NORTHROP GRUMMAN SHIPBUILDING
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APPENDIX E - DOD CONTRACTS
TECHNICAL MANUALS

I. INTRODUCTION.

Appendix E is provided for sellers (vendors) to use when developing technical manuals to submit to Northrop Grumman Shipbuilding (NGS) in order to satisfy coded note requirements included in individual equipment purchase orders. The use of Appendix E by the vendor will ensure format and content requirements of the applicable contract are met along with ensuring delivery of consistent technical manual products between various vendors. The overall goal of Appendix E is to limit the amount of rework required by the vendor through first time submittal of technical manuals that are formatted correctly and contain the technical content requirements called out by the applicable contract.

Appendix E is presented in two parts. Part 1 covers the submittal of vendor technical manuals developed in accordance with a Technical Manual Preparation Guideline (TMPG). Part 2 covers the submittal of vendor technical manuals developed in accordance with a Technical Manual Contract Requirement (TMCR) and is applicable to CVN70 and CVN71 RCOH.

General information pertaining to both Parts 1 and 2 is covered in the following section.

II. GENERAL.

Technical manuals shall be furnished as specified in Part 1 or Part 2, whichever is applicable.

Where the requirements of the purchase order and this appendix, which forms a part of the purchase order, are at variance with other referenced specifications, the purchase order shall apply.

Where the requirements of the TMPG are at variance with contract specifications, the contract specification shall apply.

The maximum use of existing manuals is expected and encouraged.

If equipment to be supplied is identical or nearly identical to equipment supplied under a previous Government contract, and is supported by an existing, Navy-approved technical manual, the vendor may propose the existing technical manual be extended as is (as long as the existing, Navy-approved technical manual covers the equipment being purchased by this purchase order in its entirety without change to any front matter, text, illustrations, drawings, or part numbers),

All manuals, whether or not they have been approved for use by the Navy or whether or not they have had NAVSEA numbers assigned, shall be submitted to the Purchaser for approval by this Company and the Navy Department for applicability to the contract.

Unless specified in the TMPG, TMCR, or purchase order, the use of certification data sheets and any such data that tends to limit the use of the manual to one ship is not allowed.

Preparation of the Final Reproducible Copy (FRC) shall not be held up pending approval of repair parts and/or addition of shock test notes to installation drawings. Such data is not required to be shown on drawings included in technical manuals.

NOTE: The use of approved production type or working drawings in technical manuals, except where needed for installation information, is not a specifications requirement. The use of such drawings in lieu of illustrative material prepared specifically for the publication should be limited. Where approved working drawings are included in technical manuals, they must be in agreement with approved drawings of the same revision in the Navy system and meet illustration requirements of the TMPG or applicable TMCR.

The Shipbuilder is contractually obligated to make delivery of final technical manuals to the Navy on a predetermined schedule. By acceptance of the purchase order, the vendor agrees to expedite all phases of technical manual preparation, to submit both preliminary and final manuals promptly, and to cooperate with the purchaser in timely delivery of the FRC to the Navy. The purchase order number shall not be shown on the title page.

PART 1

TECHNICAL MANUAL PREPARATION GUIDE (TMPG) FOR CVN68 CLASS AIRCRAFT CARRIERS

1-1 PURPOSE.

This Technical Manual Preparation Guide (TMPG) provides vendors the requirements to use for developing technical manuals to ensure the format and content requirements of the applicable contract are met.

1-2 COMMERCIAL OFF-THE-SHELF (COTS) TECHNICAL MANUALS.

COTS manuals may be supplied in lieu of contractor-furnished technical manuals when specified by the procuring activity and identified by purchase order coded notes. COTS manuals must be prepared in accordance with contract requirements (or acceptable industry standards where the contract is silent) and should contain operating, troubleshooting, and maintenance procedures including applicable repair parts listings, foundation and anchor bolt plans, and wiring diagrams.

Submission of preliminary COTS manuals for equipment is required unless otherwise specified by the purchase order. Technical Manual Identification Numbers (TMINs) will be obtained, as necessary, by the Shipbuilder and be marked on the final COTS manuals.

It is preferred that COTS manuals be prepared in digital format since material which is not of raster scanning quality will not be accepted. COTS manuals will be delivered as received and do not require approval by the procuring activity unless required by the contract. All printing of these manuals shall be accomplished by the vendor. The number of copies required shall be as specified in the purchase order. In addition, two copies shall be packaged and shipped with the equipment.

1-3 CONTRACTOR-FURNISHED TECHNICAL MANUALS.

The contractor will develop new technical manuals, revise existing technical manuals, or provide change pages to existing technical manuals, as appropriate.

1-3.1 Format and Style. The hard copy must be fully edited, validated, and typewritten single-columned, single-spaced, on one side of a sheet only. The page size is 8-1/2 x 11 inches with image area restricted to 6-1/2 x 9 inches. The binding edge margin is 1-1/2 inches and the outside edge margin is 1/2 inch. Any method of duplication, covering, and binding that will provide legible, collated copies of the manuscript will be acceptable. If a change to an existing manual is developed in lieu of a new manual, the format and style of the existing manual is followed. The use of change symbols (i.e., vertical line, asterisk, pointing hand, etc.) will be determined by the contractor. If a change occurs on only one side of the page, legible backing pages must be furnished.

The hard copy contains the table of contents, text, illustrations, and tables to be included in the manual as specified in this document. Manuals contain the following data, as applicable, to provide instructions for installation, operation, and maintenance and shall be arranged as follows:

- Front Matter
- Technical Content
- Technical Manual Deficiency/Evaluation Report (TMDER)

1-3.2 Front Matter. The vendor is responsible for providing front matter consisting of the following, in the order provided below.

- Title Page
- Change Record (as required)
- Foreword (as required)
- Table of Contents
- List of Illustrations

- List of Tables
- Safety Summary (as required)

1-3.3 Technical Content. Technical content should be presented in clear language using the simplest words and phrases that will convey the intended meaning to a high school graduate having specialized training as a technician through Navy training courses. All essential information must be included either by direct statements or by reference. For maximum clarity and usefulness, maintain consistency in terminology within the same publication or series of publications.

1-3.4 Technical Manual Deficiency/Evaluation Report (TMDER). The contractor will provide the TMDER, NAVSEA Form 4160/1, for each manual/volume.

1-3.5 Writing Style. Use short and concise sentences. The U.S. Government Printing Office (GPO) Style Manual provides general guidance for capitalization, punctuation, compounding of words, numerals in text, and spelling of non-technical words. Use technical words only when no other wording will convey the intended meaning. Do not use quotation marks and underscoring for emphasis. Do not use words which have more than one meaning which will fit the context in which they are used, such as "replace" for "reinstall." Ensure nomenclature remains consistent within the publication and throughout parts lists, parts breakdowns, and other directly related publications. When identifying applicability for individual items of equipment, use specific serial number(s), block designation(s), specific model designation(s), or similar identification. Technical publications published in accordance with this document shall not refer to age, sex, race, or national origin. Use sex neutral terms but avoid use of the word "person." (Terms such as "midshipman" and "workman" are considered sex neutral.)

The second person imperative mood is used for procedures (e.g., "Remove test set from carrying case."). Third person indicative mood is used for descriptions and discussions (e.g., "When switch A is in the ON position, lamp 34 lights up.").

Abbreviations and acronyms will be held to a minimum and each will be defined on its first appearance in each chapter. Abbreviations and acronyms will be in accordance with the requirements of MIL-STD-12 or applicable contract specification. Where an equipment-unique abbreviation or acronym differs from a MIL-STD-12 abbreviation or acronym, the equipment acronym takes precedence.

1-3.5.1 References. The text refers to:

a. Only models or types covered by the manual. To facilitate coverage of modified or additional models or types at a later date, references should be held to a minimum consistent with clarity.

b. Temperature readings as calibrated on the equipment. If other than Fahrenheit, give the equivalent parenthetically in Fahrenheit. Express general temperature references, such as room temperature, in degrees Fahrenheit.

c. Speed, distance, and meter readings as calibrated on the equipment. When the metric system is used on the equipment, follow parenthetically with U.S. conversion. If the technical content of the document so requires, convert U.S. measurements to metric measurements.

d. Switch positions and panel markings exactly as marked on the equipment.

e. Measurements in U.S. standard units (ounces, pounds, gallons, inches, feet, knots, miles, etc.) except instances in which metric measurements are required.

f. Illustrations by figure number, including section/letter/number when applicable, and the sheet number for multisheet illustrations. Refer only to illustrations within the same manual or in

another volume of the same manual. Include figure and sheet number when referring to multisheet illustrations.

g. Index numbers on illustrations first, followed by the figure number (34, figure 2-67). However, when multiple references in a paragraph refer to the same figure, only the first reference need indicate the figure number.

h. Tables by table number. Refer only to tables within the same manual or in another volume of the same manual.

i. Other supporting paragraphs in the same manual or another volume of the same manual by paragraph number.

j. Other publication numbers (omitting dates, page, figure, and paragraph numbers) to avoid duplication of material. Refer only to publications in the publication system(s) of the service(s) that will use the publications and are authorized at user level. Include the publication title, followed by the publication number.

1-3.5.2 Reference Placement. References will conform to the following.

a. When a reference applies to one item within a sentence, place the reference parenthetically immediately after the item being referenced. When a reference applies to an entire sentence, place the reference at the end of the sentence.

b. When the reference applies to an entire paragraph, place the reference after the paragraph head.

c. When reference is made to items in figures by reference designations, the numbers are indicated in the following manner: ON-OFF switch (1S8, figure 3-6).

1-3.6 Divisions of Manuals. Publications are divided into volumes, parts, chapters, sections, and paragraphs, as appropriate. There shall be at least two of each subdivision used. Where there is a volume 1 there shall be a volume 2; where there is a part 1 there shall be a part 2; where there is a chapter 1 there shall be a chapter 2, etc. All volumes, parts, chapters, sections, and numbered paragraphs are titled except procedural steps or those subparagraphs that follow a colon.

Two or more volumes are identified sequentially by volume numbers and subtitles indicative of volume content and have a unique Navy Technical Manual Identification Number System (TMINS) number assigned as provided by the procuring activity.

Volumes, parts, and chapters are numbered consecutively in Arabic numbers. Use upper case Roman numerals to number sections consecutively within each chapter. Each part is identified by both its volume and part numbers and has a unique TMINS number assigned as provided by the procuring activity.

1-3.6.1 Paragraphs. Text is divided into primary paragraphs and subordinate paragraphs. Subordinate paragraphs may be further identified as first subordinate, second subordinate, and third subordinate. There must be at least two numbered paragraphs per chapter or section. Paragraphs may also be divided into procedural steps. Procedural steps may be further divided if necessary. Decimal paragraph numbering and the order of heading are as follows:

1-1 PRIMARY SIDEHEAD.

1-1.1 First Subordinate Sidehead.

1-1.1.1 Second Subordinate Sidehead.

a. First procedural step.

(1) First subordinate procedural step.

(a) First sub-subordinate procedural step.

1-2 NEXT PRIMARY SIDEHEAD.

1-2.1 Next First Subordinate Sidehead.

1-3.6.2 Procedural Steps. Procedural steps are used to provide step-by-step instructions, such as disassembly, reassembly, and alignment procedures. Steps may be further divided into substeps. Procedural steps and checklist items are numbered in accordance with subordination requirements. The steps/items are indented in block format.

The first line of procedural steps is indented two spaces or characters from the preceding paragraph. The first lines of substeps are indented two additional spaces or characters. All lines of warnings, cautions, and notes are indented approximately five spaces or characters from both left and right margins. When the right margin is unjustified, indentations of five spaces are from the maximum allowable width of the typed text.

1-3.6.3 Page Numbers. Page numbers are located at the outer (loose-leaf) edge of the page. Even numbers, including zero, are assigned to left-hand pages and odd numbers to right-hand pages.

A blank page shall be assigned a number, but it shall appear on the preceding or following page (i.e., 1-9/(1-10 blank) or (1-9 blank)/1-10).

