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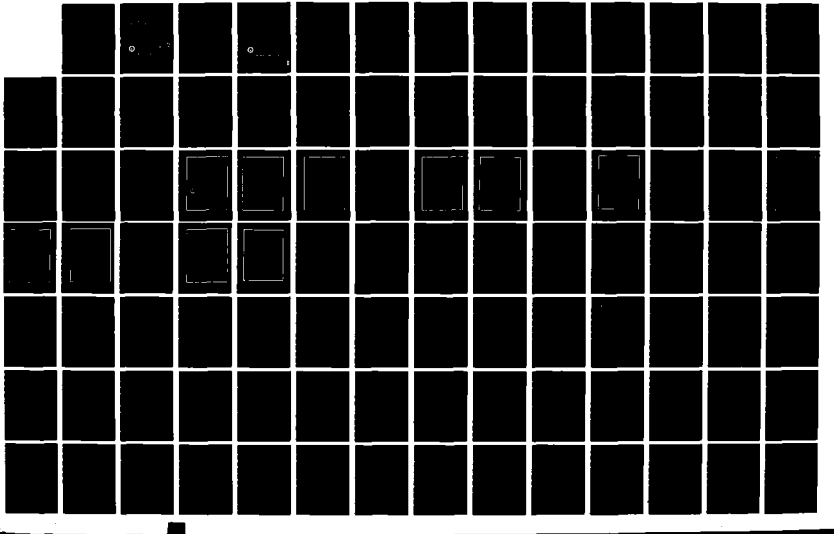

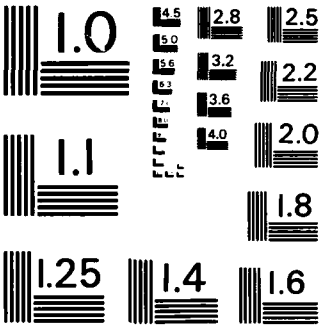

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NUSC Technical Document 7333

(Supersedes NUSC TD 5329B of 8 December 1980)

NUSC Technical Publications Guide

Command Support Department

Naval Underwater Systems Center
Newport, Rhode Island / New London, Connecticut

NUSC TD 7333 — TECHNICAL PUBLICATIONS GUIDE

NUSC Technical Document 7333
1 May 1985

(Supersedes NUSC TD 5329B of 8 December 1980)

NUSC Technical Publications Guide

Command Support Department

Naval Underwater Systems Center
Newport, Rhode Island / New London, Connecticut

Preface

This document was prepared by the Command Support Department (Code 02) under Job Order 702D10.

Reviewed and Approved: 1 May 1985

D. H. Boyd, Captain, U.S.N.
Head, Command Support Department

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6a. NAME OF PERFORMING ORGANIZATION Naval Underwater Systems Center 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) New London Laboratory New London, CT 06320	7b. ADDRESS (City, State, and ZIP Code)
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8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

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12. PERSONAL AUTHOR(S)
Command Support Department

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Style Guide	FROM _____ TO _____	1 May 1985	142

16. SUPPLEMENTARY NOTATION
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17 COSATI CODES		
FIELD	GROUP	SUB-GROUP
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05	07	

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
Communicating Technical Information
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Report Preparation
Science Writing

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

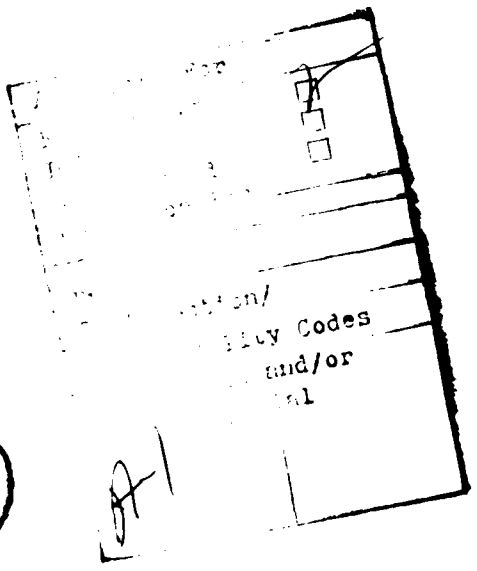
This Guide is a basic reference for the preparation and processing of technical reports, documents, manuals, memoranda, journal articles, brochures, and pamphlets at the Naval Underwater Systems Center. It has two main purposes: (1) to establish common standards of communicating technical information at the Center and (2) to promote a common understanding among author, editor, and reviewer of the requirements and responsibilities that each type of technical publication imposes. In addition to discussing the preparation and processing of technical publications, the Guide offers techniques and devices to aid an author.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL Karen Holt	22b. TELEPHONE (Include Area Code) (203) 440-4199 22c. OFFICE SYMBOL

DD FORM 1473, 84 MAR 83 APR edition may be used until exhausted. All other editions are obsolete.

18. (Cont'd.)

Style Manuals
Technical Communications Guidelines
Technical Writing and Editing



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FOREWORD

Every written communication produced by the Naval Underwater Systems Center (NUSC) becomes a part of its history. For this reason, the *NUSC Technical Publications Guide* establishes the official standards for ensuring quality and consistency in Center publications. However, the *Guide* will succeed in its mission only if all writers earnestly follow these policies and rules of style and format. In the interest of cost effectiveness, time constraints, unique sponsor requirements, political management exigencies, or common logic, exceptions to the guidelines may be made by the proper authority, but only if this will not compromise the reputation of the Center.

NUSC TECHNICAL PUBLICATIONS GUIDE

1. NUSC PUBLICATION POLICIES

CHOOSING THE PUBLICATIONS CATEGORY

The Center's principal publications include technical reports (TR's), technical documents (TD's), technical memoranda (TM's), journal articles, brochures and pamphlets, and technical manuals (see table 1–1). The Center recommends that authors choose wisely the medium to best document and disseminate technical information by considering the publication in the context of the total situation in which it may eventually be used.

After the category has been selected, the author should read section 1 for guidance on general publication policies. Then, section 2, 3, or 4 should be consulted to determine specific publication requirements for content, preparation and release procedures, and format. Guidelines for writing the manuscript and rules of style and usage are discussed in sections 5 through 8, as well as in the *U.S. Government Printing Office Style Manual*. Although the *Guide* is designed to answer most of the questions that an author, editor, or typist might have, the Technical Publications Branch may be contacted for further direction or for issues that have not been addressed.

DUAL PUBLICATION

The Center's policy requires that dual publication be avoided whenever possible. A case in point would be publication of a manuscript as a NUSC technical report and as a technical article in the *Navy Journal of Underwater Acoustics*. If an author believes that there is a good chance of having a manuscript accepted by a professional journal, the material should be prepared specifically with that purpose in mind. The Center will not then publish the same material as a technical report, but instead will buy reprints and number and catalog them as reprint reports. The only exceptions to the above would be the following:

1. A classified report from which an unclassified article could be prepared.

2. A lengthy report from which a brief article could be prepared, or vice versa.

Although it may seem economical to duplicate a publication, the major disadvantage is that the two media usually have different audiences with different interests and backgrounds. A manuscript prepared specifically as a technical report usually does not make an effective technical article unless it is almost completely rewritten.

OFFICIAL NAVY EMBLEM

The official Navy emblem shown on the front cover of this document is established in SECNAV Instruction 5600.20. This emblem is the only symbol to be

Table 1-1. Types of Technical Publications*

Type	Content	Format	Distribution
Technical Report Formal publication Documents Center's position Processed by Technical Publications Branch	In-depth report on research, development, test, and evaluation phases of long term program (investigative, analytical, theoretical)	NUSC TD 7333 MIL-STD-847B NUSCINST 5200.4B	External: Client (sponsor), Cognizant government groups and laboratories, R&D community
Technical Document Formal publication Documents Center's position Processed by Technical Publications Branch	Compilation of data; description of facility; summary of conference; bibliography; operating handbook	Same as above	External: Cognizant government groups and laboratories, R&D community
Technical Memorandum Informal publication Documents Center's position only if officially endorsed Processed by author in New London, by Technical Publications Branch in Newport	Communication on day-to-day operations or short-range project; work proposal or quick response to outside sponsor; professional comment to R&D community	NUSC TD 7333 NUSCINST 5602.1D	External if department head approves
Journal Article Formal publication Provides forum for author Processed by Technical Publications Branch	Article in professional journal on technical subject of general interest	Specification of journal	Scientific and technical community
Brochure and Pamphlet Formal publication Promotes Center's capabilities Processed by Technical Publications Branch	Descriptive announcement of availability of special service or facility; treatment of subject of special or general interest	NUSC TD 7333 NUSCINST 5200.7A SECNAVINST 5600.20	General public and private sector
Technical Manual Formal publication Documents Navy position Processed by Technical Publications Branch	Instruction on installation, operation, maintenance, repair, and parts support of systems and equipment	MIL-M-15071H MIL-M-38784B	Fleet personnel

* The terms formal and informal are arbitrary terms relating to the purpose, format, and distribution of a publication. Thus, they designate the general standards required for preparation and processing.

3. Examine the conclusions and recommendations made by the author in the light of the investigation and the resulting data, as well as in the light of the data obtained by other investigators referenced in the publication.

4. Certify the technical accuracy and adequacy of the information. (The technical reviewer is not expected to repeat the investigative and analytical work required for complete verification.)

5. Review critically the security classification assigned to each part of the publication and to the publication as a whole in the light of the attached classification criteria, keeping in mind the need to safeguard those advances in technology detailed in R&D publications that may affect national security.

6. Review critically the limitation placed upon distribution of the publication.

7. Resolve any disagreements or problem areas directly with the author.

8. Complete the technical review within 2 weeks; otherwise, notify the author and department head of any delay.

9. Return the publication to the author with appropriate comments.

Editor's Role

The Technical Publications Branch is a special services group. Its editors are professional people trained in every phase of processing technical publications. Their backgrounds include familiarity with the latest standards and specifications for various types of technical communications, including standards, specifications, and directives of the Department of Defense (DoD), the Department of the Navy, the Naval Material Command, and the Naval Sea Systems Command. It is the first responsibility of the editor to see to it that the assigned TR or TD meets the pertinent standards and specifications.

For a classified publication, the editor ensures that the required overall security and classification designations are provided by the author, that each paragraph, illustration, and table is marked according to its security classification, and that distribution limitations are imposed, as necessary. The editor also must follow the publication through the review and release stages and keep the author informed of its status.

Role of Final Reviewers

Formal publications are a main product of the Center, with every TR and TD bearing the official Navy emblem. The policy of requiring that official communications be reviewed and approved by those in top positions of responsibility is, therefore, logical and reasonable.

Review and approval for publication by the concerned department head or associate technical director is not a mere formality. Every publication is different -- in content, in purpose, in audience. Quality control, therefore, can not be handled by batch sampling; every publication must be read and judged individually.

Role of Branch Head and Division Head

The branch head and the division head serve as sponsors and first-line critics of any formal publication originated by those under their aegis. As sponsors, they have the responsibility to help the author produce a meaningful, intelligible publication within a specified time. It must be meaningful in that it must relate to the purposes and interests of the Center, the Navy, and the client or reader. It must be intelligible in that it must communicate within a context that the reader can readily understand. And it must be completed on schedule; otherwise, its impact and usefulness might be lost.

The branch head (usually the author's technical supervisor) is responsible for checking the technical coverage of the message to ensure that it is technically complete before it goes to any other reviewers. The branch head also should help the author determine whether a security classification is necessary and, if so, what classification is appropriate.

The division head should concentrate on checking the logic of whatever conclusions and recommendations the author may have drawn from the technical data presented. It is also important at this stage in the publication process to determine whether the content agrees with or contradicts any viewpoints or policies in the chain of command through which the publication must pass. The division head is in an excellent position to perform this initial screening.

In summary, the branch head and the division head form a frontline reviewing team. All reports that pass their review have been given a preliminary check for coverage and policy and are ready for detailed scrutiny by the technical reviewer (if required) and the technical editor.

Technical Reviewer's Role

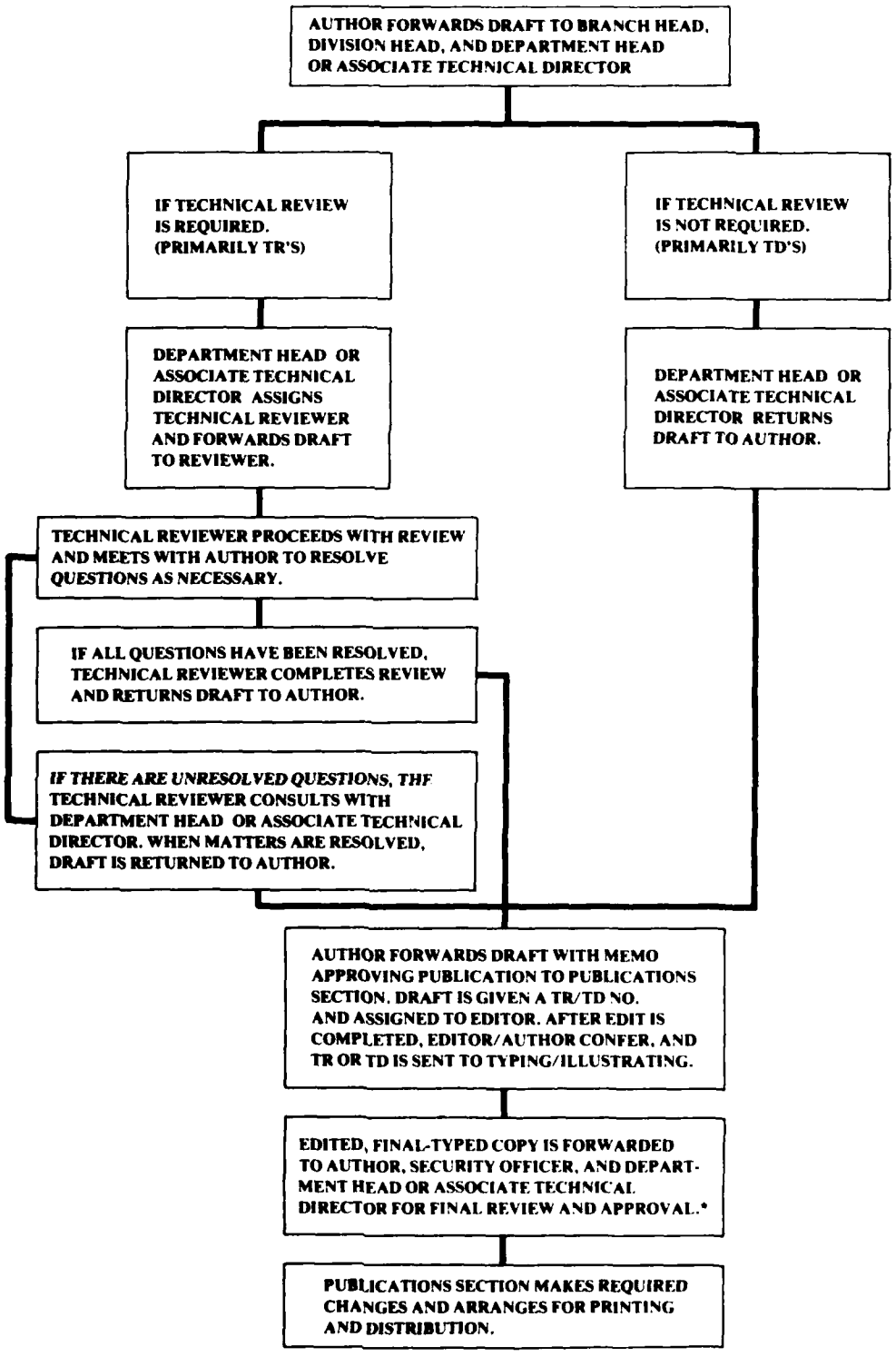
This review procedure is designed to ensure publication quality by providing for objective technical reviews by subject matter specialists. Such reviews are not a substitute for those expected of line management; rather, they help to strengthen management's role in this important area of responsibility. Although this procedure applies primarily to NUSC TR's, it may be invoked for any TD, journal article, or technical memorandum if the information is important enough to warrant such review, or if the information is being cleared for public release.

Technical reviewers share responsibility with authors for ensuring that advances in technology detailed in R&D reports are properly safeguarded and that the nation's technological advantage is not compromised, especially those advances in technology that affect vital national interests. Note that the author must attach copies of all applicable classification authorities to publications requiring technical review.

The technical reviewer shall be expected to fulfill the following specific responsibilities:

1. Read the publication critically to ensure a reasonable presentation based on a solid technical foundation.

2. Examine hypotheses and methodology in relation to known scientific and engineering principles.



*NOTE: A public release publication requires review and approval by the originator, technical reviewer (if applicable), department head, Security Office, and Public Affairs Office (figure 1-1).

Figure 2-1. Flowchart for Processing a TR or TD

Technical Document

Like the TR, a TD is a formal publication documenting the Center's official position on a particular subject. Unlike TR's, however, TD's vary widely in purpose and function. For example, they include publications that are essentially a compilation of data; publications, such as brochures, that describe facilities; summaries of the proceedings of conferences and symposia; bibliographies; reprints of journal articles; and operating handbooks. Most of the time the choice of whether to publish material as a TR or as a TD is clear. However, when in doubt, authors should consult the Technical Publications Branch.

OVERALL PREPARATION AND RELEASE PROCEDURES

After the author chooses to publish a manuscript as a TR or TD, the process of bringing the publication from its initial conception in the mind of the author to its final distribution in the hands of the reader involves many stages:

1. Preparation of a draft of the manuscript by the author. Review and polish of the preliminary draft to present the author's best effort.

2. Review and publication approval of the draft by the cognizant branch head, division head, and department head (or associate technical director).

3. Detailed analysis of the draft for technical coverage and accuracy by a technical reviewer (if required).

4. Editing of the draft and preparation of final copy by the Technical Publications Branch.

5. Final review and approval by the author and the cognizant department head (or associate technical director).

6. Publication and distribution by the Technical Publications Branch.

Figure 2–1 shows the flow of the manuscript from one stage to the next. For help in writing the rough draft that is described in stage one, the author should consult section 5 of this *Guide*, which provides step–by–step instructions for preparing a good technical communication. Further responsibilities of the author and the responsibilities of each reviewer during the remaining stages are described below.

Author's Role

When authors originate a TR or TD, they become reporters on assignment for the branch, division, department, and laboratory in which they work and for the Center as a whole. Thus, people at higher levels in the organization have the right (and duty) to review what the author says and to ask for revisions if they believe the content is inaccurate or the emphasis is inconsistent with the objectives and standards of their respective organizational groups.

As the prime movers of formal publications, authors are responsible not only for the initial inputs but also for revisions to those inputs.

2. TECHNICAL REPORT (TR) AND TECHNICAL DOCUMENT (TD)

INTRODUCTION

This section of the *Guide*

- Defines the contents of a TR and a TD (also see table 1–1),
- Provides a description of their overall preparation and release procedures, and
- Establishes the NUSC standards for their formating, text preparation, and style.

These guidelines incorporate many of the provisions of Military Standard 847B and NUSC Instruction 5200.4B.

CONTENT

Technical Report

A TR is a formal publication that reflects the Center's thinking and records the Center's official position on a particular subject. It is used to convey information on the Center's research, development, test, and evaluation activities. As such, a TR usually is investigative, analytical, or theoretical in nature and, thus, logically contains conclusions and offers recommendations. It is of interest not only to the client (the department, agency, or command sponsoring the work) but also to cognizant government groups and laboratories. A TR, therefore, constitutes one of the Center's principal means of in-depth reporting on technical subjects to the outside world. The following criteria identify material appropriate for a TR:

1. Material that reports on or summarizes a completed project, when the results are potentially of value to more than a few individuals outside the Center.

2. Material that reports on completed phases of a project, when such reports are comprehensible in themselves and make it possible to avoid having a single, extremely long, unwieldy final report.

3. Material that reports on completed phases of lengthy projects, when such reports will provide information of value to authorized persons outside the Center and when the timeliness of such information is important.

4. Material not covered above that constitutes a complete and clear treatment of a *subject area* potentially of value to authorized persons outside the Center.

5. Material that is valuable in providing perspective in looking at complicated projects or subject areas.

6. Proposals that are sufficiently important and carefully enough prepared to bring credit to their authors and to the Center.

NOTES

for reports, documents, reprints of journal articles, technical manuals, and brochures. Self-covers, which are the same weight as the text, are used for memoranda (see NUSC Instruction 5602.1D); exceptions to this regulation are discussed in section 3 of this *Guide*.

The printing of more than one color ink, reverse images, tint blocks, index tabs, or the use of special papers and bindings must be approved by NPPSO.

SECONDARY DISTRIBUTION

The Technical Information/Administrative Services Division will no longer store extra copies of NUSC publications. Therefore, in addition to including copies for each Center library on the original distribution list,* the author must also designate the addressee (code) to receive copies for storage.

External requests for secondary distribution of NUSC publications on file with the Defense Technical Information Center (DTIC) will be referred to DTIC; internal requests will be referred to the NUSC New London or Newport Library. For publications not sent to DTIC (many TM's, for instance), all external and internal requests will be processed through the NUSC Newport Library.

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* The Internal Distribution List for New London publications should include three copies for the New London Library and two for the Newport Library; the Newport list should include three copies for the Newport Library and two for the New London Library.

3. The third, or *downgrade to,* line is used only when downgrading is applicable; the marking *Secret* or *Confidential* and the specific date are shown.

Foreign Intelligence Control Markings. When foreign government (or NATO) intelligence information is used in a NUSC publication, the cover will state *This Document Contains Foreign Government (or NATO) Information.* (Paragraphs will then be appropriately marked as (UK-C), (AUS-S), (CAN-C), (NATO-S), and so forth.) If the intelligence information might compromise the status of relations with collaborating foreign governments or officials, the cover (and first page) will state *Not Releasable to Foreign Nationals.* (The appropriate paragraphs will then be marked as (C-NF) or (S-NF) and each affected page as *NOFORN* either at the top or at the bottom of the page, immediately after the overall classification marking.) Other authorized control markings may be obtained from the Security Office or in OPNAV Instruction 5510.1G.

