdoor acrylic latex caulk, as manufactured by:

MACCO
15885 West Sprague Road
Strongsville, Ohio 44136
800-545-2643
www.liquidnails.com

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- d. DAP® ALEX PLUS® acrylic latex caulk plus silicone, as manufactured by:
- DAP Inc.
2400 Boston Street Suite 200
Baltimore, Maryland 21224-4723
888-327-8477
www.dap.com
- e. Red Devil 25-Year acrylic latex interior wall and wood caulk, and Red Devil LIFETIME® siliconized acrylic adhesive sealant, as manufactured by:
- Red Devil, Incorporated
4175 Webb Street
Pryor, Oklahoma 74361
918-825-5744
www.reddevil.com
5. **General Purpose Caulk** - Clear silicone rubber, standard grade RTV Silicone Number 108, as manufactured by the General Electric Company, as specified in this Division, 4.4, F., 2.
6. **Acrylic Cement** - Weld-On 40 adhesive, as manufactured by:
- IPS Corporation
455 West Victoria Street
Compton, California 90220
310-898-3300
800-421-2677
www.ipscorp.com
7. **Graphic Mounting Adhesives** - In accordance with Division 6, Graphics, 6.10.
8. **Artifact Case Curing Time** - All artifact case adhesives, sealants, and finishes shall be allowed to cure while exposed to the fabrication shop environment for a minimum of two weeks prior to enclosing the case structure and installing the artifacts. The contractor shall be responsible for consulting the manufacturers' technical data to verify exact conditions of time, temperature, and humidity for the adhesives, sealants, and finishes to fully cure.
- G. Finishes** - As specified on the drawings and in accordance with the following. Finishes inside artifact cases shall be in accordance with Attachment E, Summary of Exhibit Conservation Guidelines, Section 5, "Exhibit Case Construction Materials."

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1. **Plastic Laminates** - High pressure decorative laminates shall meet the minimum performance standards of the International Organization of Standardization (ISO) ISO-4586-2:2004 and the National Electrical Manufacturer's Association, LD3-2005. Laminate shall be Grade 10, general purpose grade, with the exception of curved, vertical surfaces, then Grade 20, vertical postforming grade is acceptable.
2. **Paint**
 - a. **Artifact Case Interiors** - Use paints with a low Volatile Organic Compound (VOC) rating for surfaces inside the artifact chamber, in accordance with Attachment E, Summary of Exhibit Conservation Guidelines, Section 5, "Exhibit Case Construction Materials."
 - b. **Aluminum and Steel** - Use Polane T polyurethane enamel and primer, as manufactured by:

The Sherwin-Williams Company
101 Prospect Avenue, Northwest
Cleveland, Ohio 44115-1075
800-474-3794
www.sherwin.com
3. **Powder Coating** - As manufactured by:

TIGER Drylac U.S.A., Inc.
Headquarters
1261 East Belmont Street
Ontario, California 91761
909-930-9100
www.tigerdrylac.com
4. **Fabric** - Fabric for use inside artifact cases shall be in accordance with the drawings and Attachment E, Summary of Exhibit Conservation Guidelines, Section 5, "Exhibit Case Construction Materials."

H. Hardware

1. **Rough** - Nails, screws, bolts, nuts, washers, anchors, threaded inserts, flush clips, and similar items of proper size and number to secure materials in place. Any fasteners used in areas where moisture is a factor shall be galvanized or aluminum.

Division 4. EXHIBIT STRUCTURES

2. **Finish** - Hinges, key-hole fasteners, concealed hinges, cam locks, slides, push locks and keys, casters, levelers, handles, and knobs as specified on approved drawings and catalog cuts. All doors in exhibit structures which provide access to interior storage cabinetry and audiovisual equipment shall be fastened with concealed hinges and provided with locks. Locks that are installed as multiples shall be keyed alike.

4.5 Execution

A. Woodworking - General

1. **Quality Standards** - AWI Quality Standards are by reference made part of this Specification. Unless otherwise clearly detailed or specified in individual task orders, all cabinetry shall be fabricated to conform to AWI Quality Standards, Section 400, for custom grade material and workmanship.
2. **Cabinetry** - All casework shall be plant assembled. Cases too large for access into the exhibit area shall be made in detachable sections with provisions for assembly inside the exhibit space.
 - a. **Fabrication Methods** - All faceplates, panel ends, and doors shall be of mortise and tenon or doweled fabrication, glued under pressure, with nails only furnishing the pressure. All nails shall be properly set for filling. Filled areas shall be sanded smooth to receive laminate, paint, or other specified finish. Edges of panels and signs shall be filled, sanded smooth, and finished or covered with material matching the panel face. Edges shall not be left unfinished unless otherwise specified on the drawings.
 - b. **Shelving** - Unless otherwise specified in individual task orders, any shelving used as part of the interior of cabinets shall be 3/4" Birch plywood. At a minimum, audiovisual equipment shelving shall have 12" square center portions of perforated metal to allow ventilation around equipment. The contractor shall be responsible for ensuring that each shelf is fabricated of material of sufficient strength for the piece of equipment for which it is intended.
3. **Architectural Millwork** - Fabricate and assemble units complete in the shop, insofar as their dimensions will permit for transportation and proper handling. All woodwork shall be shop finished and delivered to the installation site with protective covering. Use solid stock for frames, jambs, heads, stops, and edges. Where veneer plywood is used, trim exposed edges with hardwood without face nailings. Accurately fit and align separate parts.

Division 4. EXHIBIT STRUCTURES

Provide ample screw, glue-and-bolt blocks, draw-bolts, tongues, grooves, splines, dowels, tenons, mortises, and other means of fastening to render the work substantial, rigid, and permanently secured in the proper position. Provide material to permit scribing to walls, floors, and related work. Provide sufficient allowance for shrinkage occurring after installation. Provide mitered corners at doorframes with hairline joints. Fit and adjust doors to achieve smooth and noiseless operation. Exposed fasteners are unacceptable without prior approval from the COR. Countersink face nails and face screws, fill with plastic wood or wood plugs, sand flush to surface, and finish without visible markings.

B. Artifact Case Fabrication - All materials and fabrication methods for artifact cases, including all structures to be installed inside artifact cases, shall be in accordance with Attachment E, Summary of Exhibit Conservation Guidelines.

1. **Sealed Case Environment** - To ensure that artifact case vitrines are as airtight as possible, seal all seams which could allow air exchange with the air outside the artifact and silica gel chambers. Fabrication shall be in accordance with Attachment E, Summary of Exhibit Conservation Guidelines, "Case Details and Illustrations, Section 6, Case Air Seal."
2. **Silica Gel Chambers** - Chambers that house silica gel shall be fabricated to maximize exchange of air with the chamber containing the artifacts and minimize exchange of air outside of the case. The chamber shall provide a sealed, stable environment necessary to protect the artifact(s) in the case. Fabrication shall be in accordance with Attachment E, Summary of Exhibit Conservation Guidelines, "Case Details and Illustrations, Section 5, Environmental Control."

C. Finishes

1. **Substrates** - Surfaces scheduled to receive etching, sandblasting, paint, laminate, photo mounts, and graphic prints, shall be made true and even with joints and nail holes filled, and shall be primed, sealed, and properly supported to prevent warping or bending.
2. **Paint** - All exposed surfaces to receive paint shall be finished smooth. Finished paint surface shall be without runs, sags, and other imperfections. Match colors specified on the drawings. Colors shall be consistent from surface-to-surface. Paint shall be applied under dry, dust-free conditions, in accordance with the manufacturer's specifications. Edges, crevices, corners, and joints shall be thoroughly cleaned. Painting shall be of uniform thickness. All exposed edges of painted panels shall be filled, sanded, and painted to match the panel face unless otherwise specified on the drawings.

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3. **Plastic Laminate** - All laminate and substrate shall be stored together for at least 72 hours and assembled in an environment of approximately 70 degrees Fahrenheit and 50 percent relative humidity. Face of the substrates shall be sanded smooth and free of grease, wax, dust, or other contaminants which interfere with adhesion. Control of the glue line and its thickness and uniformity of spread shall be given constant attention. Spot bonding shall never be used. Cover all areas where contact is made with adhesive. **IN ALL CASES, THE ADHESIVE MANUFACTURER'S INSTRUCTIONS FOR USE SHALL BE FOLLOWED.** Avoid chipping of laminate by the saw blade. Finish smooth edges on curved cut by sawing the part oversize and finish it by routing, filing, or sanding. When cutting laminate, make certain to prevent hairline cracks or over-cutting at inside corners. Inside corners shall be rounded to prevent corner cracking.
4. **Veneer** - All veneer shall be ordered in a minimum 3:1 ratio per square foot of plywood substrate required. Face veneer shall be flat sliced with adjacent pieces randomly matched. The maximum width of sapwood per flitch shall not exceed two-inches. Panel face assembly shall be running matched. Veneer millwork shall not be sequence matched. All edges shall be veneer banded on all four edges for final use in the exhibit.
5. **Panel Edges and Backs, Concealed Areas** - Finish in accordance with the following unless specified otherwise on the drawings.
 - a. **Concealed Areas** - Those areas completely enclosed by solid opaque framing and skin. No finish required.
 - b. **Semi-Exposed Areas** - Those areas only visible by opening doors or access panels. Finish with wood sealer.
 - c. **Flat Panels, Framed** - The back side of plywood or other framed material. A minimum of two coats flat lacquer primer for the surface.
 - d. **Flat Panels, Unframed** - The back side of plywood or other material without framing such as cabinet doors and applied panels. A minimum of three coats of paint, laminate backing sheet, or other finish equal in density and weight to that specified on the drawings for the exposed surface.
 - e. **Edges** - All exposed edges of panels, plaques, and graphic prints shall be fitted and sanded smooth. Edges shall be finished to match adjoining surfaces as specified on the drawings.
 - f. **Panel Backs** - Backs of panels shall be finished with spray-applied lacquer finish or laminate backing sheet in color specified on the drawings.

Division 4. EXHIBIT STRUCTURES

6. **Artifact Case Interiors** - All surfaces inside artifact cases which share air exchange with the artifact and silica gel chambers shall be finished in accordance with Attachment E, Summary of Exhibit Conservation Guidelines, "Technical Notes, Section 5, Exhibit Case Construction Materials."

- D. **Plastic** - Follow manufacturer's printed instructions. Cut material to the size specified on the drawings, allowing for expansion and contraction. Welded joints shall be free of gaps and bubbles, continuously sealed, and absolutely clear. All exposed edges shall be hand polished, no flame polishing. Surfaces of acrylic shall be free of scratches, stains, or other imperfections.

- E. **Metal Work** - Fabricate to detail and finish as specified on the drawings. All metals shall be prepared and finished in accordance with the finish manufacturer's specifications. Ease all sharp edges and corners on horizontal or angled panel frames or railings.
 1. **Welding** - Use appropriate welding materials, grind welds smooth, and ease all sharp or ragged edges. Standards for welding shall be as recommended by:

American Welding Society
550 NW LeJeune Road
P.O. Box 351040
Miami, Florida 33126
305-443-9353
800-443-9353
www.aws.org

 2. **Fasteners** - Use appropriate fasteners for fabrication of metal structures, as recommended by the organizations specified under this Division, 4.4, C., Metals.