Pages, tables, and illustrations for chapters are numbered consecutively within each chapter using a two-part Arabic number separated by a hyphen. The first number is the chapter number and the second number indicates the order within the chapter. When a chapter starts with a full page illustration, the illustration may be placed on a left-hand page and the page numbered "zero," i.e., 2-0, 3-0, etc. Manuals divided into chapters and, in turn, divided into sections contain consecutively numbered pages, illustrations, and tables for the entire chapter. Multiple-sheet illustrations are consecutively sheet numbered following the title (i.e., (Sheet 1 of 3), (Sheet 2 of 3), etc.).

1-3.6.4 Headings. Numbers and titles for parts, chapters, and sections are centered at the top of the first page of text for each. Parts and chapters begin on a right-hand page. The Section I heading is centered immediately below the chapter heading; subsequent section headings are centered on the page preceding applicable text.

1-3.6.5 Warnings, Cautions, and Notes. Warnings and cautions (figure 1) must precede (on the same page) the text to which they apply. Notes may precede or follow the text to which they apply depending upon the material to be highlighted. However, to prevent excessive gapping of text, a warning, caution, or note may end on an even numbered (left-hand) page of double-sided text. Warnings, cautions, and notes do not contain procedural steps. The headings are not numbered. When a single warning, caution, or note consists of two or more paragraphs, the heading WARNING, CAUTION, or NOTE is not repeated above each paragraph. If it is necessary to precede a paragraph by a warning and a note, or a caution and a note, etc., warnings shall precede cautions, which in turn shall precede notes. Warnings, cautions, and notes shall be short, concise, and used only to emphasize important or critical data. Normally, no page should end with a warning, caution, or note.

WARNING

Warnings identify an operating or maintenance procedure, practice, condition, or statement, which if not strictly followed, could result in death or serious injury to personnel.

CAUTION

Cautions identify an operating or maintenance procedure, practice, condition, or statement, which if not strictly followed, could result in damage to or destruction of equipment or loss of mission effectiveness, or long-term health hazards to personnel.

NOTE

Notes highlight an essential operating or maintenance procedure, condition, or statement, which is essential, but is not of known hazardous nature as indicated by warnings and cautions.

Do not use notes in lieu of procedural steps. Notes are confined solely for use in narrative or illustrative nonprocedural data. Notes are never used in lieu of WARNINGS or CAUTIONS, nor are they used to modify an action.

1-3.6.6 Tables, Charts, and Graphs. Reference data shall be presented (other than illustrations, drawings, or diagrams) in tabular, chart, or graph form. Charts and graphs are considered illustrations and are assigned figure numbers. When a small amount of tabulated information is to be inserted, and will not require referencing from adjacent text, it may be included within a paragraph of text without identifying it as a table.

A horizontal rule is placed at the beginning (head) and at the end (foot) of a table or chart. The table or chart number and title is centered above the head rule of a table or chart. The first letter of the first word and of each principal word is capitalized; the remaining letters are lowercase. The first letter of the first word of a boxhead title is capitalized; the remaining letters are lowercase. Tables are so designed that related entries in different columns are aligned. Carryover lines are to be indented two spaces.

When a table or chart is continued on a following page, the number and title are repeated at the head of the columns on all following pages of the table, followed by a dash and the abbreviation CONT. Tables may be vertically ruled as required for clarity. Horizontal rules are placed at the beginning and at the end of the table or chart.

1-3.6.7 Illustrations. A manual may contain illustrations such as a frontispiece (assembled view), exploded, operational, procedural, functional, or location views. Artwork must clearly, adequately, and economically portray the information to be illustrated. Illustrative material is used to: describe an item or idea if this can be done more efficiently and effectively by graphic methods; clarify text; present phases difficult to describe by text alone; call attention to details; and furnish graphic identification of parts and tools. Multiple sheet, or sequence number illustrations, in addition to step-by-step operational type, may

be used for depicting disassembly, reassembly, removal, and installation. Locate illustrations as near as possible to the point at which they are first referenced.

Illustrations are assigned figure titles. The title follows two spaces after the figure number and is centered below the applicable illustration. The title shall be short and describe the contents or purpose of the illustration.

Illustrations shall be legible line drawings and must be of raster scanning quality. Blueprints or photographs are not acceptable. Line tracings of photographs are acceptable. Parallel lines on wiring and schematic diagrams must not be less than 1/16 inch apart when reduced to printed size. Callouts (in uppercase type no smaller than 8-point and no larger than 10-point font) are used, when necessary, to identify significant features. Except in chapter 6 where callouts are in numerical disassembly sequence, all callouts must be descriptive or noun names. Leader lines may end close to the callout and object, or may touch the objects to which the lines apply. Lines must be uniform, and as short and straight as possible. Lines must not cross or come in contact with other callout lines nor shall they obscure essential details. Arrowheads may be added for clarity.

Only the use of a pointing hand is acceptable for identifying new or changed items on illustrations.

Designations, diagrams, and graphic and letter symbols must comply with DOD-STD-100 or appropriate industry standards. New designations, diagrams, and symbols not covered by DOD-STD-100 or appropriate industry standards may be used so long as they are explained in the manual.

When an illustration will exceed one page, unless the usefulness of an illustration will be adversely affected, the illustration is divided and planned for presentation on facing pages and numbered as follows: Figure 1-1. Motor (Sheet 1 of 2) and Figure 1-1. Motor (Sheet 2 of 2).

Foldout pages should be avoided if possible. If required, specifications on format for foldout pages will be provided by the contractor. Foldouts are placed at the end of the applicable chapter or at the end of the last chapter in the manual.

1-3.7 Technical Content Arrangement. Manual content shall be arranged in chapters in accordance with the following:

- Chapter 1 - General Information and Safety Precautions
- Chapter 2 - Operation
- Chapter 3 - Functional Description
- Chapter 4 - Scheduled Maintenance
- Chapter 5 - Troubleshooting
- Chapter 6 - Corrective Maintenance
- Chapter 7 - Parts Breakdown
- Chapter 8 - Installation

1-3.7.1 Chapter 1 - General Information. This chapter contains an overall description of the functions and purposes of the equipment. This information is intended for use at the command level and for others requiring a general summary of the equipment or system, its performance, and limitations. This chapter will not include information on operation and maintenance. Figure 1 contains the standard wording for page 1-1 of each manual.

The next numbered paragraph is the introduction which provides an explanation of the purpose and scope of the manual.

The equipment description is non-technical and describes the intended use (why, where, when, how, and with what), capabilities, and limitations of the equipment. Text covering physical description or structural

arrangement is brief, with special attention given to avoiding unnecessary or repetitious details that are easily illustrated. The equipment, or all units of the equipment, can be clearly illustrated and identified.

A pictorial illustration representing the equipment or all units comprising the equipment is included and designated Figure 1-1. The illustration shows the major units of the equipment, relative size of each unit, basic interconnections between units, and their relationship with other equipment.

Reference data is included in tabular form and contains the following:

a. Descriptive (identification plate data) data which identifies manufacturer, type, model, component identification number (CID), and Repairable Identification Code (RIC), if available, as applicable.

b. Functional characteristics, such as: power requirements, horsepower, pressure, capacity, modes of operation, power output, frequency, pulse characteristics, sensitivity, selectivity, and tolerances, where applicable.

c. Capabilities and limitations, such as: pounds of thrust, knots, turning radius, minimum and maximum ranges, degree of coverage, resolution, and accuracy.

d. Rated outputs, such as: wattages, voltages, horsepower, and gallons per minute.

e. Environmental characteristics, such as: ambient temperatures, heat dissipation per unit, humidity limits.

Equipment and systems (such as controls, accessory items, and related publications) which are not furnished with the basic equipment covered by this manual, but which attach or relate importantly to the basic equipment, are described in sufficient detail to establish their correlation with respect to physical and functional interfaces. If applicable, a reference should be made to the appropriate technical manual that contains additional information.

PART 1

TECHNICAL MANUAL PREPARATION GUIDE (TMPG)
FOR CVN68 CLASS AIRCRAFT CARRIERS

(Insert TMIN)

CHAPTER 1

GENERAL INFORMATION AND SAFETY PRECAUTIONS

1-1 SAFETY PRECAUTIONS.

1-1.1 Warning/Caution Usage. Warnings and cautions appearing throughout this manual are of utmost importance to personnel and equipment safety. Thoroughly review and understand all warnings and cautions before making any attempt to operate, maintain, troubleshoot, or repair any part of the (insert name of equipment being covered) (figure 1-1). Refer to the Safety Summary, found in the front matter pages of this manual, for a complete listing of warnings and cautions used throughout the manual.

1-1.2 Warning/Caution/Note Definitions. The following paragraphs define warnings, cautions, and notes as they are used in this manual.

WARNING

Warnings identify an operating or maintenance procedure, practice, condition, or statement, which if not strictly followed, could result in death or serious injury to personnel.

CAUTION

Cautions identify an operating or maintenance procedure, practice, condition, or statement, which if not strictly followed, could result in destruction of or damage to equipment or serious impairment of system operation.

NOTE

Notes highlight an operating or maintenance procedure, condition, or statement, which is essential, but is not of known hazardous nature as indicated by warnings and cautions.

1-1

Figure 1. Chapter 1 Standard Wording

1-3.7.2 Chapter 2 - Operation. Operating instructions include routine and emergency procedures necessary to enable operating personnel to efficiently and effectively use the equipment in accomplishing its designated task. These operating instructions are in sufficient detail to allow operators not specifically trained on the equipment to independently and safely operate it with no special training.

The introduction describes each operator's relationship to the equipment and identifies those units having controls and indicators that the operator is expected to use in the performance of assigned duties. The introduction is supported by illustrations, which identify and locate all operator controls and indicators. The intended function and application of the equipment is fully explained so that the operators will know exactly what they should expect to accomplish with the equipment.

1-3.7.2.1 Controls and Indicators. A description of all operator controls, indicators, protective devices, and jacks shall include the following:

a. Names of panel designations as marked on the equipment.

b. Positions and operating functions for each control and the normal operating condition of each indicator in each of the operating functions.

When more than one operator is required to operate the equipment, their designated position, function, and relationship to the controls and indicators are specified.

1-3.7.2.2 Operating Procedures. Operating procedures include the following:

a. Operator Turn On. All steps necessary to bring the equipment from off through standby condition to full operation.

b. Modes of Operation. Procedures for each mode of operation; e.g., manual, automatic, local, remote, etc. The use and relative advantage of each mode is described.

c. Operation under Interfering Conditions. Describe the equipment antijamming and interference reduction features, the advantages of each feature, and the operating procedures to be followed in all possible situations. Supporting illustrations (such as indicator displays, waveforms, etc.) are included which provide typical observations of jamming and interference for evaluation by the operator.

d. Operator Turn Off. This procedure includes all steps necessary to bring the equipment from full operation through standby to the off condition.

e. Battle-short or Emergency Operation. This procedure covers operating the equipment during emergency conditions; e.g., control failure, air failure, lube oil failure, loss of cooling water, etc. Provide a warning or caution to return the equipment to proper operation when the emergency condition is corrected.

f. Emergency Turn Off. This procedure covers turning the equipment off during an emergency as in cases of fire, water, smoke, hazard to personnel, loss of coolant, normal power, etc.

1-3.7.2.3 Step-by-Step Procedures. Operating procedures are concise, simply worded instructions, and include the following:

a. A short explanation of the operation to be performed.

b. Initial safety requirements (actions, inspections, and emergency turn off procedures).

c. Connection of any accessory equipment not permanently connected.

d. Instructions for obtaining or confirming the presence of all critical inputs such as power, coolant, air, signal, air-conditioning, etc.

e. Procedures for setting controls and making adjustments, which must be accomplished by the operator before equipment turn on.

f. Procedures for determining operational readiness and the acceptable indications expected from built-in indicators such as meters, lamps, and gauges.

g. Milestones in the operational status of the equipment are identified and included by brief statements such as "The generator is now in STANDBY."

h. Visual or aural observations that occur as a result of an operator action, such as boom lowering, sweep rotation, blower motor running, etc.

i. Procedures that can be hazardous to personnel or equipment are emphasized by warnings or cautions placed immediately before the specific step involving the possible hazard. Do not use notes.

j. Illustrative material supporting the procedures identifies and locates all operating controls and indicating devices as well as normal in-use positions or indications.

k. Operator's checks and adjustments in proper sequence.

