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NAVAL RESEARCH LAB WASHINGTON DC 1984

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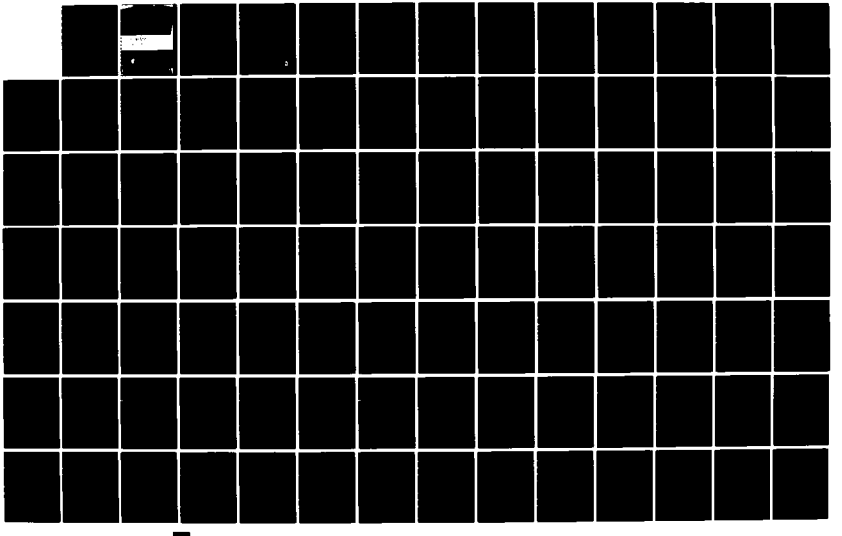