- F. **Glass** - Material shall be cut to size as specified on the drawings, allowing for expansion and contraction. Surfaces shall be free of scratches, bubbles, stains, rough edges, or other imperfections.
 1. **Laminated Safety Glass** - All exposed edges shall be eased and finely ground to be smooth, with broad surfaces free of imperfections.

 2. **Tempered Safety Glass** - All exposed edges shall be polished, with broad surfaces free of visible tong marks or any other imperfections.

- G. **Finish Hardware or Fasteners** - Shall be applied and installed so they are fully functional. Screws shall be countersunk to flush level with surface, free of burrs, and at a 90-degree angle to the surface plane.

Division 4. EXHIBIT STRUCTURES

H. Security Hardware

1. Provide locks for all access doors to artifacts, audiovisual equipment, cabinets or kiosks containing computer equipment, and storage areas in accordance with approved drawings and catalog cuts.
2. Install locks so that the hardware is concealed yet easily accessible. Locks may be installed behind removable outer panels, on the unexposed underside of structures, or as otherwise specified on the drawings. Unless specified otherwise in the drawings, access doors to chambers not requiring locks (such as silica gel chambers) shall be hinged panels using the same hardware as panels used to conceal the locks.
3. All locks shall be keyed alike, with the exception of donation boxes. Donation box locks shall be keyed separately from all other exhibit locks.
4. For hardware requiring special tools, such as tamperproof screws and cam locks, the contractor shall provide a minimum of two of each tool required.

Division 5. ELECTRICAL/ELECTRONIC

5.1 Introduction

Purchase, fabricate, assemble, install into buildings and exhibit structures, and thoroughly test all electrical, electronic, and mechanical devices; this includes lighting. Install audiovisual equipment into exhibit structures, including electrical components to provide and ensure fully operational audiovisual systems for each exhibit unit.

5.2 Quality Assurance

The National Electrical Code (NEC) shall be the required standard for all electrical work. In the event other codes, state and local, are in effect at the final exhibit site, they shall be included as part of this specification and requirements. All manufacturers printed recommendations for materials are a part of this specification. Standards for other trades are included as part of this contract.

Information on the NEC is available at: www.necdirect.org

Persons trained and experienced in the fabrication, installation, and implementation of professional audiovisual, video, sound reinforcement, cinema playback, and show control systems shall perform all assembly, fabrication, and installation work. All installation practices shall be adhered to as described in pertinent chapters of the following publications or their latest published edition:

- “Audio Systems Design and Installation”, Author: Philip Giddings, Focal Press
- “Sound System Engineering”, Second Edition Authors: Don and Carolyn Davis, Howard W. Sams & Co.

In addition, all requirements of the latest published edition including, but not limited to, the following shall apply unless otherwise noted. In case of conflict between cited or referenced standards, the more stringent example or standard shall apply.

- National Electrical Code (N.E.C.)
- Federal Communications Commission (F.C.C.)
- Society of Motion Picture and Television Engineers (S.M.P.T.E.)
- American Society for Testing Materials (A.S.T.M.)
- Electronic Industries Association (E.I.A.)
- Handbook for Riggers, 1977 Revised Edition, W.G. Newberry; Calgary, Alberta Canada
- Basic Principals for Suspended Loudspeaker Systems, Technical Notes Volume 1, Number 19, JBL Professional Division

Division 5. ELECTRICAL/ELECTRONIC

5.3 Product Handling

Store electrical, electronic, and mechanical components in a dry location. Do not expose to extreme changes in temperature and humidity. Protect components from damage during shipping, handling, storage, and installation. Pack components in containers in which components were shipped from the manufacturer. Exercise care so as not to damage electrical and electronic components. Store in a protected environment.

5.4 Testing

Electrical, electronic, and mechanical components of exhibits, including audiovisual equipment and lighting, shall be tested in the contractor's fabrication shop prior to delivery to the site. The contractor shall ensure that all equipment is fully operational prior to installation at the site.

5.5 Materials

A. **Electrical** - Materials shall be new and U/L approved.

1. **Wiring** - Wiring for high voltage applications shall be as required under the latest version of the NEC. Provide plenum rated cables of the types specified where required by the NEC or other governing building codes.
2. **Conduit** - All conduit shall be 3/4" electric metallic tubing unless specified otherwise.
3. **Outlets** - Multi-outlet power strips with integral circuit breaker and grounded outlets.
4. **Surge Protection** - Provide an electrical surge suppression system dedicated to each audiovisual system, all fiber optic illuminators, and each interactive electronic exhibit. Size the suppression device to accommodate the maximum load plus 100 percent.

B. **Lighting**

1. **Fixtures** - Provide fixtures and accessories as specified in individual task orders.
2. **Lamps** - As required to make illuminated exhibit elements complete and fully functional.
3. **Controls** - Lighting dimmer controls as manufactured by Leviton Manufacturing Company, Inc.; and by Electronic Theatre Controls (ETC) Architectural. Manufacturer directory can be found in Division, 5.7.

Division 5. ELECTRICAL/ELECTRONIC

4. **Controls for Artifact Case Lighting** - Materials and devices to filter UV (ultraviolet) light and control or modify overall light levels inside artifact cases shall be in accordance with Attachment E, Summary of Exhibit Conservation Guidelines, Technical Notes, Section 4, and Case Details and Illustrations, Section 2. Fluorescent lighting for illumination of artifact case interiors shall be filtered through one of the UV-filtering acrylics specified in Division 4, 4.4, B., 1., Artifact Vitrines.

C. **Audiovisual Equipment**

The contractor shall purchase and/or install audiovisual equipment as specified in individual task orders. Cables, connectors, racks, and mounting accessories required for the proper installation and operation of the equipment shall be provided by the contractor unless specified otherwise.

All materials furnished by the contractor shall be new and all work completed to the satisfaction of the COR.

Government-furnished equipment shall be integrated into the audiovisual system by the contractor. The contractor shall protect all equipment against cosmetic and operational damage, and shall replace equipment damaged while in the contractor's possession.

1. **Computers** - The contractor shall purchase equipment directly off the Dell U.S. Department of the Interior list under the most current version of the Department of the Interior Enterprise Licensing contract for computer hardware. Manufacturer directory can be found in Division, 5.7.
2. **Cables** - Manufacturer directory can be found in Division, 5.7.
 - a. Line and microphone level analog audio cables, balanced and unbalanced: Belden 8451, Belden 9451, or West Penn 291.
 - b. Digital audio cables, balanced: Belden 1800A; West Penn DA2401.
 - c. Loudspeaker level audio cables, low impedance:
 - 1) 25' or less - West Penn 225;
 - 2) 40' or less - West Penn 226;
 - 3) 75' or less - West Penn 227.
 - d. Loudspeaker level audio cables, high impedance: West Penn 225.
 - e. Composite video cable: Belden 1505A.
 - f. S-video cable: Extron MHR-2 or Liberty 23-YCLL.
 - g. Component video cable: 50' or less - Belden 7787A or Belden 7794A.

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- h. Control cables: West Penn 222, 242, or 262-267.
 - i. Data cables: Belden 1419A, 9533 or West Penn D2402, D301.
 - j. Portable video cables - Canare LV77S (Composite) or V5-4CFB (Component) or equal by Belden or Extron.
 - k. Portable audio cables - Canare L4E6S.
 - l. Portable control cable - As recommended by control system manufacturer.
3. **Connectors** - Manufacturer directory can be found in Division, 5.7.
- a. Balanced audio connectors: Neutrik NC series, Switchcraft QG series, or ITT-Cannon XLR.
 - b. Unbalanced audio connectors: Canare or Neutrik.
 - c. Miscellaneous audio connectors: Neutrik, Switchcraft, or ITT Cannon.
 - d. Video connectors - Crimp or soldier type connectors shall be used, as manufactured by Canare, Kings, or Trompeter. Provide as required according to cable type.
 - e. Terminal blocks - Use eurostyle screw terminal strips that have captive wire retention screws with wire protectors to protect stranded wires from screw damage. All metal parts shall be recessed providing a dead front design to ensure safety and to prevent short-circuiting. As manufactured by Weidmuller, Altech, Weco, or Wago. Provide as required according to cable type.
4. **Pushbuttons** - Pushbuttons for "Play Selection" or "Push to Play" shall be momentary action. Pushbuttons for "Push for Captions" or "Captions" shall be alternate action or maintained type. Manufacturer directory can be found in Division, 5.7.
- a. Type A Pushbutton Switches, visitor activated - Round with front removable replaceable lenses and LED lamps (as required). Each switch shall include DPST normally open gold plated nickel contacts with less than 50mΩ resistance, voltage range of 100 micro Volts/10 micro Amps to 42 V/100mA. The pushbutton shall have an anticipated mechanical life of 5-million operations. Provide action (momentary, maintained, or alternate action) as specified. Provide one set of any specialized tools (wrenches, lamp removal tools, etc.) necessary for dismantling or servicing these switches lighted or not. Provide 20 percent more lamps than required for spares. Provide EAO Series 14 Low Level switch with plastic lens and diffuser (verify colors with COR before ordering if not specified) and anodized aluminum front ring flush adapter.

Division 5. ELECTRICAL/ELECTRONIC

- b. Type B Pushbutton Switches, employee activated - Round, square, or rectangular with front removable replaceable lenses and LED lamps (where required). Each switch shall include DPST normally open gold plated nickel contacts with less than 50mΩ resistance, voltage range of 100 micro Volts/10 micro Amps to 42 V/100mA. The pushbutton shall have an anticipated mechanical life of 5-million operations. Provide action (momentary, maintained, or alternate action) as specified. Provide one set of any specialized tools (wrenches, lamp removal tools, etc.) necessary for dismantling or servicing these switches lighted or not. Provide 20 percent more lamps than required for spares. Provide EAO Series 31 low level switch with flat translucent lens. Verify colors with COR before ordering if not specified.
 - c. Type C Rotary Selector Switches - Round with short or long actuator lever, as required. Each switch shall include normally open gold plated nickel contacts with less than 50mΩ resistance, voltage range of 100 micro Volts/10 micro Amps to 42 V/100mA. The selection switch shall have an anticipated mechanical life of 1-million operations. Provide action (momentary or maintained) as specified. Provide one set of any specialized tools (wrenches, etc.) necessary for dismantling or servicing these switches lighted or not. Provide EAO Series 14 low level selector.
5. **Relays** - Manufacturer directory can be found in Division, 5.7.
- a. Type A CMOS-TTL Compatible Relay - Each relay shall include fine silver contacts with contact voltage range of 100mA to 3A or 1mA to 2A. The relay shall have an anticipated mechanical life of 100-million operations. Provide one socket and accessories as required. Provide P&B Series R10S super sensitive, logic compatible relay.
 - b. Type B Solid State Relay for Industrial I/O - Each relay shall include SPST-NO switch form with 4kV optical isolation between input and output. Provide one socket and accessories as required. Provide P&B Series IAC/OAC or IDC/ODC input/output modules.
6. **Equipment Racks** - Standard audiovisual equipment racks shall be used any time multiple sources and processing equipment are grouped together in one location. Manufacturer directory can be found in Division, 5.7.
- a. Floor Standing Rack - Provide a floor standing metal equipment rack with locking rear door, removable vented side panels, and vented top. The rack shall accommodate mounting of standard 19" width electronic apparatus in 1.75" height increments.