1-3.7.3 Chapter 3 - Functional Description. Chapter 3 includes a description of how the equipment operates. The description is in simplified technical language and supported by simple line illustrations, preferably on the same page. All illustrated assemblies, subassemblies, and components must be identified by noun names. A building block technique is used to functionally describe the operation of the equipment as follows:

a. Major subassemblies of the equipment are described and illustrated.

b. Interactions of major subassemblies are described and illustrated.

c. Detailed mechanical and electrical functional operation is described and illustrated.

d. A description of how the equipment works or operates is illustrated.

e. Overall and functional block diagrams and descriptions show the major functions of the equipment correlated in a logical manner to show outputs, inputs, cooling, built-in-test equipment, air pressurization, power distribution, etc. Hardware packaging is subordinated to the functional arrangement. The following shall apply:

(1) For multifunction equipments, whether single or multiunit, each major function is represented by a block and pressurization, power distribution, etc. All functions covered in Chapter 5 are shown on this diagram.

(2) The blocks are connected by lines and arrowheads showing the direction of the flow.

(3) Each block is identified by the functional name only.

(4) Each equipment input and output is identified by title. Waveforms are included as applicable.

(5) Modes of operation are identified by title or symbols, as applicable.

f. Functional descriptions of power distribution, power supplies, and regulators include the following:

(1) Briefly, describe conventional electronic circuits and refer to the maintenance schematic diagrams in Chapter 5. Describe alternating current (ac) and direct current (dc) power distribution in detail; support the descriptions by reference to the power distribution diagrams in Chapter 5.

(2) Describe mechanical devices, cooling systems, etc., that support the descriptions by reference to the above specified diagrams.

1-3.7.4 Chapter 4 - Scheduled Maintenance. Figure 2 contains the standard wording for Chapter 4 in its entirety. If Planned Maintenance System (PMS) documentation does not exist for the equipment being covered by the technical manual, the contractor will provide guidance.

1-3.7.5 Chapter 5 - Troubleshooting. Troubleshooting procedures and data contain information necessary for a technician to locate common malfunctions in the equipment. This chapter contains instructions and information necessary to locate common troubles and conduct tests on each component, assembly, or subassembly of the equipment as follows:

a. Troubleshooting guides providing step-by-step procedures for logical isolation of faults. This information directs the technician to observe meters, fuses, circuit breakers, valves, and other available indicators that would indicate the presence of trouble.

b. Complete instructions on signal tracing for electric circuits including the use of special test instruments and unusual servicing techniques.

c. Where appropriate because of equipment complexity, troubleshooting diagrams including schematics giving details of mechanical and electrical assemblies and relationships.

(Insert TMIN)

CHAPTER 4

SCHEDULED MAINTENANCE

4-1 INTRODUCTION.

Scheduled maintenance instructions are furnished in the Planned Maintenance System (PMS). When conflicts exist between this manual and the PMS, the PMS documentation shall take precedence. Such conflicts should be reported immediately, in accordance with maintenance procedures, on one of the Technical Manual Deficiency/Evaluation Reports (TMDERs) found in the back of this manual.

4-2 PLANNED MAINTENANCE SYSTEM.

Recommended preventive maintenance procedures to be performed on a scheduled basis are provided in PMS documentation. OPNAVINST 4790.4 describes the PMS, and also covers departmental and work center record keeping, as well as the Maintenance Index Page (MIP) and Maintenance Requirement Cards (MRCs). The MRCs cover scheduled inspection and lubrication procedures for the (insert equipment/system). The extensive and comprehensive scheduled maintenance information provided by the MRCs precludes the need for detailed coverage within this chapter. Specific corrective maintenance requirements (adjustment, alignment, and repair) are covered in chapter (6) of this manual.

4-1/(4-2 blank)

Figure 2. Chapter 4 Standard Wording

1-3.7.5.1 Diagnostic Troubleshooting. This chapter also provides guidance regarding diagnostic analysis of possible trouble situations wherein malfunction, fault, or failure of the equipment or related equipment could render it inoperative or unable to perform its intended function. This information directs the operator/technician to observe lights, gauges, meters, fuses, circuit breakers, valves, and other available indicators that would indicate the presence of trouble. These instructions also cover tracing-out mechanical system flows and signals in electrical circuits, including the use of special test instruments and unusual servicing techniques. Kinds of troubles may include, but are not limited to, the following:

- Regulation of speed, load, voltage, current, temperature, fluid flow, or vacuum
- Excessive fluid leaks
- Inoperative valves
- Failure to start, operate, or stop equipment or accessories
- Failure of electrical circuit faults (open or closed circuits), circuit elements, readout equipment, or instrumentation
- Malfunction of safety devices
- Excessive vibration
- Bent or bowed rotating elements
- Damaged or broken gear teeth or mechanical or electrical interfaces

1-3.7.5.2 Troubleshooting Charts. Troubleshooting guides in the form of charts are included to enable the technician to quickly identify (in the manual) the trouble or symptoms along with the immediate action to take, the probable cause, and the concurrent follow-on corrective action. Trouble analysis or troubleshooting charts should be included as tables in this chapter (see Figure 3).

When diagrams included elsewhere in the manual are useful troubleshooting tools or aids, they are cross-referenced in the pertinent column of the applicable troubleshooting charts. As applicable, include simplified electrical schematics, piping diagrams, and mechanical schematic diagrams.

Table 5-1. Hydraulic Fluid System Troubleshooting

Malfunction	Probable Cause	Corrective Action
1. Neither hydraulic pump motor starts	Fluid level too low	Check sump tank fluid level and fill as necessary. If level is below 9 inches, fill to normal operating level.
	Temperature too high	Check fluid temperature at all thermometers. If temperature is greater than 120 °F (48 °C), refer to table 5-2, malfunction 1.
2. Both hydraulic pump motors shut down	Pressure too high	Check pressure at all pressure gauges. If pressure is greater than 1,750 psi, refer to malfunction 4.

Figure 3. Troubleshooting Table

1-3.7.6 Chapter 6 - Corrective Maintenance. This chapter contains instructions required to adjust and align the equipment; and remove, repair, reinstall, and align all repairable parts, modules, subassemblies, and assemblies. The instructions identify the action to be accomplished; safety precautions to be observed; special tools, parts, materials, and test equipment required; preliminary control settings; test equipment setup instructions; and step-by-step instructions, with supporting illustrations, to accomplish the maintenance task. If more than three special tools or testing devices are required, present in tabular format, indicating name, part number, and use. Corrective maintenance instructions are provided to the manufacturer's designated lowest repairable level unless this information is included in another technical manual and can be referenced.

Use clear, sharp illustrations to supplement description and maintenance coverage, as required.

a. Typical bearings for rotating or moving equipment.

b. Method of taking clearance measurements, where required.

c. Typical mechanism for absorbing thrust, where applicable.

d. Locking devices, when applicable.

e. Typical seal assembly (pressure and/or vacuum seals or controlled leakage between rotor and casing).

f. Typical assembly of blading to rotor, with lock devices, where applicable.

g. Typical assembly of field poles, laminated core iron, electrical windings, commutator, slip rings, and brush rigging, where applicable.

h. Equipment assembly with upper-casing partially removed.

i. Series of illustrations showing installation of supervisory instruments (such as RTEs in bearings). Include an introduction paragraph to explain the purpose, scope, and arrangement of the corrective maintenance data.

1-3.7.6.1 Section I, Adjustments and Alignment. This section contains all information and procedures required to perform all necessary adjustments and alignments as follows:

a. Operator/non-operator type adjustments.

b. Alignments requiring external jigs, test equipment, or bench setups.

c. Alignments that are accomplished after a repair or replacement of a part or module.

d. Test equipment setup and other illustrations necessary to support the procedures.

1-3.7.6.2 Section II, Repair. The repair section contains all procedures required in the repair of assemblies and repairable parts.

a. Removal, disassembly, and inspection.

b. Repair or replacement of piece parts.

c. Cleaning, reassembly, installation, calibration, and checkout.

d. Exploded view illustrations in top-down breakdown sequence to support the procedures.

e. Repair procedures are arranged in top-down breakdown numeric-alpha unit designation (disassembly) order of the equipment. (See Figure 4.)

1-3.7.7 Chapter 7 - Parts Breakdown. The illustrated parts breakdown (IPB) contains the related parts lists for the equipment covered in this manual. The major equipment/installation and its related assemblies, subassemblies, and component parts and how they physically relate to each other is organized and broken down in disassembly sequence. The chapter's introduction contains the following information: explanation of the models, marks, and modifications; dash numbers; series; or blocks of the article covered by the breakdown. A definition of suitable used on code numbers appearing in the Group Assembly Parts List (GAPL) when more than one variation of equipment is presented in this manual in tabular format. A tabular listing of the abbreviations and acronyms used in the GAPL is presented immediately following the last GAPL in this chapter. An illustration is provided to support the GAPL. This illustration can be either an exploded view (see Figure 4) or a cut-away view identifying all the parts listed in the GAPL, whichever better illustrates part orientation and installation.

1-3.7.7.1 Group Assembly Parts List. As shown in Figure 5, each column of the GAPL contains the following information.

a. The figure and index number column lists in numerical order the figure and index number of each part shown on the corresponding illustration in Chapter 6.

b. The reference designation column lists the manufacturer's established reference designation for each electrical, electronic, hydraulic, or pneumatic part shown on the corresponding illustration. If there are no such parts, the column remains blank.

c. The part number column lists the manufacturer or government part number for all parts shown on the corresponding illustration. Parts shown on the corresponding illustration that are generally available through a variety of commercial sources or vendors have the entry "COML" in this column. This column may also include the entry "NO NUMBER" indicating that the part has no applicable part number but is identified for procurement by the data in the description column. If the part has no applicable part number but is listed on a manufacturer's drawing parts list, the drawing number appears in this column followed by the entry "(DWG)."

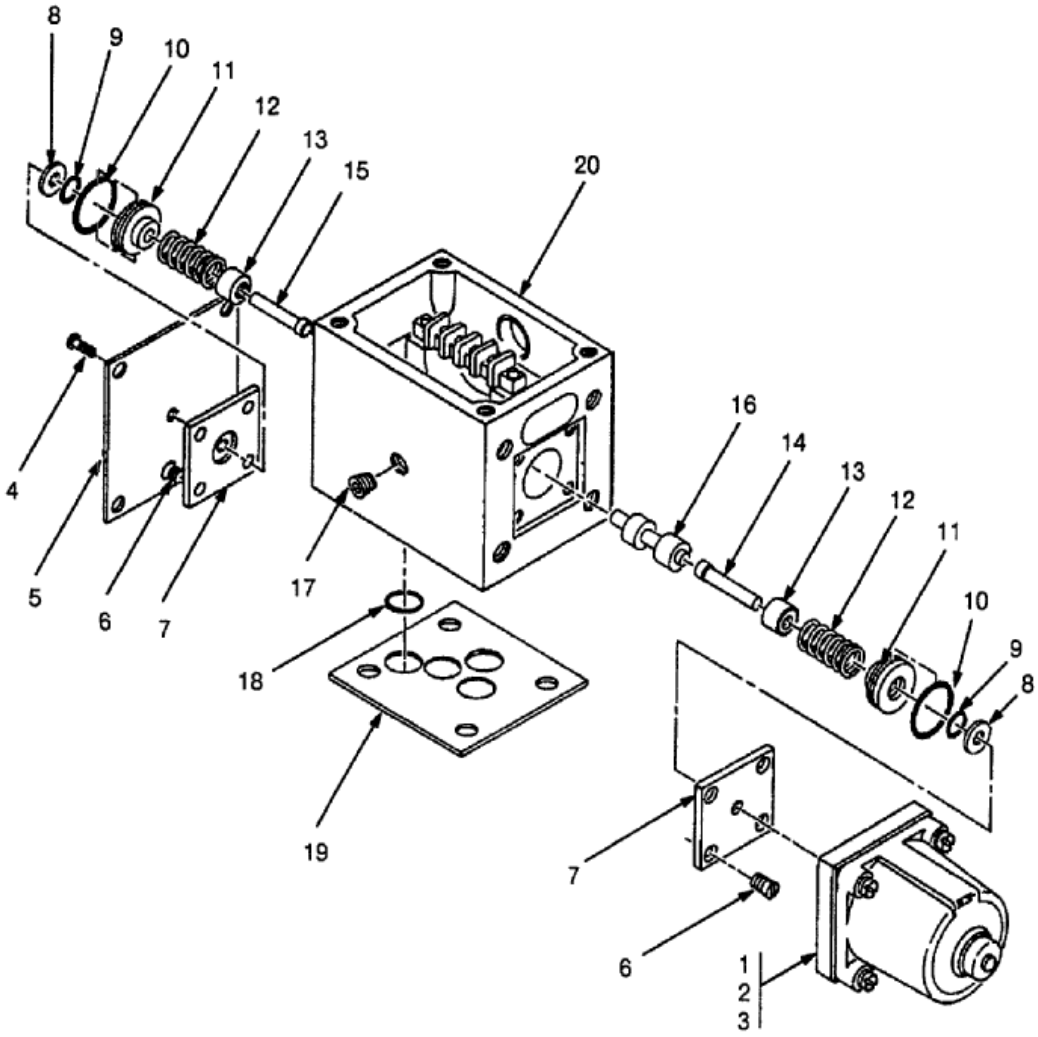

Figure 4. Solenoid Control Valve (Typical)

d. The indent column contains a number to indicate the relationship of individual assemblies, subassemblies, and parts in the breakdown. The top assembly (first item) always has indent code "1." The indent codes increase in number to show the levels of subordination (from assemblies, to subassemblies, to parts). Normally, subordination is not needed beyond indent code "5." The indent sequence is as follows:

(1) An indent "1" indicates an installation, general arrangement, or primary assembly (first item listed). The first item (6-1-0, 6-2-0, etc.) in each GAPL always has indent number "1."

(2) An indent "2" indicates subassemblies or parts that are directly removable from, or associated with, the preceding indent "1" item.

(3) An indent "3" indicates additional subassemblies or parts that are directly removable

from, or associated with, the preceding indent "2" item.

(4) The indent sequence continues in this manner to the lowest order/depth of disassembly.

e. The description column contains descriptions for all parts as illustrated in the applicable disassembly drawings. Wording is arranged so that the identifying noun or key word is always the first part of the description. If the item is an assembly or installation, the word "ASSY" or "INST" immediately follows the noun. This is followed by the balance of the modifying words included in the manufacturer's drawing title or parts list. When a separate illustration is used to show the detail parts of an assembly, the description column contains the appropriate figure cross-reference "(For Details See Fig.__)." This forward cross-reference appears in the listing where the assembly is first described, and a backward cross-reference "(For NHA See Fig.__)" appears in the listing in which the next higher assembly is broken down. In this case, the abbreviation "REF" appears in the quantity per assembly column. The description column may also contain the entry "(AP)", which denotes that the item is an attaching part to the previously listed item having a figure and index number. Use of abbreviations and acronyms is highly desirable in the description column due to space constraints. Where an equipment-unique abbreviation or acronym differs from a MIL-STD-12, or applicable contract specification, abbreviation or acronym, the equipment acronym takes precedence and the MIL-STD-12 noun name is used in this column.

f. The manufacturer's code column lists a number identifying the manufacturer (supplier) of the part. The vendor's identification number is designated in H4/H8 Commercial and Government Entity publication. To provide a convenient reference for users of this manual and facilitate parts procurement as necessary, a list of manufacturers' names and addresses in CAGE code sequence is presented at the end of this chapter.

g. The quantity per assembly column contains one of the following entries: a number, indicating the quantity of the item at the indicated location only; the abbreviation REF, indicating that the required quantity is listed with the figure referenced as next higher assembly (NHA) in the description column; or the abbreviation AR, indicating that the item is used in quantity, size, or length as required.

h. The used on code column contains alphanumeric characters to indicate specific usability by serial, type, model, or series number on the articles for which the breakdown is prepared. If no code appears in this column, the item is applicable to all top assemblies/subassemblies listed in the GAPL.

FIG. & INDEX NUMBER	REFERENCE DESIGNATION	PART NUMBER	INDENT	DESCRIPTION	MFR'S CODE	QTY PER ASSY	USED ON CODE
6-1-0		6371DM2139	1	DEVIATION FIELD METER AC MAGNETIC CONTROLLER	99999	003	
6-1-1	OX, OA, CR, UPX, DNX	6599CM558	2	AC MAGNETIC CONTROLLER CONTACTOR, AC CONT (FOR DETAILS SEE FIG. 6-17)	99999	005	
		COML	3	CAPSCREW, HEX, 3/8-11UNC-2A X 1-1/4 IN (STL) (AP)		004	
6-17-0	OX, OA, CR, UPX, DNX	6599CM5583	1	AC CONTROL CONTACTOR (FOR NHA SEE FIG. 6-1)	99999	REF	
6-17-1		COML	2	NUT, 10-32UNF-3B	99999	004	
6-17-2		COML	2	WASHER, NO 10		004	
6-17-3		COML	2	LOCKWASHER, NO 10 HICOL		004	
6-17-4		COML	2	SCREW, PNH MACH,10-32UNF-2A X 7/16 IN (STL) (AP)		004	
6-17-5		NO NUMBER	2	CASE, CONTRACTOR	99999	002	

FIG. & INDEX NUMBER	REFERENCE DESIGNATION	PART NUMBER	INDENT	DESCRIPTION	MFR'S CODE	QTY PER ASSY	USED ON CODE
6-1-0		9X9XX9X		J-DIAL TELEPHONE	53711	AR	
6-1-1	OX, OA, CR, UPX, DNX	9X9XX9X	2	HANDSET (MIL-C-2212) FOR DETAILS SEE FIG. 6.2)	53711	001	
		COML	2	CORD, TEL HNDST(SPECIFY 4,6,8,12,20 FT, MIL-G-22122)		001	
		PL-125/8	2	PLUG, ELEC CL (MIL-G-2212) (AP)	9XX99	002	

Figure 5. Group Assembly Parts List (GAPL)

1-3.7.7.2 Other Items. Do not list these items:

a. Parts that lose their identities by being welded or joined to other pieces as a permanent unit.

b. Items made from raw (bulk) stocks such as lockwire, bonding braid, upholstery cloth, friction tape, etc.

c. Structural items such as, stringers, stiffeners, skin, doublers, gussets, etc., which serve no purpose in description of parts relationship or attachment of significant procured parts.

1-3.7.7.3 Items Requiring Special Attention. The following items require special attention.

a. Oversize and Undersize Parts. Oversize and undersize parts required and furnished, which are neither interchangeable with nor within allowable production tolerances of the standard size part, are identified as identified in the contract drawing specifications. Descriptive information is included which indicates all dimensional differences.

b. Tolerances for Electrical/Electronic Parts. Percentages or actual values of allowable tolerances for such items as nonmilitary standard resistors, capacitors, etc., are shown as a part of the description expressed as plus and minus values. Example: RESISTOR, FIXED, CMPSN, 1000 OHMS, +5 PCT, -10 PCT, 1/2 W.

c. Undrilled or Untrimmed Parts. Design activity part numbers identified in the contract drawing specification requirements are assigned to each part requiring drilling or trimming before installation. Notes are included in the description column to indicate that such parts require drilling or trimming at time of installation.

d. Matched Parts. Parts which would normally be individually procured (such as gears, cams, hydraulic sleeves and pistons, resistors, and vacuum tubes) but have been machined to fit as a matched set or lapped assembly, or matched electronically to meet circuit requirements, are coded or annotated to indicate the parts are not to be requisitioned separately because they are in a set and that the set of matched items or the next higher assembly must be requisitioned.

e. Quick-Change Units. Items comprising a quick engine change assembly, or other quick-change unit used as a maintenance spare to support the article, are identified by the symbol "QCU" located at the far right of the last line of the description column. Following the breakdown of the group or assembly to which the quick change unit relates, list in a straight-line format all parts required to complete the unit, including those omitted pursuant to paragraph 1-3.7.7.2 as well as adapting parts, except when the quick change unit is to be repaired only at depot level, such as an electronic equipment module. In these cases, no parts listing is made. In all cases, the part number and description of the quick-change kit, if applicable, follows the breakdown of the quick-change unit.

f. Government Standard Items Containing Nonstandard Detail Parts. Items covered by Government standard drawings, including assembly drawings, are listed under the Government standard assembly part number except when the item contains repair parts that are not designated by Government detail design drawing numbers. In such cases, the item is identified by the design manufacturer's part number in the part number column and the Government standard part number, when known, is shown in the description column.

g. Government Standard Parts. Government standard parts are listed by the applicable MS, AN, AF, NAF, MIL, or JAN part number or specification number in the order of preference indicated in the contract drawing specifications. Complete Government numbers, including prefixes and suffixes to the basic number, are shown in the part number column.

h. Altered, Selected, or Source-Controlled Government Standard, Vendor, and Commercial Items. When any Government standard, vendor, or commercial item is altered or selected, or is a source-controlled item because of special fit, tolerance, weight, or reliability of performance, the part number of the design activity responsible for the alteration, selection, or source control appears in the part number column. Repainting, reidentifying, or other nonsignificant operations are not considered alterations, selections, or source controls.

i. Commercial Hardware. Commercial hardware procurable from normal commercial sources and not identifiable as Government standard is identified in the part number column by the manufacturer's part number. If a part number has not been assigned, the item is identified as commercial by the symbol "COML" in the part number column and identifying information such as dimensions, size, material, type, special features, and commercial catalog number is entered following the description. Such information must be sufficiently complete to enable the procuring activity to make replacement procurements from commercial sources.

1-3.7.7.4 Similar Assemblies. If right and left, top and bottom, front and rear, or other similar or symmetrically opposite assemblies contain a majority of identical parts, the assemblies are combined and broken down as follows:

a. Both assemblies are listed first, followed by the detail parts in disassembly order.

b. Parts peculiar to only one assembly shall have indicated, by code, footnote, or description, the assembly of which they form a detail.

c. Parts identical but differing in quantity per assembly are listed separately and are coded or explained by footnote or explained in the description column.

d. Parts identical and used in the same quantity are listed only once, and the units per assembly column shows the quantity required for one assembly only.

e. If a sufficient number of parts are not identical to both assemblies, or if the continuity of indention cannot be maintained by combining the listings, such assemblies are broken down separately.

1-3.7.7.5 Symmetrically Opposite Parts. Symmetrically opposite parts are identified in accordance with the contract drawing specifications. Symmetrically opposite parts are listed on separate lines.

1-3.7.7.6 Articles Without Part Numbers. Type and model numbers for equipment of Navy Commands such as, Naval Sea Systems Command, are not listed in the part number column. The phrase "NO NUMBER" is inserted in the part number column in these cases. The type and model designation are entered in the description column.

1-3.7.7.7 Vendor Items. When vendor items are listed, the vendor's part numbers are entered in the part number column. Vendor items are those used by the contractor exactly as produced by the vendor. The last sentence of 1-3.7.7.3.h regarding nonsignificant operations applies.

1-3.7.7.8 Redesigned Parts. When the design or the material of a part is changed to the extent that interchangeability or physical or functional performance is affected, the new part number assigned in accordance with the contract drawing specification is listed. The original part is omitted when not authorized for continued use. If the original part has continued application, the applicable model, block numbers, and serial number of the items on which the part is usable are indicated by the used on code system. Such notes as "ALTERNATE FOR" or "USE UNTIL EXHAUSTED" should follow the description as applicable.

1-3.7.7.9 Parts Kits. When repair parts for the article or for repairable units within the article are to be supplied in the form of kits, a part number is assigned to each kit in accordance with the contract drawing specification requirements. An appropriate notation is inserted in the description column, following the description of the article or unit for which the kit is supplied, of the fact that parts kit(s) is available.

1-3.7.7.10 Dimensions. When units of measurement are the same, they are not repeated with each dimension. Example: "1/8 x 21/32 inch". To avoid confusion, a hyphen is used between a whole number and a fraction. Example: "1-1/8, 2-3/32, 4-9/64". When a decimal with a value of less than 1.0 is given, a zero precedes the decimal point.