PHOTOTYPESETTING

Because of the expense involved and because of the high quality print produced by word processing systems, the use of phototypesetting for NUSC publications will be the exception rather than the rule. It will be reserved for special promotional pamphlets and brochures in which the overall effect produced by this process is required. The phototypeset copy will be prepared in strict accordance with SECNAV Instruction 5600.20, *The Department of the Navy Graphic Design Standards.* The Publications Branch, Code 0211, will act as the consultant when variations or exceptions to the instruction are requested.

PRINTING

All technical publications issued from the Center are printed or reproduced by the Naval Publication and Printing Service Office (NPPSO) in accordance with NAVSO P-35. No more than five copies of a NUSC publication may be provided by an outside source.

A NUSC publication is submitted for printing to NPPSO by the Technical Publications Branch, except for technical memoranda from New London, which are submitted by the author. Before completing a printing request (DD Form 844A for copying or DD Form 282 for offset printing), the editor or author should check to ensure that

- Pages are in order,
- Classified publications are composed on confidential or secret mattes,
- Staples are removed,
- Internal and external distribution lists are included, and
- Mailing labels are submitted.

Normally, a NUSC technical publication is printed on white paper with black ink and bound with three staples on the left side. Hard covers (100-pound stock) are used

Overall Markings

Every page of a classified publication shall bear the overall security classification marking of the publication. A confidential report will have all its pages marked CONFIDENTIAL and a secret report will have all its pages marked SECRET. An exception to this rule may be made in the case of a clearly identified appendix having a lower security classification than that of the report. If the appendix is unclassified, the pages of the appendix may be marked UNCLASSIFIED and no paragraph marking is required; a confidential appendix in a secret report may have its pages marked CONFIDENTIAL, but the paragraphs must be appropriately marked.

Authors should note in particular that the illustrations and tables (including their captions and titles) and the headings, paragraphs, and subparagraphs of text in a classified publication shall be marked with the appropriate security classification markings. Also, the title and abstract of a technical publication must be individually classified and marked with the appropriate symbol. (See section 2 for detailed information on the placement of these security markings.)

Cover Markings

Color Coding. To aid in distinguishing classified from unclassified publications and the degree of classification assigned, the self-covers of technical memoranda, as well as the covers of reports and documents, are color coded. The following colors are standard: white for unclassified, green for confidential, yellow for secret, and pink for top secret.

Classification Markings. The overall classification marking (CONFIDENTIAL, SECRET, or TOP SECRET) of the publication must appear on the top and bottom of the front and back covers and the appropriate symbol ((U), (C), (S), or (TS)) must follow the title (see sample cover in section 2).

Classification Authority and Declassification Information. All classified material must be marked with the classification authority and the declassification information on the lower left face of the publication (i.e., cover, self-cover, or first sheet), as specified in OPNAV Instruction 5510.1G and as shown on the sample cover in section 2.

1. The first, or *classified by*, line indicates the security classification guide (see OPNAV Instruction 5510.1G), source document, or other authority used for classification. If more than one guide or source is used, the words *multiple sources* are inserted.

2. The 6- and 20-year declassification and review time limits of Executive Order 12065 have been superseded by Executive Order 12356, which states that the original classification authority must classify information for as long as required by national security considerations. Thus, the second, or *declassify on*, line will either indicate a specific date or event that is certain to occur or, if the classification guide does not show such a date or event, will read *Originating Agency's Determination Required (OADR)*. When multiple sources are used, the declassification date with the longest duration will be shown.

Statements B Through X: Distribution Limitations on Classified and Unclassified Information

Distribution statements B through X are used to control the distribution of all classified publications and those unclassified publications that are not released to the public–at–large. Two requirements that authors often overlook when preparing a limited distribution publication are that (1) all working papers must be appropriately marked or stamped and (2) each classified reference must be properly identified.

Restrictions on the Use and Dissemination of Commercial Information. Information from a private source with a restriction on use or dissemination shall not be incorporated in Center publications unless accompanied by a notice of restriction. Publications containing such information should be marked with statement B as follows: *Distribution authorized to U.S. Government agencies only; Proprietary Information, (date). Other requests for this publication must be referred to the Naval Underwater Systems Center.* Normally, such information will be included only with the written permission of the proprietor of the data. Questions concerning the validity and scope of the restrictions imposed by private organizations may be referred to the Center's Patent Counsel for resolution. Under no circumstances will publications containing restricted information be given unlimited distribution. Responsibility for ensuring that restricted information is properly marked rests with the author of the publication.

Additional Notices

In addition to the distribution statement, publications containing export–controlled data must carry the following warning on the cover:

> *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 Executive Order 12470. Violations of these export laws are subject to severe criminal penalties.*

If a publication is marked with distribution statement B, C, D, E, F, or X, it must carry a destruction notice at the bottom of the preface page:

> *DESTRUCTION NOTICE: For classified documents, follow the procedures in DoD 5200.22–M, Industrial Security Manual, Section II–19, or DoD 5200.1–R, Information Security Program Regulation, Chapter IX. For unclassified, limited documents, destroy by any method that will prevent disclosure of contents or reconstruction of the document.*

SECURITY MARKINGS FOR CLASSIFIED PUBLICATIONS

OPNAV Instruction 5510.1G, *The Department of the Navy Information Security Program Regulation*, and NUSC Instruction 5500.1, the *NUSC Security Manual*, describe the security requirements for all technical publications.

ROUTING SHEET FOR RELEASE OF UNCLASSIFIED TECHNICAL INFORMATION
NUSC 5216/9 (8/81)

APPLICABLE CLASSIFICATION GUIDES(s)
(SEE ITEM 7 BELOW)

TITLE OF PROPOSED RELEASE	DATED
TYPE OF INFORMATION (PRESENTATION, ARTICLE, REPORT, ETC.)	
INTENDED FOR PUBLICATION IN / PRESENTATION AT	
BRIEF STATEMENT OF PURPOSE OF RELEASE	

TO THE BEST OF YOUR KNOWLEDGE, IS PROPOSED RELEASE:	ORIGINATOR YES	ORIGINATOR NO	TECHNICAL REVIEWER YES	TECHNICAL REVIEWER NO	DEPARTMENT HEAD YES	DEPARTMENT HEAD NO	SECURITY YES	SECURITY NO
1. TECHNICALLY ACCURATE?								
2. FREE OF INFORMATION WITH POTENTIAL INTELLIGENCE VALUE?								
3. FREE OF INFORMATION THAT WOULD ADVERSELY AFFECT THE SECURITY OF THE U.S.?								
4. CONSIDERED BORDERLINE FROM BEING CLASSIFIED?								
5. CLASSIFIED WHEN ASSOCIATED WITH A KNOWN PREVIOUS RELEASE?								
6. LIABLE TO DAMAGE THE SUCCESS OF OPERATION OF A SYSTEM?								
7. SECURITY CLASSIFICATION GUIDES CONSULTED TO ENSURE NO "CLASSIFIED OR "FOR OFFICIAL USE ONLY" INFORMATION? (APPLICABLE GUIDE(s) TO BE NOTED IN BLOCK AT TOP OF SHEET.)								

ROUTING (NAME AND CODE)	SIGNATURE AND DATE	REMARKS
ORIGINATOR		
TECHNICAL REVIEWER (IF APPLICABLE)		
DEPARTMENT HEAD		
SECURITY OFFICER		
PUBLIC AFFAIRS OFFICER	☐ APPROVED ☐ DISAPPROVED	APPROVAL STAMP (IF APPLICABLE)
RETURN TO		

Figure 1-1. Form for the Release of Unclassified Information to the General Public

Table 1-2. Distribution Statements

	Statement	Reason for Applying Statement*
A	Approved for public release; distribution unlimited.	
B	Distribution authorized to U.S. Government agencies only; (reason), (date). Other requests for this document must be referred to the Naval Underwater Systems Center.†	1. Foreign Government Information. 2. Proprietary Information 3. Test and Evaluation 4. Contractor Performance Evaluation 5. Export Limitations. 6. Administrative/Operational Use 7. Software Documentation 8. Specific Authority (Identify Valid Documented Authority)
C	Distribution authorized to U.S. Government agencies and their contractors only; (reason), (date). Other requests for this document must be referred to the Naval Underwater Systems Center.	1. Critical Technology 2. Administrative/Operational Use 3. Specific Authority
D	Distribution authorized to DoD and DoD contractors only; (reason), (date). Other requests for this document must be referred to the Naval Underwater Systems Center.	1. Premature Dissemination 2. Software Documentation 3. Critical Technology 4. Specific Authority
E	Distribution authorized to DoD components only; (reason), (date). Other requests for this document must be referred to the Naval Underwater Systems Center.	1. Foreign Government Information 2. Premature Dissemination 3. Software Documentation 4. Critical Technology 5. Specific Authority
F	Further dissemination only as directed by the Naval Underwater Systems Center, (date), or higher DoD authority.	(Normally used only on CLASSIFIED documents, but may be used on UNCLASSIFIED documents when specific authority exists.)
X	Distribution authorized to U.S. Government agencies and private individuals or enterprises eligible to obtain export-controlled technical data in accordance with regulations implementing 10 U.S.C. 140c (date of determination). Other requests for this document must be referred to the Naval Underwater Systems Center.	(Used on unclassified or formerly classified documents when statement B, C, D, E, or F is not applicable, but document contains technical data as explained in DoD Directive 5230.25.)

* The definition of each reason is found in DoD Directive 5230.24.
† Occasionally, the controlling DoD office is the office of the program manager.

publications be assigned one of the distribution statements listed in table 1-2.* The use of these statements is intended to permit a wider distribution of technology inside the defense community and a more selective dissemination outside of it.

Statement A: Release of Unclassified Information to the General Public

When an unclassified publication is released to the public-at-large, it must carry statement A and is subject to internal review by cognizant Center personnel. The material is first reviewed by the author before it is sent to the department head, technical reviewer, security officer, and public affairs officer (figure 1-1). However, certain specified areas of unclassified technical information must still be submitted by the security officer to higher authority for clearance before public release:

1. Information of national interest that will draw the attention of Congress or the general public.

2. Information originated at or proposed for release at the seat of the Government.

3. Information concerning foreign and military policy; guided missiles; chemical, biological, and radiological warfare; high energy lasers; weather modification; surface effects ships; new weapon systems; environmental protection; pollution abatement; Trident; Poseidon; Polaris; and antisubmarine warfare.

4. Information concerning subject areas of potential controversy among the military services.

5. Material concerning significant policy within the purview of other agencies of the Federal Government.

6. Other information specifically designated from time to time by the Chief of Naval Operations, or higher authority, as requiring clearance.

7. Naval nuclear propulsion information, classified and unclassified. (This information is specifically prohibited from public release and shall not be handled in any manner that could result in direct or indirect release to the public.)

NUSC Instruction 5570.1D is to be used as a guide. The Technical Publications Branch, Public Affairs Office, or the Security Office may be contacted for assistance in obtaining the review.

One requirement that authors often overlook is that all references in technical publications for public release must be available to the general public. Publications having references that are either classified or are marked with a limiting distribution statement cannot be released to the public-at-large, unless the reference is identified as a *Private Communication* or is described as *Available to Authorized Requesters Only.*

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* Sample covers carrying distribution statements are shown in section 2.

printed on the cover (or first page) of a formal publication to identify it as a Department of the Navy publication and to indicate its official character. The use of other seals, logos, or emblems formerly used by NUSC or its constituents is prohibited.

METRIC SYSTEM OF MEASUREMENTS*

In anticipation of an ultimate conversion to the metric system, the Department of Defense (DoD) requires that reports, studies, and position papers include metric units of measurement in addition to or in lieu of U.S. customary units. This policy is to be followed for all NUSC technical publications except those pertaining to items dimensioned in U.S. customary units. With respect to existing contracts, this requirement applies only if such documentation can be obtained without an increase in contract costs. Exceptions to the requirement may be made only with the approval of the head of the department in which the principal author is located. The *International System of Units (SI)* described in ASTM E 380–82 or successor documents listed in the DoD Index of Specifications and Standards will be the metric system used.

Use of dual dimensions (i.e., both metric and U. S. customary) on drawings will be avoided unless it is determined in specific instances that such usage will be beneficial. However, the use of tables to translate dimensions from one system of measurement to the other is acceptable.

COPYRIGHTED MATERIAL

Copyrighted material will not knowingly be included in publications or other works of the Department of the Navy without the consent of the copyright owner or approval of the Secretary of the Navy or his duly authorized representative. For this purpose, the duly authorized representative of the Secretary is the Chief of Naval Research or his designee. ONR Instruction 5870.5 outlines the procedures to be followed in obtaining permission for the use of copyrighted material. The Technical Publications Branch will coordinate requests for permission to use copyrighted material.

When a publication is not copyrighted, protocol requires that credit for its use be given to the originator. If a noncopyrighted publication is extensively quoted by an author, it is recommended that written permission for its use be obtained.

A publication prepared by an employee of the U.S. government as part of that person's official duties cannot be copyrighted. Therefore, a NUSC employee cannot sign a document that claims or transfers a copyright. When a transfer of rights is requested, most publishers will have a place on their form where a Government employee can certify that the work is that of the U.S. government and is not protected by a U.S. copyright.

DISTRIBUTION STATEMENTS

The interim policy of the DoD regarding the distribution of classified and unclassified technical publications requires that the covers or title pages of all such

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* A metric conversion chart is provided in section 8.

Department heads or associate technical directors possess certain information not available to those in lower echelons (e.g., information that cannot always be exposed to wider circulation). Consequently, the final reviewers bring a viewpoint to the reading that differs from that of the other members of the publications team. They also, of course, have broader responsibilities than their teammates. As final reviewers, they must ensure that the publication contains no violations of official Center and Navy policy, that the current *thinking* of the Center is correctly represented, and that the timing of the publication will not jeopardize the chances for a favorable reception of the publication or interfere with other projects underway or currently planned. Their opinions also are helpful in that these officers are familiar with the interests and backgrounds of their counterparts in other centers, laboratories, commands, and departments of the Navy, and they, therefore, can help authors determine whether or not their publications will meet specific reader needs.

After the final routing sheet has been signed by the appropriate authorities (see figure 2–2), the signature of the department head or associate technical director on the preface page of the final copy indicates approval to publish and distribute. (When projects are funded under the Independent Research and Independent Exploratory Development Program (IR/IED), the Associate Technical Director for Technology signs the preface page.)

FORMAT

Order of Elements

Individual elements of NUSC TR's are listed below in their order of appearance. Italicized items are required in all formal reports.

Front Matter	*Front Cover* *Back of Front Cover (Preface)* *Report Documentation Page (DD Form 1473)* Summary *Table of Contents* List of Illustrations List of Tables List of Abbreviations and Symbols Foreword
Body	*Introduction* *Presentation of Evidence* *Conclusion(s)* or *Summary* Recommendations
End Matter	References* Bibliography* Appendix(es) *Distribution List* *Back Cover*

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* In certain circumstances, the references and bibliography can follow the appendixes (see page 2-17).

ROUTE SLIP FOR EDITED MATERIAL
NUSC/NL-5600/3 (NON) (REV. 12-73)

UNCLASSIFIED

ACTION SYMBOLS

A - For Approval B - For Approval and Signature C - Comments D - Recommendations E - Note and Return

From: **Date**

ROUTING	ACTION	DATE	INITIALS	ROUTING	ACTION	DATE	INITIALS
1 Publications Head	A			11			
2 Author	A			12			
3 Department Head or Assoc. Tech. Dir.	B			13			
4 Security Officer	A			14			
5 Editor	A			15			
6 Print	A			16			
7				17			
8				18			
9				19			
10				20			

TITLE OF MATERIAL:

AUTHOR(S):

NUSC REPORT NUMBER:

CLASSIFICATION: UNCLASSIFIED

REVIEWERS PLEASE NOTE

A Checkoff List for External Distribution of Technical Reports is enclosed with this manuscript. The report will be distributed solely on the basis of management's review of this list. It is therefore imperative that the list be carefully reviewed by all levels of management up through Director in order to avoid possible embarrassment either by the omission of key Navy activities or Codes who have an interest in the report, or, conversely, by the unwarranted inclusion of large numbers of addressees. The reviewer should signify his review and approval of the distribution list by placing his initials in the space provided on the list.

UNCLASSIFIED

12 20-73 300 FIRST RUN BELOW STD

Figure 2–2. Final Routing Sheet for TR's and TD's

Because there are many kinds of TD's, no one standard format is applicable to all. In general, an author should follow as closely as possible the specifications set for TR's:

- The body of a TD should have a clearly defined beginning, middle, and end.
- A TD should contain headings, particularly when they will be used as a source of continuing reference. Instruction books are an example.
- Visual aids, including tables, are important in most types of TD's. Sometimes, they are more important than the text material.

In summary, the format of a particular TD should be developed so that it best serves the needs of the intended readers.

Authors are encouraged to examine specimen reports and documents in the Technical Library, which has a large collection of both types on file. The Technical Publications Branch will gladly help an author select one to use as a model.

Front Cover. The outside of the front cover contains the classification designation (secret, confidential, etc.) if the TR or TD is classified, the NUSC TR or TD number, the title, the name and department of the author, the emblem of the Navy, the date of publication, the name of the Center and the city and state of each of the major laboratories, the classification authority and declassification information if the TR or TD is classified, and the distribution statement. Figure 2-3 shows a sample cover for a classified publication; figure 2-4 shows an unclassified one.

Back of Front Cover. The reverse side of the front cover (or preface page) contains the following material, as shown in figure 2-5.

- Preface

  NUSC project number and title

  Name and code of the principal investigator

  Navy project and element numbers

  Name of program manager

  Name and code of technical reviewer

  Acknowledgment statement, when appropriate

- Date of final review and approval
- Signature of approval authority
- Destruction statement, if applicable

CONFIDENTIAL

NUSC Technical Document 5780C
1 July 1984

(Supersedes NUSC TD 5780B of 12 December 1979)

ASW Standoff Weapon: Technical Information Center Catalog (U)

Mary N. Barravecchia
Elizabeth Redfield
Information Services Department

Rudolph L. Vetovis
Weapon Systems Department

Naval Underwater Systems Center
Newport, Rhode Island / New London, Connecticut

Further dissemination only as directed by the Naval Underwater Systems Center, 1 July 1984, or higher DoD authority.

Classified by: OPNAVINST S5513.5-44
Declassify on: OADR

CONFIDENTIAL

Figure 2-3. Sample Front Cover for a Classified TR or TD

NUSC Technical Document 5780C
1 July 1984

(Supersedes NUSC TD 5780B of 12 December 1979)

ASW Standoff Weapon: Technical Information Center Catalog

Mary N. Barravecchia
Elizabeth Redfield
Information Services Department

Rudolph L. Vetovis
Weapon Systems Department

Naval Underwater Systems Center
Newport, Rhode Island / New London, Connecticut

Figure 2–4. Sample Front Cover for an Unclassified TR or TD

CONFIDENTIAL

Preface (U)

(U) This report was prepared under Project No. A61415, *Parametric Sonar Echo Ranging Systems (U)*, Principal Investigator W. L. Konrad (Code 313). The Sponsoring Activity is the Naval Sea Systems Command, D. Porter (SEA 63R11). Important contributions required to conduct the work were made by Raytheon Company under NAVSEA sponsored contract N00024-76-C-605.

(U) The Technical Reviewer for this report was Dr. R. H. Mellen (Code 313).

(U) .The authors wish to acknowledge the contribution of the Submarine Signal Division of the Raytheon Company, in particular, H. C. Single, D. D. McCrady, J. Little, and R. Hayden for making available and operating the Raytheon DE1167 sonar, the receiving electronics, and the Serbuoy active target. Without this equipment, the tests could not have been conducted. Also the authors wish to acknowledge the cooperation and assistance of E. C. Gannon (Code 313) and the NUSC Seneca Lake Facility personnel especially that of A. Castelluzzo, E. Deland, J. Gesel, and E. Szlosek (all of Code 4343).

Reviewed and Approved: 14 July 1980

D. Walters
Head, Surface Ship Sonar Department

DESTRUCTION NOTICE — For classified documents, follow the procedures in DoD 5200.22-M, Industrial Security Manual, Section II-19, or DoD 5200.1-R, Information Security Program Regulation, Chapter IX. For unclassified, limited documents, destroy by any method that will prevent disclosure of contents or reconstruction of the document.

CONFIDENTIAL

Figure 2-5. Sample Preface for a Classified TR or TD

(If acknowledgments are unusually lengthy, they may be shown separately as the last item of the front matter.)

Documentation Page. A completed DD Form 1473 (figure 2-6) will appear as the first right-hand text page (unnumbered). This will be the only place in the TR or TD where the abstract will appear. This form will be included in every TR and TD; it will be filled out in accordance with the instructions given in the appendix to Military Standard 847B.

Abstract. The abstract is the report (or document) in miniature. It should be written by the author after the manuscript is finished when the relevant items are apparent. As a general rule, abstracts should be less than 200 words so that the information can be typed on an abstract card.

There are two main types of abstracts: informative and indicative. The informative abstract is a distillation of the report (or document) and follows its pattern by briefly presenting the background, the main points of evidence, and the main evaluation. Words and sentences may be taken directly from the body. The indicative abstract might be called a prose table of contents. It does not take quantitative data from the body, for example, but *indicates* to the reader that the data are in the publication.

The informative type of abstract is preferred for TR's; however, in long or complex reports, the abstract may have to be partially informative and partially indicative to avoid excessive length. The indicative type of abstract will lend itself more easily to a TD than the informative type, but the informative abstract should not be ruled out. Often a combination of the two types will be used for a TD.

Summary. Because the abstract appearing on the documentation page (DD Form 1473) is limited to 200 words, a lengthy, weighty publication may have a *lean* abstract. In this case, a summary may be used to provide a digest of the publication, to explain the reason for the initiation of the work, and to outline principal conclusions and recommendations. When used, such a summary will be located on the first right-hand page (Roman numeral page i) after the DD Form 1473 and will not normally exceed two pages in length.