Division 5. ELECTRICAL/ELECTRONIC

The rack vertical mounting height shall accommodate all equipment with appropriate vent and blank panels and room for growth. The rack shall have enough internal depth to allow all equipment, cabling, and power distribution to fit inside the rack. The contractor shall provide a rack layout for review and approval by the COR before installing equipment in the rack. Equipment not manufactured for traditional rack mounting methods shall be provided with a rack mount shelf sized appropriately for that equipment. Use blank and vent panels of the same color as the rack to fill in unused spaces in the equipment rack. Include within the rack hardware necessary to accommodate routing and segregation of cables according to signal levels. The rack styles to be used for single rack requirements are Middle Atlantic Products WRK-SA, ERK, or PTRK series; for multi-rack applications use gangable models WRK or MRK series racks or equal by Atlas-Sound or Lowell.

- b. Rack Power Distribution - Use switched power strips with surge suppression on the front of the racks that will allow the audiovisual equipment to be turned off when required: Tripp-Lite IBAR-12-UL20 or approved equal. Vertical power strips shall be mounted in the back of the rack for extra outlets to accommodate all equipment mounted in the rack: Middle Atlantic PD-2415SC-NS or approved equal.

In high current or large sound systems provide a sequential power system for rack mounted and peripheral equipment. The power system shall include a front panel mounted on/off power control for the audiovisual system. The power control shall provide electrical power first to headend equipment such as mixers, switchers, processors, and media players, and after a predetermined timed delay provide power to audio amplifiers. No single sequenced outlet shall be encumbered with more than 90% of its load rating.

- c. Uninterruptible Power Supply (UPS) - This is required for all video projectors, computers, and control systems unless the manufacturer specifications state that it may be shut down by a switched outlet. The UPS shall constantly protect connected equipment against brownouts and over-voltages without draining battery power. It shall provide surge suppression and noise protection.

A UPS shall be required for all other equipment in locations that are prone to frequent black-outs. Use Tripp-Lite OmniSmart or SmartPro series or approved equal.

Division 5. ELECTRICAL/ELECTRONIC

D. Mechanical

1. **Ventilation Fans** - Fans shall be provided as necessary to vent heat out of enclosed environments in which equipment or lighting is installed. Provide fans of type and quantity to replace the enclosed volume of air a minimum of every two minutes. No individual fan shall contribute more than 35 dBa of noise to the environment.
2. **Thermostat** - Provide line voltage thermostat as necessary to achieve the temperature control specified under this Division, 5.6, D., 3., Heat Ventilation.

5.6 Execution

A. Electrical - The contractor shall obtain all requirements pertaining to the most recent state and local codes:

1. **Power** - Circuits within each installed exhibit structure shall be distributed from one four-gang box mounted inside the exhibit structure. The box shall be connected to the power source (120 volt AC) through flexible conduit. Power supplies for the lighting systems and lighting shall be hard wired to the power source (120 volt AC) through flexible conduit. Provide sufficient extra length of flexible conduit to accommodate movement of power supply on sliding access shelf. All connections to power sources shall be made at the locations specified on the drawings.

The contractor shall evaluate power supply versus power demand to determine appropriateness of existing circuits.

It shall be the responsibility of the contractor to advise the COR if total power service requirements for any exhibit structure exceeds 15 amperes.

The contractor shall ensure that power cables do not cause interference with audiovisual signal cables.

2. **Coordination** - Provide secondary distribution lines and one three-prong grounded female receptacle within each applicable exhibit unit for hook-up of electrical equipment.
3. **Craftsmanship** - Circuits shall be clearly and neatly labeled with special operating and maintenance instructions mounted on descriptive panels with each applicable exhibit unit. Run wiring exposed to minor potential physical damage in electric metallic tubing. Run inaccessible wiring in conduit. All conduit, junction boxes, fixtures, and equipment shall be neatly and securely attached to support members and concealed.

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4. **Access** - Ensure serviceability to each and every piece of equipment. Provide cutouts and access panels to facilitate maintenance. Avoid alterations to exposed surfaces.
5. **Support** - Provide additional support such as clip angles, plates, brackets, thrust blocks, bushings, and bearings necessary to reinforce exhibit structures, and devices relative to "hands-on" use and abuse of each exhibit.
6. **Termination of Wiring** - Conductors shall be terminated at ends where attached to components using crimp-type lugs if the component possesses screw-type terminals. Where the component has only soldering lugs, connection shall be by good quality electrical joint using rosin core solder. Connection of conductors and wiring, one to another, shall be by the application of screw -type terminal strips and spade lug connectors. Such terminations shall be located in a National Electrical Manufacturers Association (NEMA) rated enclosure. All crimp connections shall be accomplished by ratchet type production crimp tools. The use of any adhesive insulating tape is not acceptable.
7. **Surge Suppression** - For each audiovisual exhibit, provide an electrical surge suppression system dedicated to that exhibit. Size the suppression device to accommodate the audiovisual system maximum load plus 100 percent.

Provide battery back-up units with built-in surge protection for all fiber optic illuminators, desktop computers, and other programmed devices such as DVD and MP3 players. Computer USP run time will be no less than 10 minutes.

B. Lighting

1. **Interior Exhibit Structure** - The contractor, in conjunction with the COR, shall review the lighting levels and heat output to ensure that proper environment of case interior is met during the first inspection of the case fabrication at the contractor's facility.
2. **Track** - During the exhibit installation, the contractor shall install and connect all lighting to power source, except as otherwise specified in individual task orders, including track lighting and accessories.
3. **Ceiling Recess or Wall Mount** - During the exhibit installation, the contractor shall install and connect all lighting fixtures to the power source, except as otherwise specified in individual task orders.

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4. **Remote Source Lighting -**
 - a. Optimum performance and safety shall be critical in developing the remote source lighting system. The efficiency of light transmission depends on the constituent materials, the quality of the bond between the core and cladding, hardware connectors, and polishing of fiber ends. Selection of fiber and illuminator shall result in a minimum Color Rendering Index (CRI) rating of 90 and a maximum lighting loss of four percent per running foot length. Methods of reducing footcandle levels without affecting color temperature shall include the use of mechanical diagrams, lighting screens installed at the lighting source, or neutral density filters mounted on or attached to the lenses. Fiber runs shall not exceed 25-feet. Illuminators shall utilize lighting sources with a minimum lamp life rating of 1500-hours.
 - b. During the exhibit installation, the contractor shall install and connect all remote source lighting system components to the power source.
5. **Final Lighting of Installed Exhibits** – As specified in Division 8, Setup and Installation, 8.4, E.

C. Audiovisual Equipment

1. **Shop Fabrication** - The contractor shall be responsible for ensuring that audiovisual equipment will fit and operate with the exhibit structures.
 - a. The government will ship one type of each piece of government-furnished audiovisual equipment to the contractor's facility, within two weeks after the postaward conference. The contractor shall demonstrate the fit and operation of the equipment to the COR during a site inspection at the contractor's facility.
 - b. When specified, the contractor shall install pushbuttons in the exhibit structures and wire them to be fully operational at the time of the final inspection. The pushbutton assembly shall fit snugly into the panel with the outermost ring sitting flush against the panel surface. The contractor shall label the attached wiring to clearly identify what component activates when pushed.
 - c. The contractor shall test all audiovisual equipment to ensure operation.
 - d. The contractor shall ensure that all audiovisual equipment has adequate heat ventilation while operating in the exhibits, and there

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- is access to the equipment for government staff to perform maintenance or repairs.
- e. The contractor shall ship audiovisual equipment and hardware in their possession to the park.
2. **Installation** - The contractor shall install all audiovisual components in the exhibits. The contractor shall connect all audiovisual components to assemble the systems and connect them to the appropriate power source.
- a. Installed equipment shall be easily accessible for cleaning, adjustment, replacement, and routine maintenance, have proper ventilation, and shall provide safety and convenience for the operator.
 - b. Switches, connectors, jacks, receptacles, outlets, cables, and cable terminations shall be logically and permanently marked as to their function. Custom panel nomenclature shall be engraved, etched, or screened. The contractor shall submit a schedule and diagrams of the proposed identification marks to the COR for review and approval.
 - c. With the exception of portable equipment, all boxes, conduits, cabinets, equipment, and related wiring shall be firmly mounted in place. Mounting shall be plumb and square.
 - d. Care shall be exercised in wiring the systems to avoid damage to cables and equipment. All joints and connections shall be made with rosin core solder or with mechanical connectors approved by the COR. Crimp type connections shall be accomplished with manufacturer recommended ratchet type crimping tools. Cables shall be free of splices between terminations at the specified equipment. Unused conductors, shields, or drain wires shall be dressed under heat shrink tubing, not cut.
 - e. Wires and cables shall be formed into harnesses that are tied and supported in accordance with accepted engineering practice. Care shall be taken to bundle and secure all cables that interconnect electronic devices integral to the exhibit with destinations outside the exhibit. Where applicable, harnessing and bundling of cables shall also accommodate movement of exhibit on casters to provide access to the rear or interior of the exhibit.
 - f. Harnessed cables shall be combed straight. Harnesses with intertwining members are unacceptable. Each cable that breaks out from a harness for termination shall be provided with a service

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- loop. Cables shall be formed in either a vertical or horizontal relationship to equipment, controls, components, or terminations.
- g. Power cables, control cables, and high level cables shall be run on the left side of an equipment rack, as viewed from the rear. All other cables shall be run on the right side of an equipment rack, as viewed from the rear.
 - h. Cables, except video cables, which must be cut to an electrical length, shall be cut to the length dictated by the run. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of appropriate length.
 - i. Cables shall not be installed with a bend radius less than that recommended by the cable manufacturer.
 - j. Cables, regardless of length, shall be marked with a unique ID number, optionally with the source and input/output port name, within 3-6 inches of both ends. There shall be no unmarked cables in the system. Marking codes used on cables shall correspond to codes shown on drawings, run sheets, and patch panels. Labels shall be any of the following styles: self-laminating; heat shrunk with electronically printed text; or, electronically printed wrap-around numbers with clear shrink wrap over them.
 - k. Terminal blocks or connectors shall be provided for all cables that interface with racks, cabinets, consoles, or equipment modules. All control panel cables shall be terminated on their own terminal strip in the rack, all bussing of the cables shall be done on the controller side of the terminal strip.
 - l. Unless specified by make and model in the design package the use of gender adapters, video or audio connection adapters, and prefabricated, molded, or modular connecting cables are prohibited for use in these systems. The low quality generic cables that are shipped with players are prohibited.
 - m. Provide the audiovisual system free of artifacts such as hum, noise, or distortion of any level above that specified by the manufacturers of the equipment specified and/or provided. System components and related wiring shall be located to minimize electromagnetic and electrostatic hum, spurious oscillation, wiring length, and shall provide proper ventilation, safety, and convenience for the operator.

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- n. The contractor shall verify all circuits and extensions for correct connection, continuity, and phasing. The contractor shall make all adjustments and modifications so that all systems are operational.