1-3.7.7.11 Attaching Parts. Attaching parts are assigned index numbers consistent with index numbers assigned in the breakdown and are exploded only when the assembly procedure is hidden and sufficiently complex to merit explosion. If the attaching parts are not visible in the illustration (for example, the nuts attaching a transformer will not be visible on a chassis top view), a consolidated callout (one index number assigned to an attaching parts group, such as nut, bolt, washer) may be used with the leader line terminating on the visible attaching part.

1-3.7.8 Chapter 8 - Installation. Drawings and information concerning installation are provided in this chapter. Include the following types of information: site selection, or installation location guide lines (such as moisture precautions and maximum temperature allowed as appropriate), special tools and materials requirements, unpacking and handling (if unusual procedures or precautions are required), preparation of foundations, mechanical assembly procedures, mounting instructions, bolting diagrams, safety precautions, grounding and bonding, clearances for access, ventilation, fluid-cooling requirements, clearances for motion under shock, recommendations for reduction of electrical and electromagnetic interference, and other interface requirements, as applicable. In addition, provide coverage for tests and test procedures required to demonstrate the equipment after installation is capable of satisfying operational requirements.

1-3.7.8.1 Installation Drawings. Installation drawings provided in digital format (Selected Record Drawings, etc.), which are available to operator/maintenance personnel, are listed for use in completing equipment installations and consist of the following:

a. Drawing list.

b. Block diagram.

c. Outline and installation drawing.

(1) Ensure the crated (if available) and uncrated height, width, and depth in inches (or inches and centimeters) of each unit or accessory is provided.

(2) Ensure the crated (if available) and uncrated weight and volume in cubic feet of each unit or accessory is provided.

d. Auxiliary cooling diagram.

e. Auxiliary dry-gas diagram.

f. Cable-running sheets.

g. Summary list of installation material.

h. RF transmission line diagram.

i. Hydraulic fluid piping diagram.

1-3.7.8.2 Site or Installation Location Information. Include date supplemental to the installation drawings. If all site information is contained on the installation drawings, reference the applicable drawing(s) by figure number.

1-3.7.8.3 Unpacking and Repacking. Include information supplemental to the installation drawings regarding unpacking and repacking. Include step-by-step procedures to prevent damage to the equipment or injury to personnel. Provide supporting illustrations to clarify procedures. When packing for reshipment is required, include step-by-step procedures for packing. When packing is simply the reverse of unpacking, this fact need only be stated. Provide any special environmental conditions required for storage. Include instructions for items in the following categories:

a. Depreservation procedures required at time of installation.

b. Represervation packaging required before repacking for storage or shipment.

c. Intricate mounting, blocking, or bracing.

d. Special cushion inserts.

e. Repairable items.

f. Sensitive or fragile components.

g. Items held in special cradles.

h. Items furnished in reusable containers.

i. Special environmental conditions required for storage.

j. Special handling procedures required.

k. Container storage or disposition instructions, as applicable.

Provide instructions sufficiently detailed to prevent handling damage to the equipment or injury to personnel. In addition, step-by-step procedural illustrations may be used to supplement the packing and handling instructions.

1-3.7.8.4 Installation Procedures. Provide supplemental information, which is not provided on the installation drawings, as follows:

a. Instructions required to assemble units.

b. Instructions required to mount units. Include bolting and bracing diagrams and data on shock mounts.

c. Instructions for making electrical, plumbing, transmission line, and all other external interface connections to the equipment.

d. Instructions for interconnecting units comprising the equipment.

e. Servicing procedures, such as initial lubrication.

f. Instructions for bonding and grounding.

g. Instructions for checking the installation of the equipment prior to initial operation.

h. Instructions for initial startup of the equipment and verification of all operating modes, including shutdown.

Provide the necessary instructions to allow personnel to ensure that the equipment has been properly installed in all respects and is ready for operation. Include step-by-step procedures to initially energize, test, operate, and secure the equipment in all operational modes. If the operating procedures in Chapter 2 provide the required information, they may be referenced rather than repeated.

1-4 MANUALS CONTAINING NAVAL NUCLEAR PROPULSION INFORMATION (NNPI) AND CLASSIFIED MATERIAL.

The contractor will work with vendors to develop NNPI and classified material manuals in accordance with applicable security regulations.

1-5 VALIDATION.

Validation of new or revised technical manuals is not required, unless specifically listed in the purchase order. If for any reason it is unclear as to the validation requirements, the vendor should contact Northrop Grumman Shipbuilding (NGS) for clarification:

- Non-Nuclear - Life Cycle Engineering Department at (757) 688-2031
- Nuclear - Purchasing Department

1-5.1. Validation Procedures. Validation shall be accomplished at the vendor's facility in accordance with contract requirements. It will include checking artwork in the manual against the actual equipment and actual performance, on one unit of a type, of the instructions in the manual relating to:

a. Assembly/disassembly and internal repair. Actual performance is required only where correct and orderly procedures cannot be readily determined by observations and reference to drawings.

b. Installation procedures.

c. All modes of operations.

d. Maintenance (in addition to assembly/disassembly requirements in step a above, validation must also consider accessibility of grease fittings and other routine maintenance points, suitability of alignment procedures, and as appropriate, adequacy of overhaul space limitations, etc.).

e. Compliance with applicable material and equipment specification requirements.

Validation does not include demonstration of any procedure which:

a. Results in destruction of material, such as removal of boiler tubes, or boring, grinding or other shaping repair procedures.

b. Requires actual removal of parts where the adequacy of internal accessibility and performance can be determined by measurement, observation, and reference to drawings.

c. Requires emergency or damage control operating procedures that would endanger material or personnel.

d. Entails excessive costs not encountered in the normal operation of the ship. Excessive costs will be construed to include the provision of aircraft, submarines, oilers, and other Naval ships for tests, unless furnished by the Government.

NOTE:

It is realized that there will be cases when validation of some procedures cannot be accomplished at the vendor's facility or that it will be impractical to do so due to the nature of the equipment. In these cases, the vendor shall advise the purchaser of the validation procedures which will not be performed and provide justification for not accomplishing the validation as soon as practicable and no later than delivery of the manuscript.

1-5.1. Validation Certificate. For manuals requiring validation, a Validation Certificate is to be provided and included in the final reproducible copy. The Validation Certificate will contain the following information as a minimum:

a. Both the Shipbuilder's and the vendor's full identification.

b. Purchase order numbers and technical manual identification numbers (NAVSEA/TMIN) and title.

c. Chapters and sections validated and date(s) accomplished.

d. Chapters and sections not validated. Justification for noncompliance must be delineated in separate correspondence.

e. Signature and authority of person validating.

The contractor will work with the vendor to develop all required validation forms.

1-6 VENDOR PRELIMINARY DELIVERABLES.

NOTE:

Where electronic media is specified, only AutoCAD (*.dwg format) and Microsoft Word 6.0/95 or later is acceptable.

1-6.1 Preliminary Manual/Change Package. Four (4) paper copies and one (1) electronic copy (CD-ROM) of all preliminary manuals are required for Navy approval and assignment of Technical Manual Identification Number (TMIN). For commercial manuals, see paragraph 1-2 herein.

1-6.2 Approval and Procurement Record (A&PR) Page. If changes or modifications to existing manuals are not required to reflect the delivered equipment configuration, four (4) copies of the updated A&PR page are to be submitted.

1-6.3 Motor and Controller Inserts. Three (3) final reproducible copies (FRC) and one (1) electronic copy (CD-ROM) of motor and controller inserts are required when applicable.

One (1) paper copy of the preliminary manual will be marked by the shipbuilder to reflect review comments and returned to the vendor for use in completing the FRC.

1-7 FINAL REPRODUCIBLE COPY OF MANUALS.

NOTE:

Where electronic media is specified, only AutoCAD (.dwg) and Microsoft Word 6.0/95 or later is acceptable.

Unless otherwise specified after approval of the preliminary manual, it is the intent of the purchase order and this appendix, which forms a part thereof, to obtain for each manual one (1) electronic copy and one (1) paper copy of suitable printing media (FRC) to enable electronic and mechanical printing of the final manuals.

When changes involve only one side of a page, an FRC copy of the obverse page (or backing page) shall also be provided.

NOTE:

Xerographic copies will not be accepted for the FRC. The FRC shall be an original black/color on white copy.

The quality of the FRC shall be such that electronic and mechanical copies produced therefrom will have a clear, sharp, distinct definition.

1-8 PRINTING.

Printing of final publications or portions thereof and final revisions or changes thereto by the Shipbuilder or his sub-contractors (vendors) is prohibited unless they are prepared and carried by equipment manufacturers for regular commercial or military sale or use, require no significant modification, and are normally supplied for the equipment.

1-9 PACKAGING AND DELIVERY.

Text pages and text page-sized material are to be packed flat, not folded or rolled. Since the FRC is expected to be the original or equal, it should be securely wrapped to prevent damage in the mail and insured. Foldout pages are preferred flat, but are acceptable rolled provided they are rolled on a rigid tube or stiffener of sufficient size to prevent kinking or distortion of the edges.

Electronic media deliverables (CD-ROM) shall be packed in accordance with accepted industry standards (e.g., in a sturdy sleeve or box and securely wrapped to prevent damage in the mail and insured). The

package will be distinctly marked to preclude the use or proximity of X-ray and/or magnetic equipment, which could destroy the imprinted materials. Disks may be packaged and shipped with FRC text, provided sufficient packing material is provided to prevent damage during shipment.

It is preferred that the Northrop Grumman Shipbuilding (NGS) purchase order number not be shown on the outside of the package or mailing tag.

All classified data must be packaged and handled in accordance with applicable Government security regulations.

Commercial manuals shall be packaged and packed for domestic bulk (not individually wrapped) shipment consistent with good commercial practice to ensure receipt at Northrop Grumman Shipbuilding (NGS) in a dry, clean condition. The packages or cartons should be addressed as for final reproducible copies.

PART 2

SUMMARY OF TECHNICAL MANUAL CONTRACT REQUIREMENTS (TMCRS) FOR VENDOR EQUIPMENT OR SYSTEM MANUALS

2.1 PURPOSE.

This document will provide sellers (vendors) a ready reference to use as a guide for developing technical manuals to ensure the format and content requirements of the applicable Technical Manual Contract Requirements (TMCRs) are met. This document is intended to be used a guide only. Vendors should consult the applicable TMCR(s) for specific information regarding technical manual format and content requirements.

2.2 TECHNICAL MANUAL DEVELOPMENT MILESTONES.

2.2.1 Narrative Outline and Book Plan (for New Technical Manuals Only). A narrative outline and book plan will be provided to the buyer (Northrop Grumman Shipbuilding (NGS)) and Government for review and approval for each new technical manual before developing the preliminary copy. This will provide Northrop Grumman Shipbuilding (NGS) and the Government the opportunity to ensure technical data required in the technical manual is reflected in the narrative outline and book plan before preliminary technical manual development.

2.2.2 Preliminary Technical Manual. A preliminary technical manual will be provided to NGNN and Government for review and approval to ensure fulfillment of all technical manual format and content requirements, and to be used for interim support of equipment or systems prior to delivery of Final Reproducible Copies (FRCs).

2.2.3 Final Reproducible Copy (FRC). Final technical manuals will be developed ready for reproduction and publication with all necessary changes incorporated as a result of engineering reviews and desktop validation, including Government conditions for acceptance or approval.

2.3 VENDOR DELIVERABLES.

The various types of technical manuals provided for the contract shall be prepared and submitted in accordance with the applicable requirement(s) specified herein. The vendor shall deliver to Northrop Grumman Shipbuilding (NGS) the following technical manual deliverables for each technical manual:

- Narrative Outline and Book Plan (new technical manuals only)
- Preliminary Technical Manual Copy
- In-Process Review (IPR) Copy (as required)
- Final Reproducible Copy (FRC)

2.4 REFERENCES.

The following TMCRs are applicable to the associated contracts.