Table of Contents. A table of contents listing all the main sections is required in every TR and most TD's. Additional headings are listed only if this is helpful to the reader. A model table of contents is shown in figure 2-7. The table of contents will start on Roman numeral page i or iii (depending upon whether or not a summary is used) and will list (1) items of front matter, beginning with the summary or, if a summary is not used, with the list of illustrations;* (2) first- and second-order text headings; and (3) all items of back matter (i.e., references, bibliography, appendixes) except for the distribution list. The initial page numbers for each listed item will be shown in a column at the right side of the page.

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* When the list of illustrations is (or begins) on the same page as the table of contents, it will not be entered in the contents listing.

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION CONFIDENTIAL	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY OPNAVINST S5513.5 (6/00)	3. DISTRIBUTION/AVAILABILITY OF REPORT Further dissemination only as directed by the Naval Underwater Systems Center, 14 July 1980, or higher DoD authority.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE OADR	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) TR 6273	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Naval Underwater Systems Center 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) New London Laboratory New London, CT 06320	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION Naval Sea Systems Command 8b. OFFICE SYMBOL (If applicable) SEA63R11	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code) Washington, DC 20362	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. 61152N PROJECT NO. ZR0000101 TASK NO. TD0601 WORK UNIT ACCESSION NO. DN389687

11. TITLE (Include Security Classification)
A COMPARISON OF CONVENTIONAL AND PARAMETRIC SONARS AGAINST LOW STRENGTH TARGETS (U)

12. PERSONAL AUTHOR(S)
William L. Konrad, Lynn F. Carlton, and William L. Clay, Jr.

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Progress	FROM 10/1/79 TO 6/1/80	14 July 1980	20

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Echo Ranging; Parametric Sonar; Nonlinear Acoustics; Reverberation
17	01		

19. ABSTRACT (Continue on reverse if necessary and identify by block number)
(U) The parametric underwater acoustic source, because of its narrow sidelobeless beam capability, should be especially advantageous in the detection of low strength targets against a background of reverberation. A side-by-side test to verify and demonstrate the advantages of the parametric source was conducted at the NUSC Seneca Lake Facility, where parametric and conventional sonars were used in the detection of an active target having strengths of 0 and -15 dB.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL W. Konrad	22b. TELEPHONE (Include Area Code) (203) 440-4919 22c. OFFICE SYMBOL 3321

DD FORM 1473, 84 MAR 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

Figure 2–6. Sample Report Documentation Page for a Classified Publication

CONFIDENTIAL TR 0000

TABLE OF CONTENTS (U)

Spacing: double for main entries, single for secondary entries.

CONFIDENTIAL i

Figure 2-7. Sample Table of Contents for a Classified Publication

List of Illustrations. This list is useful to the reader if illustrations are a primary means of communicating important information and must be referred to regularly. Illustrations include circuit schematics, block diagrams, curves, line drawings, photographs, etc.; all constitute figures and should be labeled as such.

When five or more illustrations or tables (or a combination of both) appear in a TR or TD, a list of illustrations or a list of tables (or both) is required. (This does not prevent using such lists when there are fewer illustrations or tables.) The list will provide the Arabic number, full title, and initial page number of all figures and tables (see figure 2-8). The list of illustrations will precede the list of tables. These lists need not begin on new pages, but may begin on the page where the preceding front matter section ends if space and good layout permit.

List of Abbreviations and Symbols. This list should be included only when the abbreviations and symbols are unfamiliar or when they are exceptionally large in number. Definitions of special nomenclature also may be included in this list. If combined with abbreviations and symbols, then the title should read LIST OF ABBREVIATIONS, SYMBOLS, AND NOMENCLATURE.

Foreword. This is an optional item. It means *a word that comes before* -- before the message, that is. Its common use in reports and documents is to tell the readers the purpose of the publication and how they might best use it.

THE INSTRUCTIONS INCLUDED UNDER THE FOLLOWING HEADINGS -- INTRODUCTION, PRESENTATION OF EVIDENCE, CONCLUSIONS, AND RECOMMENDATIONS -- FORM THE BODY OF A TR. THE BODY OF A TD VARIES (DEPENDING ON ITS SUBJECT), BUT IT SHOULD ALWAYS CONTAIN A BEGINNING, A MIDDLE, AND AN END, AS WELL AS HEADINGS AND SUBHEADINGS.

Introduction. The purpose of the introduction is to set the investigation into proper context so that the evidence presented to the reader will be meaningful and easy to follow. The introduction, therefore, should begin with a statement of the problem. It must answer the following questions: *Why was the investigation necessary?* and *What problem brought it about?* The introduction must also contain a statement of the purpose of the investigation. It must answer the following question: *What was the specific objective of the investigation in terms of solving the problem?* These two statements, together with any historical background that may be necessary to place the investigation in proper perspective, form what is called the *briefing*. This enables the writer to close in on his subject matter by establishing a common ground of understanding with the reader and then proceed from the familiar to the unfamiliar, from the general to the specific.

The introduction will begin on a right-hand page (page 1), immediately under the title (in capital letters) of the publication. Succeeding sections within the body will normally begin on the page (right- or left-hand) where the preceding section ends. However, if there is less than one-third of a page of space remaining (approximately 16 line spaces), a new page will be started. Also, a section may be started on a new page if intervening illustrations or tables make it impractical to start it on the page where

LIST OF ILLUSTRATIONS (U)

Use single or double spacing within these lists, depending on length and layout. Leave 6 line spaces when a list starts on page where preceding list ends.

LIST OF TABLES (U)

Figure 2-8. Sample List of Illustrations and List of Tables for a Classified Publication

the preceding section ends. (If the body is divided into chapters or numbered sections, each chapter or section will begin on a new right-hand page.)

Presentation of Evidence. The author presents evidence to the readers so that they can evaluate the investigation in terms of the available facts. Material is *out of order* if it does not bear directly on the premise announced in the introduction, or briefing. The arrangement of subject matter in this part of the publication depends on the type of investigation and the nature of the subject matter. The usual progression of information, however, is to describe what was done and then present the results achieved (see section 5 for a typical outline).

Conclusions (or Summary). This section is subjective. It represents the author's opinion of what was achieved during the investigation, based on the objective(s) set forth in the statement of the problem. (This section should not be termed SUMMARY when the publication contains a front matter summary.)

Recommendations. As stated earlier, recommendations are not always required. In many cases, however, the recommendations section brings the reader full circuit by presenting a solution to problems posed in the introduction, or by showing a need for more research before a solution can be reached. Recommendations are also important because they can provide a sponsor with an assessment of the future requirements of a project for funding, manhours, and equipment.

References and Bibliography. References cited in the text will be collected (in the order cited) in a list that will follow the last page of the main text. Unless readability is impaired, superscript Arabic numerals will be used for the citation of references. (Superscripts follow *all* punctuation marks except for (1) a dash and (2) a closing parenthesis when applying only to the matter within the parentheses.) Reference *footnotes* (asterisk first, then dagger) will be used in the text only if there are one or two references in the entire publication.

If more than two reference citations are in an appendix or among the appendixes, the reference list will be moved to follow the last appendix, and a continuation of the main text superscripts (Arabic numerals) will be used in the appendix(es). In such a case, the page(s) carrying the reference list will be numbered R-1, R-2, and so forth. If there are only one or two reference citations in an appendix or among the appendixes, they will be footnoted by means of an asterisk first, then a dagger. In this case the reference list will remain in its normal position, i.e., following the last page of the main text.

The difference, in theory at least, between a list of text references and a bibliography is that a standard bibliography lists *all* sources of information, whereas a reference list accounts only for entries specifically cited in the text. A Ph.D. dissertation, for example, might contain hundreds of bibliographical entries, many of which would not be referred to directly in the text.

If a bibliography is used in place of a list of references, it will follow the last page of the main text. When used together, the bibliography will follow the list of references. Entries in the bibliography will be compiled in alphabetical order by author's last name.

In a publication intended for public release, the reference list and bibliography must not include any classified or limited distribution publications. When such a reference is listed, the publication cannot be released to the general public but must carry a statement to limit distribution (see section 1).

Formats of the list of references and bibliography are shown in figures 2–9 and 2–10, respectively.

Appendix(es). The following material is typical of that commonly found in appendixes:

- Tabulations of data represented in graphs in the main text,
- Derivations of equations,
- Sample calculations,
- Sample forms used in the investigation, and
- Descriptions of equipment or facilities not important enough to occupy space in the body.

When there are two or more appendixes in a publication, they will be letter designated (A, B, C, etc.). When there is one appendix, it will not be letter designated, although its page, illustration, and table numbers will be shown as A–1, A–2, A–3, etc.

The arrangement of appendixes at the back of the publication will correspond to their order of mention in the text. Each appendix will begin on a right–hand page. The appendix designation and title will be centered, all caps (first–order–head style), three line spaces below the top margin of the first page, and the appendix text will begin three line spaces below the title on the same page. Appendix title pages will be used only for unusual situations.

Pages, figures, tables, and equations within each appendix will be separately numbered in consecutive Arabic numerals preceded by the appendix letter designation and a hyphen (e.g., figure A–1, table B–2, equation (C–3)).

Distribution List. Beginning on a right–hand page, the Initial Distribution List for external addressees forms the last pages of the publication. If the distribution list is only one page, it will be printed on the inside of the back cover. Names of addressees will, insofar as possible, be abbreviated (CNO, CNM, NAVSEASYSCOM, DTIC, etc.). A sample distribution list is shown in figure 2–11.

It is the author's responsibility to ensure that all levels of management up through the department head have reviewed and approved the *Checkoff List for External Distribution of Reports* to avoid possible embarrassment, either by the omission of key Navy activities who have an interest in the publication or, conversely, by the unwarranted inclusion of inappropriate addressees.

After review by management, the editor will review the distribution list to ensure that copies of the publication are earmarked for DTIC (12 if for public release and 2 if for limited distribution or classified) and other addressees who should receive copies (such as the program sponsor).

TR 0000

CONFIDENTIAL

REFERENCES (U)

(Informal Report, Unclassified)	1.	G. T. Griffin, "OMAT Umbilical Cable Configurations," NUSC Technical Memorandum 771186, Naval Underwater Systems Center, New London, CT, 28 June 1977 (UNCLASSIFIED).
(Informal Report, Confidential)	2.	G. R. Swope, "An Error Analysis of the Array Shape Algorithm" (U), NUSC Technical Memorandum 771124, Naval Underwater Systems Center, New London, CT, 22 June 1977 (CONFIDENTIAL).
(Formal Report, Unclassified)	3.	R. W. Morton, Measurements of Sediment Sound Velocity in Carbonate Sediments, NUSC Technical Report 4365, Naval Underwater Systems Center, Newport, RI, 19 April 1973 (UNCLASSIFIED).
(Formal Report, Confidential)	4.	D. H. Hageman, Indirect Measurement of Pressure Near an Underwater Sound Source (U), NUC TP 366, Naval Undersea Center, San Diego, CA, January 1974 (CONFIDENTIAL).
(Textbook)	5.	R. J. Urick, Principles of Underwater Sound for Engineers, McGraw-Hill Book Company, Inc., NY, 1967, pp. 82-121.
(Journal Article)	6.	H. W. Marsh and M. Schulkin, "Sound Absorption in Seawater," Journal of the Acoustical Society of America, vol. 34, no. 6, 1962, p. 864.
(No Author)	7.	Introduction to Sonar Technology, Tracor, Inc., Austin, TX, 1965. (UNCLASSIFIED).
(Ph.D. Dissertation)	8.	R. F. Santopietro, "Measurement, Analysis, and Reduction of Noise in the High Frequency Electrocardiogram," Ph.D. Dissertation, University of Pennsylvania, 1973.
(Edited Book)	8.	O. W. Eshbach, ed., Handbook of Engineering Fundamentals, John Wiley & Sons, Inc., NY, 1936.
(Proceedings)	10.	B. J. Meyers, "Reduction of Mutual Interference in the SQS-26 Sonar System" (U), Proceedings of the 27th Navy Symposium on Underwater Acoustics, October 1969 (CONFIDENTIAL).
(Patent)	11.	K. Seknakas and E. A. Gauger, Jr., "Hydroxy-Functional Hydrophylic Resins," U. S. Patent 3,650,998, patented 6 June 1972.
(Foreign Journal Article)	12.	F. Gassman,, "Über die Elastizität Poröser Medien," Vierteljahrsschr.Naturfosch, Ges. Zurich, vol. 96, 1951.
(Message)	13.	CNO message 0515542, September 1973 (CONFIDENTIAL).
(Letter)	14.	NUSC ltr to CNO, Ser. 745-452, 6 October 1977 (CONFIDENTIAL).

CONFIDENTIAL

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Figure 2-9. Sample List of References for a Classified Publication

NOTES

and usage of words, as well as on the symbols and signs routinely found in NUSC publications. For more help, the author or editor may consult the bibliography in section 9, which provides a list of references on matters of style and usage.

REVISIONS

When a NUSC TR or TD is revised, a supersedure statement appears on the cover (and DD 1473) and the original identification number is followed by the letter of the alphabet that indicates which revision it is (see upper left corner of figure 2-3).

Equations will be numbered in consecutive Arabic numerals enclosed in parentheses, e.g., equation (1). Appendix equation numbers will be prefixed by the letter designation of the appendix, e.g., equation (A-1). Equation numbers will be located against the right margin on a line with the main line of the equation. (For equations that run more than one line, the number will be shown on the last line of the equation.) A series of related equations may be numbered individually (e.g., (3a), (3b), (3c)) or may have an all-inclusive number placed on a line with the center equation of the series.

Numbering of displayed mathematical matter serves two purposes: to give prominence to a particular expression and to facilitate later reference to it.

Security Markings

In classified publications, security classification markings will be employed in accordance with the rules given below. Page markings will be shown top and bottom center in letters larger than text capitals; markings for paragraphs will be shown flush left on the first line of the paragraph in text capitals; markings for figures and tables will be shown within or near the figure and above or below the table; and markings for the figure captions or table titles will be shown between the number and the caption or title (see figure 2-14).

1. Each page will be marked with the overall security classification of the publication. An exception to this rule may be made in the case of a clearly identified appendix having a lower security classification than that of the main text. If the appendix is unclassified, the pages of the appendix may be marked UNCLASSIFIED and no paragraph marking is required; a confidential appendix in a secret publication may have its pages marked CONFIDENTIAL, but the paragraphs must be appropriately marked.

2. On each page, all items (paragraphs, figures and figure captions, tables and table titles) will be marked with their individual classifications as described earlier.

3. The last page (i.e., the left-hand page facing the back cover) of every classified publication will be marked with the overall security classification even if it is blank.

4. Short phrases or incomplete sentences that appear as numbered or lettered items or steps under a paragraph will not be individually marked, but will assume the classification of the parent paragraph. However, complete sentences presented in this manner will be individually classified unless the parent paragraph is unclassified.

5. The classifications of all headings, captions, and titles will be indicated in the table of contents, list of illustrations, and list of tables, as shown in figures 2-7 and 2-8.

RULES OF STYLE AND USAGE

Sections 6 through 8 of this *Guide* make no attempt to cover all the rules of style and usage, but provide a brief look at some of the most common areas where errors are found by editors of NUSC TR's and TD's. The *Government Printing Office Style Manual* contains additional information on the preferred spellings, abbreviations, compounding,

$$x = \sum_{n=1,2,3}^{a-b} \frac{a_n + b}{b_n} + \int_{y+2}^{x+1} dx \ , \tag{2-4}$$

$$x = \lim_{a \to \infty} \frac{a}{2} \ , \tag{2-5}$$

and

$$\min_{a<b<c} = \max_{a<b<c} R(abc) \ . \tag{2-6}$$

5. Leave no space between a letter, symbol, number, etc., and an opening parenthesis, bracket, or brace. Leave no space between a closing parenthesis, bracket, or brace and the next character. Leave no space between back-to-back parentheses, brackets, or braces:

$$a(b + c) = [d(e + f)g][(h + i)(j + k)]^2 \ . \tag{2-7}$$

6. *Sin, cos, tan, log,* etc., will have one space before and after them except when they immediately precede a parenthesis, bracket, or brace, in which case they will be closed up. Superscripts and subscripts to these terms are, of course, closed up:

$$\sin x = \sin y + d \tan(x + y) + \cos^2 B \tag{2-8}$$

and

$$\log x = \log c + \log(a + b) + 2 \log_{10} y \ . \tag{2-9}$$

7. Except as indicated in the foregoing, one space will be left

a. on each side of built-up fractions,
b. on each side of a radical sign,
c. on each side of differential pairs,
d. between two fractions on the main line, and
e. between the end of an equation and the punctuation mark.

8. When appearing together in the same equation, parentheses will be used first, followed by brackets, and then braces:

$$\left\{\left[\frac{(x + y)(a + b)}{2ax}\right]\left[\frac{(c + d)(y + z)}{2y}\right]\right\}^2 \ . \tag{2-10}$$

running more than one line will begin to the right of the primary equal sign. Such equations will be broken before an equal, plus, minus, or multiplication sign.

Opening and closing parentheses, brackets, and braces should be the same height as the tallest expression they enclose. Numerators will be separated from denominators by a line as long as the longer of the two. Both the numerator and denominator will be centered with respect to this dividing line.

Connecting words of explanation, such as *hence, therefore, similarly,* etc., will be set flush left on a separate line when they are followed by a displayed equation.

The word *where* following an equation will be set flush left and ensuing terms and definitions, if simple and uninvolved, will be run in with it (in paragraph form). If terms or definitions involve built-up fractions or complicated mathematical expressions, they will be displayed, each indented seven spaces, beginning one line space below the *where* line. Double spacing will normally be used between the terms.

Short equations run in with the text will not be broken if at all possible. Fractions in such equations will not be built up (solidus will be used). For fractions in displayed equations, the solidus will be used within the numerator or denominator and for subscripts and superscripts.

When appearing together, subscripts and superscripts will be aligned on the left.

Guidelines for spacing within equations follow:

1. Leave no space between a character and its superscripts and subscripts, between a character and factorial signs, between a character and primes.

2. Close up all parts of a superscript and subscript pattern and all parts of limits to an integral, summation, product, etc.:

$$x^{-eij} = y_{abc} \tag{2-1}$$

and

$$x = \sum_{n=1,2,3}^{a-b} + \int_{y=2}^{x=1} dx \ . \tag{2-2}$$

3. On the main line of an equation, allow one space before and after operation signs (+, −, x, etc.). (Exception: when a minus sign is an adjective describing a negative quantity, it is closed up with the letter, number, symbol, etc., to which it belongs.)

$$a + b = -c \times (d + e) \ . \tag{2-3}$$

4. Allow one space before and after (the full expanse of) an integral, summation, product, min, max, lim, etc.:

Foldout illustrations will be avoided whenever possible. When they must be used, foldout pages will have the figure caption, page number (double-numbered), page classification, and report or document number so located as to be visible when the illustration is folded.

Tables

Tables will be kept as simple as possible and will be set up so that they are easily understood. Vertical rules will not normally be used at the outside of tables nor between columns of a table, except when tight spacing causes columns to run together. Generally, horizontal rules will be used only at the head of the table, beneath the column heads, and at the end of the table (the very end of tables that run more than one page). For a sample layout, see table 1-2.

Column headings will be in initial capitals. Applicable units of measurement will be given in the column heading and will not be repeated in the columns.

Tables will be located after and as near as possible to the first text reference (except in special situations).

To the maximum extent possible, tables will be placed upright on the page. Those that must be placed sideways will have the top of the table parallel with the left margin.

All tables (except for small tabulations *sandwiched* in the text) will be numbered and titled. Numbering will be in consecutive Arabic numerals; appendix table numbers will be prefixed by the letter designation of the appendix. Titles will be shown in initial caps for all principal words and will be centered above the table. Spacing and punctuation within table titles will be as shown for illustrations in figure 2-14.

Tables continued from page to page will repeat the full title of the table preceded by the abbreviation *Cont'd* in parentheses. On continued pages of a table, all column headings will be repeated. For a sideways table continued from a left- to a right-hand page, neither the table title nor the column heads need be repeated.

Footnotes to tables will be set as paragraphs, except that several very short notes may be spaced out on the same line. If a table runs more than one page, the appropriate footnotes will go with each page or all footnotes will be placed at the end of the table and the note *See footnotes at end of table* will be shown at the bottom of each table page.

In classified documents, the classification of the table will be displayed above or below the table itself, and the classification of the table title will appear between the table number and title, as shown for illustrations in figure 2-14. (Footnotes to tables do not require a separate classification.)

Mathematical Matter

All mathematical matter will be treated as part of a grammatically correct sentence; thus, in all cases, proper punctuation must be used.

Displayed equations will be placed immediately after the first text reference and all will be indented seven spaces from the left margin. The overrun from equations

Illustrations will be located after and as near as possible to the first text reference. In special situations (such as a publication containing only a few text pages and many illustrations), all illustrations may be grouped in numerical sequence following the last page (preceding the references or bibliography).

Every effort will be made to place illustrations upright on the page so that the publication need not be turned sideways to view an illustration. When an illustration must be placed sideways on a page, it will be turned so that its bottom is parallel with the right margin of the page.

Lettering on illustrations (except for units of time and measurement, which will follow text style) will be all capitals, approximately 8 to 10 point when reproduced.

All illustrations (with the possible exception of small simple sketches *sandwiched* in the text) will be numbered and captioned. Numbering will be in consecutive Arabic numerals; appendix illustration numbers will be prefixed by the letter designation of the appendix. Captions will be shown in initial caps for all principal words and will be centered beneath the illustration. Spacing and punctuation within figure captions will be as shown in figure 2-14. In classified publications, the classification of the figure will be displayed within or near the top or bottom of the figure itself, and the classification of the figure caption will appear between the figure number and the caption.