D. Mechanical

1. **General** - The contractor shall install mechanical devices in accordance with manufacturer's written instructions in the exhibit structures and wire them to be fully operational at the time of final inspection.
2. **Support Hardware** - All hardware shall be of a grade equal to at least five times the rated load weight of the equipment supported.
3. **Heat Ventilation** - The contractor shall determine total heat loads of all active equipment used in the exhibit structures. The contractor shall provide convection vents and/or cooling fans with thermostats as necessary to prevent the equipment environment's temperature from rising above 100 degrees Fahrenheit, or above the equipment's maximum operating temperature, whichever is less.
 - a. Fans shall be selected and installed to provide the maximum amount of airflow with the minimum amount of noise, in accordance with this Division, 5.5, C., Audiovisual Equipment.
 - b. Convection vents shall be located to maximize intake of cool air as close to the floor as possible and exhaust of warm air out of the top of the exhibit. Convection air flow inside the exhibit shall flow unimpeded through casework containing the audiovisual and lighting equipment.
 - c. Ballasts for fluorescent fixtures and illuminators for fiber optic systems shall be located where heat ventilation can be maximized and shall be as remote as possible from artifact cases and audiovisual equipment.
4. **Testing** - The contractor shall test environmental conditions for all operating equipment for heat build-up, in their shop and again on-site after the exhibits have been installed, but before the artifacts are installed. Test by operating the equipment for a minimum of two consecutive hours with all ventilation controls in place. Do not open and close the environment during the test; do not open the environment to read the temperature; use a sensing device inside the environment with a remote read-out.

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5.7 Directory of Manufacturers referred to in this Division:

Altech Corp.

35 Royal Road
Flemington, New Jersey 08822
908-806-9400
www.altechcorp.com

Atlas Sound

4545 E. Baseline Road
Phoenix, Arizona 85042
800-876-3333
www.atlassound.com

Belden Wire and Cable Corp.

2200 U.S. 27 South
Richmond, Indiana 47374
800-235-3361
765-983-5200
www.belden.com

Canare

531 5th Street #A
San Fernando, California 91340
818-365-2446
www.canare.com

Dell, Inc.

Department of the Interior, IT
Hardware Storefront
www.doi.gov/ocio/erm/hardware.html

**Electronic Theatre Controls
(ETC) Architectural**

3031 Pleasant View Road
PO Box 620979
Middleton, Wisconsin 53562-0979
800-688-4116
www.etcconnect.com

Extron Electronics

1230 South Lewis Street
Anaheim, California 92805
800-633-9876
714-491-1500
www.extron.com

ITT Cannon

666 E. Dyer Road
Santa Ana, California 92705-5612
714-557-4700
800.854.3028
www.ittcannon.com

Kings Electronics

1685 Overview Drive
Rock Hill, South Carolina 29730
803-909-5000
www.kingselectronics.com

Leviton Manufacturing Company

59-25 Little Neck Parkway
Little Neck, New York 11362-2591
718-229-4040
www.leviton.com

Liberty Wire & Cable

11675 Ridgeline Drive
Colorado Springs, Colorado 80921
719-260-0061
www.libertycable.com

Lowell Manufacturing Company

100 Integram Drive
Pacific, Missouri 63069
636-257-3400
www.lowellmfg.com

Middle Atlantic Products

300 Fairfield Road
Fairfield, New Jersey 07004
973-839-1011
www.middleatlantic.com

**National Electrical Manufacturer's
Association (NEMA)**

1300 North 17th Street
Suite 1752
Rosslyn, Virginia 22209
703-841-3200
www.nema.org

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Neutrik USA

195 Lehigh Avenue
Lakewood, New Jersey 08701
732-901-9488
www.neutrikusa.com

P&B / Potter & Brumfield

Tyco Electronics
PO Box 3608
Harrisburg, Pennsylvania 17105
717-564-0100
www.pandbrelays.com
www.tycoelectronics.com

Switchcraft

5555 N. Elston Avenue
Chicago, Illinois 60630
773-792-2700
www.switchcraft.com

Tripp Lite

World Headquarters
1111 W. 35th Street
Chicago, Illinois 60609
773-869-1234
www.tripplite.com

Trompeter Electronics, Inc.

5550 E. McDowell Road
Mesa, Arizona 85215
800-778-4401
www.trompeter.com

WAGO Corporation

N120 W19129 Freistadt Road
Germantown, Wisconsin 53022
262-255-222
www.wago.us

**USA: WECO Electrical
Connectors Inc.**

2330 State Route 11
Mooers, New York 12958-4306
518-298-4810
www.weco.ca

Weidmuller USA Headquarters

821 Southlake Boulevard
Richmond, Virginia 23236
804-794-2877
www.weidmuller.com

West Penn

2833 W. Chestnut Street
Washington, Pennsylvania 15301
800-245-4964
412-222-6420
www.westpenn-cdt.com

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6.1 Introduction

Provide fabrication of all exhibit graphics. Except as otherwise specified in individual task orders, graphic layouts will be government-furnished to the contractor in a digital format.

6.2 Specific Requirements

- A. Review all government-furnished materials. Work includes:
 - 1. Inventory of the government-furnished sources to ensure that the actual sources match the accompanying inventory list;
 - 2. Inspection of each source to ensure that it is acceptable for use in the exhibit;
 - 3. Verify that FPO files match the government-furnished sources;
 - 4. Compare the graphic layouts with the structural design drawings to verify that the final output size of each graphic layout matches the size of the corresponding panel;
 - 5. Verify the fit and cropping of images within graphic layouts; and
 - 6. Verify that all required files and fonts are furnished with digital files.
- B. Create Graphic Production Files - As specified in individual task orders, work may include:
 - 1. Preparation of digital files for specified output;
 - 2. High-resolution scanning of graphic images;
 - 3. Insertion of high-resolution scans into digital layouts; and
 - 4. Adjusting digital graphic layouts for color corrections and bleed.
- C. Provide creative graphic design services as specified in individual task orders.
- D. Produce original artwork as specified in individual task orders.
- E. Produce Sample Proofs - Produce and submit intermediate proofs, samples, and revised layouts for review and approval by the COR.

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- F. Produce Final Graphic Media - Produce all final graphic media. Media includes, but is not limited to, digital output processes, photographic prints and transparencies, screen printing, porcelain enamel graphics, fiberglass embedded prints, photo-etched or sandblasted materials, painted backdrops, and cut-out lettering.

6.3 Review of Material

Upon receipt of the government-furnished graphic materials and digital files, the contractor shall review all graphic, photographic, and text materials prior to production.

- A. Inspect all government-furnished graphic sources to ensure that they correspond to the accompanying inventory list, typically specified on the project database.
- B. Inspect the quality of each source to ensure that it is suitable for use in the exhibit.
 - 1. Government-furnished photographic negatives, prints, transparencies, or other media to be scanned by the contractor shall be checked to verify that a high quality image can be obtained at the final resolution and size required.
 - 2. Inspect government-furnished digital files to ensure that they are scanned at a resolution that is suitable for production of a high quality print at the specified output.
- C. Compare each image source against the corresponding FPO on the government-furnished design drawings or graphic layouts to ensure the images match, and against the layouts to ensure that they correspond properly.
- D. Compare the government-furnished graphic layouts with the design drawings and verify that the dimension of each graphic layout matches the corresponding structural panel.
- E. Verify that the proposed cropping, orientation, and dimensions of images will fit within the layout as designed.
- F. Digital files shall be checked against the drawings and the exhibit plan to ensure that all layouts and required fonts are provided and that the material is complete and ready for production.
- G. The contractor shall check the digital files against government-furnished color samples and correct the digital files as necessary to ensure that the final output colors shall match the samples. Any errors, inconsistencies, omissions, or incorrect identification shall be brought to the attention of the COR.

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- H. Provide to the COR a written report entitled "Inventory of government-furnished graphic sources" that identifies missing, incorrect, inadequate, or damaged government-furnished materials as soon as possible after receipt of government-furnished materials and prior to submittal of samples and proofs.

6.4 Handling of Source Material

Provide professional care and handling of source materials. The contractor shall provide protection from loss and physical damage at all times. Certified mail and written receipts or tracking numbers shall be used in transferring sources to and from photographic and graphic processors. All government-furnished source materials shall be returned to the COR unaltered and undamaged. No retouching or other alteration on original government-furnished prints, negatives, transparencies, or digital files is permitted.

- A. **Handling of Photographs** - Photographic material shall be handled wearing white cotton gloves or powder-free latex examination gloves.

B. **Archival Storage Materials**

1. Digital files shall be archived on CD-ROM, DVD-ROM, or other digital media as approved by the COR.
2. Negatives, transparencies, and prints shall be stored in archival protectors as specified below, as manufactured by:

Light Impressions
P.O. Box 787
Brea, California 92822-0787
800-828-6216
www.lightimpressionsdirect.com

- a. 4" x 5" negatives and color transparencies, place in TransView sleeves, clear, Item Number 5313, and HD PolyChron envelopes, Item Number 20567.
 - b. 8" x 10" prints, place in a HD PolyChron envelope, Item Number 20570.
 - c. 8" x 10" negatives and color transparencies, place in TransView sleeve, clear, Item Number 5315 and HD PolyChron envelope, Item Number 20570.
 - d. Place negatives, transparencies and prints in archival top loaders, Item Number 3225, for inclusion in binder.
- C. **Binder** - The contractor shall assemble photographic source materials in three-ring binders using archival sleeves, as identified in this Division, 6.4, B., Archival

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Storage Materials. Each prepared image shall be inserted into an 8-1/2" x 11" archival quality polypropylene sleeve punched with three holes to fit into a three-ring binder. Computer media (CD-ROM, DVD-ROM, or other media approved by COR) shall be placed in binder sheets designed for that media.

1. **Specifications for Binder Content:**

- a. **Digital Files** - Digital files shall be archived as specified in this Division, 6.5, B., including high-resolution scans of graphic images and final versions of graphic layout files which have been modified by the contractor to make them production-ready. Each disk shall contain a "Read Me" or text file that shall be printed out and included in the three-ring binder. The "Read Me" files shall contain the following information about all files included on that disk:
 - 1) List of all file names, making clear the location of all files in the exhibit. The contractor shall name all files using the identification numbers in the government-furnished exhibit plan. Exhibit numbering shall be in accordance with Attachment B, "Harpers Ferry Center, Exhibit Numbering System Guidelines." File names shall end in the appropriate program extension so that the program needed to open the file may be easily determined by both PC computers operating Windows XP (or better) or Mac OS-X version 10.3 (or better).
 - 2) Software program used, including the version number.
 - 3) Location of all linked files. The linked files shall be included on the same disk whenever possible.
 - 4) All fonts used.
- b. **Labeling of Media** - Each disk shall be labeled with basic information on the project name and contents or number keyed to the printed "Read Me" files located in the three-ring binder. An example of a label on the disk is as follows:

Manassas NBP
Henry Hill VC
Production Files
Digital Graphics
CD # 1 of 15

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- c. **Labeling of Photographic Material** - The graphic number shall be written in clear, concise print with film pen on a small, foil-backed archival label. Typed labels are acceptable. The label shall be placed in the top right corner of each sleeve. Labels shall not be placed directly on photographs, negatives, or transparencies.
- d. **Graphic Schedule** - The contractor shall update the government-furnished graphic schedule and graphic facsimiles to reflect as-built conditions and submit the updated schedules as a hard copy and as a digital file.

6.5 Graphic Production Files

- A. **Software** - The most current version, or one major release prior to the most current version of the following software is acceptable:

- 1. Adobe InDesign for graphic layout files.
- 2. Adobe Photoshop for image (raster based continuous tone) files.
- 3. Adobe Illustrator for vector based graphic illustration work.
- 4. Adobe Acrobat for PDF (portable document format) files.

Substitution of other software programs shall be approved, in advance, by the COR.

