

APPENDIX A

SAMPLE ARCHITECT-ENGINEER (A-E) STATEMENT OF WORK

1. General. Development of operation and maintenance (O&M) documentation and training requirements for facilities is a two-step operation shared by the A-E and the construction contractor. Since the construction contractor's effort is competitively bid, the A-E must specify in detail what the construction contractor must supply. Several different types of documentation are to be prepared by the A-E. These include:

a. Technical concept narrative (TCN) portion of Systems O&M Manuals (SOMM).

b. Design master equipment list (DMEL).

c. Construction Specifications for O&M Documentation.

d. Training requirements.

2. TCN. The A-E shall develop a TCN (basically, a design O&M manual) for each functional system requiring O&M.

a. The TCN is comprised of Chapters 1, 2, and 3 of the SOMM as outlined in paragraph 2.3.2. For those chapters and appendices to be completed during the construction phase, the A-E shall describe in detail what the construction contractor must provide to achieve comprehensive Systems O&M Manuals (SOMM). The SOMM is intended to provide all the information necessary for the installation engineer to operate and maintain the system, as well as provide overall system checks.

b. The A-E shall describe the intended use and operation of each functional system including its interrelationship with other functional systems and subsystems. A discussion of the theory of operation of the facility system and major pieces of equipment shall be provided, written at the level necessary for journeyman understanding. All system requirements and their application shall be covered.

c. In addition to preparing the TCM, the A-E shall furnish the labeled binders and tab dividers labeled to be used by the construction contractor when completing the SOMM. The A-E shall also prepare introductions for Chapters 4-7 of the SOMM summarizing what the construction contractor is to provide per the specifications developed by the A-E in accordance with paragraph 3.0.

(1) The SOMMs shall be organized by systems. For complex systems, the respective SOMM shall be broken down into volumes

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containing one or more subsystem. Additionally, the SOMM shall be structured (into volumes) so as to facilitate use by different installation O&M organizations. If there is more than one O&M organization involved the Contracting Officer will provide the A-E a list identifying the various O&M organizations and the systems/subsystems for which respective O&M responsibilities require special packaging of the SOMM.

(2) The SOMM arrangement shall be as follows:

Front Matter.

Chapter 1--General Information

Chapter 2--System Description.

Chapter 3--Theory of Operation.

Chapter 4--Operations.

Chapter 5--Preventive Maintenance (PM).

Chapter 6--Trouble Analysis (TA).

Chapter 7--Corrective Maintenance and Checkout Procedures.

Appendix A--Special Tools and Test Equipment List.

Appendix B--Repair Parts List.

Appendix C--Vendor Data/Acceptance Tests.

Appendix D--Warranty Data Information.

(a) Front Matter. The cover, title page, list of effective pages, foreword, table of contents, list of illustrations, list of tables, and list of abbreviations and acronyms should be prepared in accordance with the requirements of MIL-M-38784B, or as otherwise specified in the provisions of the contract.

(b) Chapter 1--General Information. This chapter shall present general information, including, in tabular format, a master index identifying all subject matter covered within each volume.

(c) Chapter 2--System Description. This chapter shall describe the system construction drawings that are essential to support the TCN and shall be referenced. For systems consisting of more than one unit or item of equipment, or where complexity must be explained, an illustration or flow diagram will be

included. If one system interfaces with another system or subsystem, this chapter shall define how they interface. Safety and security topics shall be covered and referenced to the operating procedures, as applicable. A table of capabilities and limitations shall be prepared for the systems. The table will include data such as gallons per minute, transfers per hour, boom capacity, rated ranges, resolution, accuracy, data-handling capability, etc. Such data shall be presented in tabular form. An additional table shall be provided to clearly illustrate the capabilities required of a given system or item of equipment that differ because of its configuration within the system. The word "differ," as used above, is meant to include those capabilities other than normal or usual. The fact that the input, output, feedback, or control levels required are within the design specifications of the system or item of equipment is not a sufficient reason for omitting the system or item of equipment from the table. Major equipment components will be identified and located by describing each component that is significant to O&M, logistics, and safety. A tabular list of leading particulars will be included as necessary to support the description of major components.

