

# The Minimanual: A New Concept in Operation and Maintenance Handbooks

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*Reduced fiscal budgets for DSN engineering documentation have necessitated a search for new and more cost-effective methods of producing the technical data required for equipment procurements and for operation and maintenance support of equipment already on-line at the Deep Space Stations. In the major documentation area of technical manuals, a new plan has been devised for achieving substantial monetary savings without sacrificing the integrity of the manuals or their utility as the central source of operation and maintenance information. Called "the minimanual," the new type of handbook has thus far shown an effective response to the exigencies of today's economics. This article describes the minimanual concept, its content and format characteristics, and the results of its first few months of implementation.*

## I. Introduction

Traditionally, full-scale operation and maintenance (O&M) manuals have been a compilation of the most pertinent existing technical data on the subject equipment. The categories of information generally included a physical description, a short functional description, installation instructions, pre-operational testing, a functional description of controls and indicators, standard and emergency operating procedures, a detailed theory of operation, a circuit analysis, preventive maintenance procedures, troubleshooting procedures, repair and replacement, qualification testing, a replaceable parts list,

and a selection of the most important engineering drawings (i.e., electrical schematics, wiring diagrams, cable diagrams, signal flow diagrams, and logic diagrams).

Because they contained the aforementioned wealth of data, the standard O&M manuals were justifiably used as the prime authoritative source of information for operation and maintenance of the equipment. But they have become costly to produce in a time of diminishing funds and blistering deadlines. Clearly, a new concept of technical manual production was needed, one that would provide the same essential information with a lesser time and cost expenditure.

In examining the problem, it was seen that the three largest cost factors were the writing time, the illustrating time, and the typing time, both for number of hours and cost per hour. Other accrued costs, such as editing time, materials, and printing and binding, were all on the lower end of the scale in dollar value. It appeared that an attack had to be made on the three largest cost factors if the overall price of manuals was to be brought down to a realistic level for the times.

By far, the largest expense in manual production was the writing time. It is the responsibility of the writer to gather the existing data from a multitude of sources and to rewrite, reprocess, and properly organize the material into a cohesive whole that conforms to the pre-established outline for the manual. He must also generate new data which may be required for use in the manual alone; such data are obtained from interviews with the cognizant engineers and technicians and from laboring over a great number of schematic and wiring diagrams. This is the time-consuming, hard-core technical writing that has always presented a challenge to cost-conscious management.

In examining the problem further, a few enlightening questions arose. Was it absolutely necessary to have the redundancy of information that the standard manual created? If a large portion of the manual is extracted from existing data in the documentation system, was it practical from an economic standpoint to reprocess the data just for the sake of having a single, all-encompassing manual? Under the current financial pinch, was it still worthwhile to continue the compilation process that gave us large, bulky manuals that were highly authoritative and definitive in coverage but were a drain on precious funds that could be used for many other practical purposes? The answers had to be in the negative. Yet, effective O&M manuals were needed. It became a certainty, however, that they would have to be restructured to meet the needs, or limitations, of current conditions.

## II. Birth of the Minimanual

The major element in the solution reached was the reversal of the compilation process. Instead of bringing the operator or maintenance technician to the one, all-encompassing manual for the data he is seeking, we send him back to the original source of the information. This is done by providing the proper source reference in the Table of Maintenance Support Documentation in the manual, unless, of course, the data have been newly generated for the manual itself and are contained within the covers. Thus, the new type of manual becomes a

central document, the hub point of a wheel of information whose spokes lead to existing test procedures, engineering drawings, data lists, design specifications, parts lists, commercial handbooks, and other documentation. It becomes, in many instances, the guiding light to essential data rather than the home for it.

Christened the "minimanual" for its abbreviated size and coverage, the newly implemented handbook has taken its place alongside the minicomputer and other "minis" as a compact, highly functional element operating in the DSN. It is not, however, solely an index document. The minimanual maintains its integrity as a bona fide O&M handbook by providing all the essential data that are required for a basic understanding of how the equipment works and what it takes to maintain it.

The high cost of writer time is cut to a minimum. No longer does the technical writer have to spend countless hours assembling diverse categories of information and rewriting the data into technical manual format. He is required only to identify the data by their existing document numbers and titles and to furnish the references in the Table of Maintenance Support Documentation. His creative efforts are thus confined to the basic task of writing original operation and maintenance procedures and a lucid theory of operation at the technician level. In instances where the engineer himself furnishes adequately written inputs, the writer's task is even further reduced to an editorial function, bringing the cost of the manual down to a very low figure.

Permissible shortcuts in writing style and format have also helped to reduce the overall costs. Boilerplate terms and paragraphs, once thought essential for reader comprehension, are not considered valid for minimanual text; the language is required only to be clear and concise, unburdened by stock phrasings and embellishments. Format shortcuts take the form of non-rigid page make-up, the elimination of typeset section headings, the freedom to reproduce existing artwork in its original form, and the use of illustrations sparingly.