- B. **File Structure** - All files generated by the contractor shall have a specific structure and shall be encoded on storage media as appropriate for the volume of data in a universal format that can be read by current Microsoft Windows XP (or better) and Apple Macintosh OS-X Version 10.3 (or better) operating systems.

The files and file structures shall be as follows:

- 1. For Raster Files (continuous tone image files) there shall be four folders:
 - a. **Raw Files** - This folder shall contain unimproved scan files, supplied files, and digital camera raw files (in Adobe DNG format). These files may be 16 bits per channel or 8 bits per channel RGB.

File names shall follow the format: **IM-00-000Raw**. The appropriate file extension shall be appended to the file name.
 - b. **Working Files** - This folder shall contain layered psd files (Photoshop native file format). These are the files in which all work has been done. All work shall be done on layers and be available for further editing.

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The current version of Adobe Photoshop (CS2) does not provide for all editing functions to be done on adjustment layers. Where this is the case, a duplicate of the image layer shall be made and these edits shall be applied to it. These files may be 16 bits per channel or 8 bits per channel RGB, shall be scaled to final use size and resolution, and shall have the Adobe RGB 1998 profile embedded.

File names shall follow the format:
IM-00-000Work.psd

- c. **FPO (For Position Only) Image Files** - This folder shall contain low-resolution versions of images used for developmental purposes. The FPO image files are linked to the graphic layout files prior to final output of the exhibit graphics. These files shall be produced at a quality level sufficient to provide a clear representation of the image as it will appear in the final exhibit, balanced against the need for a manageable file size that can be easily stored, transmitted and printed. Compressed image formats such as JPG are acceptable for FPO files. The FPO images shall be cropped and scaled to match the Final Files they are representing. These files shall be 8 bits per channel RGB and shall have the Adobe 1998 profile embedded.

File names shall follow the format: **IM-00-000FPO**. The appropriate file extension shall be appended to the file name.

- d. **Final Files** - This folder shall contain the result of flattening the working files. These are the files linked to the layouts. These files shall be 8 bits per channel RGB and shall have the Adobe 1998 profile embedded.

2. **Vector Illustration Files** - These files shall be created in Adobe Illustrator, and shall be organized into layers determined by the content in the document. In addition:

- a. Supporting information shall be located in the document margin, and shall be placed on a separate layer. This data includes but is not limited to the file name, and date or revision number.
- b. Vector illustrations shall be designated as images in the content management system. File names shall follow the format:

IM-00-000Dev.ai for design development level vector illustrations.

IM-00-000Prod.ai for production level vector illustrations.

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3. **Linked Files** are raster or vector files required by the primary file in order to print correctly. Graphic layout files often require one or more linked image files. Supporting files shall always be linked to, not embedded in, the primary file. Approved formats for linked files are tif, pdf, psd, and ai.
 4. **PDF Files** are used for electronic distribution, viewing, and printing of review documents. Unless otherwise approved in advance by the COR, PDF files shall not be used for final exhibit production output. The PDF file name shall be identical to the file from which it was created, with the **.pdf** extension replacing the original file's extension.
- C. **Color Management** - The design and production processes shall be color managed from beginning to end using ICC (International Color Consortium) and ColorSync color management as follows:
1. All raster image and vector files shall be RGB files.
 2. Color working space shall be Adobe RGB (1998). The Adobe RGB (1998) profile shall be embedded in all RGB files.
 3. Color settings for InDesign and other Adobe applications shall be US Prepress Defaults. Important settings in this context are:
 - Enable Color Management
 - Working Space: RGB; Adobe RGB (1998)
 - Conversion Options:
 - Engine: Adobe ACE
 - Intent: Relative Colorimetric
 - Use Black Point Compensation
- All soft proof color evaluations shall be made in this in this environment.
4. The D50 standard viewing conditions ANSI PH2.30-1989 for graphic arts and photography - color prints, transparencies, and photomechanical reproductions - viewing conditions shall apply, and all hard copy color evaluations will be made in this environment.
 5. All defined colors swatches in InDesign and Illustrator shall be set to Color Type: Process.
- ICC color management information is available from:

International Color Consortium
1899 Preston White Drive
Reston, Virginia 20191
703-264-7200
www.color.org

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D. Fonts

1. Unless otherwise specified on individual task orders, the contractor shall provide all font files necessary to view, edit, and print all graphic layouts produced under this contract.
2. When no other font specification is provided, OpenType fonts are the preferred format. Type 1 fonts are acceptable. The use of TrueType fonts or any other font technology shall not be acceptable unless approved in advance by the COR.
3. The contractor is responsible for meeting all software licensing requirements of the font copyright owner. The requirement to provide font licenses may be waived when the fonts and licenses are specified as government-furnished in the individual task order.

E. Requirements for Production-quality Image Scanning

1. Prior to scanning, the contractor shall review the resolution, cropping, and final size of the production image that will be created from the scan. The contractor shall notify the COR if the quality of the source image is not suitable.
2. Scans requiring extreme enlargements of the source image shall be performed using a process and equipment capable of providing high quality results. This shall include the wet mounting of transparencies and negatives and/or use a drum scanner when necessary. The contractor shall consult with the COR to determine when specialized processes and equipment are necessary.
3. Unless otherwise specified on individual task orders, the following scanning specifications shall be followed:
 - a. Resolution: 150 – 200 dpi at final image size and cropping,
 - b. Color Space: RGB or Grayscale,
 - c. Profile: Adobe RGB (1998) or Gray Gamma 2.2,
 - d. File type: PSD, TIFF, PDF with no compression, or DNG.

6.6 Samples

The contractor shall provide the samples for COR review and approval as specified in Division 3, Samples/Mock-ups/Prototypes, 3.2, C, Graphics.

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6.7 Corrections to Digital Files and Proofs

- A. The contractor shall be responsible for the correctness of all contractor-generated layouts, and to all contractor-generated changes or corrections.
- B. The contractor shall make corrections to the digital layouts and files when any of the following are specified on individual task orders:
 - 1. When text is found to be incorrect, either due to errors in the original text or in preparation of the layouts;
 - 2. When original graphics cannot be obtained or are found to be incorrect, or the use rights cannot be purchased and substitutions have to be found;
 - 3. When readability of text is found to be unacceptable and adjustments to the layout and/or font size are needed to enhance contrast between text and the background; and/or
 - 4. When color settings in digital files are inconsistent with the color specifications for each output media as specified on the government-furnished color sample board and exhibit plan drawings.

6.8 Graphic Output

A. Digital Output

- 1. **Archival Inkjet Prints** - The contractor shall provide inkjet prints using archival inks on glossy substrate at high resolution, with no visible dot patterns, graining, or banding.

Prints may also be specified on other materials including, but not limited to, paper, fabric, scrim, and vinyl.

- 2. **Digital High Pressure Laminate** - Digital high-pressure laminate from 1/16" (1.5mm) to 1" (25mm) in thickness, with a black solid phenolic resin core and a matte finish, as manufactured by:

Fossil Industries, Inc.
44 Jefryn Boulevard
Deer Park, New York 11729
800-244-9809
www.fossilinc.com

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iZone
2526 Charter Oak Dr., Suite 100
Temple, Texas 76502
888-464-9663
www.izoneimaging.com

FOLIA Industries Inc.
58 York, Huntingdon QC
Canada
J0S 1H0
888-264-6122
www.folia.ca

3. **Direct Digital Photographic Prints** - High resolution, large format, continuous tone, laser-based output prints of digital files on C-prints, Duratrans, or Duraflex, as manufactured by:

Eastman Kodak Company
Rochester, New York 14650
800-242-2424
516-659-0410
www.kodak.com

4. **Scotchprints** - 3M Scotchcal Electrostatic Permanent Graphic Film 8641 (ES) on .063" clear anodized aluminum substrate or as specified on the drawings. Overlamine with 3M Scotchcal Protective Overlamine, Luster 8910 (ES). Scotchprints are manufactured by:

3M Commercial Graphics Division
3M Center, Building 220-6W-06
St. Paul, Minnesota 55144-1000
800-374-6772, extension 214
www.3m.com

- B. **Photographic Prints** - Custom color, museum quality paper C-prints and Duratrans transparencies as manufactured by Eastman Kodak Company, in accordance with this Division, 6.9, Image Quality.
- C. **Screenprinting** - The contractor shall use compatible screenprinting ink and solvent approved by the COR for each substrate.

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- D. **Vinyl Cut-Out Letters and Shapes** - 3M Scotchcal HP Series 220, in colors as specified on the drawings, as manufactured by:

Gerber Scientific Products, Inc.
83 Gerber Road
South Windsor, Connecticut 06074
800-222-7446
860-643-1515
www.gspinc.com

6.9 Image Quality

- A. **Contractor Inspection and Acceptance** - All government-furnished source material shall be inspected by the contractor for final determination as to acceptability and use as intended output media. If the source material is found to be unacceptable, the contractor shall notify the COR prior to processing or using the material.
1. **Digital Scans** - The contractor shall scan artwork, photographs, and other material to be used for digital output at the resolution recommended for the particular output device used, based on the final size and detail of the image.
 2. **Digital Output** - Colors in the final image shall match color samples, original artwork, or photographic images. The contractor shall save the original scan on digital storage media in accordance with this Division, 6.5, Graphic Production Files.
- B. **Quality Control** - The contractor shall be responsible for the quality and durability of images produced and installed. The contractor shall bear the costs associated with replacement or repair of those images that are unsatisfactory after installation because of improper techniques, use of inferior materials, improper handling, mounting, or installation.
- C. **Image Quality** - The following are required for acceptable graphic output media:
1. Prints and transparencies shall have high color saturation and correct color balance, and all colors shall match consistently from panel-to-panel.
 2. The contractor shall adjust cropping of images to achieve a correct finished size, for subject matter, and for best overall composition. Seams shall be located away from text and important images. The contractor shall allow for necessary bleed and trimming.
 3. The contractor shall ensure evenly balanced backlighting of display transparencies, including proper diffusion sheeting, control of lighting intensity, and even distribution of lighting across all areas of the image.

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- D. **Consistency** - The contractor shall ensure consistency of panels that are intended to line up to form one large image or are part of a group.
1. **Murals and Multi-Panel Images** - Images that are mounted on more than one panel shall line up exactly from panel-to-panel. All colors and tones shall remain consistent. Seams shall be equally spaced and shall occur so that all panels that make up the mural are equal width; as an exception, the outermost panels may be narrower in width as long as both outer panels are of equal width. Seams shall not occur through text that is part of the printed panel, nor through significant details in graphic images that are part of the printed panel.
 2. **Panel Groups** - Panels of the same output type that form part of an exhibit grouping shall be made consistent in color balance, tones, contrast, and mounting methods, unless specified otherwise in individual task orders.
- E. **Screenprinting**
1. **Durability** - The contractor shall determine, through manufacturer's specifications and testing, which type of screenprinting ink is most durable and long lasting for each substrate. All screenprinted images shall adhere completely to the substrate and shall not chip, flake, or pop off the substrate. Image and text shall be cured in accordance with manufacturer's specifications until they are completely dry. All surfaces to be screenprinted shall be clean and free of grease, dirt, wax, and other coatings which can prevent the ink from adhering to the substrate. Plastic laminate surfaces shall be wiped with alcohol and lacquer thinner or other solvents as recommended by the manufacturer to remove wax coating on surface prior to screen printing.
 2. **Quality of Printing** - Perfect register, exact measurement, proper color match, opaque, and crisp images shall be required. Ghosting, ragged, and soft edges are not acceptable. All borders shall be consistent width throughout panels. Weight of graphic images, text, and other images used in a "set" shall be consistent throughout the exhibit.
 3. **Color Contrast** - Upon review and approval of samples by the COR, color adjusting may be required in order to ensure high contrast between type, color, and background.