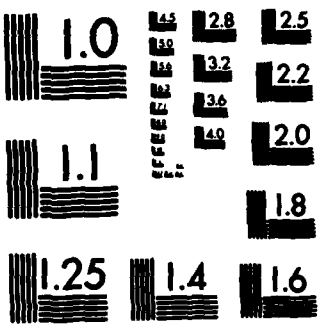

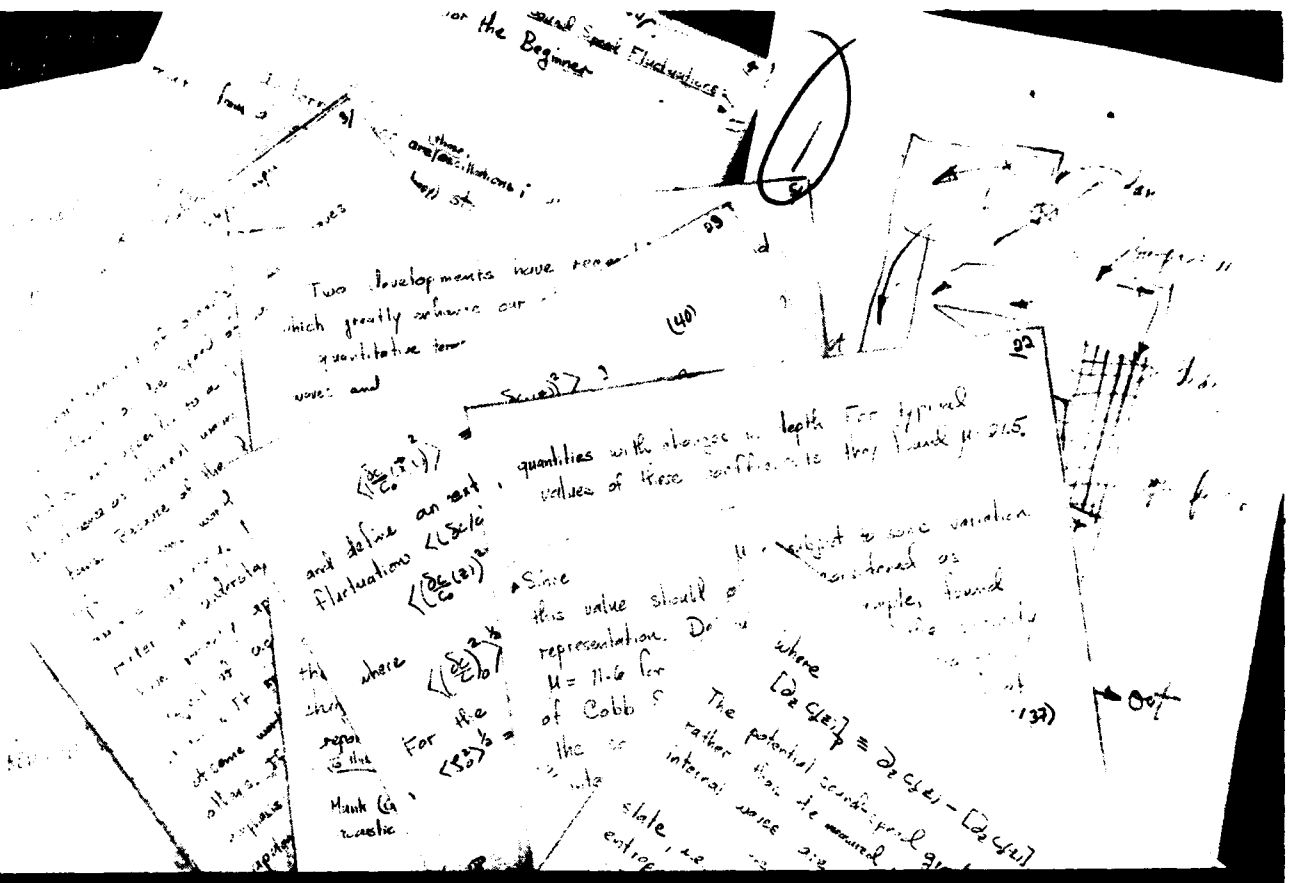

FORMAT GUIDE for SCIENTIFIC and TECHNICAL REPORTS

Published by the NAVAL RESEARCH LABORATORY
Washington, D.C.

CONTROL OF SHIPBOARD DAMA

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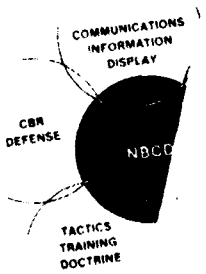

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Signal Sampling and Coherent Detection

W. M. WATERS AND B. R. JARNETT

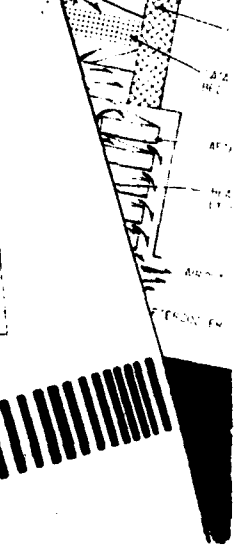
Search Radar Branch
Radar Division

Report 8520

December 24, 1

NAVAL RESEARCH LABORATORY
Washington, D.C.

OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING



TID DIRECTORY

CODE	UNIT	SECTION OR GROUP	BLDG/RM	EXT
2602	Administrative Office	Main Office	222/148A	73370
		TID Service Desk	222/146	73500
2604	Historian	N/A	43/325	73419
2605	Systems Analyst	Computer Systems Support	222/237	73445
2610	Information Services	Exhibits	222/234A	72541
		Public Affairs	222/234A	72541
		Labstracts	222/234A	72702
2620	Technical Library	Library Services	43/300	72269
		Bibliographies	43/323	73419
		Documents	43/14	73367
		Circulation	43/300	72134
				73369
		Distribution	43/14	72949
		Reference	43/300	72354
2630	Publications	Branch Office	222/253	72379
		Publications Control Center	222/253	73508
		Editorial	222/253	72782
		Graphic Services	222/234	72756
				73989
		Computerized Technical Composition	222/237	72850
		Printing and Reproduction	222/276	72386
2650	Photographic/ Illustration	Branch Office	222/241	76171
		Photographic Services	222/257	73608
		Illustration Services	222/242	73536
		Video Services	222/159	73984
		Photographic Supply	222/241B	72981