PART 2

SUMMARY OF TECHNICAL MANUAL CONTRACT REQUIREMENTS (TMCRS)
FOR VENDOR EQUIPMENT OR SYSTEM MANUALS

Table 2-1. CVN70 (N0110) TMCR References

TMCR Number	TMCR Title
NDMS-010197-000	Master TMCR
NDMS-010197-001	TMCR for Commercial Off-The-Shelf (COTS) Manuals
NDMS-010197-003	TMCR for HM&E Equipment
NDMS-010197-004	TMCR for Electronic and Interior Communication (IC) Equipment
NDMS-010197-005	TMCR for HM&E or Electronic and Interior Communication (IC) Systems Technical Manual
NDMS-010197-006	TMCR for Digital Systems
NDMS-010197-007	TMCR for Digital Equipment
NDMS-010197-008	TMCR for SIB/TM Change Package
NDMS-010197-009	TMCR for TM Update Revision

Table 2-2. CVN71 (N0111) TMCR References

TMCR Number	***TMCR Title***
NDMS-060115-000	***Master TMCR***
NDMS-060115-001	***TMCR for Commercial Off-The-Shelf (COTS) Manuals***
NDMS-060115-003	***TMCR for HM&E Equipment***
NDMS-060115-004	***TMCR for Electronic and Interior Communication (IC) Equipment***
NDMS-060115-005	***TMCR for HM&E or Electronic and Interior Communication (IC) Systems Technical Manual***
NDMS-060115-006	***TMCR for Digital Systems***
NDMS-060115-007	***TMCR for Digital Equipment***
NDMS-060115-008	***TMCR for SIB/TM Change Package***
NDMS-060115-009	***TMCR for TM Update Revision***

2.5 GENERAL REQUIREMENTS.

Technical manuals shall be supplied in accordance with the applicable TMCR when the requirement for a technical manual is invoked in the NGNN equipment purchase order. Technical manual requirements may be fulfilled using existing Government or commercial manuals conforming to the guideline identified herein or by developing a new technical manual in accordance with the applicable TMCR. Develop a new technical manual only if an existing, Navy-approved technical manual cannot be modified to meet the

equipment or application requirements of the purchase order.

COTS technical manuals for laundry and food service equipment (as determined via COTS TMCR NDMS-010197-001, paragraph 3.0 **for *CVN70 and NDMS-060115-001, paragraph 3.0 for CVN71***) shall be prepared with preference to American Society of Testing Materials (ASTM) F760-93 and forwarded, via NGNN, to the Government for validation against the equipment. This is to facilitate a timely approval process. All other COTS manuals will be prepared in accordance with Data Item - Technical Manual Specifications and Standards (DI-TMSS) 80527A and do not require Government approval. It is not the intent of this document to require equipment suppliers to develop new COTS technical manuals when a COTS technical manual containing adequate installation, operation, maintenance, and repair information (including parts lists) meeting the requirements of ASTM F760-93 or DI-TMSS 80527A, as applicable, exists.

A technical manual change must be developed if a Navy-approved technical manual exists. The maximum use of existing manuals is expected and encouraged. If equipment to be supplied is identical or nearly identical to equipment supplied under a previous Government contract, and is supported by an existing, Navy-approved technical manual, the vendor has two options. The vendor may either propose the existing technical manual be extended as is (as long as the existing, Navy-approved technical manual covers the equipment being purchased by this purchase order in its entirety without change to any front matter, text, illustrations, drawings, or part numbers), or provide change pages incorporating the actual equipment configuration (new components or modifications to existing components), as applicable. If change pages to existing manuals exceed 25 percent of the total pages in the publication, a revision to the existing manual will be required.

2.6 NARRATIVE OUTLINE AND BOOK PLAN.

Technical manual narrative outlines and book plans shall be developed and submitted for new technical manuals only and shall be developed in accordance with the Master TMCR and applicable subordinate TMCR. Narrative outlines and book plans shall be submitted to the Government, via NGNN, for acceptance prior to developing the preliminary technical manual. If rejected, the unacceptable portions shall be corrected and resubmitted for Government approval.

2.6.1 Narrative Outline Requirements. The narrative portion of the narrative outline shall indicate the planned technical manual development approach, identify which options are permitted by the contract, and specify options the vendor is electing to pursue. The narrative outline shall contain the following:

a. A text outline that shall be in accordance with the requirements of the applicable TMCR, showing volume, part, chapter, section, and paragraph titles to indicate the intended coverage of the various aspects of the equipment or system. Each paragraph title shall be followed by a brief statement outlining the information to be presented. The text outline shall clearly state the specific equipment or system and related procedures and data planned for inclusion in the manual.

b. An illustration outline and a table outline keyed to the text outline. Each illustration and table listed in the outlines shall be described. The illustration outline shall contain figure numbers, title, intent of the illustration, and approximate size and nature of the illustration (e.g., exploded view, schematic, line drawing). The table outline shall describe the tables by table number and information content.

c. An estimated page count and a statement indicating the scope, depth, or coverage for each chapter.

d. A synopsis of the validation approach to the manual content based on a plan for use as supplied by the Government and a logistics support analysis of the equipment. The synopsis shall indicate coverage on a comprehensive and systematic basis of the most effective and efficient method of performing necessary maintenance. The synopsis shall be correlated to the Logistics Support Analysis Requirements (LSARs) (if available) by direct referencing.

e. For equipment requiring overhaul:

(1) The approach to be used in presenting the overhaul strategy shall be described. A repair process flow chart shall be used to present the overhaul strategy.

(2) The range and depth of outline coverage shall be based upon the LSARs, reliability centered maintenance program of the equipment, and the complexity of the planned overhaul and shall include:

(a) The minimum procedures and testing requirements to ensure the Class B overhaul can be performed in an efficient manner by a journeyman-level technician.

(b) The minimum mandatory replacement parts consistent with the required period between planned overhauls.

f. For compound equipment, the preferred method of data presentation is to divide the equipment into functional assemblies and their associated subassemblies. Each functional assembly should be contained in a separate volume. It may be considered appropriate to present the test data record sheets for each functional assembly as a separately bound part of a volume. For hull, mechanical, and electrical (HM&E) equipment, include examination, test, and repair action record data sheets in a separately bound part of a volume for each functional assembly.

g. The outline shall fully represent all content requirements.

h. Problems regarding TMCR requirements, interpretation, and/or application shall be identified.

i. Conflicts between guidance documents shall be highlighted.

2.6.2 Book Plan Requirements. The book plan shall portray the planned technical manual coverage by volume, part, division, etc., and shall reflect the narrative outline. The book plan shall be developed based on the development of a table of contents for each planned volume (including separately bound parts of that volume). The book plan shall contain the following:

a. A text guide listing chapter, section, and informative paragraph titles. A brief statement outlining the content and intended coverage shall follow each chapter, section, and paragraph title.

b. A list of illustrations and a list of tables keyed to the text plan. Each illustration and table listed shall be described. The illustration plan shall contain figure numbers, title, information content, and approximate size and nature for all illustrations (such as schematic, line drawing, and exploded view). A sample of each drawing type referenced in the illustration plan shall be included.

c. The estimated total number of text and illustration pages per chapter shall be listed.

d. A list of front matter to be developed, including a brief description of the material to be presented in the foreword.

e. Data required for the technical content portion of the manual outlining the planned coverage by proposed volumes, parts, divisions, etc., in accordance with the content and format requirements of the applicable TMCR.

2.6.3 Narrative Outline and Book Plan Submittals. All narrative outlines and book plans shall be submitted for NGNN and Government review and approval in accordance with Master TMCR requirements. Any unapproved sections shall be corrected by the vendor and resubmitted. This process shall continue until the entire narrative outline and book plan is approved.

When specified or approved by the Government; an existing, Navy-approved technical manual covering similar equipment may be used as a model to develop the narrative outline and book plan for a new technical manual. The existing, Navy-approved technical manual table of contents shall be marked up to show any required changes, as applicable. Text from the existing technical manual may be used verbatim with changes to cover equipment differences and to correct inconsistencies, unclear wording, or obvious editorial or typographical errors. However, the format requirements in the applicable TMCR shall apply to all new technical manuals developed for the availability. Narrative Outline and Book Plans shall be submitted, via NGNN, to the Government for review and approval. All inconsistencies, unclear wording, or errors noted in the existing manual shall be identified in the marked up copy submitted to the Government for review and approval. All deviations from the existing manual shall be approved by NGNN and the Government.

2.6.4 Narrative Outline and Book Plan Updates. The narrative outline and book plan shall be kept up-to-date throughout development of the preliminary technical manual, until accepted. Significant changes to the narrative outline and book plan shall be submitted, via NGNN, for Government review and approval. Improved data presentation shall be a prime justification for developing changes to the narrative outline and book plan.

2.6.5 Narrative Outline and Book Plan Approval. All narrative outline and book plans shall be submitted, via NGNN, for Government review and approval. Any unapproved sections shall be corrected by the vendor and resubmitted. This process shall continue until the entire narrative outline and book plan is approved. The Government-approved narrative outline and book plan then become supplementary specifications to the applicable TMCR to be used to develop the preliminary technical manual. Narrative outlines and book plans will be compared with preliminary technical manuals at the In-Process Review (IPR) (if required). Acceptance of the narrative outline and book plan by the Government shall not waive any technical manual requirements within the scope of the contract.

2.7 IN-PROCESS REVIEWS (IPRs).

IPRs will be convened for technical manuals to provide a mechanism to ensure coordination between the Government and NGNN during technical manual development. These government-initiated reviews permit early detection of problems in scheduling, contract interpretation, specification requirements, and/or maintenance concepts. IPRs can be authorized quarterly and convened by the Government at NGNN or, if approved by the Government, at a designated Government facility. Only technical manuals that have been reviewed, desktop validated, and have received preliminary approval by NGNN at the time of the Government's request will be eligible for an IPR. NGNN will coordinate the time, date, and place of the IPR. The contractor and vendor will support IPRs and provide access to materials used to develop technical manuals, to include preliminary and final products. At a minimum, IPRs will include evaluation of:

- Source data
- Narrative outline and book plans
- Modes of presentation
- TMCR compliance
- Modes of preparation
- Complete documentation (text and artwork) format and technical content
- Readability

2.8 TECHNICAL MANUAL DEVELOPMENT.

2.8.1 New Preliminary Technical Manual Development. New preliminary technical manuals will be developed using the format and technical content requirements as called out in the applicable TMCRs listed in table 2-1. All deviations from contractual specifications must be annotated in the individual narrative outline and book plan for each technical manual and approved by the Government.

NOTE

Changes to an existing, Navy-approved technical manual will be developed using the existing size, content, and format arrangement in accordance with the base technical manual as noted in TMCR No. NDMS-060115-008**,** TMCR for SIB/TM Change Package (refer to paragraph 2.8.2).

NOTE

Revisions to an existing, Navy-approved technical manual will be developed using the existing size, content, and format arrangement in accordance with the base technical manual as noted in TMCR No. NDMS-060115-009**,** TMCR for TM Update Revision (refer to paragraph 2.8.3).

Standard page size shall be 8-1/2 x 11 inches. Front matter, text, illustrations, drawings, and tables shall be final size, complete with titles and figure or table number, in accordance with the applicable TMCR.

The words PRELIMINARY ISSUE shall be placed on the title page above the Technical Manual Identification Number (TMIN). Letters shall be 18-point boldface type and capitalized.

The TMIN will be listed at the upper outer edge of all pages (in the header) except title and blank pages. The TMIN will be listed at the upper outer segment of all foldouts.

Page numbers (normal type) shall be located at the lower outer edge. Even page numbers, including zero, shall be assigned to left-hand pages and odd page numbers to right-hand pages. The page number for a foldout page shall be so placed (lower outer edge ending at the outside margin) that the number will be visible when the printed page is folded. Blank page numbers will be formatted as follows: 1-9/(1-10 blank).

Chapters shall be identified by chapter number (Arabic), hyphen, and successive page number. Sections shall be numbered using Roman numerals. Paragraphs shall be numbered with decimals only (no hyphen).

Proper classification markings shall appear on every page (top and bottom), if applicable.

The United States Government Printing Office (GPO) Style Manual 2000 shall be used for capitalization, punctuation, compounding of words, numerals in the text, and spelling of non-technical words.