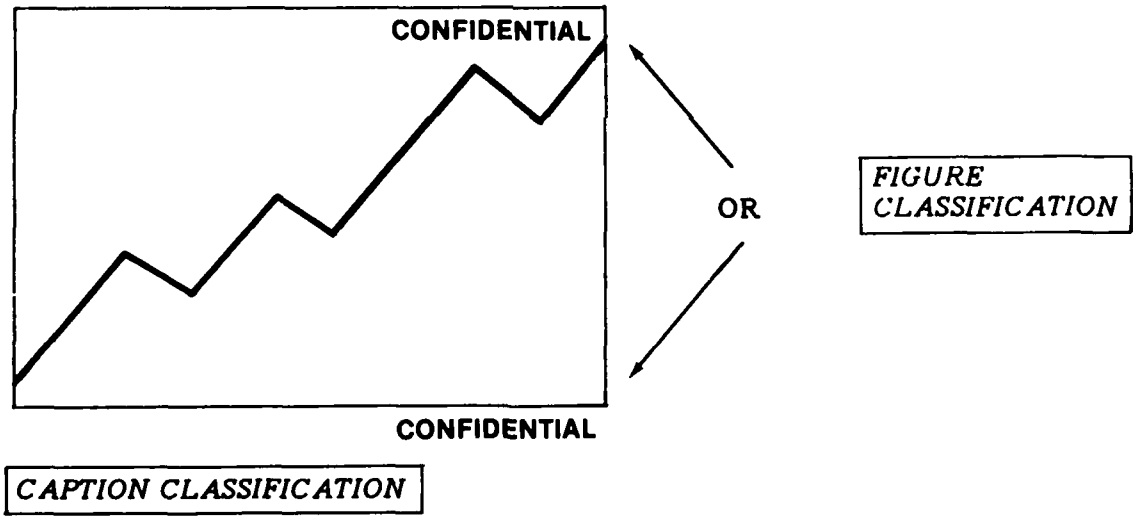

Figure 2-14. Sample Captions and Security Markings for Illustrations

Page Numbering

The front cover, its reverse side, and DD Form 1473 will be unnumbered; remaining pages of front matter will be numbered in lowercase Roman numerals, with the table of contents beginning on page i or iii (depending on whether or not a summary is used). If the front matter ends on a right-hand page, that page will be doubled numbered:

iii/iv
Reverse Blank

The main text, references, and bibliography will be numbered in Arabic numerals, with the Introduction starting on page 1. Again, double numbering applies if the last page is a right-hand page.

The appendix pages will be numbered according to the letter designation of the appendix (e.g., A-1, A-2, B-1, B-2). Distribution list page(s) will be unnumbered unless a lengthy list causes a collating problem; in such a case, Dist-1, Dist-2, etc., will be used.

Foldout pages will be double numbered in the same manner as a page whose back is blank.

Section and Chapter Numbering

When sections or chapters are used, they will be numbered in consecutive Arabic numerals. The section or chapter titles are the first-order headings in text.

Pages, illustrations, tables, etc., will be numbered consecutively throughout a publication, using Arabic numerals. However, if deemed useful, pages may be numbered on a chapter or section basis.

Footnotes

As shown in this *Guide*, footnotes are double spaced below a 1-inch bar and indented to paragraph depth. (The bar itself is triple spaced below the last line of text.) To avoid conflict with reference citations and exponents, reference marks for footnotes will consist of symbols in the following sequence: asterisk, dagger, double dagger, section mark, parallel, and number sign. If more footnotes are required, these symbols are doubled, then tripled. Footnote marks will follow all punctuation marks except for (1) a dash and (2) a closing parenthesis when the footnote mark applies only to the matter within the parentheses. In a classified publication, the security marking of the footnote will be placed flush left.

Illustrations

Illustrations supplement text, call attention to details, and present ideas difficult to describe by text alone. If an illustration does not fill one of these needs, its use should be questioned. It is the editor's responsibility to see to it that the only artwork used is that which will clearly, adequately, and economically portray the needed information.

Spacing Allowances

Line spacing for particular text situations will be as specified in the following tabulation:

Between	Spacing
First–order head (chapter or section title) and text or second–order head	Triple
Second– or third–order head and text	Double
Text of previous section and new first, second–, third–, or fourth–order head	Triple
Text and table title	Triple
Table title and body of table	Double
End of table and text	Triple
Text and top of illustration	Triple
Illustration and caption	Double
Figure caption and text	Triple
Numbered and lettered items under a paragraph	Double*
Text and displayed equation	Triple
First and second lines of displayed equation	Double
End of displayed equation and text	Triple

Front matter heads (Preface, Table of Contents, List of Illustrations, List of Tables), first–order heads (or chapter and section titles), and back matter heads (References, Bibliography, Appendix, Distribution List) will be triple spaced below the top of the 9–inch image area unless these sections are considerably less than one page in length; then, the title is further lowered so that the information on the page presents a better appearance.

Page Size and Layout

Text pages will be 8 1/2 by 11 inches with a 6 1/2 by 9 inch image area. Copy will usually be single spaced in a single column. However, if equations with subscripts or superscripts are run in with the text, then space and one–half is recommended. Marginal copy will include the classification of the page (if the publication is classified) centered top and bottom; the TR or TD number placed in the upper outer corner of each page (against the margin and approximately three lines from the top of the page); and the page number placed in the lower outer corner of each page (against the margin and approximately three lines from the bottom of the page).

---

* When items in such a listing are very short, single spacing may be used.

TR 0000 **CONFIDENTIAL**

(U) Numbered or lettered items and steps are to be handled as indicated in the following examples:

5 spaces → 1. (U) First numbered item gets paragraph indentation and two line spaces are left between it and the parent paragraph.

2. (U) If items are lengthy (as these are), use double spacing; otherwise, single spacing may be used.

3. (U) Be consistent in the use (or non-use) of closing punctuation; short items and incomplete statements can usually do without punctuation.

4. (C) Two spaces are left after the number or letter of the item in all cases.

9 spaces → a. (C) Lettered items subordinate to a numbered item are indented so that they begin under the first letter of the numbered item.

b. (U) Spacing and punctuation for these items should follow that used in the parent item.

c. (U) Further subordination examples are indicated below:

13 spaces → (1) (U) First word . . .
(2) (U)
(3) (C)

17 spaces → (a)
(b)

5. (U) Runover lines of numbered and lettered items generally return to the left margin.

(U) The advantages of an enumeration run in with the text are (1)----------, (2)----------, and (3)----------.

CONFIDENTIAL

Figure 2-13. Numbered and Lettered Items and Steps in a Classified Publication

TR 0000

FIRST-ORDER HEADING

[triple spacing]

SECOND-ORDER HEADING

[double spacing]

Text----------

---.

[triple spacing]

Third-Order Heading

[double spacing]

Text----------

[triple spacing]

Fourth-Order Heading. Text----------

[double spacing]

Text----------

[triple spacing]

FIRST-ORDER HEADING

Figure 2-12. Typewriter Headings in Text (With Standard Font) for an Unclassified Publication

Conversely, the editor must question distribution lists of unusual length to verify the need for such widespread distribution.

The internal distribution list (not printed as part of the final publication) should be formulated during the management review. It is standard procedure to include both Center libraries (see footnote, page 1-10) and the Technical Publications Section Head of the Newport or the New London Laboratory (one copy) on this list.

TEXT PREPARATION

Headings*

Typewriter headings in text will be prepared as follows (see figure 2-12):

First-Order Heading -- all caps, centered, no underscore.

Second-Order Heading -- all caps, flush left, no underscore.

Third-Order Heading -- initial caps, flush left, underscored.

Fourth-Order Heading -- initial caps, indented five spaces from left margin, underscored, followed by a period, run in with the text.

If the report is divided into numbered sections or chapters, first-order headings will be the section or chapter titles.

For further subordination under a given paragraph and for a listing of items, steps, substeps, etc., the format shown in figure 2-13 will be observed. Arabic numerals will be used first, followed by lowercase letters, parenthesized Arabic numerals, and parenthesized lowercase letters. Bullets may be used instead of Arabic numerals.

Enumerations that are run in with the text will be indicated by parenthesized Arabic numerals (e.g., (1), (2), (3)).

Indentations

Indentations for paragraphs will be as shown in figure 2-12 (i.e., all paragraphs will be indented five typewriter spaces from the left margin). When security classification markings are used, the marking will be placed flush left followed by two spaces to the text (see figure 2-13).

For numbered and lettered items and steps, indentations will be as shown in figure 2-13. Primary numbered steps or items will be indented to paragraph depth (five spaces), with two spaces to ensuing text. Substeps and subitems will be indented so that their letter or number designation begins under the first letter of the parent item or step. Runover lines of all steps, items, substeps, and subitems will generally return to the left margin.

---

* Figure 2-12 shows text headings prepared with the standard font; the text headings in the *Guide* are prepared with a bold font, which is preferable, if available.

CONFIDENTIAL

INITIAL DISTRIBUTION LIST (U)

Addressee	No. of Copies
CNO (OP-03EG, -95)	2
CNM (MAT-03, -03L(2), -032 (J. Miller))	4
NAVSEASYSCOM (SEA-660, -662)	2
NAVSURFWPNCEN White Oak (Code 54)	1
ARL, Penn State	1
NOSC, San Diego (Attn: Mr. J. Smith)	1
DTIC, Alexandria	2
MAR, Inc. (Contract N00014-29-C-0230 (G. Rowan))	1

This list is single or double spaced depending on length.

NOTE: To satisfy the need-to-know requirements of OPNAV Instruction 5510.1G, a Navy contract number must appear alongside each contractor's name on the distribution list of a classified or limited distribution publication.

CONFIDENTIAL

Figure 2-11. Sample Distribution List for a Classified Publication

BIBLIOGRAPHY (U)

Eshbach, O. W., ed., Handbook of Engineering Fundamentals, John Wiley & Sons, Inc., NY, 1936.

Gassman, F., "Über die Elastizität Poröser Medien," Vierteljahrsschr. Naturfosch. Ges. Zürich, vol. 96, 1951.

Griffin, G. T., "OMAT Umbilical Cable Configurations," NUSC Technical Memorandum 771186, Naval Underwater Systems Center, New London, CT, 28 June 1977 (UNCLASSIFIED).

Hageman, D. H., Indirect Measurement of Pressure Near an Underwater Sound Source (U), NUC TP 366, Naval Undersea Center, San Diego, CA, January 1974 (CONFIDENTIAL).

Introduction to Sonar Technology, Tracor, Inc., Austin, TX, 1965. (UNCLASSIFIED).

Marsh, H. W., and M. Schulkin, "Sound Absorption in Seawater," Journal of the Acoustical Society of America, vol. 34, no. 6, 1962, p. 864.

Morton, R. W., Measurements of Sediment Sound Velocity in Carbonate Sediments, NUSC Technical Report 4368, Naval Underwater Systems Center, Newport, RI, 19 April 1973 (UNCLASSIFIED).

Myers, B. J., "Reduction of Mutual Interference in the SQS-26 Sonar System" (U), Proceedings of the 27th Navy Symposium on Underwater Acoustics, October 1969 (CONFIDENTIAL).

Santopietro, R. F., "Measurement, Analysis, and Reduction of Noise in the High Frequency Electrocardiogram," Ph.D. Dissertation, University of Pennsylvania, 1973.

Seknakas, K., and E. A. Gauger, Jr., "Hydroxy-Functional Hydrophylic Resins," U. S. Patent 3,650,998, patented 6 June 1972.

Swope, G. R., "An Error Analysis of the Array Shape Algorithm" (U), NUSC Technical Memorandum 771124, Naval Underwater Systems Center, New London, CT, 22 June 1977 (CONFIDENTIAL).

Urick, R. J., Principles of Underwater Sound for Engineers, McGraw-Hill Book Company, Inc., NY, 1967, pp. 82-121.

Figure 2-10. Sample Bibliography for a Classified Publication

3. TECHNICAL MEMORANDUM (TM)

INTRODUCTION

The technical memorandum (TM) is designed to provide the principal and most expeditious means for Center engineers and scientists to document and disseminate technical and scientific information. The general standards for its preparation and processing, which are described below, contain many of the provisions of NUSC Instruction 5602.1D.

CONTENT

The TM usually contains information that covers short range projects or the day-to-day operations of projects in formative stages. A TM also provides program managers and authors with a medium to express tentative work proposals and a cost-effective format for both quick response R&D documentation and individual professional comment.

OVERALL PREPARATION AND RELEASE PROCEDURES

The direct responsibility for a TM lies with the author who prepares and signs it. A TM written by a Newport Laboratory author is processed through the Technical Publications Branch, where basic editing services assist the author in preparing the final copy. In the New London Laboratory, TM's are not normally edited by the Technical Publications Branch; the author, therefore, is expected to act as the editor (although the services of the Technical Publications Branch are always available). In both laboratories, TM numbers are assigned by the Technical Publications Branch.

Security Markings

Authors are responsible for (1) determining the proper security classification of the TM; (2) correctly applying the required security markings in the text and on the cover; and (3) routing the TM through the proper security review cycle in accordance with the *NUSC Security Manual* (NUSC Instruction 5500.1).* The Security Office is available for assistance in security matters. A basic review of classification markings required for NUSC publications is given in sections 1 and 2 of this *Guide*.

Distribution

Before submitting a TM for review, the author shall prepare a distribution list and select one of the distribution statements shown in table 1-2 for use on the TM cover.

---

* It is recommended that all TM's be routed through the Security Office.

Internal Distribution Only. A TM that is intended solely for distribution within the Center is routed to the division head (or equivalent) for review. Such a TM will carry distribution statement B, C, D, E, F, or X.

External Distribution. Although TM's are designed primarily for internal communication, external distribution of selected TM's is encouraged (see NUSC Instruction 5602.1D). In this case, the author must ensure that a letter of transmittal accompanies the TM and that the letter, the distribution list, and the TM are submitted to the department head or associate technical director before release. Other regulations concerning NUSC policy for the external release of a TM are listed below:

- *For Public Release*: An unclassified TM that is released to the general public (distribution statement A) must undergo the review that is described in figure 1-1.

- *As Official Policy:* As a general rule, a TM is understood to represent Center policy only when accompanied by an official letter of endorsement. Thus, if a TM is released for distribution to an external addressee, it may not be regarded as an official publication unless it is accompanied by a letter that specifically approves its contents. Otherwise, the TM is released *For Information Only.*

- *To Other Government Agencies:* Department heads or associate technical directors may release TM's to other laboratories and centers, Fleet commands, program managers, and similar levels. In the case of Flag Ranks, a TM will be released only with the written approval of the department head, associate technical director, or Deputy Technical Director.

- *To DTIC:* Upon the recommendation of the author and the cognizant department head or associate technical director, TM's of interest to the R&D technical community shall be forwarded (along with a completed form DD 1473) to the Defense Technical Information Center (DTIC). Unclassified TM's released to DTIC must be approved for public release or carry statement B, C, D, E, F, or X.

- *Under IR/IED Funding:* A TM prepared under the NUSC Independent Research and Independent Exploratory Development (IR/IED) Program must be approved for external release by the Associate Technical Director for Technology.

- *To Contractors:* A TM shall not be released for external distribution to a Navy contractor unless a need-to-know has been established. In the case of NUSC contracts or naval systems command contracts for which NUSC has been specifically assigned the technical guidance function, decisions on the release of specific publications will be made locally. Such decisions will be made on the basis of recommmendations by the senior project engineer responsible for the contracts in question and will require a review by the Security Office and the approval of the department head or associate technical director.

When a TM is to be released to a Navy contractor, a forwarding letter must be prepared for the signature of the author's department head or associate technical director; it will refer to the contract under which the contractor's need for the TM has been established.

Requests by contractors for the loan of classified NUSC TM's relating to contracts for which NUSC has no responsibility must be sent to NUSC through the cognizant technical desk in the contracting systems command or laboratory for endorsement. This endorsement must certify the contractor's need-to-know for the requested material in terms of a specific contract.

When a TM is released on a loan basis, a statement should be included indicating that the publication is being loaned for a specific period (e.g., 30, 60, 90 days) or for the duration of the contract. The letter should then be forwarded via the NUSC Security Office, which will affirm the necessary need-to-know, facility clearance, and storage capability of the recipient.

FORMAT

The format of a TM is designed to disseminate information quickly and cost effectively to a limited number of recipients. It is a modified version of the format used with technical reports (TR's) and technical documents (TD's). For formating guidance not provided below, authors may consult section 2 (including figures 2-6 through 2-10).

Front Matter

The simplified front matter includes

- Title Page (Self-Cover)
- Abstract
- Administrative Information

Title Page: Self-Cover or Hard Cover. The title page, or self-cover, is shown in figure 3-1. Usually the entire TM, including the self-cover, will be duplicated on the same weight stock. The use of covers of a heavier weight or different color than the text adds to production and material costs and thus must be approved by the local Naval Publications and Printing Service Office. In cases where sponsors require a more distinctive type of publication, the cover design and stock may follow that of a TR if the department head approves.

Abstract and Administrative Information. The abstract and administrative information appear on the same page, as shown in figure 3-2. The abstract should be of the informative type (the TM in miniature) and should be kept to under half a page. In extremely short TM's, abstracts may not be necessary.

The administrative information section appears on the same page as the abstract. It should designate such items as the project number and its title, the Center's principal investigator, the Navy subproject and task number, the program manager in Washington, the funding organization and its code, the contract number (if any), and an ackowledgment statement (if appropriate). A destruction statment should also be included on this page whenever distribution statement B, C, D, E, F, or X is used.

TD 7333

CLASSIFICATION
(Overall security classification in top and bottom margin of each page if TM is classified.)

TM No. 85-XXXX
(Assigned by Publications Branch)

NAVAL UNDERWATER SYSTEMS CENTER
NEWPORT LABORATORY
NEWPORT, RHODE ISLAND 02841
(Name and location of applicable laboratory)

Technical Memorandum

DEVELOPMENT OF SEA TEST PARAMETERS FOR MULTIPATH RANGING CONDITIONS ( )

(Title is marked with appropriate letter in parentheses if TM is classified)

Date: 10 February 1985

Prepared by: (Signature)
Author
Division or Branch
Department

Distribution statement and warning notice (*if required*)

Classified by:
Declassify on:
Downgrade to: *(if applicable)*

CLASSIFICATION

Figure 3-1. Sample Self-Cover for a TM

CLASSIFICATION
(Overall security classification in top and bottom margin of each page if TM is classified.)

TM No. 85-XXXX

Abstract ( )

( ) Reverberation caused by deep scattering layers (DSL) was measured from the DRV DEEPSTAR 4000 in the Gulf of Mexico and on the continental rise north from Florida. A narrow-beam, transducer-reflector system operating between 3.25 and 4.75 kHz was employed at several depths to make horizontal transmissions with pulse lengths of 40 and 120 ms, while graphic records of the depth of the DSL were obtained onboard the support ship.

( ) Daytime scattering strengths were at a noise threshold of -80 dB. Maximum nighttime values of scattering strength of -55 dB were observed east of Delaware, with decreases in magnitude both north and south of this location. East of Cape May, results obtained 1 year earlier with DRV STAR III were confirmed. Nighttime reverberation was attributed to scatterers between the surface and a depth of 300 m. Also, no measurable frequency dependence in scattering strength was noted in the range from 3.25 to 4.75 kHz.

ADMINISTRATIVE INFORMATION ( )

( ) This memorandum was prepared under Project No. A40005, "Near Shore ASW Environmental Investigations," Principal Investigator R. G. Williams (Code 3635). The Sponsoring Activity is the Naval Ship Systems Command (Code 00V1), Program Manager B. K. Cooper. This memorandum was also prepared under Project No. A04100, "Applications of Statistical Communication Theory to Target Detection and Classification," Principal Investigator A. H. Nuttall (Code 3636). The Sponsoring Activity is the Chief of Naval Material, Program Manager J. H. Huth.

ACKNOWLEDGMENT ( )

( ) Appreciation is gratefully extended to T. Galib, Jr. (Code 3635), who prepared all the computer programs that provided the calculations and who prepared the curves for this memorandum. The Ocean Engineering Department also acknowledges the help in preparation of this memorandum provided by S. Connagle, consultant under Contract N00140-76-6702.

DESTRUCTION STATEMENT (*IF APPLICABLE*)

i/ii
Reverse Blank

CLASSIFICATION

Figure 3-2. Sample Abstract and Administrative Information for a TM

Body

Introduction. All TM's shall have an introduction. It should be short and to the point, providing the readers with the following information:

- The background material necessary for the reader to understand the message.
- The purpose(s) of the TM.
- The scope of the TM.
- The relationship of the work to concerned Center projects.

The introduction shall be titled INTRODUCTION.

Presentation. Authors may choose whatever order they believe will be the most effective for the presentation of the subject matter. However, the organization of the information should follow some logical plan. Authors may use headings and subheadings to emphasize material or divide it into sections. The wording should be chosen so that the final writing is straightforward and easy to read. Tables and figures shall be included whenever necessary to supplement the text.

End Matter

Any addition of supporting material, such as a list of references or an appendix, is left to the judgment of the author. A distribution list must be included; the format of this list is shown in figure 3–3.

TEXT PREPARATION

The final copy of a TM is typed in the author's own organizational section. To conserve paper, TM's of more than a few pages will be duplicated back-to-back. For classified TM's, each page shall bear the overall classification of the TM and the security classification of each paragraph shall be indicated at the beginning of the paragraph as (U), (C), (S), (C–NF), (S–NF), (CAN–C), etc. (see sections 1 and 2).

To help keep TM's short, main sections (except for the Introduction) do not have to begin on new pages. Main headings should be typed in all capital letters, however, and triple spacing should be used between the end of one section and the heading for the next section, so that the division of the material is self–evident.

To expedite the typing and assembly, figures generally are grouped at the end of the TM. Small figures, such as simple curves and logic diagrams, may be inserted into the text if the author believes they will help the reader understand the material more readily. It is not recommended, however, that illustrations appear both in the text and at the end of the TM.

For additional guidance in text preparation (i.e., page size, margin and spacing allowances, tables, mathematical matter), authors may refer to section 2 (including figures 2–12 through 2–14).

CLASSIFICATION
(Overall security classification in top and bottom margin of each page if TM is classified.)

TM No. 85-XXXX
(Typed on every page.)