6.10 Mounting and Overlaminating

Graphics images and layouts that are output on paper, including digital inkjet prints and prints on photographic paper, shall be mounted on a rigid and stable support substrate, and shall be covered with a clear overlaminate layer to protect them from minor physical damage and ultraviolet light. The following mounting methods are acceptable:

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A. Mounting to Aluminum, with MACtac Overlamine

1. **Materials** - Mount the print to anodized aluminum with MACtac Permacolor, Permatrans Mounting Film, IP2100 Series. The surface of the print is protected with MACtac Permacolor Permagard Premium Overlaminating Film, IP7300 Series Lustre finish. MACtac as manufactured by:

Bemis Company, Inc.
222 South Ninth Street
Suite 2300
Minneapolis, Minnesota 55402-4099
612-376-3000
www.mactac.com

2. **Execution:**

- a. **Substrates** - Prior to use, all aluminum shall be washed clean of residual manufacturing chemicals, dirt, oil, or foreign substances to ensure a good bond. Cut panels evenly, to the correct dimensions, and finish edges. Aluminum shall be anodized prior to use as a photo substrate to provide corrosion resistance.
- b. **Mounting to Substrate** - A cold roll system press shall be used to mount print with MACtac IP2100 mounting film in accordance with the manufacturer's specifications. Print shall be securely mounted to substrate surface, free from wrinkles, blisters, scratches, rips, tears, adhesive residue, or other imperfections. Trim print square and clean, and lightly ease all aluminum edges with fine grit sandpaper on sanding block, held at 45-degree angle. Corners shall be well fastened and eased, with no untrimmed pieces left. Substrate and print shall remain flat, true, and even after mounting.
- c. **Protective Coating** - Apply clear film MACtac IP7300 overlamine so that it is wrapped around print and aluminum sandwich and adhered to back of aluminum substrate for a two-inch overlap. Overlamine film shall only be applied after all aluminum and print edges are trimmed clean and square. The contractor shall ensure that the clear film overlamine provides a continuous bond with the print. The overlamine shall be free of bubbles, scratches, dirt, indentations, and impressions from packing material used for transport and storage of overlaminated print.

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3. **Unacceptable Mounting Substrates** - Moderately Expanded PVC Sheet (Sintra®) is not acceptable for use as a graphic substrate.
- B. **Subsurface Mounting to Non-Glare Acrylic or Polycarbonate**
1. **Materials** - Mount the print behind non-glare Plexiglas or Acrylite acrylic, or non-glare Lexan polycarbonate sheet, using MACtac Permacolor, Permatrans Mounting Film, IP2100 Series, as manufactured by Bemis Company, Inc., this Division, 6.10, A.1.
 2. **Execution** - Bevel all edges at a 45° angle or round off edges, whichever is specified in the drawings, polish all edges, and ease all sharp corners.
- C. **Subsurface Mounting for Non-Flat Mounting Configurations** - Graphic prints to be mounted to curved surfaces and cylinders shall be mounted as follows unless specified otherwise on the drawings or in individual task orders:
1. **Materials** - MACtac Permacolor IP6000 Lustex®, 15 mil, with pressure-sensitive adhesive on one side and low-gloss textured surface, as manufactured by Bemis Company, Inc., this Division, 6.10, A.1.
 2. **Execution** - Follow all manufacturer's recommendations for laminating of the graphic, temperature and humidity ranges, bending radius, and other factors so as to maximize the exhibit's durability during the life of the exhibit. If the edges of the graphic panel are to be exposed to frequent touching by visitors, it is recommended that the edges be protected by a molding or frame.
- D. **Application to Exhibit Structure** - The contractor shall apply finished graphics to, or install on, exhibit structures and panels as specified on the drawings. Exact measurement and precise alignment shall be required.

Graphics substrates shall be adhered to exhibit walls and panels using 3M VHB Double-Coated Foam Tape, as manufactured by:

3M Industrial Specialties Division
3M 220-8E-04
St. Paul, Minnesota 55144
800-227-5085
612-733-4813
www.3m.com/bonding/

Apply tape along the perimeter of the rear of the substrate, one inch in from the edge, with another strip across the middle at the widest point. Use 1/16" thick x 1" wide tape, or width and thickness sufficient to support the substrate as recommended by the manufacturer.

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E. **Cutouts** - The following methods of fabricating graphic cutouts are acceptable.

1. Digital high pressure laminate panels shall be the default standard material for cutout graphic panels unless specified otherwise on the drawings. Two methods of production are acceptable:
 - a. Digital high pressure laminate panels with a thickness of ½" thick, or thicker (which are self-supporting), and have a solid black phenolic resin core; or
 - b. Digital high pressure laminate panels, less than ½" thick, laminated to MDF, with the edges and back of the MDF painted black. Sand the edges smooth, and fill and sand all imperfections.
2. Subsurface mount a print to non-glare Plexiglas or Acrylite acrylic, or non-glare Lexan polycarbonate sheet using MACtac Permcolor, Permatrans Mounting Film, IP2100 Series, or subsurface mount the print to MACtac IP6000 Lustex®. Adhere the mounted print to MDF and cut out the graphic image. Sand the edges smooth, and fill and sand all imperfections. Paint edges and back of the cutout in accordance with the colors specified on the drawings.
3. For any of the fabrication methods specified above, cut out the image, following the crop lines as specified on the graphic references. All edges and back shall be smooth and finished, and all laminated layers shall be tightly adhered.

F. **Flip Books**

Digital high pressure laminate panels shall be the default standard material for flip books, lift and drop graphic panels, and other similar low-tech interactive graphics which are moved by the visitor and have to be rigid and durable. Panel thickness and associated hardware shall be in accordance with reviewed and approved fabrication drawings.

Flip book page holes or slots shall be placed outside the image area of the flip book page. For a three-ring flip book with holes 1/2" wide by 3/8" high, stagger the holes so that the top hole is 3/32" further in from the edge than the center hole and the center hole is 3/32" further from the edge than the bottom hole. This is to allow the hole or slot to be big enough for ease of movement and yet the page will hang straight and not pull downward at the bottom right corner while at rest.

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6.11 Graphic Panels for Exterior Use

For graphic output manufactured for exterior use, including digital high pressure laminate (phenolic resin panels), fiberglass embedment, porcelain enamel, and other processes, the contractor shall submit samples in accordance with Division 3,3.2, B, Materials and Finishes Samples. The contractor shall include the manufacturer's technical specifications for review and approval by the COR.

Division 7. CONSERVATION GUIDELINES

7.1 Introduction

Provide design and fabrication of artifact mounts, installation of artifacts into exhibit cases, and silica gel humidity ballast for conditioning of exhibit cases.

7.2 Quality Assurance

All materials and fabrication methods for mounting of artifacts, artifact cases, and all structures or materials to be installed inside artifact cases, shall be in accordance with Attachment E, Summary of Exhibit Conservation Guidelines.

7.3 Artifact Categories

- A. **Artifacts** are those objects which can be considered non-replaceable for cultural, scientific, or historic reasons, which are one-of-a-kind, which have a high monetary value, or which are delicate because of their condition, materials, and construction. Artifacts shall be handled, mounted, and installed in accordance with the guidelines contained in this Division.
- B. **Reproductions, Replicas, Props, Models, or Facsimiles** are those objects which are replaceable and which were fabricated or purchased for the exhibit. These objects are not required to be mounted and protected in accordance with the guidelines contained in this Division, but shall be mounted and installed in accordance with fabrication details approved by the COR as specified in Division 2, Fabrication Drawings.

7.4 Specific Requirements

- A. Travel to the park, Harpers Ferry Center Conservation Lab, and/or other locations as specified in individual task orders, to inspect, measure, photograph, and produce templates needed for artifact mount production.
- B. Handling of artifacts that are irreplaceable because of cultural, scientific or historic value, or have a high monetary value.
- C. Design individual custom mounts for artifacts and production of preliminary and final mount drawings for review and approval by the COR.
- D. Ensure fit of all artifacts within the casework as designed by review of artifact dimensions and adjustments to casework dimensions as required.
- E. Storage of replaceable objects at the contractor's facility during the fabrication process and transportation of the objects to the installation site.
- F. Fabrication of custom mounts for artifacts.

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- G. Installation of custom mounts, mounting systems, and artifacts on panels, platforms, and in cases.
- H. The contractor shall be responsible for setting up a facility at the exhibit installation site to modify or alter pre-made case elements and artifact mounts.
- I. Reassemble and clean cases after artifacts are mounted.
- J. Provide and install silica gel humidity ballast into artifact cases.
- K. Adjust lighting on artifacts and test light levels to ensure footcandle limits are not exceeded.

7.5 Artifact Handling

A. **Damage**

The contractor shall utilize extreme care and abide by the Specifications set forth in this Division. Should the contractor break, chip, fracture, scratch, or otherwise damage any artifact, the contractor shall immediately notify the COR. The contractor shall not attempt any repair, treatment, or preservation procedure. The government will execute any repairs.

B. **Security**

The contractor shall be responsible for the safety and security of artifacts in their possession. During the time the artifacts are being photographed, measured, fit, or installed in a government facility, the contractor shall handle the artifact with care and shall ensure that it is returned to the authorized personnel when work is not in progress or has been completed. The security of artifacts stored in a government facility is the responsibility of the Agency. The contractor shall not leave artifacts in an exposed and unsecured area.

C. **Storage**

The contractor shall store only replaceable objects at their facility. The contractor shall store the objects in a lockable, protected area to eliminate damage and theft. Access to the objects shall be limited to the contractor and his staff. All objects shall be locked up when not in use. All non-replaceable artifacts will remain at a government facility during the design and fabrication of the mounts. The contractor shall measure, examine, and fit mounts of non-replaceable artifacts either at the Harpers Ferry Center Conservation Lab, park site, or other government storage facility as specified in individual task orders.

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D. Transport

The contractor shall only transport replaceable objects to the installation site that were stored at their facility during fabrication of the exhibits. The government will provide transportation of non-replaceable artifacts to the installation site.

7.6 Materials

A. **Artifact Case Materials** - In accordance with Attachment E, Summary of Exhibit Conservation Guidelines and Division 4, Exhibit Structures.

B. **Silica Gel** - In accordance with Attachment E, Summary of Exhibit Conservation Guidelines, Section 2 under "Technical Notes", and Section 5 under "Case Details and Illustrations."

C. Artifact Mounts

1. **General** - The contractor shall use the same type and quality of materials for mounting artifacts and replaceable objects. Fabrication materials shall be of the highest quality and shall be non-damaging to the displayed artifacts. All mountmaking materials that will be used for onsite mounting shall be available at the final inspection for review and approval by the COR.

2. **Materials Considered Safe for Use with Artifact Mounts** - In accordance with Attachment E, Summary of Exhibit Conservation Guidelines, "Narrative Guidelines", D:3, "Design and Fabrication of Conservation Mounts." The following are commonly used acceptable mount materials:

a. **Plastic** - Rigid acrylic and polycarbonate.

b. **Metal** - Brass, with silicone rubber, acrylic resin, or foam barrier between the artifact and the metal.

c. **Cushioning Material** - Polyethylene foam, polyester felt, fabric-covered polyester batting, 100 percent cotton fabric, acid-free buffered tissue paper.