(d) Chapter 3--Theory of Operation. This chapter shall contain a discussion of the theory of operation and a listing of all the functions of the system, and shall show how the various facility subsystems functions are tied together to accomplish the overall system function. The description shall include an overall analysis of the principles of operation of the system equipment and its functions, such as control interlocks, where such principles would not be obvious to journeyman technicians. Particular attention shall be paid to the interface between facility systems and other systems. The descriptions shall be sufficiently detailed to provide system personnel with the understanding necessary to adequately perform the system activities and to correctly interpret the results of these activities.

3. Construction Contract Specifications for Contractor Furnished O&M Documentation. The A-E shall prepare the contract specifications for the O&M documentation which is to be added to the TCNs by the construction contractor in accordance with the outline shown in 2.c.(2). The following subparagraphs describe the end products desired from the construction contractor

a. Chapter 4--Operations. This chapter is to include equipment and/or system layouts showing all piping, wiring, breakers, valves, dampers, controls, etc., complete with functional diagrams, schematics, isometrics, and data to explain the detailed operation and control of each individual piece of equipment and/or system, including system components. Layouts should show the location within the facility of controls, valves

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switches, dampers, etc., by reference to site locations, wing designation, floor, room number, or other clear and concise directions for locating the item. Operator data may be identical to posted data and framed instructions, but shall be included as part of the O&M manuals. The instructions shall include:

(1) Initial adjustments and control settings.

(2) Precautions and prechecks to be executed prior to start-up or shutdown of equipment and/or system, including safety devices, monitoring devices, and control sequence.

(3) Step-by-step sequential procedures for start-up, shutdown and normal operation checks for satisfactory operation. Safety precautions and instructions that should be followed during these procedures shall be incorporated into the operating instructions and flagged for the attention of the operator. Procedures shall include test, normal, and automatic modes.

(4) Procedures for normal and emergency shutdown of equipment and/or systems. The instructions shall include any procedures necessary for placing the equipment and/or system on standby or preparing the equipment and/or system for start-up at a later time. Procedures shall include test, normal, and automatic modes.

(5) Procedures for isolating individual equipment from the system and bringing individual equipment on-line once the system is operating.

(6) Operational logs and records requirements.

b. Chapter 5--Preventive Maintenance (PM).

(1) Recommended procedures shall indicate PM (e.g., lubrication, checks, adjustments, etc.) and good-housekeeping practices which should be performed by operating personnel, as well as more complex maintenance time-frames or operating hours for specific maintenance to be accomplished. Safety precautions and instructions that should be followed during these procedures shall be incorporated into the maintenance procedures and flagged for the attention of personnel. The procedures shall include necessary operating instructions for taking equipment off-line, putting equipment on-line, or putting equipment on standby. The instructions shall address all material, equipment, and system data needed to perform maintenance work and shall include, but not be limited to, manufacturers' bulletins, catalogs, and descriptive data; certified performance

curves; copies of approved test plans, including logs and records of performance acceptance and inspection; system layouts, including block, wiring, control, and isometric diagrams; schematic items within the facility; and interrelationships with other items of the system.

(2) Schedules indicating time-frames or operating hours for initiating operator maintenance and adjustments and including manufacturer's recommended major maintenance requirements shall be provided. Emergency adjustments shall be included and flagged for the operator's attention. The instructions shall also include procedures for emergency repairs that could be performed by operating personnel.

c. Chapter 6--Trouble Analysis (TA). TA procedures for locating and correcting the trouble shall be presented in a step-by-step format. Repair procedures shall be keyed to a troubleshooting guide outlined in three columns with the following heading:

Column 1--Trouble.

Column 2--Probable Cause(s).

Column 3--Correction.