DEVELOPMENT OF SEA TEST PARAMETERS
FOR MULTIPATH RANGING CONDITIONS ( )
S. Connagle
Active Systems Division
Ocean Engineering Department
TM No. 85-XXXX
10 February 1985
DISTRIBUTION STATEMENT
CLASSIFICATION

DISTRIBUTION LIST

External

NAVSEASYSCOM (SEA-00, -123, PMS-123)
DTNSRDC (Code 15 (Attn: A. Walker))
DTIC, Alexandria (2)

Internal

Codes: 35
36
37
38
389
0211 (R. Bernier (1))
021311 (New London (1))
021312 (Newport (2))

Total: 15

The distribution list is prepared by the author; it should include the desired external and internal addressees, in addition to the required internal addressees for each laboratory (i.e., two copies for the library of the laboratory where the TM was prepared, one copy for the library of the other laboratory, and one copy for the technical publications branch head).

CLASSIFICATION

Figure 3-3. Sample Distribution List for a TM

RULES OF STYLE AND USAGE

The rules of style and usage for a TM are the same as those for a TR or TD. Sections 6 through 8 of this *Guide* and the *Government Printing Office Style Manual* provide authors with specific guidance on the preferred style for NUSC publications.

REVISIONS

When the distribution of a TM is internal and the changes to it are minor, a letter of errata with a list of pen and ink corrections is forwarded to the distribution list; if the changes are extensive, the completely revised pages are forwarded.

When the distribution is external, a new TM number is assigned in the Technical Publications Branch and the cover carries the statement *Supersedes TM No. XX-XXXX (old number)* beneath the new number. If the revisions affect the classification and distribution of the TM, the proper security markings and distribution statement must be applied.

NOTES

4. OTHER PUBLICATIONS

TECHNICAL ARTICLE

Introduction

Incentive Awards. The Center encourages engineers and scientists to publish technical articles relating to their work. In fact, monetary incentive awards up to $100 are made for journal articles, in accordance with NUSC Instruction 12451.1A. It is felt that publication in professional journals not only advances the stature of authors among their colleagues but also reflects favorably on the Center.

Dual Publication. The publishing of material from a single manuscript in different formats (as a technical report (TR) and as a journal article, for example) is to be avoided whenever possible. The Center's policy on dual publication is discussed further in section 1.

Content

Not all types of investigations lend themselves to journalistic reporting. But certainly much of the work at the Center is of interest to the technical and scientific communities at-large. Potential authors who believe they have acceptable material should compare it with the type and scope of material that appears in the journals.

Valuable help may be obtained from the NUSC Technical Library staff. The library subscribes to all journals and magazines of note in technical fields allied with the work done at the Center. The reference librarian can check on articles dealing with the subject matter to provide an adequate picture of the research and publication in a given field.

Overall Preparation and Release Procedures

Articles to be sent to professional journals should be submitted to the Technical Publications Branch for editing and preparation in accordance with the specifications of the journal.

The Technical Publications Branch personnel also write, co-author (with technical or other personnel), process, and place NUSC-related articles in semiprofessional journals and trade magazines. Suggestions for subjects for such articles are always welcome.

Review. Before the article is sent to the journal, the final manuscript is enclosed with a forwarding letter for supervisory review (see figure 4-1). The letter is signed by the author's department head, in accordance with NUSC Instruction 5000.3C. (When

DEPARTMENT OF THE NAVY
NAVAL UNDERWATER SYSTEMS CENTER

NEWPORT LABORATORY
NEWPORT, RI 02841

NEW LONDON LABORATORY
NEW LONDON, CT 06320

IN REPLY REFER TO:
5600
Ser 402111-24

Dr. M. L. Smith
M.I.T. Lincoln Laboratory
P.O. Box 73
Lexington, MA 02173

Dear Dr. Smith:

The enclosed article, "Hybrid Ray Antennas," by W. K. Lang is submitted for publication in the IEEE Transactions on Antennas and Propagation.

Sincerely yours,

W. A. Von Winkle
Associate Technical
Director for Technology

Encl:
(1) Manuscript
(original and
3 copies)

Approved by:

Head, Technical Publications Section (Code)

Author (Code)

Department Head (Code)

Associate Technical Director for Technology (Code)

Editor (Code)

Mailroom (Code)

Articles for professional journals must be approved for public release in accordance with NUSC Instruction 5570.1D. (See figure 1-1.)

Figure 4–1. Sample Forwarding Letter for a Technical Article (With Superimposed Routing List)

the article is written under Independent Research/Independent Exploratory Development (IR/IED) funds, the Associate Director for Technology signs the letter.)

All manuscripts prepared for publication in the public domain must receive clearance for public release, in accordance with NUSC Instruction 5570.1D (see section 1). (Statement A must be visible in the lower right-hand corner of the title page.) Classified articles are to be submitted to controlled publications only, such as the *U.S. Navy Journal of Underwater Acoustics.*

Format and Text Preparation

The length and format of each article will vary according to the specifications set by the publishing agency. The Technical Library has authors guides on file published by the various professional societies and government agencies.

TECHNICAL BROCHURE OR PAMPHLET

Introduction

A brochure or pamphlet is a Center-approved, formal publication designed to meet some special communication need or purpose. It is usually prepared for wide distribution, often for a segment of the general public. It is often highly pictorial to most effectively address its intended audience (see NUSC Instruction 5200.7A).

Content

Technical brochures and pamphlets are used to announce the availability of special services and facilities or to address an outside audience about subjects of special or general interest. Examples include (1) descriptive pamphlets on facilities, such as the NUSC Computer Laboratory and the Newport Ranges, and (2) management publications, such as the *NUSC Brief* and recruitment brochures.

Overall Preparation and Release Procedures

A badly conceived or poorly executed brochure communicates a correspondingly negative sense of the Center's competence. For this reason, among others, the originator of a brochure or pamphlet must obtain approval from the department head and assistance from the Technical Publications Branch (i.e., to edit the text, design the layout, route the publication for review, and arrange for printing and distribution). The Technical Publications Branch will also ensure that the issued brochure has been approved to carry the following statement: *The Secretary of the Navy has determined that this publication is necessary in the transaction of business required by law of the Department of the Navy. Funds for printing of this publication have been approved by the Navy Publications and Printing Policy Committee.*

Review. The originator of a brochure or pamphlet should provide the Technical Publications Branch with a proposed distribution list (external and internal). This list

will be submitted for approval along with the brochure to the Commanding Officer or Technical Director. The issued publication will carry the signature of (or be endorsed by a letter of approval from) the Commanding Officer. (The review cycle for recruiting brochures or pamphlets should also include the Personnel Department.)

Printing and Distribution. Arrangements for printing and distribution will be made by the Technical Publications Branch. This branch determines the number of copies to be printed, based on present and future needs of the originator and other organizational units. The requesting cost center is expected to bear the cost of preparation and printing. The Technical Publications Branch makes external distribution in accordance with the list provided, as well as internal distribution to the department or division level, as appropriate. Storage and later distribution of extra copies are the responsibilities of the originator (see section 1).

Format and Text Preparation

If a brochure or pamphlet is phototypeset, its cover and interior must be prepared in accordance with SECNAV Instruction 5600.20, *Department of the Navy Graphic Design Standards*. If it is not phototypeset, flexibility in the interior layout is allowable, consistent with good design principles, but the cover must follow the Navy standard.

TECHNICAL MANUAL

Introduction

A technical manual is the basic source of technical information for Fleet personnel responsible for the installation, operation, maintenance, repair, and parts support of military systems and equipment.

Guidance in the preparation of technical manuals for the Fleet is provided by NAVSEA directives, which define the policies, procedures, and responsibilities for the acquisition of new technical manuals and the maintenance of existing technical manuals. NAVSEA has also established a uniform system for assigning identification numbers to all Navy technical manuals. (This new identification system will eventually replace all technical manuals now identified with Ordnance Data (OD) or Ordnance Publication (OP) numbers.)

Content

The content for all technical manuals (new and revised) is prepared in accordance with MIL-M-15071H. This specification defines how the technical data are to be presented; what each chapter will contain; and what illustrations, schematics, and flow diagrams are required to fully describe the equipment for the intended user. This information is presented in a technical manual contract requirement (TMCR) for contractor effort or in a technical manual seatask requirement (TMSR) for in-house effort.

Overall Preparation and Release Procedures

The preparation of a technical manual requires coordinated effort between the cognizant NUSC organizational segment and the NUSC Technical Publications Branch.

Organizational Segment Responsibilities. The cognizant organizational segment has overall responsibility for the preparation and maintenance of publications under its program management, including responsibility for technical validity, accuracy, and adequacy. It usually performs the following functions:

- Establishes the technical requirements and priority for preparation or revision of a publication.

- Provides the Technical Publications Branch with the technical intent or changes required.

- Validates or verifies the accuracy and adequacy of each new publication or proposed change by performing or witnessing the performance of the procedure with the actual hardware and test equipment.

- Provides engineering or technical assistance.

- Reviews and approves completed publications for compliance with technical intent before release for printing and distribution.

Technical Publications Branch Responsibilities. The Technical Publications Branch is responsible for administering the technical manuals program for the Center and coordinating the efforts involved in the preparation of new technical manuals and the maintenance and update of existing technical manuals. The section maintains a close liaison with NAVSEA on policy matters pertaining to technical manual acquisition and maintenance and is responsible for the organization and presentation of the technical information submitted by project engineers. To ensure that these efforts are properly planned, scheduled, and controlled, the Technical Publications Branch should be contacted during the early stages of equipment design and procurement. Functions of the Technical Publications Branch include the following:

- *Coordination:* Plan, schedule, and accomplish the preparation (organizing, writing, editing, and illustrating) and production (composing, printing, binding, and distributing) of all new, revised, and changed publications assigned to the Center in consonance with priorities established by the project engineers. Participate in the establishment of funding requirements and budgetary estimates for the preparation and publication of new or revised technical manuals.

- *Contract Monitoring:* Prepare the TMCR that specifies the manuals required to support the hardware, along with their technical content and format. Review and approve the manual outline, the review manuscript, and the final camera-reproducible copy. Conduct in-process reviews for conformance with specifications, editorial requirements, writing level, and overall effectiveness. Cooperate with the project engineer in checking the technical content of the manual.

COMPLEMENT, COMPLIMENT
Complement is that which completes; a *compliment* is praise.

COMPOUND, SEMICOMPOUND, AND ALTERNATE SUBJECTS
A compound subject uses a plural verb.

The transmitter and receiver *are* onboard the same ship.

A semicompound subject uses a singular verb.

The transmitter, as well as the receiver, *is stored* in the control room.

Alternate subjects use a singular verb if the subject is singular and a plural verb if the subject is plural; if one is singular and one is plural, the verb agrees with the subject closer to it.

The transmitter or receiver *is stored* in the control room.

The transmitters or receivers *are stored* in the control room.

The transmitters or receiver *is stored* in the control room.

COMPOUND WORDS
A compound word is a union of two or more words, with or without a hyphen. A *true* compound word will retain its hyphen even when it does not occur before a noun (i.e., *half-baked*). Preferred compound word forms are found in section 7 of this *Guide*..

COMPRISE
Comprise means to include, embrace, or contain (i.e., the whole *comprises* the parts).

No one knows the name of the trilogy (whole) that *comprises* the three books (parts) [BUT The three books constitute (or make up) the trilogy].

CONTINUAL, CONTINUOUS
Continual means frequent repetition, breaks in succession; *continuous* means unbroken continuity, no cessation.

The mechanical failures caused *continual* interruptions in the flow.
The new pump and improved piping resulted in a *continuous* flow.

CORRELATIVE CONJUNCTION
Correlative conjunctions are used in pairs: *both . . . and, either . . . or, neither . . . nor, so . . . as, not only . . . but (also), whether . . . or.* The things connected by the conjunctions must be the same kinds of grammatical elements in parallel form.

When *both* is used with *and*, the words that appear after *both* must be grammatically parallel with those that appear after *and*.

> Everything she said was told to *both* the supervisor (noun) *and* the manager (noun) [NOT *both* to the supervisor (prepositional phrase) *and* the manager (noun)].

CAN, MAY

Can means the ability or power to do something; *may* asks for permission to do it.

CAPITALIZATION

Capitalization will follow the rules given in the *GPO Style Manual* and the list in section 7 of this *Guide*. Particular attention is directed to paragraph 3.9 in *GPO*, which states

> a common noun used with a date, number, or letter . . . for the purpose of reference . . . does not form a proper name and is therefore not capitalized.

Thus, such items will be shown as *figure 1, table 1, chapter 1, section 1, equation (1), appendix A, etc.*

Paragraph 3.17 of *GPO* states that

> the full name of existing or proposed organized bodies and their shortened names are capitalized.

Thus, such terms will be shown as *U.S. Navy, the Navy, Navy officer* [BUT *naval shipyard, naval officer*].

COLLECTIVE NOUNS

A collective noun usually has a singular verb, especially if the *oneness* idea predominates.

> The *number* (total) of attendees *was* the largest in history.
> A great *number* (many) of the participants *have suffered* heatstroke.

(*The* used with a collective noun is the signal to use a singular verb; *a* is the signal for a plural verb.)

COMPARE TO, COMPARE WITH

When two things are likened to each other or put in the same category, *to* is used with the verb *compare*; if their differences or similarities are examined side by side (which is the more common usage), *with* is used.

> Her manners have often been *compared to* those of a chimpanzee.
> *Compared with* the expense and inconvenience of foreign travel, a domestic itinerary is appealing.

ANYBODY, ANY BODY
This is one word unless it means *a body*.

Won't *anybody* help me?
After an exhaustive search, the police still could not find *any body*.

ANYONE, ANY ONE
This is one word unless it means a particular person or thing.

Has *anyone* seen the results of the tests?
He saw the test results, but he did not agree with *any one* of them.

ASSURE, ENSURE, INSURE
Assure means to make a person sure of something, *ensure* means to make certain or guarantee, and *insure* means to indemnify against loss.

The doctor *assures* me that my hearing loss will be small.
The use of safety devices *ensures* each worker's physical well-being.
The company cannot provide a policy to *insure* against acts of God.

AT ABOUT
The proper form is *at* or *about*, never *at about*.

BETWEEN, AMONG
Between applies to only two objects, *among* to more than two. However, sometimes *between* is the only word available to express the relation of a thing to three or more surrounding things severally and individually.

Talks *between* the three factions were inevitable [NOT *among* the three factions].

BETWEEN, FROM
A single noun that follows *between* is plural; a single noun that follows *from* is singular.

The road is poorly paved *between* Oak and Elm Streets.
Boys perform best *from* the fourth to the sixth grade.

BI-
Bimonthly means every two months; *biweekly* means every two weeks or twice a week; and *biannual* means twice a year (so do semiannual and semiyearly). For the reader's sake, these confusing prefix forms should be avoided whenever possible.

BOTH
Both is redundant when it is used with *as well as, equally, alike, at once, between,* or other words expressing the two-together idea.

Tom and Jerry were *equally* upset [NOT *Both* Tom and Jerry were *equally* upset].

However, a verb and its object should not be split.

They have understood the questions *correctly*.

Splitting an infinitive with an adverb should only be done to avoid an ambiguous meaning, illogical conclusion, or artificial structure.

The apparent object is to *almost* double sugar consumption in 3 years.

AFFECT, EFFECT
The verb *affect* means to influence; the verb *effect* means to bring to pass, to accomplish. *Effect* is also used as a noun meaning result.

Any rise in temperature *affects* storage safety.
The company will *effect* safer storage through use of thicker insulation.
The *effect* of additional heat must be determined.

ALL OF
The *of* in *all of* is unnecessary unless it is followed by a pronoun.

All the work on this project is complete [NOT *all of* the work].
All of us wish to thank our sponsors for their support.

ALL READY, ALREADY
All ready means completely ready; *already* means by this time, previously.

The decorations for the party are *all ready*.
The food has *already* been delivered.

AMOUNT, NUMBER
Amount refers to bulk or mass; *number* refers to individuals or units.

A large *amount* of food was required for this party.
A large *number* of hamburgers were consumed at the picnic.

AND
And, the weakest of all conjunctions, should not be used to connect unrelated clauses.

The book, *which is on the night table*, is a history of World War II;
[NOT The book is a history of World War II *and is on the night table*].

AND/OR
This combination is unacceptable in formal writing. When the use of one or the other conjunction alone will not work, the solution is to use plain English: *a or b, or both*.

His violation will result in a $1000 fine *or* a 30-day work suspension, *or both*
[NOT a $1000 fine *and/or* 30-day work suspension].

ABOVE or BELOW; OVER or UNDER; UPON or BENEATH
These antonyms are sometimes improperly used.

> The oil painting was placed on the wall *above* (or *below*) the watercolor [NOT *over*, *under*, or *beneath*].

Generally, *beneath* and *under* mean covered by; *over* and *upon* mean covering. For example, the painting on the wall cannot be *beneath* (or *under*) another; wallpaper is *beneath* (or *under*) the painting.

ABSOLUTE CONSTRUCTIONS
These are words, phrases, or clauses that are grammatically independent of the rest of the sentence.

Some of these constructions have their own subject:

> *The sun having set*, we decided to camp for the night.

Some do not have a subject:

> *Speaking of entertainment*, don't you think movies are a bore?

If the absolute construction does not contain a subject, it must not be attached to anyone or anything else in the sentence (see DANGLERS).

Many participles, and their combinations, through idiom have become absolutes: *considering, given, judging, concerning, excepting, failing, granted, provided, regarding, generally speaking, beginning, taking one thing with another, speaking of, owing, seeing, etc.*

ACCEPT, EXCEPT
Accept means to agree to, to believe as true, or to receive; *except* means to exclude or leave out.

> He graciously *accepted* the honorary degree from the University of Pennsylvania.
> The high school science teacher wisely *excepted* sulfuric acid from the list of chemicals for use in laboratory experiments.

ADVANCE PLANNING
Planning is the laying out of a future course; *advance* is therefore redundant.

ADVERBS, PLACEMENT OF
The natural position of an adverb with a compound verb is often between the auxiliary and the rest of the verb or between a linking verb (is, are) and its complement.

> I have *never* traveled to Italy.
> She is *very* attractive.

6. STYLE AND USAGE

This section covers the rules of style and usage that most often confound writers of technical publications. When a question is not answered here, the 1984 edition of the *Government Printing Office Style Manual* (*GPO Style Manual*) should be consulted.

A, AN

The article *an* is used before a vowel sound (*an eagle*) or with an unsounded *h* (*an hour*). The article *a* is used before a consonant sound (*a vote*). The way people say an abbreviation or acronym will determine whether the *a* or the *an* is used.

She received *an* M.A. degree [BUT *a* master's degree].
He conducted tests on *an* FSP [BUT *a* floating shock platform].

ABBREVIATIONS

Section 7 of this *Guide* lists the preferred abbreviations of various words, phrases, and units of measurement that typically occur in NUSC technical publications. These abbreviations may be freely used in illustrations, tables, footnotes, listings, and other places where space is a factor. (When an abbreviation is used once on an illustration or table, it must be used everywhere on the same illustration or table; the availability of space will determine its use on other illustrations or tables in the same publication.) In text, however, where formality is the watchword and where space is not a prime consideration, abbreviations should be used sparingly. Generally, abbreviations will be used in text for

compound units (cubic centimeters, pounds per square inch, feet per second, etc.) when used with numerals (10 f/s), but not when standing alone (speed is measured in feet per second), and for

cases where simple units of measurement (feet, inches, meters, pounds, seconds, etc.) appear so frequently that it would be cumbersome to spell them out each time. However, when used infrequently, such units should be spelled out in text.

ABOUT, APPROXIMATELY

The preposition *about*, which means in the general area of, suggests inexactness; *approximately*, which means very near, suggests accuracy. Thus, in technical writing, *approximately* is usually the word used with figures.

The alcohol content of wine is *approximately* 12 percent.
It is *about* a mile to the church.

ABOVE

Above does not mean more than.

His pay is *more than* mine [NOT *above* mine].

NOTES

Testing the Title and Abstract

The author can test the adequacy of the main title and abstract by giving the abstract, without title, to a colleague unfamiliar with the project being reported. The colleague should read the abstract and write out a title. The two versions do not have to be worded exactly the same, but they should agree in scope and emphasis. If they do not, then either the author's abstract is poor or the title does not accurately represent the report. The test should reveal which is at fault.

Testing the Effectiveness of the Introduction

One way to test for an effective introduction is to fill in the blank in the following sentence:

The purpose of this investigation was to _____.

Compare the test sentence with the information in the introduction. Does the additional length of the original contribute meaningfully to the message the report is meant to carry? If not, it needs to be shortened.

Testing the Validity of the Conclusion

Most readers draw their own conclusions about much of the evidence in a report before they reach the author's formal conclusions at the end. The author should ask someone with a background similar to the intended reader's to go through the report carefully up to the conclusions section and then to jot down the conclusions that are justified by the evidence presented. A comparison of the two sets will show whether or not the author has presented the evidence clearly and accurately and, therefore, whether the readers will consider the conclusions to be valid.

REREADING THE MANUSCRIPT

After all revisions are finished, the author should set aside the manuscript overnight and reread it from front to back the next day to see how it fits together with the changes made. This is the final step before the author has the manuscript typed in the appropriate format and sends it to the reviewers.

HELPFUL REFERENCES

The bibliography of this *Guide* lists a small collection of helpful references on technical writing. Authors are urged to inspect these to determine which material best suits their needs.

The following suggestions are intended to assist in this phase of the operation.

Leave Time Between Steps. It is best not to begin to polish a draft immediately after it is written. As a rule, the more time between the writing and the polishing, the better the chance to view the writing objectively. Authors have to be practical, however, and generally must settle for a day or two at the most.

Read All the Way Through. The first step should be to read the draft all the way through, as though someone else had written it. This tests the organization and flow of the message. Rough spots in expression and inaccuracies and inconsistencies in the material should be underlined and marked in the margin, but should not be corrected at this time. Simple errors in grammar, punctuation, and spelling can be corrected on the spot, if doing so will not interrupt the reading. Otherwise, they should be marked and corrected later.

Revise the Marked Passages. The marked passages should now be reread. Effective revision may require *backing up* some distance to put the error in context. It may be easier to write a new paragraph or even a subsection than to *doctor* a faulty one satisfactorily.