D. Packing Materials

The government will transport non-replaceable artifacts to the installation site. Packing materials for non-replaceable artifacts is Not In Contract.

Division 7. CONSERVATION GUIDELINES

7.7 Execution

A. Artifact Case Fabrication

In accordance with Attachment E, Summary of Exhibit Conservation Guidelines, Division 4, Exhibit Structures, and the drawings.

B. Mount Fabrication

In accordance with the Attachment E, Summary of Exhibit Conservation Guidelines, "Narrative Guidelines", D:3, "Design and Fabrication of Conservation Mounts," and the drawings.

1. **Mount Design Drawings** - The contractor shall provide drawings of proposed mounts for artifacts, including identification of materials and fastening hardware, to the COR for review and approval prior to fabrication, in accordance with Division 2, Fabrication Drawings.
2. **Mounting Systems** - When work requires design of a modular or flexible component display system for use in the exhibit, the system shall be designed so that as much as possible of the individual parts can be pre-fabricated and fit together onsite. Artifact mount design shall be coordinated with the general design of the exhibit.
3. **Mount Design Guidelines**
 - a. Mounting design and materials shall be in accordance with Attachment E, Summary of Exhibit Conservation Guidelines, "Narrative Guidelines", D:3, "Design and Fabrication of Conservation Mounts." Materials shall be compatible with the artifact and shall be inert, cushion the artifact, and have smooth edges. Replacement and repair of existing mounts shall be of like design and materials unless otherwise specified on the drawings.
 - b. Mounts shall provide adequate support to prevent physical stress or unbalanced weight distribution on the artifact. The center of gravity and original intended use shall be considered.
 - c. Mounts shall not be permanently attached to any artifact. Each artifact shall be easily removable from its mount in the event of curatorial maintenance or emergency.
 - d. Fastening system shall be based on mechanical design and use no adhesives or sticky substances.
 - e. Mounts shall be designed to minimize vibration and abrasion.

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- f. Mounts shall protect artifacts from theft.

4. Mount Fabrication

- a. Original artifacts shall never be drilled, trimmed, tacked, nailed, screwed down, or glued down. The contractor shall not use "museum wax", silicone rubber, or adhesive tapes.
- b. Original clamps, hooks, strings, and straps already attached to the artifacts shall not be used for support or to take weight off of the artifact.
- c. Mounts shall not utilize fabrics or materials that contain unstable dyes which could transfer colorants to artifacts.
- d. Sharp edges shall be removed from materials in close proximity to the displayed artifacts.
- e. An artifact shall never be forced to fit in a bracket, cradle, or other mount. The mount shall support, not compress; straps or brackets shall fit snugly, not tightly.
- f. Clamps and brackets shall be padded with non-abrasive, inert materials.
- g. Replacement mounts shall be of the like kind and materials unless otherwise specified on the drawings.

C. Artifact Handling

- 1. Do not smoke, eat, or drink while working with artifacts.
- 2. Avoid haste while handling artifacts; use both hands when carrying an artifact.
- 3. In moving any artifact or group of artifacts, avoid travel shock.
- 4. Clean hands prior to handling artifacts. Wear white, lint-free, clean cotton gloves when handling artifacts.
- 5. Wear no jewelry that may scratch artifacts.
- 6. Use more than one person in moving a cumbersome or heavy artifact.
- 7. Know the nature of the artifact you are going to handle: structural compositions, weak, and strong elements.

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8. Limit the number of artifacts put in a carrying box. Never put lightweight and heavy artifacts in the same container. Always use separation battens, padding, or some kind of cushioning material between pieces when more than one artifact is put in a single box.
9. Never discard any packing or padding material until it has been thoroughly searched, especially if breakage of the unpacked artifacts is known to have occurred.
10. All government tags shall remain with the item for identification; when possible, tags shall remain tied to the item. Do not discard any tags removed from artifacts to be displayed; return them to the COR.

D. Transportation

In the event that replaceable objects are sent to the contractor from the government, the package will contain an inventory list. If for any reason this list is missing, the contractor shall contact the COR immediately. When unpacking the objects, the contractor shall examine each object and indicate on the list that the individual item(s) have been received, note the condition of the object(s), and return a copy to the following address or as specified in individual task orders:

National Park Service
Harpers Ferry Center
Office of the Registrar
P.O. Box 50
Harpers Ferry, West Virginia 25425-0050

When shipping or returning objects or mounts, the contractor shall include a copy of the shipping list and shall make an additional listing of the mounts. The object(s) shall be repacked in the original packing material and container. The object(s) shall be returned to the address listed in individual task orders. For shipping packages to the Harper's Ferry Center's Registrar's Office, the address is as follows:

National Park Service
Harpers Ferry Center
Office of the Registrar, Room 141
31 Maple Tree Drive
Charles Town, West Virginia 25414
304-535-6716

Division 7. CONSERVATION GUIDELINES

E. Installation

1. **Handling** - Handling of artifacts at the installation site shall be in accordance with this Division, 7.7, C., Artifact Handling. Provide a clean, undisturbed work area at the exhibit site away from visitor access and any conditions that could be harmful to the artifacts, such as extremes of temperature and humidity, direct sunlight, smoke, and materials unsafe for direct contact. All identification tags removed from artifacts when they are mounted in the exhibit shall be turned over to the COR. **Do not discard any identification tags** or remove them prior to final installation of the artifact. Place removed tags in a box or other small container designated for that purpose as specified by the COR onsite.
2. **Rehabilitation** - When repairing or replacing an existing mount, care shall be taken not to damage, disturb, or otherwise impact negatively on other artifacts in a display. If the repair or replacement of a mount calls for complete removal of all artifacts in a case, the contractor shall not undertake this task. Arrangements shall be made with the COR prior to disassembly of an artifact case so that artifacts removed from an artifact case during repair of a mount can be secured by park staff.
3. **Installation of Silica Gel** – Unless otherwise specified in individual task orders, the contractor shall furnish and install silica gel humidity ballast for the artifact cases in accordance with this Division, 7.6, B., Silica Gel, and in accordance with Division 4, 4.5, B., 2, Silica Gel Chambers.

Silica gel shall be conditioned to the required relative humidity level, provided in the required quantity per case, and packaged in bags or containers in accordance with Attachment E, Summary of Exhibit Conservation Guidelines. Conditioned silica gel shall be kept in the container from the manufacturer or in a vapor-proof bag, tightly closed, until immediately before installation into the artifact case, so as to maintain the conditioned humidity level as long as possible prior to installation.
4. **Artifact Case Lighting** – Unless otherwise specified in individual task orders, the contractor shall aim and adjust all lighting on artifacts in accordance with required footcandle levels furnished by the COR for each object. The contractor shall use an approved light meter to check the light intensity on each object or group of objects. No light levels shall exceed the footcandle limit.

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5. **Clean and Close Artifact Cases** - Upon completion of artifact mounting, adjustment of lighting, installation of silica gel, and all other objects to be installed in the case, the contractor shall clean the inside of the case one last time using a clean cloth. No spray cleaner shall be sprayed inside the case. Do not open and clean the case during or after other work that may raise dust levels in the vicinity of the case, such as vacuuming or dusting of adjacent exhibit structures.

The contractor shall close and lock the case as soon as possible in the installation process so as to limit exposure of the artifacts to unconditioned air, excess light, insects, and damage or theft in the installation work area.

Division 8. SETUP AND INSTALLATION

8.1 Introduction

Provide setup and installation of all exhibit elements so that they are complete, fully operational, and ready for use.

8.2 Specific Requirements

- A. Pre-installation meeting at the contractor's facility.
- B. Staging of the exhibits and audiovisual components at the contractor's facility, for inspection by the COR prior to final packing or crating for installation.
- C. Packaging and shipping of exhibit elements and materials to the site.
- D. On-site installation of exhibit elements and materials.
- E. Professional lighting of the installed exhibits.
- F. Delivery of the maintenance manuals and maintenance kit.
- G. Walk-through inspection of completed exhibits, with operational training for park staff.
- H. Punch list corrections of work that the COR has inspected and determined is unacceptable.
- I. Photography of the completed, operational exhibit.

8.3 Materials

A. Wood Crates

The contractor shall fabricate or supply wood crates, using CDX plywood and pine framing in thickness required, based on size of crate. Crates shall be fastened using galvanized nails and screws for crate top.

B. Packing Materials

The contractor shall pack materials using polyethylene air bubble cushioning material such as "bubble pack", flexible corrugated packing material, polyfoam peanuts, and/or heavy blankets.

Division 8. SETUP AND INSTALLATION

C. Installation Tools and Materials

The contractor shall provide all installation tools and materials in sufficient number to accomplish the job, such as a vacuum cleaner, ladders, tools, trash bags, cleaning materials, interior and exterior protective covers, barriers, and "No Admittance" signs.

8.4 Execution

A. Pre-Installation Meeting

The contractor's Project Manager and members of the contractor's installation team shall meet with the COR at the contractor's facility to discuss the project and review work at the time of the exhibit staging.

B. Staging and Acceptance

1. **Setup** - Prior to shipping the exhibit elements to the site for installation, a thorough inspection of the completed and functioning exhibits will be made by the COR at the contractor's facility. The contractor shall place all exhibit units in exactly the same configuration and dimensioned area as they will be installed. Focal points specified on the floor plan shall be laid out on the floor with masking tape.
2. **Demonstration** - All units shall be fully operational at the time of final inspection. Exhibit units with built-in lighting, electrical, mechanical, and audiovisual equipment shall be connected to power sources. The contractor shall demonstrate that each operation is fully functional, in accordance with Division 5, Electrical/Electronic.

C. Packing and Shipping

1. **Structures** - Structures shall be blanket-wrapped with all attached exhibit elements protected.
2. **Audiovisual Equipment** - Audiovisual equipment shall be shipped in original shipping box from manufacturer with all original packing materials in place.

Division 8. SETUP AND INSTALLATION

3. **Graphics** - During storage prior to the installation and during transportation to the installation site, the contractor shall use flat, smooth-surfaced materials between graphics which are mounted and protected with overlamine film. The contractor shall ensure that dust, dirt, sawdust, bubble wrap, styrofoam sheet or peanuts, and the rear surfaces of other graphic panels do not come in contact with the face of overlaminated prints and leave impressions in the overlamine surface. Mounted prints with patterns impressed into the overlamine film are unacceptable.
4. **Screen Printed Graphics** - All screenprinted surfaces shall be protected with brown paper secured with masking tape until completion of final on-site setup.
5. **Shipping** - The contractor shall pack and crate all materials which shall be shipped by their own or commercial carrier in such a manner that they will arrive at the designated site undamaged. If exhibit elements are damaged in transit, the contractor shall bear the full responsibility for repair or replacement.

D. Installation

1. **Installation Team** - The contractor shall provide adequate personnel to install the exhibits, including the Project Manager. The contractor shall provide all required tools and materials in sufficient number to accomplish the job.
2. **Demolition** - The contractor shall remove and dispose of existing exhibit structures, furniture, lighting, and other elements from the exhibit area, as specified in individual task orders.
3. **Cleanup** - The contractor shall maintain all areas in a clean condition on a daily basis and provide means of preventing dirt or waste material from being tracked into adjacent areas of the building.
 - a. The contractor shall provide bags and containers for storage of trash. The contractor shall be responsible for removing waste materials generated during installation from the park. The contractor shall not dispose of their waste in dumpsters or containers that belong to the government or to other contractor's working on-site.