REVIEWED AND APPROVED
FEBRUARY 1984

E. E. KIRKBRIDE
Head, Technical Information Division

FOREWORD

This *Format Guide* has been prepared for use by Naval Research Laboratory personnel engaged in the writing and publishing of reports. For most people involved in demanding projects, publishing can be a trying experience. The problem of finding the time to get words on paper and then coordinating the production process can be overwhelming. However, for many projects, the publications that evolve are the only tangible products of the extensive research conducted here at the Laboratory. Thus, the documentation should be carefully thought out and adequately prepared.

As indicated by the title, this publication is a format guide for NRL Reports and Memorandum Reports. The standard elements contained in most of these publications are explained, their order is established, and samples are shown.

The *Format Guide* has been reviewed for content by the following offices: Publications Branch, Technical Library, Information Services Branch, Security Branch, Records and Correspondence Management Branch, and Patent Counsel.

We anticipate that further refinements and improvements will be made as the need arises. Reader feedback is encouraged and welcomed by the Editorial Section, Code 2631 (x73374 or x72782).

A blank page labeled "Notes" is placed at the end of each section. You may use this space to jot down additional information as it becomes available.

CONTENTS

SECTION 1

GENERAL INFORMATION

USE OF THE GUIDE

This *Guide* is intended to aid authors and typists in preparing NRL technical reports. Publications are a vital part of the research effort of the Naval Research Laboratory. It is chiefly through these publications that the Laboratory's work is documented and disseminated to the scientific and technical community. Use of the *Guide* will ensure that the Laboratory's technical reporting efforts are accomplished as effectively and efficiently as possible.

SCOPE

While this *Guide* applies to all NRL Reports and Memorandum Reports, it is also useful for general guidance in the preparation of reports to sponsors, instruction books, annual reviews, administrative publications, and working papers.

The *Guide* has been designed to be as comprehensive and yet as concise as possible. It is not intended to replace the rules of common sense and appropriateness in situations that have not been anticipated. It should answer most questions managers, authors, typists, and editors have about publication requirements. It establishes specific format policy for NRL Reports and Memorandum Reports. In addition, it clarifies many of the publications processes and sets forth current elements of style and format. Those who cannot find the answers they need in the *Guide* are encouraged to contact the Editorial Section, Code 2631 (x73374 or x72782).

BASIC REGULATIONS

Policy

DoD Directive 3200.12, DoD Scientific and Technical Information Program (STIP), directs that:

1. *The Department of Defense shall pursue a coordinated, comprehensive STIP to ensure that scientific and technical information (STI) provides maximum contribution to the advancement of science and technology; permits timely, effective, and efficient conduct and management of DoD research, engineering (RE), and studies programs; and eliminates unnecessary duplication of effort and resources* by encouraging and expediting the interchange and use of STI. The STIP shall provide for interchange of STI within and among DoD Components and their contractors, federal agencies and their contractors, and the national and international scientific and technical community.

2. The STIP is a basic and integral part of the Office of the Under Secretary of Defense for Research and Engineering (OUSDR&E) function and is affected by the DoD studies program. As such, it is incumbent upon the managers and performers of R&E to use and support the STI services and functions that comprise this program. STI processes are used to facilitate the communication and enrich the development and use of technical information during the planning and conduct of RE and studies efforts. Conversely, *the performance of these program efforts is not considered complete until the STI, including related program management information required under this program, has been documented satisfactorily and provided to the appropriate STI distribution activities.*

3. The Defense Technical Information Center (DTIC) is designated to provide a source of STIP services to assist in carrying out STIP policy and administration; to perform technical information support services for the OUSDR&E and OSD Principal Staff Assistants; to operate DoD-wide STI systems; to explore and demonstrate new supporting technology.

The Secretary of the Navy has assigned, by SECNAVINST 5600.15, the primary responsibility for the issuance of publications and printing to the sponsoring component or activity.