Check the Mechanics of Format. A methodical check of the mechanics of format should be done for each page. Because it is a routine job, it can be saved until the end. The following checklist shows some of the most common problems:

- Captions, titles, or numbers are not assigned to figures and tables.
- Figures and tables are not referred to in the text.
- Figure and table references appear after the figures and tables.
- Appendix material is not referred to in the text.
- Pages are numbered incorrectly.
- Security markings are not properly applied.
- Classification authority and declassification information are omitted.
- Distribution statement is omitted.
- Preface information is missing.
- References are incomplete or out of order.
- Distribution list is not included.

RUNNING DIAGNOSTIC TESTS

The following subsections offer a few simple diagnostic tests to ensure the adequacy, effectiveness, and validity of the technical information presented. These tests can be used to pinpoint a problem whenever an author feels that something is wrong with the manuscript.

An outline is intended to be a writer's tool, a bridge for transcribing raw material into prose. However, it will perform its intended function only if the author will carry the outline to a level of detail that provides entries for paragraphs.

Paragraph Entries. The above outline, consisting only of very general section and subsection headings, would make a good table of contents if the author were to substitute words specifically describing the subject matter under investigation. However, even then the entries would be too broad to provide an author with sufficient talking points for composing a rough draft quickly and efficiently. Entries are needed that stand for paragraphs, because paragraphs are the building blocks of a written communication.

The procedure for representing paragraphs is not difficult. Each paragraph must begin with a topic (or key) sentence, and the sense of the paragraph must develop from that lead sentence. An outline entry that summarizes the topic sentence, therefore, represents the paragraph. The points developed in the paragraph can be listed under the topic sentence, but this is optional and usually not necessary for every paragraph.

WRITING THE ROUGH DRAFT

The first step for producing a well-written manuscript, ready for reviewing, begins with writing a rough draft. The justification for writing a rough draft is that it enables the author to transcribe notes into prose without having to worry about the refinement of language and usage and the mechanics of composition and spelling. With it, the author puts the story together for the first time and does it without stopping to doctor every sentence.

If the outline has entries that represent the topic sentences of paragraphs, it will help the author decide what to say and the order in which to write it so that there is continuity to the story as it unfolds.

If it helps, the author might try dictating the rough draft. It is not necessary to start with the beginning of the report. If the author feels ready to talk about procedures or tests, then the draft can begin with either of these sections and the introduction can follow. Nor is it necessary to do the whole draft in one sitting. The main requirement is to finish a logical division of subject matter so that continuity of thought can be maintained.

If the rough draft is written longhand, the author should read it over quickly when it is finished, correcting any obvious errors, and then have it typed double spaced or triple spaced. It is essential, psychologically, that the author have clean copy to work on, one without scribbles, deletions, and inserts. Triple spacing of the text is recommended; it provides good work space and also prevents the author from acting on a spur-of-the-moment notion to submit a rough draft for review, rather than a polished manuscript. Most typists do not have scientific backgrounds; authors, therefore, must be certain that the equations, expressions, and symbols they turn over for typing are correct, legible, and properly aligned.

Polishing the Draft

In the next step, the author can concentrate on inspecting the writing, as writing.

Keeping the Project Notebook

A common mistake many authors make is postponing their writing chores until the investigation is over. They then become so involved with the mechanics of writing that little time is spent in achieving clear and forceful expression.

Naturally, a complete report cannot be written until sufficient data are in, but the author can keep a project notebook for storing information during the investigation that will make the final writing job easier. The project notebook functions as a daily log, where authors can record data, make sketches and diagrams, spell out definitions as they evolve, and write up and evaluate key ideas for use in the final report.

Determining the Statement of Thesis

An author needs to prepare a statement of thesis to give direction to the reporting of the investigation. Thus, the author must decide what main thought or conclusion the readers should carry away with them when they finish reading the report. The author then writes this out in a statement of thesis, using this statement as a filter for screening all the raw material gathered (data, notes, observations, etc.). By testing the raw material against the thesis, the author determines (1) which material is relevant for this particular communication (and which is not) and (2) of the relevant, which is primary and which is secondary (or appendix material).

Constructing a Useful Outline

An outline definitely will ensure an orderly presentation if the author is willing to invest more than token effort in preparing it. Any system that will group the entries into logical divisions and show the relationship of one division to another will work. A typical outline with general section and subsection headings is shown below:

TITLE

I. Introduction
   - A. Statement of Problem
   - B. Statement of Purpose
   - C. Approach

II. Theoretical Analysis
   - A. Assumptions
   - B. Calculations

III. Experimental Work
   - A. General Procedure
   - B. Facilities and Equipment
   - C. Tests
   - D. Results of Tests

IV. Comparison of Theoretical and Experimental Results

V. Conclusions

VI. Recommendations

5. WRITING THE MANUSCRIPT

INTRODUCTION

This section of the *Guide* describes a procedure for the author to use in writing a manuscript. This procedure will be helpful to those writing technical reports, documents, memoranda, and journal articles.

SEARCHING THE LITERATURE

Before beginning a project, an author should conduct a search of the literature bearing on the subject, because the project probably will be building on a base of research and experimentation that has been done by other people before. The author will benefit from knowing who these people are, what they accomplished, and what they recommend for future work. Moreover, the author will want to make certain that the work about to be performed has not been done previously by other investigators.

If an author receives a written request to conduct an investigation, a good place to start the search is with the references listed in this primary directive. These references, in turn, probably will list other references, and so a small, but meaningful, compilation of source material becomes almost automatic.

If the investigation is to result in a proposal or if the research is in a new area, the author should definitely consult the reference librarians in the Technical Library at the laboratory. As professionally trained information specialists, they can accomplish in-house literature searches or obtain more comprehensive searches from such organizations as the Defense Technical Information Center (DTIC) and the National Technical Information Service (NTIS).

Both DTIC and NTIS supply current or retrospective annotated bibliographies tailored to requests. DTIC searches both classified and unclassified Department of Defense (DoD) research reports, whereas NTIS covers unclassified reports from a variety of government agencies, as well as private institutions under contract with the Federal Government. In addition, DTIC supplies Work Unit Information, which indicates who is doing what research, where, when, and how throughout the DoD establishment.

PLANNING THE WRITING

Written communication is an integral part of an engineering or scientific investigation; no project can be considered complete until the required reports are in. Investigators, therefore, would be wise to estimate the number and types of reports that will be required and the number and identity of the potential readers. The time to start this planning is at the initial project conference because it gives the would-be author an excellent opportunity to press for a reasonable allocation of man-hours for report writing. (As experience shows, additional time is always hard to get when a deadline is close at hand.) Moreover, sufficient time should be made available for the editorial and other publication functions to be performed.

NOTES

- *Validation and Verification:* Assist technical personnel and project engineers in on-site validation and verification procedures. Ensure that the manuals meet all requirements for format, content, presentation, accuracy, and adequacy.

Format and Text Preparation

The format of all technical manuals (new and revised) must be prepared in accordance with MIL-M-38784B. This specification also describes the requirements for the text preparation (front matter, paragraphing, page numbering, illustrating, etc.).

IN ADDITION TO MANUALS

In addition to technical manuals, the Technical Publications Branch prepares

- *Field Change Bulletins (FCB's):* The FCB's are publications that provide a list of materials supplied or required and step-by-step instructions to accomplish a field change. A field change is any modification or alteration made to electronic equipment for the purpose of improving the performance, operation, maintainability, reliability, and safety of equipment for NAVSEA and NAVELEX. They are usually accomplished after delivery of the equipment to the Government.

- *Engineering Changes:* An engineering change is an alteration in the configuration of an item or items delivered, to be delivered, or under development. These changes normally apply to drawings, which can become part of the kit to accomplish a field change.

- *Ship Alterations (SHIPALT's):* A SHIPALT is similar to an FCB, except that it often involves structural changes to a ship and is usually accomplished in a shipyard, alongside a tender, or dockside.

- *Ordnance Alterations (ORDALT's):* An ORDALT instruction is a technical directive that contains the detailed instructions, test procedures, provisioning information, support documentation, and other related information required to perform an alteration. An ORDALT is a change effected on naval ordnance equipment by the addition, deletion, rework, or replacement of parts, assemblies, or equipment; by a change in material; or by a change in assembly procedures. The format for an ORDALT instruction is specified in MIL-STD-1662.

- *Test Procedures:* These publications are used to document shipboard equipment certification and testing. They are usually used by certification teams to ensure that shipboard equipment meets the design specification.

- *Handbooks:* These publications take many forms, ranging from documentation of a specific manufacturing procedure to a compilation of related information. A handbook is usually assigned a technical document (TD) number.

- *Specifications and Standards:* Specifications written for the design and performance requirements of system or equipment acquisitions should be prepared in accordance with MIL-S-83490 and MIL-STD-490. Specifications for items or products intended for issue as military specification should be prepared in accordance with MIL-STD-961; standards intended for the same application should be prepared in accordance with MIL-STD-962.

The winners could claim *either* a cash prize (noun) *or* a round-the-world trip (noun) [NOT The winners could claim *either* a cash prize (noun) *or* take a round-the-world trip (verb phrase)].

DANGLERS

A word is called a dangler because it does not refer clearly and logically to some word in the sentence or because it attaches itself to an incorrect reference.

By *mowing* the grass frequently, you can have a beautiful lawn
[NOT By *mowing* the grass frequently, your lawn will be beautiful].

Using the handwheel, you can start the motor
[NOT *Using* the handwheel, the motor is started].

Having a broken arm and nose, the statue looked ugly to me
[NOT *Having* a broken arm and nose, I thought the statue was ugly].

When the dangler is not wrongly attached to another word in the sentence, there is usually no objection to its dangling (see ABSOLUTE CONSTRUCTIONS).

DATUM, DATA

The singular is *datum*, but it is rarely used; the plural is *data*. Even when *data* may be considered a collective noun, it is treated as a plural in NUSC publications.

One of the data is missing.
The measurement *data are tabulated* below.
Ship and shore *data were collected* at various coastal sites.

DEFECTIVE, DEFICIENT

Defective means having flaws; *deficient* means lacking completeness, having a deficit.

DEFINITE, DEFINITIVE

Definite means explicit, with fixed limits; *definitive* means establishing limits, settling something finally, absolutely.

This explanation of the problem is *definite*, but it will be many years before it may be termed *definitive*.

DEVICE, DEVISE

Device is a contrivance, a machine, a trick; *devise* means to invent, to plan.

The *device* for the remote control of a garage door is useful, particularly during a rainstorm.
Inventors should *devise* more time-saving appliances for working men and women.

DIFFERENT FROM, DIFFERENT THAN

Different from is usually the correct choice (especially when the next element in the sentence is a noun or pronoun). *Different than* is usually used to replace the phrase *from that (or those) which*, or more words.

Are Ivy league schools *different from* state schools?
How *different* the wheat fields appear in the spring *than* in the fall.

DOUBLINGS

Repetition of a general idea does not make it more precise.

He will *assist* in the managment section [NOT *assist* and *advise*].

DUE TO

Due to should be used in the sense of *caused by* when it is an adjective modifying a noun.

The crash was *due to* the icy road [*due* modifies crash].
She crashed *because of* the icy road [NOT crashed *due to* the icy road (no modified noun)].

EACH

The word *each* is singular; when used as a subject, it takes a singular verb.

Each of the acts has three scenes
[BUT The acts have three scenes *each*].

EMPLANTMENT, IMPLANTMENT

Emplantment means to place an object firmly on the surface, in the sense of an emplacement. This word has been traditionally used in Center oceanographic publications to replace *implantment*, which means to plant deeply, to embed.

The sonar device was *emplanted* on the ocean floor.
The heart was *implanted* in the patient.

EXCESS, EXCESSIVE

Excess as a noun means superfluity; as an adjective it means more than or above the specified amount. *Excessive* is an adjective meaning exceeding what is usual, greater than the usual amount.

An *excess* of fluid drained into the tank.
Excess baggage delayed the trip.
Excessive explanations destroyed his credibility.

FARTHER, FURTHER

Farther means physical distance; *further* is used for everything else.

The valve was opened 2 inches *farther.*
The Navy design is *further* advanced than that of the Air Force.

FEASIBLE, POSSIBLE
Feasible means that something can be done; *possible* means that something can happen.

Although it is *feasible* to conduct testing during the winter,
it is *possible* that some of the equipment may need deicing.

FEWER, LESS
Fewer means a number of individual persons or things; *less* means quantity.

His achievements are fewer (not so numerous) than hers.
His achievments are *less* (not so great) than hers.

FORCE, PRESSURE
Force is the total pressure exerted over the whole area; *pressure* is the force exerted on a square unit of an object.

The *force* of the water completely eroded the beaches.
The *pressure* per square foot has been doubled for this test.

FORWARD, FOREWORD
Forward means to send or transmit; a *foreword* means a word that comes before.

The message was *forwarded* to the ship through a new communications satellite.
The *foreword* in many novels is written by a colleague of the author.

GENERALIZATIONS
Although generalizations must sometimes be used to sum up vast amounts of information or to avoid smothering details, the use of a specific word is always better when the context allows it.

He is running pressure tests on the new transducers [NOT He is
engaged in a highly complex and technical assignment].

GRAY, GREY
Gray is American; *grey* is British.

HYPHENATION
In general, hyphens will be used where custom, meaning, and readability require, not where their sole justification is adherence to some obscure rule. Section 7 of this *Guide* contains further guidance on the use of hyphens commonly found in NUSC publications.

IF, WHETHER

If (after such verbs as see, ask, learn, doubt, and know) and *whether* are both used to introduce a noun clause. However, because *if* suggests a condition, it should not be used at the beginning of the sentence where no condition is to follow.

He asked *whether* I would help him study.
He asked *if* I doubted his word [NOT *If* I doubted his word was the question].

IMMITTANCE

Immittance is the response function for which one variable is a voltage and the other a current. It is a general term for both *impedance* and *admittance*, if the distinction is irrelevant.

INFER, IMPLY

Infer means to draw a conclusion; *imply* means to hint, to suggest, to insinuate.

This information leads me to *infer* that the glazing process is costly.
Did he *imply* in the conversation that his information was not sufficient to provide a reliable estimate of glazing costs?

INFRASONIC, SUBSONIC, SUPERSONIC, ULTRASONIC

Infrasonic refers to a frequency lying below the audiofrequency range. The use of *subsonic*, once used in acoustics as a synonym for *infrasonic*, is obsolete. *Ultrasonic* refers to a frequency lying above the audiofrequency range. The term *supersonic*, formerly applied to frequency, now pertains to velocities above those of sound waves — it should no longer be used as a synonym for *ultrasonic*.

IN, INTO

In denotes position; *into* denotes movement to an interior position. Motion verbs usually take *into*.

The golf clubs are *in* the closet.
He dove *into* the lake.

"ION OF" AND "MENT OF"

Whenever the context permits, words ending in *ion* and *ment* should be turned into verbs.

Use the new format *to prepare* your report [NOT for the *preparation* of your report].

IT IS, THERE IS

The use of *it is* and *there is* often stretches sentences, delays meanings, hides responsibilities, and encourages passive verbs.

All personnel must receive vaccinations [NOT *It is* mandatory for all personnel to receive vaccinations].

Two test sites are mentioned in the report [NOT *There are* two test sites mentioned in the report].

ITS, IT'S
Its is a possessive pronoun. *It's* is a contraction of it is.

It's time the committee planned *its* next meeting.

LAY, LIE
Lay, laid, and laid mean to put or place something (takes an object); *lie, lay, and lain* mean to recline (does not take an object).

He must be careful when he *lays* the explosive (object) in the box.
He *laid* the foundation (object) for a favorable reaction.
I *have laid* the agenda (object) on his desk.

The shells *lie* on the beach.
The laboratory *lay* idle for months.
My father *has lain* in his hammock for 2 hours.

METRIC SYSTEM
Writers will follow the procedures established by the Department of Defense for the use of the International Metric System. A summary of these rules is provided in section 1 and a conversion table in section 8 of this *Guide*.

MINIMIZE, REDUCE
Minimize means to reduce to an absolute minimum. Usually the writer means *reduce*.

Acoustic paneling is one way to *reduce* noise [NOT *minimize* noise].
The peace mission *minimized* hostilities for the time being.

MODIFIERS, AMBIGUOUS
The modifier at one end of a series may be understood as describing the entire series or the closest item only.

The instruments *in contact with the hull*, the valves, and the piping were examined [NOT The valves, piping, and instruments *in contact with the hull* were examined].

MODIFIERS AND NOUNS, CLOTS OF
Long clots of modifiers and nouns should be avoided.

Requirements by the Board of Inspection and Survey for service acceptance trials are listed here [NOT The Board of Inspection and Survey acceptance trials requirements are listed here].

NONSEQUITURS

Nonsequiturs link unrelated ideas.

> Mrs. Breen is the leading spokesperson for the animal welfare league [NOT Mrs. Breen, *who loves to sew quilts in her spare time,* is the leading spokesperson for the animal welfare league].

NOUNS AS ADJECTIVES

The awkward or ambiguous use of a noun as an adjective should be avoided.

> An engineering student must know basic *mathematical* principles [NOT *mathematics* principles].

NUMERALS

Use of numerals in text will comply with the rules set forth in the *GPO Style Manual,* excerpts from which follow.

> A figure is used for a single number of 10 or more (*one* hat, BUT *11* hats), with the exception of the first word of a sentence.
>
> Units of measurement and time, actual and implied, are always expressed in figures (*7* inches, *4* hours, *1* foot).
>
> Figures are used in a group of 2 or more numbers, any one of which is 10 or more.
>
> > That man has *3* suits, *2* pairs of shoes, and *12* pairs of socks.
> > That man has *three* suits, *two* pairs of shoes, and *nine* pairs of socks.
>
> A unit of measurement or time, which is always expressed in figures, does not affect the use of figures for other numerals in the sentence.
>
> > Each of the *five* girls earned *75* cents an hour.
>
> Fractions standing alone, or followed by *of a* or *of an,* are generally spelled out (*three fourths of an inch*; NOT 3/4 inch or 3/4 of an inch).

PARALLELISM

Two or more ideas that are of equal importance should be arranged so that they are grammatically parallel. Parallelism saves words, clarifies ideas, and provides balance.

> The symposium is a forum for *sharing* information and not for *setting* standards [NOT The symposium is a forum for the dissemination of information and is not intended to establish standards].

PARENTHETICAL PHRASES

A parenthetical phrase is one that can be omitted from the sentence without affecting the basic sense of what is being said. It must be enclosed by commas; the omission

of the comma can sometimes affect the meaning.

> The Democrats, *say the Republicans,* will not win the 1988 election [NOT The Democrats say the Republicans will not win the 1988 election].

PARTLY, PARTIALLY

Partly in the sense of part of a whole is the preferred word unless it means not completely, not totally.

> The tubing was *partly* copper.
> The test provides a *partially* reliable check for watertightness.

PER

Per means for each, in an economical or statistical context.

> Rents *per* room range between $10 and $35.

PERCENT, PERCENTAGE

Percent means in a hundred or out of a hundred or by the hundred; it should be used with a numeral. *Percentage* means a part or proportion of a whole; it is not used with a numeral.

> Of the samples tested, *10 percent* were impure.
> A *large percentage* of that test batch was impure.

POSSESSIVES

The possessive case of a singular or plural noun not ending in *s* is formed by adding an apostrophe and *s* (man's, men's); the possessive case of a singular or plural noun ending in *s* or with an *s* sound is formed by adding an apostrophe only (hostess', hostesses', Schmitz').

The possessive case (*'s*) is usually associated with animate beings or with things that have the suggestion of an individual life (no matter how faint).

> The *ship's crew* worked tirelessly.

The possessive case is not used when the meaning is more descriptive than possessive.

> The *editors handbook* was helpful.

In measures of time and space, the possessive is used unless the relationship is more descriptive than possessive.

> The task requires *a day's labor* (labor belonging to 1 day)
> [BUT This task requires *day labor* (day describes labor)].

When a noun precedes a gerund, the possessive case is used.

> The foreign *ship's hovering* nearby was a concern to the Navy.

PRACTICAL, PRACTICABLE
Practical means useful or sensible as opposed to theoretical. *Practicable* means possible, capable of being put into practice, usable.

His timesaving ideas showed him to be a *practical* person.
His ideas for repairs proved to be *practicable*.

PREPOSITIONS
A preposition must not attach itself to all the verbs in a sentence when it belongs with only one.

This power bus generates and controls electric power and distributes it to equipment in the sonar control room [NOT This power bus generates, controls, and distributes electric power to equipment in the sonar control room].

PREVENTIVE, PREVENTATIVE
Preventive is the preferred form.

PRINCIPAL, PRINCIPLE
The adjective or noun *principal* means chief or major. The noun *principle* means rule, basic law, fundamental truth, doctrine.

The *principal* reason has been stressed often.
The experiment is based on fundamental scientific *principles*.

PRONOUNS
The antecedent of a pronoun must always be clear, especially in technical writing.

King Henry is scolding Hal for *his* past life [NOT King Henry was talking to Hal about *his* past life].

PSI, PSIA, PSIG
The forms described below should be used to replace *psi*, *psig*, and *psia* when pound-force per square inch is meant. For standard atmospheric pressure (14.696 pounds per square inch), which is measured by gage, $lbf/in.^2g$ is the correct term. For zero pressure, which is expressed as absolute (a), $lbf/in.^2a$ is correct. When no reference point is used, such as for a pressure drop, the expression is $lbf/in.^2$.

PUNCTUATION

Apostrophe:

- The use of the apostrophe is also discussed under POSSESSIVES.
- The apostrophe is used to express the plurals of acronyms, abbreviations, and figures (i.e., FSP's, vol.'s, or 1920's).

Colon

- The colon means *for example, that is, this is what that means.* It is used between a complete statement (subject and verb) and a final clause that amplifies the complete statement.

  Three things are essential for success: initiative, dependability, and skills [NOT The three things essential for success are: initiative, dependability, and skills].

Comma

- The use of the comma is also discussed under PARENTHETICAL PHRASES.

- The comma is used within a series of three or more words, phrases, letters, or figures used with *and, or,* or *nor.*

  The colors of the wires are black, white, and red [NOT black, white and red]. The absence of the second comma suggests there could be two (not three) wires, one of which is white and red.