Division 8. SETUP AND INSTALLATION

- b. Drilling and cutting shall be completed prior to the installation of artifacts, models, original art, and audiovisual equipment to avoid excessive dust and debris that may damage the sensitive items. On-site work shall be phased so that drilling, cutting, rough carpentry, sanding, and use of finishes or adhesives is accomplished, followed by a thorough cleanup and allowance for dust to settle and fumes to dissipate. Protective paper or plastic floor coverings that are torn or thoroughly soiled shall be replaced with clean material. Then, installation of the sensitive materials and equipment can proceed.
 - c. The contractor shall thoroughly clean exhibit surfaces to remove handprints, dust, and miscellaneous markings generated during the installation.
 - d. The contractor shall handle all acrylic, glass, and graphic panels with clean gloves to minimize handprints of natural skin oils. Panels shall be thoroughly cleaned until all dust, prints, and smears are removed from the face and rear surfaces. Acceptable materials for cleaning acrylic are specified in this Division, 8.4, H, 3, Cleaning Materials.
 - e. The contractor shall provide labor, materials, equipment, and supplies for final cleaning of the exhibit site, including vacuuming the entire exhibit space. For carpeted spaces, vacuuming equipment shall be appropriate for professional cleaning of carpeting; shop vacuums are not acceptable. The use of equipment belonging to the government is not acceptable.
4. **Storage** - Exhibit elements shall be stored at the exhibit site during installation. Prior to the installation, the contractor shall plan how storage shall be accomplished so as to provide protection of the exhibit elements and minimize disruption of park operations. The contractor shall discuss their plan with the COR for review and approval prior to the installation.
5. **Existing Work** - The contractor shall request authorization from the COR prior to cutting, drilling, altering, or removing material within the building. Work that is replaced shall match existing work. Anything damaged or defaced within the building due to the contractor's error during installation shall be restored to the original condition by the contractor. Restoration work shall be coordinated with the COR.

Division 8. SETUP AND INSTALLATION

6. **Protection** - The contractor shall provide adequate protection for parts of the building, its contents, and occupants wherever work under this contract is being performed. This includes dust protection where required and protective coverings for interior surfaces and furnishings adjacent to the work area. The contractor shall provide cardboard, plastic, or heavy kraft paper for the floor of the exhibit and adjacent work areas; use masonite in adequate thicknesses to protect floors from indentations and other damage when heavy loads will be wheeled over, or temporarily stored on, the floor. The contractor shall provide barriers and post "No Admittance" signs. The contractor shall also ensure that artifacts are not left unattended and that they are stored in a secure location when the work site is unattended.

E. Final Lighting of Installed Exhibits

The contractor shall illuminate the installed exhibits and artifacts, as specified on the government-furnished lighting plan or as specified on individual task orders. Exhibit lighting shall combine a balance of aesthetic and practical requirements. Care shall be given to the protection of artifacts from direct and reflected light; to the readability of text and graphics; and to minimizing power consumption. Work shall include:

1. Aim and adjust all exhibit lighting, including exhibit lighting equipment and accessories installed by others.
2. Adjust lamp wattages and beam spread, as well as dimmers when available.
3. Install lenses and accessories as required to meet the specified effects.
4. Document final placement and aiming of lighting fixtures onsite after installation of exhibits and case contents, including measurement and adjustment of exhibit lighting levels. This detailed information shall be included in the maintenance manual, as specified in Division 2, 2.4, F, 2.

F. Walk-Through Inspection

Upon completion of the on-site work, the contractor shall conduct a final walk-through inspection of the exhibits with the COR and park staff. The contractor shall notify the COR ahead of time when the walk-through can be scheduled and shall assemble installation team members with the appropriate expertise to demonstrate the equipment and answer questions. Walk-through inspections shall occur Monday through Friday between 9:00am and 4:00pm, excluding federal holidays, or as specified in individual task orders.

Division 8. SETUP AND INSTALLATION

1. The inspection shall identify punch-list items (items that need to be corrected by the contractor). The contractor shall record and maintain a list of the punch-list items as they are identified by the COR and provide a copy of the list to the COR after the walk-through inspection.
2. The contractor shall demonstrate operation of all electrical, mechanical elements, and audiovisual components in the exhibit. The exhibit shall be fully operational at the time of the walk-through inspection.
3. The contractor shall demonstrate access into exhibit structures for maintenance purposes, including artifact cases, silica gel chambers, lighting chambers, and all other electrical and electronic equipment, including audiovisual equipment.

G. **Maintenance Manual**

Provide two copies of the final maintenance manual to the COR at the installation. A third copy shall be submitted to the COR as part of the closeout package, as specified in Division 9, Project Closeout. Assemble the maintenance manuals as specified in Division 2, Fabrication Drawings.

H. **Maintenance Kit**

1. **Container** - A heavy-duty plastic storage container with a lid.
2. **Touch-up Materials** - Bottles or cans of each paint, stain, wax, and other finishes used on the exhibit, with tightly fitted lids or caps, and clear identification of the contents on firmly attached labels. For each type of finish, provide appropriate solvents and brushes or other tools as required to apply the finish. Provide a minimum of one full quart of each paint and stain, one two-ounce bottle of each screen ink, and one full quart of each type of protective finish, such as polyurethane, except as otherwise specified on individual task orders.
3. **Cleaning Materials** - Cleaning materials for each type of surface in the exhibit, including glass, acrylic, plastic laminate, metal, and wood. Provide one full bottle of each type of cleaner. Provide appropriate applicators for use with each type of cleaning product in sufficient quantities to clean the entire exhibit for a minimum of 60 days. All cleaning materials shall be listed in the maintenance manual, with manufacturer's address, telephone number, and website address (if applicable). If the exhibit includes acrylic glazing or surfaces, provide the following materials for cleaning acrylic:

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- a. Brilliantize, as manufactured by:

The Brilliantize Company
Kleenmaster Products
4966 Industrial Highway
Benicia, California 94510
800-445-9344
707-751-0656
www.brilliance.com

- b. WypAll Plus All-Purpose Wipers, as manufactured by:

Kimberly-Clark Corporation
World Headquarters
351 Phelps Drive
Irving, Texas 75038
972-281-1200
www.kimberly-clark.com

4. **Keys and Tools** - All keys to exhibit locks and specialized tools, including screwdrivers for tamperproof screws, wrenches for roto locks, and allen (hex) wrenches, or any other specialized tool which shall be used for case access, mobility, or security. Provide three copies of each type of key and tool. Each key and tool shall be identified with the exhibit project name and number.

I. Operational Training Session

After inspection and acceptance of the installed exhibits, the contractor shall conduct an operational training session for the COR and park staff.

1. During the training session, the contractor shall provide and identify the components of the maintenance kit, assembled in accordance with this Division, 8.4, H.
2. The training session shall include, but not be limited to:
 - a. Day-to-day cleaning of the exhibits;
 - b. Minor repair and touch-up procedures;
 - c. Access into exhibit structures, including operating locks and tamperproof hardware, opening hinged doors, removing and replacing cover panels, removing and inserting silica gel desiccant, changing lamps in lighting fixtures, and removing and replacing mounted artifacts, models, and life-size figures; and

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- d. Start-up and shutdown procedures for audiovisual equipment, lighting, and other electrical equipment, including troubleshooting in the event of a power outage, lightening surge, or other potential hazard.
3. In addition, the contractor shall provide to the COR two copies of a prerecorded video that demonstrates all key topics covered in the operational training session, for reference by park staff. The videos shall be on CD-ROM or DVD-ROM, and available for submittal to the COR at or prior to the operational training session. The video shall be divided into four chapters that cover the work specified in H.2. above.

J. **Completion of Punch List Work**

The contractor shall clarify with the COR all work that is part of the punch list, and provide a schedule and plan for its completion.

K. **Photography of the Completed Exhibit**

The contractor shall document the completed, operational exhibit with digital photographs that clearly show the overall exhibit, with additional photos of each of the exhibit areas and close-up photos that show the details within each exhibit area. The quality of the photos shall be within a range of contrast that clearly shows the details of the exhibit without being washed-out or too dark. Submit photographs to the COR as specified in Division 9, Project Closeout, 9.4, A., 8.

Division 9. PROJECT CLOSEOUT

9.1 Introduction

Prepare and organize all exhibit production material for submittal to the COR and closeout of the project.

9.2 Specific Requirements

Assemble, organize, and submit a Closeout Package consisting of all government-furnished references and graphic sources, along with all materials generated during the production process including drawings, digital files, samples, one copy of the final maintenance manual, and photographs of the installed exhibits.

9.3 Materials

A. Closeout Package

1. **Digital Media** - Materials in accordance with Division 6, 6.4, Handling of Source Materials.
2. **Photo Negatives and Source Materials** - Materials in accordance with Division 6, 6.4, Handling of Source Materials.
3. **Maintenance Manual** - In accordance with Division 2, Fabrication Drawings.
4. **Photographs of the Installed Exhibits** – In accordance with this Division, 9.4, A.8.

9.4 Execution

A. Closeout Package

1. **Digital Media**
 - a. **As-Built Exhibit Plan Database** - Stored on CD-ROM or DVD-ROM.
 - b. **As-Built Graphic Layouts** - Stored on CD-ROM or DVD-ROM in accordance with Division 6, 6.4, Handling of Source Material.
 - c. **High-resolution Scans of Art and Photos** - Stored on CD-ROM or DVD-ROM in accordance with Division 6, 6.4, Handling of Source Material.
 - d. **Digital Photos of the Completed, Operational Exhibit** - As specified in this Division 9.4, A8.

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2. **Photo Negatives and Sources** - Assembled and organized in accordance with Division 6, 6.4, Handling of Source Material.
 3. **Artwork** - Digital artwork shall be stored on CD-ROM in accordance with Division 6, 6.4, Handling of Source Material. Government-furnished and contractor-produced artwork, sketches, and layouts shall be placed in acid-free folders or wrapped in acid-free paper. Identify all artwork by project name and graphic number.
 4. **Drawings and Plans** - Government-furnished exhibit drawings and planning documents.
 5. **Government-Furnished References** - The contractor shall return all government-furnished reference materials.
 6. **Samples** - All samples, models, and mock-ups required as submittals to the COR for review are the property of the government, including samples returned to the contractor for reference or stored in the contractor's shop. The COR will inform the contractor which samples are no longer of use and can be discarded and which shall be included in the closeout package.
 7. **Maintenance Manual** - A total of one copy shall be provided by the contractor in the closeout package.
 8. **Photographs of the Installed Exhibits** - The contractor shall submit photographs of the installed exhibits in one or both of the following media formats, or in another media format, as specified in the individual task order:
 - a. Digital prints on CD-ROM; and/or
 - b. One set of 8" x 10" color prints.
- B. Storage of Exhibit Resource Materials at the Contractor's Facility**
1. **During Fabrication** - The contractor shall ensure that all government-furnished books, negatives, archival, and resource materials are stored in a safe place and remain in the same condition as they were received.
 2. **After Project Completion** - The contractor shall store copies of digital files used during the project at their facility for a minimum of one year following the installation of the exhibit.