Publishing Authority

Essential phases of any information program are the generation, production, and distribution of a variety of publications. This is especially true of a research organization such as this Laboratory. While the authority to publish comes to NRL from the Secretary of the Navy, other Government activities are also concerned that the Laboratory adhere to this program, not only with propriety, but also with maximum economy. These other Government activities include the Congressional Joint Committee on Printing (JCP) and the Navy Publications and Printing Service (NPPS).

JCP Regulations

Basic regulations are set forth in the *Government Printing and Binding Regulations* published by the JCP. DOD has also promulgated a number of directives bearing specifically upon the handling of information within DOD. See Section 11, Bibliography, for currently applicable directives.

TID PUBLICATION SERVICES

The Technical Information Division (TID) is a support organization charged with helping you with your information needs. The following paragraphs briefly discuss TID's publishing services. Other TID services are discussed in *A User's Guide to the Technical Information Division* which is available at the TID Service Desk.

TID Organization

TID employs approximately 130 people and is organized into four major branches with group and staff support as shown in the organization chart in Fig. 1. This organization provides a wide range of services in response to the needs of the research and support personnel at the Laboratory and the Office of Naval Research. The TID Directory, which contains a listing of organizational elements, locations, and phone numbers, is located on the inside front cover.

Publications Branch Organization

The Publications Branch (Code 2630) is organized as shown in Fig. 2. The services offered by each of these sections is described in the following paragraphs.

The Publications Control Center

The Publications Control Center (Code 2630.1) is responsible for assisting the Publications Branch Head in the management of the printing and publications program for ONR and NRL. The Center receives, controls, and coordinates all requests for the printing and distribution of publications; administers laws and policies concerning control of printing; provides advice, technical assistance, and time and cost estimates for reproduction and printing tasks; and assists in obtaining permission to use copyrighted materials. The Publications Control Center also controls the internal and external distribution of all ONR- and NRL-sponsored publications, prepares mailing labels, and processes the printed documents for distribution.