- The comma is used with coordinate adjectives modifying the same word or word group.

  She is an intelligent, sensitive writer.
  It was a bright, airy public dining room [NOT bright, airy, public dining room (public dining room is a word group)].

- For phrases with a common termination, the commas set apart the explanatory phrase.

  It is the best, as well as the only, testing equipment available.

- The comma separates the parts of a compound sentence.

  The crew installed the new computer on the ship, but time did not permit them to run the tests that would check its operation.

- An introductory modifying phrase preceding the subject requires a comma.

  Tired and thirsty, the campers straggled home.

Dash

- A dash marks a sudden break in thought; it sets off a summary at the end of a sentence or encloses a thought within a thought in the middle of a sentence.

  I was a mediocre student -- that is, until my senior year.
  Housing insulation -- measured by today's standards -- was scanty.

- Sometimes a dash is used instead of commas or parentheses if it clarifies the meaning.

These are shore deposits -- sand, gravel, and clay -- but marine sediments underlie them.

Ellipses

Three periods are used to denote an ellipsis; four periods, when the sentence is brought to a close. In mathematical expressions, commas or operational signs are placed after each term and after the three ellipsis dots if a final term follows them.

$x_1, x_2, \ldots, x_n$

$x_1 + x_2 + \ldots + x_n$

Hyphen

The use of hyphens is discussed under HYPHENS.

Parentheses

Parentheses enclose the following:

- An expression that is not part of the main statement.

  The result (see figure 2) is most rewarding.

- An interruption that is too great to be shown by commas.

  You find it neither in French dictionaries (at any rate not in *Littre*) nor in English dictionaries.

- An explanatory word or phrase.

  The information is from the Portland (Oregon) Chamber of Commerce.

- Numbers or letters designating items in a series.

  You must bring (1) a canvas tent, (2) waterproof footgear, and (3) dry foods.

A common fault of authors is to use the parentheses as a catchall for material that has nothing to do with the rest of the sentence.

Semicolon

The semicolon separates independent clauses not joined by a conjunction (*and, but, or, nor, for*) or a series of equal elements already containing commas.

Art imitates reality; it holds a mirror up to nature.
She held a bouquet of yellow, red, and white roses; a prayerbook; and a pair of white gloves.

RESPECTIVELY

Respectively, which means in regard to two or more, in the order named, is often thrown into sentences unnecessarily. Sometimes it is confused with *consecutively*, which means following in order, without interruption, successive.

The first and second prizes went to Mary and George, respectively.
Fluid flows through PI–1, PI–2, and PI–3, consecutively.

SHORT SENTENCES

For variety, long sentences and short ones should be mixed. Excessively long sentences should be broken into manageable units; then needless words and ideas can be pruned.

Half the people will attend on one day and half on the other. The EMC department will make final adjustments [NOT Attendees will be divided between the two briefing dates with the understanding that any final adjustments will be made by the EMC department to facilitate equitable distribution].

SINCE

Since means from some time in the past until the present. It is sometimes mistakenly used in place of *because*.

This testing has been conducted in the Atlantic Ocean *since* 1934.
Because the testing is conducted in sea water, the equipment must be watertight.

SO, SO THAT

So cannot join main clauses; *so that* is the proper form.

Henry left *so that* I could study [NOT *so* I could study].

SOME

Some means approximately more or less when used before a figure.

Some 3000 spectators attended the races [NOT *Some* 3068 spectators attended the races].

SPEED, VELOCITY

Speed is a scalar quantity indicating the magnitude (size) of the rate of change in position; *velocity* is a vector quantity indicating speed (magnitude) and direction.

The *speed* of sound in an ocean depends on many environmental parameters.
The *velocity* profile of sound waves traveling from the ocean bed to the surface is in the report.

SPELLING
Preferred spellings of many words used in NUSC technical publications are listed in section 7 of this *Guide*..

THAT, WHICH
That introduces a limiting or restrictive clause; *which* introduces a parenthetical or nonrestrictive clause. If the clause can be omitted without changing the meaning of the sentence, it should be introduced by *which*; otherwise, it should be introduced by *that*.

The Connecticut River, *which flows through Massachusetts to the Long Island Sound,* has swift currents.
The river *that flows through Hartford* is the Connecticut River.

THOUGH, ALTHOUGH
These two words are used interchangeably (*though* is the more common) with the following exceptions:

- *Though* is used as an adverb at the end of a sentence.

  She said she felt well; she looked tired, *though*.

- *Although* is used at the beginning of a sentence.

  Although he claims to be a professional artist, no one has seen his paintings.

THROUGH, TO
Through means up to and including; *to* means until.

Tests will be conducted Monday *through* Friday [including Friday].
Tests will be conducted Monday *to* Friday [not including Friday].

THUS, THUSLY
Thus is the adverb; *thusly* should not be used.

TOWARD, TOWARDS
The preferred form is *toward*. *Towards* is the British version.

UNDER
Under does not mean less than.

My pay is *less than* his [NOT *under* his].

UP UNTIL
The *up* in this expression is superfluous.

UPWARD, UPWARDS
Upward is the preferred form for the adverb and the only acceptable form for the adjective (i.e., *upward* mobility).

VERBS, PASSIVE OR SMOTHERED
By tradition, technical reports are written in the third person. This often causes authors to write all verbs in the passive voice, a habit which results in dull, stilted writing. However, with a little effort, passive phrases can be converted to active ones without using personal pronouns.

A new wash has reduced unsatisfactory results [NOT Unsatisfactory results have been reduced through the use of a new wash].
Heating dissolves the salt [NOT Solution of the salt is accompanied by application of heat].

VIA
The word *via* means by way of (in a geographical sense), not by means of. It should be used in technical writing only if it carries the original meaning of *by this route.*

The equipment is controlled *by means of* (not *via*) a thermostat on the front panel.

WHILE
While means during the time that; it should never be used as a substitute for *and* or a semicolon

He spoke to me *while* he was making coffee.
She is a broker and her husband is a salesman [NOT She is a broker *while* her husband is a salesman].

WITH THE EXCEPTION OF
This phrase should be replaced with *except* or *except for.*

WORDY EXPRESSIONS
Wordy expressions do not give writing impressive bulk; they clutter it by getting in the way of words that carry the meaning. A list of wordy expressions and their simpler substitutes is provided in section 7 of this *Guide.*

NOTES

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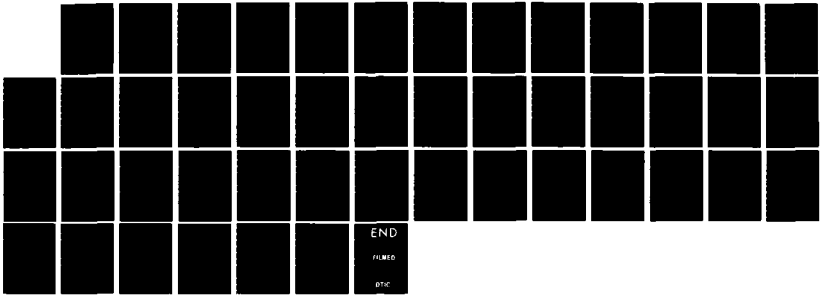

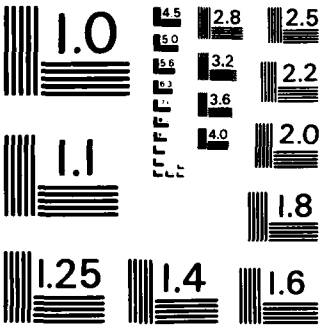

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

7. WORD LISTS

ABBREVIATIONS

This list contains the preferred abbreviations for the words, phrases, and units of measurement used in NUSC technical publications (except in technical manuals, where preferred abbreviations are found in MIL–STD–12C and ANSI Y10.19). For the units of measurement, Department of Defense (DoD) policy states that metric units be included in addition to, or instead of, U.S. customary units in all technical reports, studies, and position papers. Exceptions to this requirement must be approved by the author's department head. The International System of Units described in ASTM E380–82 (ANSI Z210.1) or successor documents listed in the DoD Index of Specifications and Standards is the metric system to be used. Other details of the metric policy may be found in section 1 of this document; a conversion table is provided in section 8.

The abbreviations for units of measurement in this list follow the standard ASTM E380–82. For U.S. customary units, the equivalent metric unit and its abbreviation are given in parentheses:

foot (meter) ft (m)

Each abbreviation denotes both the singular and the plural form.

Term	Abbreviation
alternating current	ac
alternating current volts	Vac
American National Standards Institute	ANSI
American Steel Wire Gage	ASWG
American Wire Gage	AWG
ampere	A
ampere–hour (coulomb)	Ah (C)
ampere meter squared	$A \cdot m^2$
ampere per meter	A/m
ampere–turn	At
amplitude modulation	AM
angstrom (meter)	Å (m)
ante meridiem, before noon	a.m.
antisubmarine rocket	ASROC
atmosphere, normal	atm

Term	Abbreviation
atmosphere technical,1 kgf/cm² (pascal)	at. (Pa)
audio frequency	AF
automated data processing	ADP
automatic frequency control	AFC
automatic gain control	AGC
automatic volume control	AVC
bar (pascal)	bar (Pa)
bathythermograph	BT
bearing deviation indicator	BDI
beat-frequency oscillator	BFO
bel	B
bits per second	b/s
British thermal unit (joule)	Btu (J)
candela	cd
candela per square meter	cd/m²
cathode-ray tube	CRT
centimeter	cm
centimeter-gram-second	cgs
combat information center	CIC
continuous wave	CW
coulomb	C
cubic centimeter, liquid	cc
cubic centimeter, volume	cm³
cubic foot (cubic meter)	ft³ (m³)
cubic inch (cubic centimeter)	in.³ (cm³)
cubic yard (cubic meter)	yd³ (m³)
decibel	dB
decibel referred to one micropascal*	dB//1 μPa

* One micropascal, equal to 10^{-5} dyne per square centimeter, has been adopted by NUSC as the standard reference pressure for acoustic measurements in liquids, superseding the microbar (1 dyne per square centimeter).

Term	Abbreviation
decibel referred to one milliwatt	dBm
degree, plane angle (radian)	deg or ° (rad)
degree, temperature	
10 to 20 degrees Celsius	10 to 20 °C
10 degrees Fahrenheit (10 degrees Celsius)	10 °F (10 °C)
kelvin	K
Department of Defense	DoD
digital voltmeter	DVM
direct current	dc
direct current volts	Vdc
direction finder	DF
direct current working volts	Vdcw
dyne (newton)	dyn (N)
electromagnetic compatibility	EMC
electromagnetic interference	EMI
electronic countermeasure	ECM
electronic data processing	EDP
expendable bathythermograph	XBT
extremely high frequency	EHF
extremely low frequency	ELF
farad	F
fathom (meter)	fm (m)
fiscal year	FY
foot (meter)	ft (m)
footcandle (lumen per square meter)	fc (lm/m^2)
footlambert (candela per square meter) (lux)	fL (cd/m^2) (lx)
foot per minute (meter per second)	ft/min (m/s)
foot per second (meter per second)	ft/s (m/s)
foot poundal (joule)	ft–pdl (J)
foot pound–force (joule)	ft•lbf (J)
frequency modulation	FM
frequency–shift keying	FSK

Term	Abbreviation
gallons per minute	gal/min
(cubic meters per second)	(m^3/s)
gauss (tesla)	G (T)
gigahertz	GHz
gram	g
gravitational acceleration	g
Greenwich Mean Time	G.m.t.
henry	H
hertz	Hz
high frequency	HF
horsepower	hp
hour	h
identification friend or foe	IFF
inch (millimeter)	in. (mm)
inch per second (millimeter per second)	in./s (mm/s)
infrared	IR
inside diameter	id
intermediate frequency	IF
joule	J
joule per kelvin	J/K
kelvin	K
kilogauss	kG
kilogram	kg
kilogram-force	kgf
kilohertz	kHz
kilohm	kΩ
kilometer	km
kilovolt	kV
kilowatt	kW
knot	Spell out

Term	Abbreviation
lambert	L
latitude	lat.
longitude	long.
low frequency	LF
lumen per square meter	lm/m^2
lux	lx
maximum response axis	MRA
megahertz	MHz
megavolt	MV
megawatt	MW
megohm	MΩ
meter	m
meter–kilogram–second	mks
meter per second	m/s
mho (siemens)	mho (S)
mho per meter (siemens per meter)	mho/m (S/m)
microampere	μA
micron (meter)	μ (m)
micropascal	μPa
microsecond	μs
microwatt	μW
mil	mil (1 mil = 0.001 in.)
mile (kilometer)	mile (km)
milliampere	mA
milligram	mg
millihenry	mH
millihertz	mHz
millimeter	mm
conventional millimeter of mercury	mmHg
millimeter per second	mm/s
millimicron	See nanometer
millisecond	ms
millivolt	mV

Term	Abbreviation
milliwatt	mW
minimum detectable level	MDL
minute, time	min
month	Spell out
nanometer	nm
nanosecond	ns
nautical mile (kilometer)	nmi (km)
neper	Np
newton	N
number, numbers	No., Nos.
ohm	Ω
ordnance alteration	ORDALT
outside diameter	od
parts per million	p/m
parts per thousand, salinity	Spell out or 0/00
pascal	Pa
percent	Spell out in text, % on figures and tables
picofarad	pF
plan position indicator	PPI
post meridiem, after noon	p.m.
pound (kilogram)	lb (kg)
poundal (newton)	pdl (N)
pound-force (newton)	lbf (N)
pound-force per square inch (pascal)	lbf/in.^{2} (Pa)
pound per square inch	See pound-force per square inch and section 6, PSI.
radian	rad
radio frequency interference	RFI
revolution per minute	r/min
root mean square	rms

Term	Abbreviation
second, time	s
ship alteration	SHIPALT
ships	DD 840, SSN 688
siemens	S
siemens per meter	S/m
signal–to–noise ratio	SNR
square foot (square meter)	ft^2 (m^2)
square inch (square millimeter)	$in.^2$ (mm^2)
square meter	m^2
square yard (square meter)	yd^2 (m^2)
steradian	sr
submarine rocket	SUBROC
superhigh frequency	SHF
tesla	T
ultra high frequency	UHF
United States	U.S.
vacuum–tube voltmeter	VTVM
variable depth sonar	VDS
variable frequency multiplier	VFM
versus	vs.
very high frequency	VHF
very low frequency	VLF
volt	V
voltage standing–wave ratio	VSWR
voltampere	VA
watt	W
yard (meter)	yd (m)
year	Spell out

NOTES

CAPITALIZATION, COMPOUNDING, AND SPELLING

This list contains the preferred capitalization, compounding, and spelling for many words and phrases used in NUSC technical publications. The preferred spelling is generally that recommended by the *Government Printing Office Style Manual (GPO Style Manual)*. For the preferred capitalization or compounding, the *GPO Style Manual* has been the guide; however, the general trends and preferences observed in recognized scientific and literary sources have been taken into consideration. In this list an abbreviation indicates the part of speech to which the entry pertains. For example, "above-water (u.m.)" means that the words "above" and "water" are used together as a unit modifier (e.g., the above-water target).

aboveboard
abovedeck
above-water (u.m.)
abscissas
A-cable
accept (see section 6)
acidproof
acknowledgment
active-passive (u.m.)
adapter
affect (see section 6)
addendum, addenda
A-frame
afterbody
airblast
air-blasted (u.m.)
airblown
airborne
air-condition (all)
air-cool (v.)
air-cooled (u.m.)
air-dropped (u.m.)
air-dry (u.m., v.)
air duct
airflask
airflow
air line (tube)
airtight
airwave
align(ment)
Allen wrench
all ready (see section 6)
already (see section 6)
analog-to-digital (u.m.)
angle iron
antennas
antialias
antiflashback
antifreeze
antilogarithm
antiseize
antisubmarine
antisurface ship (u.m.)
any time
apex, apexes
appendix, appendixes
arctic (descriptive adjective)
Arctic
assure (see section 6)
audio frequency
audio-visual
autocorrelation
auxiliary
axis, axes

backfitted
backlight
backpressure
backscattering
back up (v.)
backup (n., u.m.)
ball bearing (n.)
ball-bearing (u.m.)
bandpass (u.m.)
bandwidth
baseline
bathyscaph
beamformer
beam pattern
beamwidth
beat-frequency oscillator
benchboard
benefited
biweekly (see section 6, BI-)
blowoff (n., u.m.)
borderline
bottom bounce
bottom-reflected (u.m.)
bottom reflection (n., u.m.)
bottomside
bottomside-up
breadboard(ed)
breakaway (n., u.m.)
broadband (u.m.)
broad band (n.)
broadside
Bruel & Kjaer
build up (v.)
buildup (n.)
built-in (u.m.)
built-up (u.m.)
bulkhead
bylaw
byline
bypass
byproduct

cableholder
Calcomp (trademark)
callout (n., u.m.)
cancel (-ed, -ing)
cancellation
cannot
capnut
capscrew
Caribbean
catalog
cathode-ray oscilloscope
cathode-ray tube
Celluloid (trademark)
centerline
cesium
checklist
checkoff (n., u.m.)
checkout (n., u.m.)
circuit breaker
clamp-ring segments
clear-cut (u.m.)
clockwise
closed-circuit (u.m.)
close-in attack
coexist
condensable
cone-shaped (u.m.)
continual (see section 6)
continuous (see section 6)
contrarotating

control (–led, –ling)
controllable
convergence zone
correlogram
cotter pin
counterclockwise
countermeasure
counterrotating
countersink (sunk)
crisscross (–ed)
criterion, criteria
cross brace (n.)
cross–check
crosscorrelation
crosscoupling
crossflow
crosshair
crosshead
cross–index
crossover (n., u.m.)
cross–reference
cross section (n.)
cross–section (u.m., v.)
cross–sectional (u.m.)
cross–slotted
cross–spectral (u.m.)
crosstalk (n., u.m.)
crosswise
cuing
cutaway (n., u.m.)
cutback (n., u.m.)
cutoff (n., u.m.)
cutout (n., u.m.)

dampproof
dateline
datum, data (see section 6)
Day–Glo
daylight
deadline
deadweight (n., u.m.)
deenergize
deep–freeze (u.m., v.)
deep scattering layer
deep sea
definite (see section 6)
definitive (see section 6)
deice
desiccate
device (see section 6)
devise (see section 6)
disk
disk–shaped (u.m.)
dockside
dome–shaped (u.m.)
Doppler
double–ended (u.m.)
dowel pin
downgrade
down points
downtime
downward
drawback (n., u.m.)
drip–dry (u.m., v.)
drive shaft
dropout (n., u.m.)
dry cell (n.)
dry–cell battery
dryclean (–ing)
drydock
drydocked
dustproof (–ed)

dusttight

echo–range (v.)
echo ranging (n., u.m.)
effect (see section 6)
electroacoustics
electromagnetic(s)
electromechanical
electro–optics
emmittance (optics)
emplantment (see section 6, IMPLANTMENT)
encase
endfire
end–item
endpiece
endplay
endproduct
en route
ensure (see section 6, ASSURE)
even–numbered (u.m.)
every time
except (see section 6, ACCEPT)
exercise head
expendable
extendible
eyebolt
eyepiece

facedown (adv., u.m.)
faceup (adv., u.m.)
farfield
farther (see section 6)
feedback (n., u.m.)
fiberboard
Fiberglas (trademark)
fiberglass (generic)
figure of merit
fingertight
fireproof (–ed)
fire–resistant (u.m.)
firesafe
fire test
firsthand (u.m.)
Fishers Island
fishtail
flameproof (–ed)
flathead screws
Fleet (U.S.)
flextensional transducer
flip–flop (u.m.)
flowchart
flowmeter
foldout (n., u.m.)
follow–on
followup (n., u.m.)
fore–and–aft (n., u.m.)
foreword (see section 6)
forklift
formated
Formica (trademark)
formulas
forward (see section 6)
forwardmost
Fourier
freeboard
freehand (u.m.)
freestanding (u.m.)
Freon (trademark)
frequency–shift keying
front–end (u.m.)
full–scale (u.m.)

Instead of	Use
elongate	stretch
emphasize	stress
employ	use
enable	allow, energize (in electronics)
encounter	meet
endeavor	try
energize	start, light, trigger, trip
engage	mesh, fit, mate
engage in a demonstration of	show
ensure	make sure
entirely	fully
enumerate	count
equitable	fair
equivalent	equal
erroneous	wrong
establish	fix, set up, prove, show
evaluate	check, rate, test
evidence	data (n.), show (v.)
evident	clear
evince	show
exhibit	show
expedite	hasten, speed up, rush
expeditious	fast, quick
expend	pay out, spend
expense	cost, fee, price
expertise	ability, skill
expiration	end
explain	show, tell
explanation	reason for
explicit	plain, clear
exterior	outside
fabricate	build
facilitate	ease, help, simplify

Instead of	Use
defect	flaw
defective	faulty, broken rusty, etc.
deficiency	lack
defined as	is
delete	cut, drop
demonstrate	show, prove
depart	leave
designate	appoint, choose, name
designation	name, number
designed to fit (show, do, etc.)	fits (shows, does, etc.)
despite the fact that	although
detect	sense, find
determine	find out, check, decide
detrimental	harmful
develop	grow, make, take place
dimension	size, height, depth, etc.
diminution	lessening
disassemble	take apart
disclose	show
discontinue	end, stop, give up
discussion	talk
disintegrate	break up
disseminate	issue, pass out, send out
dissimilar	unlike
due to the fact that	because
duplicate	copy
during the period	during
echelons	levels
effect modifications	make changes
effectuate	carry out, make
elect	choose
elevated	high
eliminate	cut, drop, end

Instead of	Use
cognizant	aware, responsible
combined	joint
come to a conclusion	conclude, finish
commence	begin, start
communicate	write, tell
comply with	follow
component	part
composition	makeup
concerning	about, on
conclusion	end
concur	agree
conduct	make, do
conduct an investigation	investigate
configuration	shape
connect	join
connection is made by	connected by
considerable	much
consolidate	combine, join, merge
constitutes	is, forms, makes up
construct	build
constructive	helpful
contains	has
contains within	contains
contribute	add, give
contradict	deny
convene	meet
conversation	talk
correspond	agree
corrode	rust (iron, steel only)
cover	lid
cubic feet in volume	cubic feet
currently	now or *omit*
deem	consider, think, believe

Instead of	Use
alteration	change
ameliorate	improve
anterior	front
anticipate	expect
a number of	some
apparent	clear, plain
appear	seem
appreciable	many
appropriate	proper, right, or *omit*
aqueous	watery
as a means of	to
ascertain	learn, find out, check
as prescribed by	under, in
assist, assistance	help
at all times	always
at an early date	soon
attach together	attach
attain	meet, reach
attempt	try
at the present time	now
automatically operated	automatic
be cognizant of	know
beneficial	helpful
be responsible for	handle
by exerting a twisting action	by twisting
by means of	with, by
cancel out	cancel
caveat	warning
center portion	center
close off	close
close proximity	near
coagulate	thicken

JUST PLAIN ENGLISH

Natural sounding words and expressions enhance technical writing. Instead of using the polysyllabic words shown on the left side of the following word list, the author should try using the simpler words on the right side, as long the meaning remains absolutely clear. In all cases, communication effectiveness is the test.