## III. A Harvest of Advantages

The question of whether the maintenance technician would be getting short shrift by having to use a minimanual was considered from the beginning. The surprising answer was that not only was he not getting short shrift but he was being aided in his tasks by being forced to go to other sources for much of the peripheral data he needed. Contradictory as this may seem, it must be remembered that the manual is usually the last

document to be updated for technical accuracy. Indeed, as funds dwindle and sometimes vanish, the manual is not updated at all. It is far, far better for the maintenance technician needing an accurate schematic to go to his blueprint or microfiche file where he is more likely to find the latest revision of the drawing. The same philosophy would apply to parts lists, test procedures, wire lists, cabling diagrams, and the like. The minimanual provides the accurate reference to these documents by number and title; the technician must provide the legwork to obtain the actual data. But it is all worthwhile. No longer will the technician have doubts about the latest effectivity of the schematic in his hand. He will have the most recent revision obtainable, for the drawing system is usually the very first to be kept up-to-date.

In producing minimanuals, drastic reductions can be effected both in costs and time schedules. Late beginnings can be offset by fewer pages to be generated. The writer, knowing exactly what information is to be included in the manual and what information is to be supplied by reference only, will have a smoother, more straightforward path to follow and will have a better chance of completing his assignment on schedule. Successful completion on schedule, or ahead of schedule, will mean the availability of documentation where and when it is needed. The reduced costs may possibly create additional funds for other critical documentation or for resolution of equipment problems that were unforeseen.

The publications production work on minimanuals calls for no specialized equipment or for any personnel other than the normal repro typist and production editor. As a non-computerized effort, the production work can be quickly and efficiently done in the universally employed methods and procedures for creating camera-ready reproduces. This is particularly advantageous, since many DSN manuals are prepared by outside vendors, small and large, who do not have computerized equipment for publications graphics. The minimanuals produced in-house by the DSN would likewise require no expensively leased or purchased data processing devices, cathode-ray tubes, magnetic tapes, and the like. A by-product of this standard, long-established production method would be sets of reproduces for O&M manuals which are all uniform in regard to type face, cameo size, and camera reduction ratio. The manual revision process is thereby simplified, since no matching of diverse type faces and sizes would be necessary. Also, fewer revisions would have to be initiated for the minimanual; most likely, it would be the reference document that would require changing, and not the minimanual itself. Instead of revising two

documents, we revise only one—with accompanying cost savings.

The minimanual is published in standard 8-1/2 × 11-inch (22 × 28-cm) size and is bound either in thin, flexible cardboard covers or in hard, three-ring binders, depending on engineering preference for the individual manual. In use, it is highly portable and may be taken to any location where it is needed. When it is not being used, it takes up only a minimal amount of desk or bookshelf space.

#### **IV. Minimanual Content**

The restructuring of O&M handbooks into the minimanual concept has eliminated four of the standard sections that were previously used: General Description, Installation, Parts List, and Drawings. The three remaining sections, however, do contain the most essential information for effective operation and maintenance of the equipment. Together with fairly standard front matter and any required appendices, the three sections suffice to provide the on-line technician with the basic facts he needs to do his job.

##### **A. Front Matter**

A combined Title Page and List of Effective Pages is the initial page in the manual. This is followed on the reverse side by a Foreword page that gives a brief description of the equipment's purpose, its physical make-up, and its location in the hierarchy of assemblies, units, groups, and subsystems. The third page contains the beginning of the Table of Contents, List of Illustrations, and List of Tables, which are run in consecutively until completion. A Safety Summary page follows, if one is required.

##### **B. Section I—Operation**

Section I contains a functional description of all controls and indicators on the equipment, which is accompanied by at least one illustration that visually displays the items discussed. This is followed by the usual equipment turn-on procedures and any pre-operational procedures that may be required. The operating procedures themselves give full sequential instructions on how the equipment is operated under normal circumstances. Emergency operating procedures, if any, and equipment turn-off procedures conclude the section.

##### **C. Section II—Theory of Operation**

Section II contains both a general and detailed theory of operation of the overall equipment and its subassemblies. Depending on the electronic, hydraulic, or mechanical

complexity of the equipment, a circuit analysis is provided to explain or clarify the internal operation of unusual circuits or component parts.

#### **D. Section III—Maintenance**

Section III contains both preventive and corrective maintenance. The preventive maintenance paragraphs provide instructions for inspection, cleaning, and lubricating, as necessary. Corrective maintenance contains a listing of test equipment and special tools, and instructions for calibrating, testing, troubleshooting, and repairing and replacing malfunctioning components. Included in the section is a Table of Maintenance Support Documentation which contains a listing, by name and number, of the most pertinent drawings, specifications, procedures, commercial manuals, and other documents that may be needed for equipment maintenance purposes.

#### **E. Appendices**

Appendices are an optional item in the minimanual concept. Data not properly falling into the three existing

sections of Operation, Theory of Operation, and Maintenance, but which are considered necessary for inclusion in the handbook, may be placed at the rear of the manual as an appendix. Such items as computer printouts, a glossary of special terms, complicated installation instructions, or special equipment modifications are proper subjects for minimanual appendices.

#### **V. Implementation**

Of the five minimanuals completed to date, the smallest has 16 pages and the largest 130 pages. Writing, typing, and printing costs have been about 40% below the cost of standard manuals. No complications were experienced in the writing and production. The manuals have been released to operations personnel and are being used at the Deep Space Stations. Their utility and effectiveness is under study.