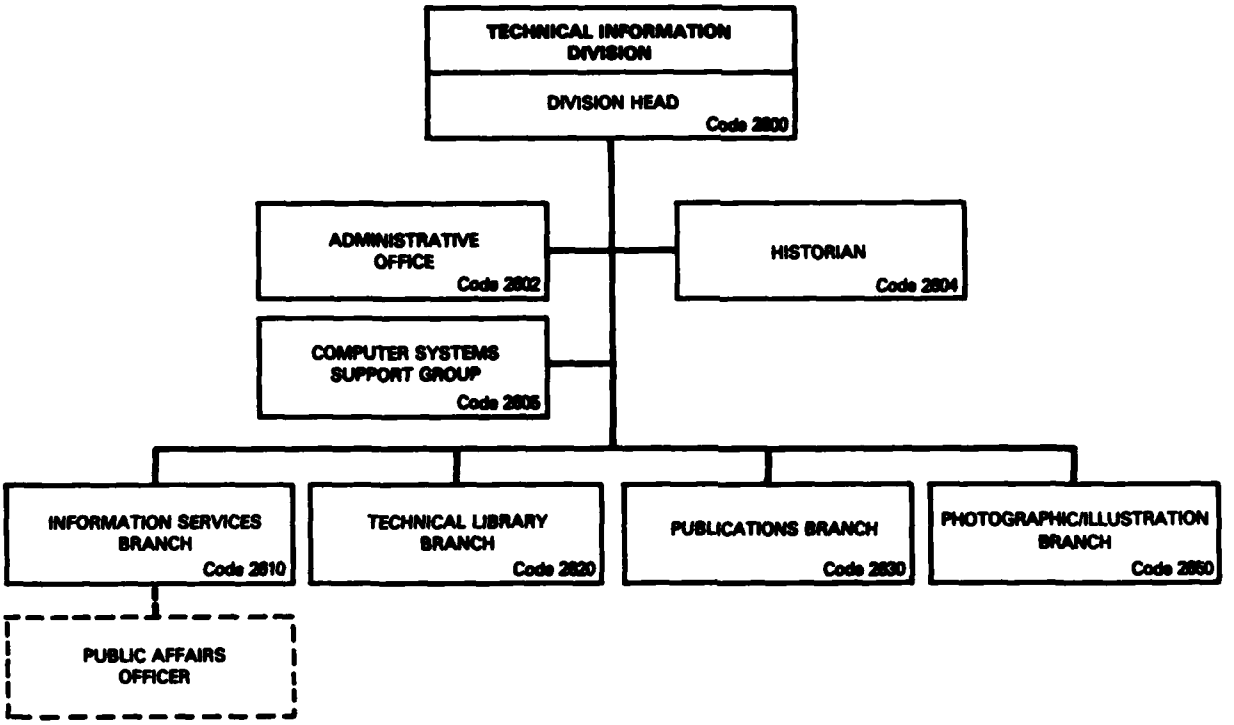


Fig. 1 — TID organization

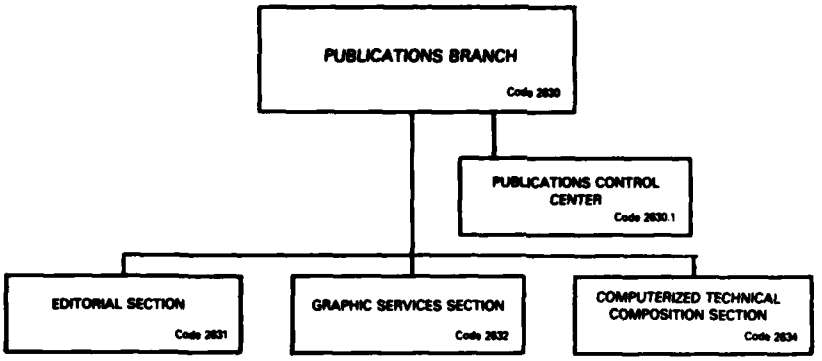


Fig. 2 — Publications Branch organization

Editorial Section

Helping you document your research is one of TID's specialties. The Editorial Section (Code 2631) provides a variety of services to assist you with your written communication efforts. The technical editors have in-depth editing experience in virtually every field of scientific research conducted at the Laboratory. Editorial assistance is available at any stage of manuscript preparation; however, early participation is recommended.

Brochures, handbooks, manuals, proceedings, and monographs are other formats for disseminating information. Editorial section personnel can assist you in the most effective and economical preparation of these materials also.

Prepublication planning is strongly urged. The effort invested early in a project to establish publication requirements, schedules, and costs greatly improves the efficient production of the manuscript. The editorial staff is available for advice on all phases of the process.

Many authors write well and do not need extensive editorial assistance. On the other hand, many manuscripts are significantly enhanced by a technical review performed by an experienced technical editor. The editor not only reviews the manuscript for grammar and format, but assists in ensuring that the report is clear and well organized and that the conclusions are supported by the discussion.

Graphic Services

The Graphic Services Section (Code 2632) provides a variety of layout and design services. Camera-ready artwork is prepared here by experienced illustrators and visual information specialists. Bulletins, certificates, plaques, and copy for in-house or contract composition and printing are also prepared by this section. If you have questions concerning any of these services, call or visit the Graphic Services Section.

Computer-generated graphics are prepared with the DICOMED system as part of the Photographic/Illustration Branch, Code 2650. For further information, call or visit DICOMED, Bldg 222, Room 239, x76159.

Computerized Technical Composition

The Computerized Technical Composition (CTC) Section (Code 2634) provides sophisticated, computerized composition services. The CTC staff prepares finished copy from material (including handwritten copy) which may contain elaborate formulas or equations.

If you have text that has already been typed, there are options available to get your text typeset without having it rekeyboarded. Automated transmission of data or text from one computer to another (either by telephone line or magnetic tape) is the most economical and time-effective method for those who have telecommunication packages on their word processors. (Note, however, that automated transmission by telephone line is available for unclassified work only.)

For further information regarding any of these services, call or visit the Computerized Technical Composition Section.