PART 2

SUMMARY OF TECHNICAL MANUAL CONTRACT REQUIREMENTS (TMCRS) FOR VENDOR EQUIPMENT OR SYSTEM MANUALS

Copies shall be loose-leaf bound in pressboard or equivalent binders. Unclassified preliminary copies may be duplicated, loose-leaf bound, and delivered in accordance with the applicable TMCR. The method of duplication, covering, and binding shall provide legible, collated copies.

The delivery of the preliminary technical manual does not relieve the vendor of any contractual requirements pertaining to delivery of complete, adequate, and accurate FRCs.

2.8.1.1 Front Matter. Front matter for technical manuals shall be prepared in accordance with the applicable TMCR, and shall include the following in the order provided.

- Title Page
- Record of Revisions
- Table of Contents
- List of Illustrations
- List of Tables
- Foreword/Preface/Introduction
- Safety Summary (as applicable)

For front matter following the Title Page, use lower case Roman numerals for page numbers (e.g., i, ii, iii, etc.).

2.8.1.1.1 Title Page. The title page for preliminary technical manuals shall meet the content and format requirements in accordance with the applicable TMCR. Unclassified technical manuals prepared for the Government shall have the following on the title page:

DISTRIBUTION STATEMENT C:	**DISTRIBUTION AUTHORIZED TO U.S. GOVERNMENT AGENCIES AND THEIR CONTRACTORS; ADMINISTRATIVE/OPERATIONAL USE; (LATER). OTHER REQUESTS FOR THIS DOCUMENT SHALL BE REFERRED TO NSWC, PHILADELPHIA (CODE 944).**
WARNING:	**THIS DOCUMENT CONTAINS TECHNICAL DATA WHOSE EXPORT IS RESTRICTED BY THE ARMS EXPORT CONTROL ACT (TITLE 22, U.S.C. SEC. 2751 ET. SEQ.) OR THE EXPORT ADMINISTRATION ACT OF 1979, AS AMENDED, TITLE 50, U.S.C., APP. 2401 ET SEQ. VIOLATIONS OF THESE EXPORT LAWS ARE SUBJECT TO SEVERE CRIMINAL PENALTIES. DISSEMINATE IN ACCORDANCE WITH PROVISIONS OF DOD DIRECTIVE 5230.25.**
DESTRUCTION NOTICE:	**DESTROY BY ANY METHOD THAT WILL PREVENT DISCLOSURE OF CONTENTS OR RECONSTRUCTION OF THE DOCUMENT.**

PUBLISHED BY DIRECTION OF COMMANDER, NAVAL SEA SYSTEMS COMMAND

Unclassified technical manuals prepared for the Government that contain NOFORN information shall have the following on the title page:

WARNING:	**THIS DOCUMENT CONTAINS TECHNICAL DATA WHOSE EXPORT IS RESTRICTED BY THE ARMS EXPORT CONTROL ACT (TITLE 22, U.S.C. SEC. 2751 ET. SEQ.) OR THE EXPORT ADMINISTRATION ACT OF 1979, AS AMENDED, TITLE 50, U.S.C., APP. 2401 ET SEQ. VIOLATIONS OF THESE EXPORT LAWS ARE SUBJECT TO SEVERE CRIMINAL PENALTIES. DISSEMINATE IN ACCORDANCE WITH PROVISIONS OF DOD DIRECTIVE 5230.25.**

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SUMMARY OF TECHNICAL MANUAL CONTRACT REQUIREMENTS (TMCRS)
FOR VENDOR EQUIPMENT OR SYSTEM MANUALS

DESTRUCTION NOTICE: **DESTROY BY ANY METHOD THAT WILL PREVENT DISCLOSURE OF CONTENTS OR RECONSTRUCTION OF THE DOCUMENT.**

NOFORN: THIS DOCUMENT IS SUBJECT TO SPECIAL EXPORT CONTROLS AND EACH TRANSMITTAL TO FOREIGN GOVERNMENTS OR FOREIGN NATIONALS MAY BE MADE ONLY WITH PRIOR APPROVAL OF THE NAVAL SEA SYSTEMS COMMAND.

PUBLISHED BY DIRECTION OF COMMANDER, NAVAL SEA SYSTEMS COMMAND

2.8.1.1.2 Foreword. The foreword shall briefly describe the purpose and scope of the technical manual. It shall indicate the structure of the technical manual by containing a list of the numerical designations and titles for all volumes, parts, chapters, and sections. The foreword shall contain the following statement:

Ships, training activities, supply points, depots, naval shipyards, and Supervisors of Shipbuilding are requested to arrange for the maximum practical use and evaluation of NAVSEA technical manuals. All errors, omissions, discrepancies, and suggestions for improvement to NAVSEA technical manuals shall be reported to Commander, NAVSURFWARCENDIV NSDSA, Bldg 1388, Code 310 TMDER, 4363 Missile Way, Port Hueneme, CA 93043-4307 on NAVSEA/SPAWAR Technical Manual Deficiency/Evaluation Report (TMDER), NAVSEA Form 4160/1 (Rev. 7-2003). To facilitate such reporting, three copies of NAVSEA Form 4160/1 are included at the end of each technical manual. All feedback comments shall be thoroughly investigated and originators will be advised of action resulting there from. Extra copies of NAVSEA Form 4160/1 may be requisitioned from the Distribution Depot Susquehanna Pennsylvania (DDSP), 5450 Carlisle Pike, Mechanicsburg, PA 17055-0789.

Activities may submit or get copies of NAVSEA Form 4160/1 online at the Naval Systems Data Support Activity Web page located at: http://nsdsa.phdnswc.navy.mil/tmder/tmder.asp?lvl=1.

2.8.1.2 Text. Text shall be prepared single-column, single-spaced, with 10-point type size and unjustified right-hand margins. The text shall be technically edited, validated and shall be computer generated. Each chapter shall start on a right-hand page. Identity numbers, nomenclature, and reference designations appearing throughout the text shall be the same as those appearing on Government approved documents. Paragraph designations shall be dual Arabic numbers, such as 1.1 or 2.1.1, whereby the number preceding the period indicates chapter and the number following the hyphen indicates the paragraph within the chapter. Page designations shall be dual Arabic numbers, such as 1-1 or 2-4, whereby the number preceding the hyphen indicates chapter and the number following the hyphen indicates the page within the chapter. When the backside of a page is blank, the page designation shall indicate the condition, 2-15/(2-16 blank). Unless otherwise specified herein, vendor-furnished technical manuals shall meet the general style and format requirements of the Master and applicable subordinate TMCRs.

2.8.1.3 Dangers, Warnings, Cautions, and Notes. Dangers, warnings, and cautions shall consist of four parts: a signal word (heading), a statement of the hazard, the minimum precautions required, and the possible result if minimum precautions are not followed (unless the result is obvious). Dangers, warnings, and cautions immediately precede the step or procedure to which they apply, but follow paragraph headings. Notes can precede or follow text. Dangers, warnings, cautions, and notes do not contain procedural steps. All danger, warning, caution, and note text entries are indented five spaces from both the right and left text margins.

2.8.1.4 Readability. The level of coverage and complexity of technical descriptions for newly-developed technical manuals, and changes/revisions to existing manuals, shall be composed and edited to the level of understanding of someone possessing a ninth (9^{th}) grade reading level in accordance with the

applicable TMCR.

2.8.1.5 Technical Content. The technical content of technical manuals shall be developed in accordance with the applicable TMCR. TMCR chapter requirements for each newly developed technical manual are as follows:

Table 2-2. Required Chapters for TMCR 010197-003 (CVN70), TMCR 060115-003 (CVN71), TMCR for HM&E Equipment, and TMCR 010197-004 (CVN70) and TMCR 060115-004 (CVN71), TMCR for Electronic and Interior Communication (IC) Equipment

Chapter Number	Chapter Title
1	General Information and Safety Precautions
2	Operation
3	Functional Description
4	Scheduled Maintenance
5	Troubleshooting
6	Corrective Maintenance
7	Parts List
8	Installation

Table 2-3. Required Chapters for TMCR 010197-005 (CVN70) and TMCR 060115-005 (CVN71), TMCR for HM&E or Electronic and Interior Communication (IC) Systems Technical Manual

Chapter Number	Chapter Title
1	General Information
2	Safety Precautions
3	Conditions of Readiness
4	Operation
5	Functional Description
6	Scheduled Maintenance
7	Fault-Isolation
8	Alignment Procedures
9	Installation Data

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Table 2-4. Required Chapters for TMCR 010197-006 (CVN70) and TMCR 060115-006 (CVN71), TMCR for Digital Systems

Chapter Number	Chapter Title
1	General Information and Safety Precautions
2	Scheduled Maintenance
3	Functional Description
4	Operation
5	Fault-Isolation
6	System Alignment
7	System Cabling
8	Unit Level Maintenance

Table 2-5. Required Chapters for TMCR 010197-007 (CVN70) and TMCR 060115-007 (CVN71), TMCR for Digital Equipment

Chapter Number	Chapter Title
1	General Information and Safety Precautions
2	Operations
3	Functional Description
4	Scheduled Maintenance
5	Troubleshooting
6	Corrective Maintenance
7	Parts List
8	Installation

2.8.1.6 Planned Maintenance System (PMS) Documentation. The scheduled maintenance instructions in the technical manuals are not intended to duplicate those furnished in the Planned Maintenance System (PMS). When items are already covered by PMS, a brief overview referencing the PMS shall be provided to prevent redundancy and duplication of existing documentation.

2.8.1.7 Illustrations. Each illustration shall follow as closely as possible its first reference in the narrative text. However, when an illustration is extensive and requires a foldout sheet, such as for a large schematic diagram, it shall be located at the end of a chapter. All illustrations shall have a figure number and title. The title shall follow two spaces after the figure number, and the figure number and title shall be

centered below the applicable illustration (except for foldout figures). Full-page illustrations turned sideways on a page will have the figure number and title placed at the bottom of the page with the manual in its normal position.

NOTE

When the majority of illustrations in a manual are turned sideways, the figure number and title shall also be turned to appear below the illustration.

Figure numbers shall be dual Arabic numbers, such as 5-12, where the first number indicates the chapter, and the number following the hyphen indicates the illustration number within the chapter. Foldouts shall be paginated sequentially with the chapter text using double numbers to account for the blank backside, such as "2-15/(2-16 blank)", to indicate the condition. On figures and foldouts with multiple sheets, only the first sheet will list the total number of sheets (e.g., Sheet 1 of 3), remaining sheets will list the sheet number only (e.g., Sheet 2).

Identity numbers, nomenclature, and reference designations appearing on the illustrations shall be the same as those appearing on Government-approved documents.

Nomenclature, callouts, tabular material, and symbols on illustrations shall be a final size of no smaller than 8-point and no larger than 10-point with upper case lettering. Index numbers for each figure (multisheet illustrations are considered one figure) start with Arabic numeral 1 and continue consecutively. Index number sequence shall be from top to bottom or clockwise, when possible. Index numbers for exploded views shall be in disassembly order. Exploded views should be used to the greatest extent possible in the technical manual.

Line drawings shall be used instead of photographs (halftones) when practical.

2.8.1.8 Foldouts. Foldouts are placed at the end of the applicable chapter or at the end of the manual. Foldouts follow normal figure and page number sequencing when placed at the end of a chapter, but when placed at end of the manual, figure and page numbers shall be as follows: Figure numbers (e.g., FO-1, FO-2, etc.) and page numbers (e.g., FP-1/(FP-2 blank), FP-3/(FP-4 blank), etc.).

The minimum margins for foldouts are 1/2-inch on the top and bottom, and 1/4-inch on the outer edge.

If hard copy, ensure that foldouts have a nine-inch apron on the left (binding edge) side.

Maximum foldout size is limited to 26 by 11 inches (including a nine-inch apron and the margins). The printable foldout area is 16 by 10 inches, which includes running heads, figure titles and numbers, and pagination. Deviations from this maximum foldout size must be documented in the narrative outline and book plan (if applicable). All foldout pages shall be prepared for printing on one side only and shall appear on right-hand pages.

Foldout titles and figure/page numbers shall be visible on the outside fold and shall be placed (as close as possible) to the 1/2-inch standard margin on the bottom and the 1/4-inch standard margin on the right-hand side.