Instead of	Use
abbreviate	shorten
abrasion	scratch
absolutely	wholly
accentuate	stress
accommodate	suit, fit
accompany	go with
accomplish	do, carry out, finish
accorded	given
accrue	add, gain
accumulate	gather
accurate	correct, exact, right
achieve	do, make
acknowledge	admit, grant, note
acquaint with	tell
acquire	gain, get
activate, actuate	begin, start, punch, press, turn
actual	real
actual experience	experience
additional	added, more, other
adhere	stick
adjacent to	next to
adjust	set
advantageous	helpful
adversely impact on	hurt, set back
afford an opportunity	permit, let, allow
after the manner of	like
aircraft	plane
a large number	many
allocate	divide, give

NOTE

X-ray
x-y plane

y-axis
y-direction

yearend
yearlong
Y-pipe

z-axis
zeros
zigzag

two–way (u.m.)

ultrahigh frequency
ultrasonic (see section 6, INFRASONIC)
underwater (u.m.)
under water (adv.)
underway (u.m.)
under way (adv.)
Univac (trademark)
update
upend (v.)
upgrade
uppercase
upside–down (u.m.)
upside down (adv.)
uptake
up–to–date (u.m.)
upwind
usable
U–shaped

vacuum–tube voltmeter
vaporproof (–ed)
vaportight
variable depth sonar
variable frequency multiplier
venthole
vice versa
viewgraph
voltage standing–wave ratio
voltmeter

warhead
warmup (n., u.m.)
war shot
waterborne
water–cooled (u.m.)
water–filled (u.m.)
water–inlet plug
water level
waterline
waterproof (–ed)
watertight
waveform
wavefront
waveguide
waveheight
wavelength
wavenumber
waveshape
wavevector
weatherproof
wedge–shaped (u.m.)
wedge–type joint
weeklong
wide–angle (u.m.)
wide–open (u.m.)
wind tunnel
wingbolt
wire–cut (u.m.)
wire guidance
wire–guided (u.m.)
world–wide
worm gear
worm wheel
worthwhile
wrenchtight
wrench–tighten (v.)

x–axis
x–direction

step–by–step (u.m.)
stepdown (n., u.m.)
step–up (n., u.m.)
stockpile (all)
stopgap
stopwatch
straightedge
streamline
structureborne
Styrofoam (trademark)
subassembly
subsection
subsonic (see section 6, INFRASONIC)
superbuoyant
superhigh
supersonic (see section 6, INFRASONIC)
swimbladder
swimout (n., u.m.)
swing bolt
switchboard
switchbox
switchgear
synchro–transmitter system

tailcone
tailormade (u.m.)
tailpiece
tailstock
takeoff (n., u.m.)
takeup (n., u.m.)
task force
teamwork
tearproof
Teflon (trademark)
test case
three–dimensional (u.m.)
throughout
thrustpower
tieback (n.)
tiedown (n., u.m.)
tie–in (n., u.m.)
tieline
tie rod
tiltboard
tilt table
timeclock
time–consuming (u.m.)
timesaving (u.m.)
timestudy
timetable
topside
torpedoborne
touchup (n., u.m.)
tow cable
towline
trademark
trade name
tradeoff (n., u.m.)
transmittance
travel (–ed, –ing)
traveltime
Trident
trouble–free (u.m.)
troubleshoot
T–shaped
T–square
tube–launched (u.m.)
turnaround (n., u.m.)
turntable
two–piece (u.m.)

sandblast
screenout (n., u.m.)
screwdriver
screwhook
screwplug
sea base
sea–based (u.m.)
seabed
seacoast
sea level
searchlight
sea water (all)
self– (as reflexive, use hyphen, e.g., self–noise)
semiannually
semiconductor
semiempirical
semi–infinite
servoamplifier
servobrake
servocircuit
servocontrol
servomechanism
servomotor
servosystem
setscrew
setup (n., u.m.)
shallow–draft (u.m.)
sharp–angled (u.m.)
sharp–edged (u.m.)
sheet metal
shelf life
shipboard
ship speed (see section 6, POSSESSIVES)
shipyard
short circuit
short–circuited (u.m.)
shutdown (n., u.m.)
shutoff (n., u.m.)
sideband
side lobe
signal–to–noise ratio
silver–plated (u.m.)
sine curve
sine wave
single–phase (u.m.)
single sideband
siphon
sizable
slide rule
slipknot
slip–on (n., u.m.)
slipproof
slipring
snaphook
snaplock
snap–on (n., u.m.)
snapring
solid–state (u.m.)
sonobuoy
spatial (not spacial)
spot check
spot–checked (u.m.)
spot weld
spot–welded (u.m.)
spring–loaded (u.m.)
square edge
standby (n., u.m.)
standing–wave ratio
standoff (n., u.m.)
stationarity

pickoff (gyro)
pickup (n., u.m.)
piezoelectric
pilothouse
pinpoint
Pitot tube
play back (v.)
playback (n., u.m.)
Plexiglas (trademark)
plug–in (u.m.)
post–run (u.m.)
powerpack
practical (see section 6)
practicable (see section 6)
preamplifier
preenable
preset
pressureproof (–ed)
pressuretight
prestarting
pretest
preventive (see section 6)
principal (see section 6)
principle (see section 6)
printout (n., u.m.)
processor
program (–med, –mer, –ming)
programmable
pseudorandom
pullaround (n., u.m.)
pullback (n., u.m.)
pulldown (n., u.m.)
pull–in (n., u.m.)
pull–on (n., u.m.)
pullout (n., u.m.)
push–pull (u.m.)
Pyrex (trademark)

quasi– (as combining form, hyphenated)
quick–charging (u.m.)

radius, radii
read–in (n., u.m.)
readout (n., u.m.)
recheck
recordkeeping
reenergize
reexamine
refracted–surface–reflected
reinforce
reinstall
rescribe
reseat
reset
resonance frequency (but resonant plate)
respectively (see section 6)
retest
reverberation–limited (u.m.)
reversible
reweld
Reynolds number
right–angle (u.m., v.)
right–hand (u.m.)
root mean square (all)
rundown (n., u.m.)
runoff (n., u.m.)
runout (n., u.m.)
rustproofed (–ed)
rust–resistant (u.m.)

monthlong (u.m.)
motor generator
movable
multi (as combining form, all one word)
multimeter

nameplate
narrowband (u.m.)
narrow band (n.)
naval
Navy (U.S.)
nearby
nearfield
near–miss (u.m.)
noise–limited (u.m.)
nonacoustic
noncavitating
nondirectional
nonidentical
noninterchangeable
nonnuclear
nontoxic
nonuniform
nonwire–guided (u.m.)
nonzero
northeast
nosedive
nosedown (adv., u.m.)
nosepiece
noseup (adv., u.m.)
n–th

oersted
off–and–on (u.m.)
off–balance (all)
off–center (all)
off–load (–ing) (u.m., v.)
offshore
oiltight
omnidirectional
onboard
one–half
one–piece (u.m.)
ongoing
online (computer terminology)
on–load (–ing) (u.m., v.)
onshore
ordnance alteration
O–ring
Otto fuel
outboard
output
overall (all)
overflow
overhaul
overrun
overshoot
overspeed
overswing
own ship (all)

padlock
passband
pay (–ed) out (v.)
payout (n., u.m.)
peacetime
percent (see section 6)
percentage (see section 6)
petcock
phenomenon, phenomena
Philips screw (trademark)

insofar as
insonification
insonify
insure (see section 6, ASSURE)

jackscrew
judgment
jury–rigged (u.m.)

keyboard
keypunch
kiloyard
knife–edge bearing

land base
land–based (u.m.)
large–scale (u.m.)
laser
lay, laid, laid (see section 6)
leakmeter
left–hand (u.m.)
letterhead
lie, lay, lain (see section 6)
lightweight (n., u.m.)
lineup (n., u.m.)
linkup (n., u.m.)
link up (v.)
Lithocon
live wire
locknut
lockscrew
lockwasher
locus, loci
Lofargram
long–handled (u.m.)
long term
loudspeaker
lowercase
lowermost
low frequency (all)
low pass (u.m.)
low–pass filter (v.)
low–pressure (u.m.)
low–speed (u.m.)
low voltage (all)

mainlobe
mainspring
makeup (n., u.m.)
man–hour
manpower
man–year
maser
mathematical model (not math model)
matrix, matrices
memorandum, memoranda
metal–coated (u.m.)
microampere
microswitch
mid–1970's
midchannel
midlatitude
midpoint
midsection
milestone
minelayer
minesweeper
mismatch
model (–ed, –ing)
moistureproof (–ed)
Monel (trademark)

full speed
full–strength (u.m.)
further (see section 6)
fuseblock
fuseboard

gage
gastight
gauss
Gaussian
Gauss law
gearbox
gearcase
gel
getaway (n., u.m.)
gray (see section 6)
greaseproof(ed)
gridline
groundwork
guideline
gyrocompass

half hitch
half hour
half–strength (u.m.)
halfway
handbrake
hand–carry (v.)
handcrank
handhold
handhole
hand pump
handtighten
handtool
hand–tooled (u.m.)
handwheel

hard–over (u.m.)
Harpoon (missile)
hatchway
heatproof
heat pump
heat–resistant (u.m.)
heattreat (v.)
heat–treated (u.m.)
heavy–duty (u.m.)
helix, helices
henry, henrys
high frequency (u.m.)
highlight
highpass (u.m.)
high–pressure (u.m.)
high–speed (u.m.)
high voltage (u.m.)
holddown clamps
holdover (n., u.m.)
homogeneous
hookup (n., u.m.)
hull–mounted (u.m.)

I–bar
I–beam
immittance (see section 6)
implantment (see section 6, EMPLANTMENT)
in–and–out motion
inasmuch as
inboard
inch–long (u.m.)
index, indexes
infrasonic (see section 6)
inline (computer terminology)
inputted

Instead of	Use
factor	reason, cause
feasible	can be done, workable
finalize	complete, finish
final outcome	outcome
for a period of	for
for example	such as
forfeit	give up, lose
formulate	draw up
for the purpose of	for, to
for the reason that	because
forward	send
fracture	break
frequently	often
function	role (n.), act, work (v.)
functions to transmit	transmits
fundamental	basic
furnish	give, send
furthermore	then, also
give assistance to	help, assist
glutinous	sticky
gravitate	settle
greatest percent	most
has a requirement for	needs
have a discussion	discuss
have an impact on	affect
helps in the production of	helps to produce
herein	here
heretofore	until now
herewith	below, here
hexagonal in shape	hexagonal
horizontal	level, flat
horizontally level	level

Instead of	Use
ideally	*omit*
identify	find, name, show
if oscillation of the ____ occurs	if the ____ oscillates
immediately	at once
immovable	firm, fixed
impacted	affected, changed, hit
implement	carry out, start
in accordance with	by, following, under
in addition	also, more, besides, too
in an effort to	to
inapplicable	unsuitable
in a situation in which	when
in a timely manner	on time, promptly
inaugurate	begin
inception	start
in close proximity to	near
in conjunction with	with
in consonance with	agree with
incorporate	blend, join, merge
incorrect	wrong, faulty
incumbent upon	must
indicate	show, point out
indication	sign
individual	person
inform	tell
inhibit	check, hinder
initial	first
initiate	begin, start
in lieu of	instead of
innovation	change
innumerable	many
inoperative	not working
in order that	for, so that
in order to	to

Instead of	Use
inquire	ask
in recognition of this fact	therefore
in regard to	about, concerning, on
inscribe	mark
inspect	check
in spite of the fact that	although, though
institute	begin
insufficient	not enough
inter alia	*omit*
interface with	deal with, meet, work with
interior	inside
in the amount of	for
in the case of	if
in the course of	during, in
in the event that	if
in the field of	*omit*
in the final analysis	*omit*
in the majority of instances	usually
in the near future	soon
investigate	study
in view of the fact that	because
is applicable to	applies to
is capable of	can
is dependent upon	depends on
is equipped with	has
is essential that	must
is imperative that	must
is provided with	has
is responsible for	handles
is used in preference to	is preferable to
is used to control	controls
it	*omit*
justify	prove

Instead of	Use
lacerate	cut, tear
likewise	and, also
limitations	limits
limited number	few
locality	place
locate	is, place, put, set, find
location	place, scene, site
magnitude	size
maintain	keep, support
maintenance	upkeep
majority	most
make a calibration	calibrate
make an alteration to	alter, change
make cognizant of	tell, inform
make for better distribution	distribute better
make the adjustment	adjust
malfunction	fail, break down
manipulation	handling
manufacture	make, build
materialize	appear, come about
measurement is made by	is measured by
methodology	method
minimal	smallest
minimum	lowest, least, smallest
modification	change
modify	change
moisture content of air	humidity
monitor	check, watch
necessitate	must, shall, should, cause
nevertheless	but, however, still
nomenclature	name
notation	note

Instead of	Use
notify	let know, tell
not later than	by
notwithstanding	in spite of, although
numerous	many, most
objective	aim, goal
obligate	bind, compel
observe	see
obtain	get
occasion	cause (v.)
occasionally	now and then
occurrence	event
of course	*omit*
on the basis of	based on, by, from
on the other hand	but
open up	open
operate	run, turn, twist, screw, etc.
operates to correct	corrects
operational	working
opportunity	chance
optimum	best, greatest, most
option	choice, way
owing to the fact that	because
oxidization	oxidation
participate	take part
penetration	hole, bore, slot, channel, port
perform	do
perform the lubrication operation	lubricate
perform the measurement	measure
periphery	edge, rim, outside
permanent	lasting
permit	let
permits reduction of	reduces

Instead of	Use
pertaining to	about, of, on
physical size	size
point in time	point, time, now
portion	part
position	place, put
possess	have
practicable	workable
preclude	prevent
predisposition	tendency
preliminary to	before
prepared	ready
present	give (v.)
previous	earlier, past
principal	chief, major
prioritize	rank
prior to	before
probability	chance
procedure	method, rule, way
proceed	go ahead, do, try
proficiency	skill
profile	outline
programmed	planned
proliferate	expand, enlarge, grow
promulgate	issue, announce
propeller	screw
proposal	plan
provide	give, supply
provided that	if
provides continuous indication of	continuously indicates
provides for	gives, allows
provides guidance for	guides
proximity	nearness
purchase	buy

Instead of	Use
range all the way from	range from
rather	*omit*
read through	read
recapitulate	sum up
recoil back	recoil
reduce	cut
reference	refer to, cite, list
reflect	show
regarding	about, of, on
reimburse	pay
relative to	about, on
relocate	move
remain	stay
remainder	rest
remedy	fix, cure
render	give, make
renumeration	pay, payment
replenish	fill
request	ask
require	must, need
requirement	need
retain	keep
retract upward	retract
review	check, go over
segment	part
segregate	set apart, separate
select	pick, choose
selection	choice
set forth in	in
significant	major
similar	same, like
simultaneously	at the same time
spread out	spread

Instead of	Use
state-of-the-art	latest
submit	give, send
subsequent	next, later
subsequently	later, after, then
subsequent to	after
substantial	large, big, real, strong
substantiate	prove
sufficient	enough, ample
tabulation	table
takes into consideration	considers
terminate	end, stop
the area of	*omit*
the level of	*omit*
the nature of	*omit*
therein	there
throughout the entire	throughout
time interval	time
timely	prompt
time period	time, period (*not both*)
to produce deliberate cycling of	to cycle deliberately
transmit	send, carry, move
- type	*omit*
ultimate	last, final
unavailability	lack
under the provisions of	under
uniformly consistent	consistent
unsuitable	unfit
until such time as	until
utilization	use
utilize	use
validate	confirm

Instead of	Use
value	cost, worth
vertical	upright, standing
viable	practical, workable
vice	instead of, versus
voluminous	bulky
warrant	call for, permit
whenever	when
with reference to	about
with the exception of	except for
witnessed	saw

NOTES

8. CONVERSION AND SYMBOL TABLES

Table 8–1. Common Conversions From the *ASTM Standard for Metric Practice*

To Convert From	To	Multiply By*
acre	square meter	4.046 873 E+03
ampere hour	coulomb	3.600 000 E+03
degree (angle)	radian	1.745 329 E–02
fluid ounce (U.S.)	cubic meter	2.957 353 E–05
foot (U.S.)	meter	3.048 006 E–01
ft^2	square meter	9.290 304 E–02
ft/s	meter per second	3.048 000 E–01
ft/lbf	joule	1.355 818 E+00
gallon (U.S. dry)	cubic meter	4.404 884 E–03
gallon (U.S. liquid)	cubic meter	3.785 412 E–03
gauss	tesla	1.000 000 E–04
gram	kilogram	1.000 000 E–03
hectare	square meter	1.000 000 E+04
inch	meter	2.540 000 E–02
$in.^2$	square meter	6.451 600 E–04
kilogram–force (kgf)	newton	9.806 650 E+00
knot	meter per second	5.144 444 E–01
$lbf/in.^2$ (psi)	pascal	6.894 757 E+03
liter	cubic meter	1.000 000 E–03
micron	meter	1.000 000 E–06
mil	meter	2.540 000 E–05
mile (U.S.)	meter	1.609 347 E+03
mile (U.S nautical)	meter	1.852 000 E+03
minute (angle)	radian	2.908 882 E–04
ohm centimeter	ohm meter	1.000 000 E–02
pound–force	newton	4.448 222 E+00
quart (U.S. dry)	cubic meter	1.101 221 E–03
quart (U.S. liquid)	cubic meter	9.463 529 E–04
second (angle)	radian	4.848 137 E–06
ton (metric)	kilogram	1.000 000 E+03
yard	meter	9.144 000 E–01

* The first number is followed by the letter E (for exponent), a plus or minus symbol, and two digits that indicate the power of 10 by which the number must be multiplied to obtain the correct value, i.e., 3.523 907 E–02 is $3.523\ 907 \times 10^{-2}$, or 0.035 239 07.

Table 8–2. Mathematical Symbols

Symbol	Meaning	Symbol	Meaning
=	equal to	∝	varies as
≠	not equal to	∞	infinity
≈	approximately equal to	∇	nabla
≡	identical with	∴	therefore, hence
≢	not identical with	∵	since, because
∷	equal to, in proportion	• • •	and so forth
<	less than	′ ″ ‴	prime, double prime, triple prime
>	greater than		
≤	less than or equal to	!	factorial
≥	greater than or equal to	| |	absolute value of quantity within bars
∠	angle		
⊥	perpendicular to	→	approaches the limit
∥	parallel to	∫	integral sign
√	radical sign, root	Σ	sigma, summation
x or •	multiplied by	Π	product
:	is to, ratio	∂	curly d, variation
±	plus or minus	lim	limits of

Table 8–3. Greek Alphabet

Letter	Upper	Lower	Letter	Upper	Lower	Letter	Upper	Lower
Alpha	A	α	Iota	I	ι	Rho	P	ρ
Beta	B	β	Kappa	K	κ	Sigma	Σ	σ
Gamma	Γ	γ	Lambda	Λ	λ	Tau	T	τ
Delta	Δ	δ	Mu	M	μ	Upsilon	Υ	υ
Epsilon	E	ε	Nu	N	ν	Phi	Φ	φ
Zeta	Z	ζ	Xi	Ξ	ξ	Chi	X	χ
Eta	H	η	Omicron	O	ο	Psi	Ψ	ψ
Theta	Θ	θ	Pi	Π	π	Omega	Ω	ω

Table 8–4. Proofreader's Marks From the *Government Printing Office Style Manual*

Mark	Meaning	Mark	Meaning
⊙	Insert period	*l.c*	Lower case, used in margin
✓	Insert comma	/	Delete or substitute, used in text
;	Insert semicolon		
:	Insert colon	⊂	Close up
?	Insert question mark	ℓ	Delete
!	Insert exclamation mark	ℨ	Close up and delete
=/	Insert hyphen	*wf*	Wrong font
✓	Insert apostrophe	⊐	Move right
✓✓	Insert quotation marks	⊏	Move left
#	Insert space	⊓	Move up
ld >	Insert lead between lines	⊔	Move down
∨	Superior	‖	Align vertically
∧	Inferior	—	Align horizontally
(/)	Parentheses	⊐⊏	Center horizontally
[/]	Brackets	⊔⊓	Center vertically
¶	Paragraph	*eq.#*	Equalize space, used in margin
no ¶	No paragraph	*vvv*	Equalize space, used in text
tr	Transpose, used in margin	*stet*	Let it stand, used in margin
∩	Transpose, used in text	.....	Let it stand, used in text
sp	Spell out	⊗	Dirty or broken letter
ital	Italic, used in margin	*run over*	Carry over to next line
——	Italic, used in text	*run back*	Carry back to preceding line
b.f.	Boldface, used in margin	*out, see copy*	Something omitted, see copy
~~	Boldface, used in text	(?)	Question to author
caps	Caps, used in margin	^	Caret, used to mark exact position of error in text
≡	Caps, used in text		

NOTES

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