Printing and Reproduction Services

In addition to the services provided by the Publications Branch, printing and reproduction services that are not directly related to NRL publications (formal and memorandum reports and instruction books) are provided by the Navy Publications and Printing Service Branch Office (NPPSBO/NRL). The Service Desk for this organization is located in Bldg 222, room 269A, x72386.

Two methods of reproduction are available: photo-offset and a Xerox 9400 duplicator which reproduces line or text copy (but not photographs) on both sides of the paper in one operation. The Xerox 9400 provides quick and economical reproduction for 15 to 200 copies involving 10 to 200 originals.

NRL PUBLICATIONS

NRL Reports

NRL Reports, sometimes called Formal Reports, are the most formal and carefully prepared of the Laboratory's scientific documents. They are used to report substantial and significant NRL research that has been completed or has reached a conclusive point. In quality they are comparable to articles in refereed journals, and are edited as are refereed journals, but are not restricted by the space and graphic limitations of a journal. NRL Reports can be amplifications of journal articles or can be books running into hundreds of pages. They can have complex typography, elaborate graphic elements, extensive computer printouts, and other unusual materials that explain the project. With few exceptions, NRL Reports should be of interest to a wide audience.

NRL Memorandum Reports

NRL Memorandum Reports, sometimes called Informal Reports, are used to document NRL research that is less complete, less definitive, or of more limited interest to potential readers than the work covered in NRL Reports. Reports that formerly were termed Test and Evaluation Reports are now published as NRL Memorandum Reports.

These reports have a more limited audience and a shorter period of interest than NRL Reports. They may be submitted for technical editing, but the originating research unit usually does most of the preparation, including final typing for reproduction. If desired, authors may bring their manuscripts to TID and have the Computerized Technical Composition (CTC) Section typeset the material into computer memory for later revising, correcting, and printing.

NRL Instruction Books

Manuals of technical procedures relating to NRL-developed equipment are published as NRL Instruction Books. These manuals have their own unique numbering system, are generally prepared for direct reproduction by TID, and are spiral-bound for convenient use in the laboratory or field site.

PUBLICATION RESPONSIBILITY

The Technical Information Division is solely responsible for all publications at NRL. However, the Underwater Sound Reference Detachment (USRD) in Orlando, Florida has been granted specific permission to compose, print, assemble, and distribute NRL Memorandum Reports prepared by their scientists after obtaining approval from NRL Patent Counsel and Classified Material Control.

NOTES

SECTION 2

FRONT ELEMENTS

GENERAL

This section discusses the preparation and content of the front matter of NRL Reports, Memorandum Reports, and other technical and administrative publications. Items are generally discussed in the order of their appearance in the normal publication rather than in the order of their relative importance.

The discussion in this section pertains both to matters that are set by official Navy regulation and to those established at NRL as a matter of format. While not all of the items discussed may appear in any one individual NRL publication, there are certain items that are covered by official regulation that must be included in every publication.

Because of special requirements, some publications may vary in the individual areas discussed in the following sections. These special requirements should be discussed with the Publications Branch before publication processing begins in order to expedite the production of the publication as effectively and efficiently as possible.

FRONT AND BACK COVERS

Although back covers are not front matter, they are discussed herein (following the front cover discussions) for convenience only. Samples are shown in Section 9, Samples.

Front Cover

The front covers of NRL Reports and Memorandum Reports contain the following elements (listed in order of appearance):

Overall classification (classified publications only)
Report number
Copy number (for publications classified secret or higher)
Title
Author(s)
Releasing group, branch, or division
Date
Activity seal
Publisher
Place of publication
Downgrading and declassifying statement (classified publications only)
Distribution statement
Overall classification (classified publications only)

NRL reports have covers of standard cover stock and are 8-1/2 by 11 inches in size. Covers are blue for NRL Reports, green for NRL Memorandum Reports, and gray for NRL Instruction Books.

Security Classification

A classified publication must carry the overall classification of the publication at the top and bottom of the front cover. An unclassified publication carries no classification markings on the cover. The final or camera copy for the cover is prepared by TID, and the classification markings are added during composition. All classified NRL Reports and NRL Memorandum Reports have diagonal black markings on the left side of the front cover.