Foldout notes, with the exception of installation control drawings, shall be placed on the apron. Apron notes shall be identified with the legends GENERAL NOTES and SPECIFIC NOTES, as applicable. General notes shall precede specific notes and be identified by capital letters (e.g., A, B, etc.). Specific notes shall be identified by Arabic numerals (1, 2, etc.). Apron notes for foldout diagrams should be placed in a final size image area of 7 by 10 inches with a minimum letter height of 0.060 inch.

PART 2

SUMMARY OF TECHNICAL MANUAL CONTRACT REQUIREMENTS (TMCRS)
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2.8.2 Preliminary Technical Manual Change Development. Preliminary technical manual changes will be developed in accordance with the size, content, and format arrangement of the base technical manual as called out TMCR 010197-008 (CVN70) or TMCR 060115-008 (CVN71), TMCR for SIB/TM Change Package.

Each change package will include the following:

- Replacement title page
- Record of Revisions
- As applicable, replacement pages for the table of contents, general information page(s), list of abbreviations or symbols, system and component diagrams, and text.

Standard page size shall be 8-1/2 x 11 inches. Front matter, text, illustrations, drawings, and tables shall be final size, complete with titles and figure or table number, in accordance with the base technical manual.

The words PRELIMINARY ISSUE shall be placed on the title page above the Technical Manual Identification Number (TMIN). Letters shall be 18-point boldface type and capitalized.
Proper classification markings shall appear on every page (top and bottom), if applicable.

The United States Government Printing Office (GPO) Style Manual 2000 shall be used for capitalization, punctuation, compounding of words, numerals in the text, and spelling of non-technical words.

Copies shall be loose-leaf bound in pressboard or equivalent binders. Unclassified preliminary copies may be duplicated, loose-leaf bound, and delivered in accordance with the applicable TMCR. The method of duplication, covering, and binding shall provide legible, collated copies.

The delivery of the preliminary technical manual change does not relieve the vendor of any contractual requirements pertaining to delivery of complete, adequate, and accurate FRCs.

All previous change symbols on a page (pointing hands, change bars, etc.) shall be deleted when a page is subsequently changed. Change symbols shall show current changes only.

2.8.2.1 Front Matter. Front matter for technical manual changes shall be prepared in accordance with TMCR No. NDMS-060115-008**,** TMCR for SIB/TM Change Package, and as follows.

2.8.2.1.1 Title Page. Indicate the change identification letter/number and change publication date below the original publication date in lower right-hand corner of the page in bolded, 14-point font (e.g., CHANGE A 15 July 1994).

2.8.2.2 Added Material. When paragraphs, illustrations, tables, and pages are added by a change, existing paragraphs, illustrations, tables, and pages shall be renumbered. If renumbering involves more than ten paragraphs on more than five pages, the following guidance shall be used:

- When paragraphs are added at the end of a sequence, the next consecutive number is used.
- When paragraphs are added in the middle of a sequence, paragraphs will be numbered by adding an alpha character (for example, 2.4A, 2.4B, 2.4.1A, and so forth), to the preceding paragraph number.
- Added illustrations, tables, and pages will be numbered by adding a decimal (for example, figure 3-2.1, page 3-26.1, etc.).
- When it is necessary to add an illustration, table, or page between items that have already been added by the preceding method, an alpha character will be used (for example, a page

added between 3-26.2 and 3-26.3 would be 3-26.2A).

- Pages will not be added between a right-hand (odd numbered) and a left-hand (even numbered) page.
- When new material is to be added to a right-hand page, any overrun will be carried to the left-hand page. The overrun from the left-hand page will be placed on the added page.
- Where material is to be added to a right-hand page (for example, 2-5) and adequate blank space is available on the preceding left-hand page (for example, 2-4), material at the top of 2-5 will be moved to the bottom of 2-4 and the new material added to 2-5.
- Sheets added to a set of multisheet illustrations, which fall between existing sheets, will be assigned the preceding sheet number plus a decimal number. For example, if a sheet is added between sheets 2 and 3, the added sheet becomes sheet 2.1. If possible, the new sheet will be added after the last sheet and be assigned the next consecutive number.
- Where a change to an illustration adds index numbers between existing numbers, the added numbers will be the same as the preceding index number, with an added decimal number (for example, 22.1, 22.2, and so forth).

2.8.3 Preliminary Technical Manual Revision Development. Preliminary technical manual revisions will be developed in accordance with the size, content, and format arrangement of the basic manual as called out TMCR 010197-009 (CVN70) or 060115-009 (CVN71)**,** TMCR for TM Update Revision.

Standard page size shall be 8-1/2 x 11 inches. Front matter, text, illustrations, drawings, and tables shall be final size, complete with titles and figure or table number, in accordance with the base technical manual.

The words PRELIMINARY ISSUE shall be placed on the title page above the Technical Manual Identification Number (TMIN). Letters shall be 18-point boldface type and capitalized.

Proper classification markings shall appear on every page (top and bottom), if applicable.

All change symbols (pointing hands, change bars, shading, screening, etc.) and change dates on all pages shall be removed when the manual is revised. Partial pages shall be eliminated.

The United States Government Printing Office (GPO) Style Manual 2000 shall be used for capitalization, punctuation, compounding of words, numerals in the text, and spelling of non-technical words.

Copies shall be loose-leaf bound in pressboard or equivalent binders. Unclassified preliminary copies may be duplicated, loose-leaf bound, and delivered in accordance with the applicable TMCR. The method of duplication, covering, and binding shall provide legible, collated copies.

The delivery of the preliminary technical manual revision does not relieve the vendor of any contractual requirements pertaining to delivery of complete, adequate, and accurate FRCs.

2.8.3.1 Front Matter. Front matter for technical manual revisions shall be prepared in accordance with TMCR No. NDMS-060115-009**,** TMCR for TM Update Revision, and shall include the following in the order provided.

- Title Page
- Record of Revisions
- Table of Contents
- List of Illustrations
- List of Tables
- Foreword/Preface/Introduction

- Safety Summary

Indicate the revision identification letter/number in the upper right-hand corner of the title page below the horizontal line in bolded, 14-point font (e.g., REVISION 01). A supersedure notice should be added to the title page if applicable.

2.8.3.2 Illustrations. New callouts inserted between items when an illustration is changed shall have the same index number as the preceding index number, but with an added decimal number. For example, a new callout added between index numbers 22 and 23 would be numbered 22.1. When it is necessary to add a callout between items that have already been added by the preceding method, an alpha character shall be used. For example, a new callout added between 22.1 and 22.2 would be 22.1A. Suffixed index numbers need not be eliminated for a revision unless the illustration must be redrawn.

2.9 TECHNICAL MANUAL CORRECTIONS.

The vendor shall correct discrepancies in technical manuals found unacceptable as a result of Government or NGNN review. A technical manual will be considered unacceptable if:

- It does not reflect the configuration purchased
- It does not meet desktop validation requirements
- It does not meet the requirements of the applicable Master and subordinate TMCR and other contractual requirements
- Vendor source data including Microsoft Word source files, Adobe PDF files, tagged image format files, and illustrations in AutoCAD are incomplete or incorrect for final technical manual deliverables

The vendor's responsibility for revisions and changes to technical manuals shall be from issue of purchase order to ship redelivery + 60 days. The vendor is responsible for the technical accuracy and adequacy of manuals provided by them to NGNN under the associated contract, as well as for those manuals provided by the vendor, from subcontractors, to NGNN.

2.10 FINAL REPRODUCIBLE COPY (FRC) DEVELOPMENT.

Final technical manuals (or change pages) shall be developed ready for reproduction and publication as an authenticated technical manual including all necessary changes made as a result of desktop validation procedures, IPRs, and Government conditions of acceptance or approval. The delivery media shall include, but will not be limited to, the FRC, direct image copies, digital text and graphic files, disks, tapes, and so forth.

NOTE

FRCs of changes to existing, Navy-approved technical manuals will be developed using the existing size, content, and format arrangement in accordance with the base technical manual as noted in TMCR 010197-008 ***(CVN70) or TMCR 060115-008 (CVN71)***, TMCR for SIB/TM Change Package (refer to paragraph 2.8.2).

NOTE

FRCs of revisions to existing, Navy-approved technical manuals will be developed using the existing size, content, and format arrangement in accordance with the base technical manual as noted in TMCR 010197-009 ***(CVN70) or TMCR 060115-009 (CVN71)***, TMCR for TM Update Revision (refer to paragraph 2.8.3).

The FRC shall be developed in accordance with the applicable TMCR with the following clarifications:

PART 2

SUMMARY OF TECHNICAL MANUAL CONTRACT REQUIREMENTS (TMCRS) FOR VENDOR EQUIPMENT OR SYSTEM MANUALS

- The FRC shall incorporate all comments resulting from technical and format compliance reviews (NGNN desktop validation and Government reviews, along with IPR comments (if applicable)), and any comments resulting from the interim use of a preliminary technical manual.
- Text shall be prepared using a word processor or document publishing system. A master copy suitable for reproduction shall be printed.
- The FRC shall include all text (including tabular data) and reproducible artwork (including foldouts) suitable for reproduction. The FRC and integrally related artwork (including schematics, wiring diagrams, and block diagrams) shall be of sufficient darkness to reproduce clearly at required reproduction size without additional treatment.
- Minimum type size for text shall be 10-point elite type. Nomenclature callouts, tabular material, and symbols on illustrations shall be uppercase with 8-point (0.10 inch) minimum size. Spacing and lettering shall conserve space without lessening usability or clarity of material. Letters, lines, and symbols shall be of a uniform contrast throughout the text material and shall not touch.
- The FRC shall have the following minimum acceptable features:

  a. Single column

  b. Single spacing

  c. Justified left margins

- Text and artwork shall not exceed the following dimensions for the indicated size manual. Technical manuals shall be prepared in 8 1/2 by 11 inch size. When specified, technical manuals shall be produced in accordance with the dimensions below.

Paper Size of Printed Manuals (Inches)	Width - Text/Art (Inches)	Depth - Text/Art (Inches)	Depth (Including Marginal Copy) (Inches)
8 1/2 by 11	7 1/4	9	10

- Type styles and sizes (fonts) shall be comparable to those shown in this document, except for the following exceptions in table 2-6:

Table 2-6. Text Size and Style

Use	Size and Style
Art callouts (pictorials, and so forth)	8 point
Art lettering	7 point
Circled keying numbers on Functional Block Diagram (FBD) art	8 point
Circled keying numbers on pictorials	10 point
Art drawing sheet numbers, title blocks, main drawing number blocks, hardware boundary titles, and functional boundary titles	8 point
Running heads	10 point bold
Dangers (heading)	10 point bold

Warnings (heading)	10 point bold caps, boxed
Cautions (heading)	10 point bold caps, underlined
Notes (heading)	10 point caps
Rules	1 point

Front matter shall be in accordance with paragraph 2.8.1 of this document except that the title page shall not include the words PRELIMINARY ISSUE above the TMIN.

Text shall be in accordance with paragraph 2.8.2 of this document.

Illustrations shall be in accordance with paragraph 2.8.1.7 of this document.

One copy of the Technical Manual Deficiency/Evaluation Report (TMDER), NAVSEA/SPAWAR form 4160/1 (Rev. 7-2003) will be included at the end of each separately bound technical manual 8 1/2 x 11 inches or larger. Auxiliary equipment vendors shall ensure the entire technical manual, including source data obtained from sub-component vendors, meets FRC requirements.

2.11 FINAL DELIVERABLES.

NOTE
Xerographic copies will not be accepted as FRC material.

2.11.1 Vendor-Developed Technical Manuals. Develop the FRC of the Government-approved technical manual in accordance with the applicable purchase order coded note..

2.11.2 COTS Technical Manuals. Develop final files in accordance with the applicable purchase order coded note.

All text and drawings must be clearly legible. NGS will supply the manuals with covers, Identifying Technical Publication Sheets, and Technical Manual Identification Numbers (TMINs). .If complete manuals exist identical to those previously approved, they shall be furnished in lieu of above manuals and will retain their originally assigned TMIN.