The procedures shall clearly indicate a major repair activity, which should be performed only in a shop or factory, as opposed to normal repair work, which may be performed on site or with equipment on-line. The procedures shall also clearly indicate the limit of repair work that may be performed by Government personnel during the warranty period without voiding warranty provisions. Safety precautions and instructions that should be followed during these procedures shall be incorporated into the repair procedures and flagged for the attention of personnel.

d. Chapter 7--Corrective Maintenance and Checkout Procedures. Procedures for troubleshooting and isolation, replacement, checkout, and integration of equipment within the system shall be provided.

(1) Troubleshooting. Procedures for troubleshooting of malfunctions that might occur during operation of the system shall be provided. Troubleshooting data, and fault isolation techniques, shall state the following: (a) The indication or symptom of trouble; (b) the instructions, including test hookups, necessary to determine the cause; and (c) procedures, for restoring the system to operating condition. Troubleshooting shall be documented to the extent necessary to locate the faulty piece of equipment within the system.

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Information may be in chart form, in logic tree form, or in tabular format with appropriate headings.

(2) Isolation, Replacement, Checkout, and Integration. Procedures for isolation, replacement, checkout, and integration of the equipment within the system shall be provided. Test, adjustment, and checkout data, after replacement, shall be included.

e. Appendix A--Special Tools and Test Equipment List. A list of all special tools and test, diagnostic measurement, and equipment for system level maintenance shall be in this appendix. For the purpose of this specification, the phrase "special tools and test, measurement, and diagnostic equipment" is used to identify all nonstandard tools and equipment designed and developed by the manufacturer and others to perform maintenance, test/calibration, diagnostic/prognostic analysis, and other related support of the equipment and required for installation, acceptance testing, and successful O&M. Frequency and method of calibration shall be indicated for all special tools, equipment, and test equipment items that require calibration. Necessary standards shall be listed immediately after each item that requires calibration.

f. Appendix B--Spare Parts List. A complete list of spare parts and supplies shall be provided. The list shall include all parts and components of individual pieces of equipment and all parts and components of each system and shall identify such items as nomenclature of part, model number, circuit or component identification, etc. Parts and supplies lists shall be included within each volume of maintenance instructions. Further, a master list of spare parts and supplies recommended from each manufacturer for one year of operation, including source of supply, shall be sub-listed with each instruction. The contractor shall also list the sources of supply for all parts and supplies, including name of supplier/manufacturer, address, and telephone number. If the parts and supplies are not normally stocked locally, necessary procurement lead time shall also be a part of the listing.

g. Appendix C--Vendor Data. A complete set of data, provided by the equipment manufacturer, required for operation, maintenance, and checkout shall be included and referenced to the appropriate specifications number. The data may consist of manufacturer's brochures, O&M manuals, catalogs, drawings, service bulletins, and illustrated parts lists necessary to support the O&M of the end item of equipment and assemblies.

h. Appendix D--Warranty Information. In addition to the

general warranty required by the contract, the O&M manuals shall include any specific warranties required by other sections of the Technical Specifications and other warranties normally provided with the particular piece of equipment or system. Warranties that are normally provided by manufacturers and which are beyond the warranty for construction shall be specifically noted.

4. Design Master Equipment List (DMEL).

a. The A-E shall develop a DMEL of facility equipment that is significant to operations, maintenance, and provisioning. The DMEL will identify each major system, subsystem, and equipment item in generation breakdown order to the purchase end item level. The DMEL shall contain as a minimum the following information:

- (1) Item nomenclature.
- (2) Functional characteristics.
- (3) Item identifier (tag number).
- (4) Specification number.
- (5) Design/construction drawing number. (File number when available).

b. The DMEL is to be provided to the construction contractor, who, by adding the manufacturer's name, manufacturers part number, and manufacturers model/serial number, will create the "as-built" master equipment list (MEL). The A-E shall prepare construction contract specifications to have the contractor submit the completed MEL to the Contracting Officer.