Report Number

NRL Reports and NRL Memorandum Reports are identified in the upper right-hand corner by their own unique number. These numbers are assigned by the TID Service Desk when the report comes in for processing. There is a separate numbering system for NRL Reports, NRL Memorandum Reports, and NRL Instruction Books. Advance or preassigned numbers can be obtained if authors have a valid reason for requesting them.

Copy Number

All copies of classified publications, secret and above, are serially numbered. The copy number, which appears in the upper right-hand corner of the cover below the report number, is added during printing. Copies of unclassified and confidential publications are not numbered.

Title

General Style — The basic function of the title is to inform the reader of the report's subject field and what distinguishes this report from other reports on the same general topic. The title should contain the fewest possible words that adequately describe the contents of the report. Do not begin the title with *On the.* Abbreviations are not generally used. The use of acronyms in the title of an NRL Report is discouraged because of the more general readership interest in these reports. Their use in the titles of NRL Memorandum Reports is acceptable because of the specialized readership interest of this type of report.

Multiple Parts — Titles must be carefully planned if a publication is to be issued in two or more parts or volumes or if publications are to be released in a series. Care must be taken to observe exact wording of titles of publications when subsequent supplements or revisions are published.

A publication issued in parts or volumes carries the identical general title on all parts, and each part carries an identifying part number plus a distinctive subtitle. A supplement or a revision is issued *after* the original publication. The general title on each remains the same; the supplement carries a subtitle although one is not necessary on a revision. The general title on publications issued in a series remains the same, although the identifying subtitle changes for each issue in the series.

Format — The title, set in the initial capital style, is centered horizontally on the page. The title of a classified publication should be unclassified. It must be followed by the symbol of its classification—(S), (C), or (U). The classification designation is not required on an unclassified report.

The title is set by TID when the report is transmitted to TID for printing. A title of two or more lines is set as an inverted pyramid. A subtitle is set below the main title in initial capital letters smaller than those used for the main title.

If possible, the title should be kept unclassified. If a classified title must be used, it does not appear on the front cover, but rather on the DD Form 1473, with the initial of its classification following it in parentheses—(C) or (S).

Series Designator

If the publication is issued in two or more parts, it should contain a series designation on all of the parts (supplements, revisions, volumes) whether the separate parts are issued at one time or at different times. This series designator is located just below the title.

Author

The name of the author (or authors) appears on the front cover of NRL Reports and Memorandum Reports. However, the author's name does not appear on brochures, facilities reports, or technical progress reports. The author's name may appear on a formal administrative publication. On books, the author's name usually appears on the title page instead of the cover.

The author's name is centered below the title. If there are two authors, their names are typed on the same line with the word *and* between them. Names of more than two authors are typed three names to a line, using the word *and* between the last two authors. Normally the lead author is listed first followed by other authors in descending order of contributions made to the report. An alternative method is to list the authors alphabetically. If the report has been written by an author who is not an NRL employee, his or her organizational affiliation is listed, with the NRL division for which the work was done shown underneath. In a multi-author report, the non-NRL author(s) (if applicable) and affiliation is generally listed below the NRL authors and their affiliation. Normal style calls for first two initials and last name. Other styles must be specifically requested, e.g., John G. Jones must be requested; J. G. Jones is standard.

Releasing Branch and Division

The author's branch, section, or project, etc., appears under his or her name. It is centered, with initial capital letters, and set in italics. The releasing division is placed under this, also with initial capital letters set in italics.

Date

The date shown on the cover (usually month, day, and year) is the date the publication is expected to be completed by the printer and, therefore, readily accessible to the public. This is not the date of release, nor is it the period covered by the report. The date is typed in initial capital letters and placed near the center of the cover. Note that the *manuscript approved* date is printed on page 1 of the text.

Sponsor's Credit Line

This item is optional and is not used in the majority of reports. Its use can serve to alert readers that a particular sponsor's order or contract was instrumental in funding the effort or research reported in the document. It also helps to identify those documents where sponsor, order, or contract number is deemed important.