5. Training Requirements. The A-E shall develop an O&M training develop concept. This concept shall be presented in two formats: (a) report for use by the Government in planning for O&M personnel training and (b) contract specifications describing what the construction contractor must furnish/perform to adequately train Government and/or O&M contractor personnel.

a. Training Concept Report.

(1) All systems and subsystems requiring training of qualified personnel to properly operate and maintain those systems shall be identified. A task and skills analysis shall be documented to identify special skill required to operate and/or maintain critical, complex, or specialized systems.

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After the skill requirements are identified, the actual training programs shall be defined.

(2) The training concept report shall identify the types (trade skills) of personnel to be trained on which systems. The A-E shall recommend instructional methods, materials and special training devices recommended to support the program of instruction, including appropriate video taping of both factory and/or on site training. Additionally, the training concept shall identify the minimum number of instructor man-hours of instruction for each system and item of equipment requiring specific training, and shall specify the appropriate proportion of the instruction time that shall be used for on-site (classroom) instruction, and for on site instruction during which reference shall be made directly to the observed equipment or system.

(3) The A-E will recommend functional areas of the operating system and/or equipment where a technical representative should be furnished by the manufacturer for training.

(4) The A-E shall prepare a cost estimate for the training services and materials to be provided by the construction contractor as recommended in the training concept report. The estimate shall take into account that information which is usually furnished by the manufacturer/supplier as part of the system/equipment purchase price.

b. Training Specifications. Based on the training concept approved by the Government, the A-E shall prepare training specifications detailing the minimum number of hours and types of instruction to be provided by the equipment manufacturer and/or construction contractor for each system, subsystem, and piece of equipment warranting training. A suggested format for the specifications is shown below.

O&M TRAINING REQUIREMENTS

<u>SYSTEM/EQUIPMENT</u>	<u>INSTRUCTIONAL HOURS</u>	<u>RELATED SECTION NO.</u>
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[NOTE: The A-E Shall Enter System/Equipment, Instructional Hours, Both Classroom and Hands-on, and Related Technical Section No.]

c. General Requirements.

(1) The construction contractor must submit a proposed training schedule at least 60 days prior to the start of the earliest training session. The training schedule shall include the following:

- An outline of all specified training, both classroom and hands-on, describing the presentation of the training.

- A day-to-day schedule showing location of training, time intervals, and the major and subordinate subjects to be covered in each session.

- Identification and qualifications of proposed instructors.

- A list of reference materials to be provided by the contractor to the trainees and a list of training materials such as O&M instructions, other written and visual aids, mock-ups, tools, etc.

(2) Review of Proposed Training Plan. The Contracting Officer will review the contractor's proposed training schedule, and the Contracting Officer's approval of the schedule shall be obtained by the Contractor prior to the start of any training. The training schedule for all required formal training shall be submitted to the Contracting Officer in draft form, four (4) copies in one submittal. The Contracting Officer will require thirty (30) days for review and approval of the schedule or for disapproval and return to the Contractor for resubmission. Upon approval of the schedule, the Contractor shall submit the final schedule, in six (6) copies, incorporating all comments or revisions noted from the Contracting Officer's review of the proposed schedule.

(3) Formal Training: The Contractor shall provide qualified competent personnel for formal training of Government and/or O&M Contractor employees. Classroom training shall be held on-site at the Government installation. Training shall be conducted between the hours of 7:30 a.m. and 4:00 p.m. on non-holiday Mondays through Fridays, unless a different schedule is approved in writing by the Contracting Officer.

(4) Audio-Video Recordings and Audio-Video Tape Player. The contractor shall provide all equipment, material, and trained personnel to visually and audibly record all field instruction training sessions. The proposed recording system shall be of one manufacturer and of studio quality and shall be

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approved by the Contracting Officer prior to its use. Upon completion of instructions, the audio-video tape player and recordings shall become the property of the Government. The recordings shall be identified, indexed, and placed in approved storage containers.

d. Training Service Cost Estimate. The A-E shall prepare a cost estimate for the training services and materials specified taking into account that which is usually furnished by the manufacturer/supplier as part of the system/equipment purchase price.