Activity Seal

The official NRL seal appears on all NRL publications. It signifies that the material is officially approved and released.

Publisher

The name of the laboratory, as publisher and issuing activity, is shown in full in caps: NAVAL RESEARCH LABORATORY.

Place of Publication

Washington, D.C. appears centered under the name of the Laboratory in initial caps. The zip code does not appear.

Downgrading and Declassifying Marking

Downgrading and declassifying statements as set by Executive Order 12356 appear on the front cover of each classified report. This information appears on the lower left quadrant of the cover located just above the final entry, which is the distribution statement.

Distribution Statement

All unclassified NRL reports must have a distribution statement as the final item on the front cover. The information for this statement is obtained from block 16 of the DD Form 1473 (see Section 10, Review and Release). The distribution statement may be printed on the cover of classified reports, but this is not required.

Inside of Front Cover

The inside of the front cover is usually left blank on both NRL and NRL Memorandum Reports.

Back Cover

The back covers on both NRL Reports and NRL Memorandum Reports are the same in layout and differ only in color. They are normally blank on the inside and are made up for mailing on the outside using the standard NRL franking statements and logo.

Binding

The NRL Report cover is a one-piece cover folded in the center and saddle-stitched using two staples in the centerfold. Larger reports are perfect bound (paperback style) with the cover glued to the spine of the report.

The NRL Memorandum Report cover is composed of two halves: front and back. It is stapled to the report by two staples through the left-hand side margin.

NRL Instruction Books are spiral bound for ease of handling in the laboratory or field.

DD FORM 1473

Purpose

The information provided on the DD Form 1473 is used by the Defense Technical Information Center (DTIC) to describe the report in the Defense RDT&E On-Line System (DROLS), an on-line data base containing citations to defense-related technical reports. The data base is used by researchers in the defense community. Access points in the data base include title, performing organization, report number(s), author(s), program element, project and task numbers, contract numbers, report data, and key words. The citation, appearing on-line and in printed bibliographies, includes this information as well as page count and the abstract. It is important that this information be accurate. If possible, this form should be kept unclassified.

Requirements

All NRL Reports and NRL Memorandom Reports must be submitted to DTIC unless specifically exempted by competent authority and, therefore, must contain a DD Form 1473. Reports prepared for informal distribution need not contain this form.

Page Location

The DD Form 1473 forms the first right-hand page after the cover. It carries a lowercase Roman page number and may be listed on the contents page if desired.

Preparation

See Section 10, Review and Release, for instructions and sample.

CONTENTS PAGE

General

All publications must include a contents page. The contents page lists the title and page number of each major chapter, section, or heading usually beginning with the body of the publication. In titling the contents page, do not use the words "TABLE OF." The contents page is a right-hand, odd numbered page. See Section 9, Samples.

Information Contained in Contents

All of the major headings as well as the titles of the appendixes appear on the contents page. It is not necessary to list headings below first order. The elements in the front matter of the publication may or may not appear on the contents page at the discretion of the author. If a foreword and/or preface is used, it (or they) normally are entered on the contents page.

Format

The format is normally single-spaced but can be double-spaced to present a more balanced appearance if the content matter is brief.

Classification Markings

In a classified publication, the overall classification of the report is placed at the top and bottom of the contents page, even if the information in the contents is unclassified. Each contents page heading entry must be followed by the appropriate classification symbol in parentheses to indicate the classification of the heading.

FOREWORD

A foreword page, if used, follows the contents page. A foreword may be used to include the following information:

- Funding or sponsorship
- Purpose of study reported
- Relationship of the publication to others
- Reviewers
- Acknowledgments

PREFACE

A preface, if used, follows the foreword. It may be placed on the same page with the foreword, if they both fit on one page. A preface may be used to:

- Provide a message from the author
- Give background information
- State previous milestones
- Give credit for copyrighted material

LIST OF FIGURES OR TABLES

A list of figure and/or table captions is optional in your printed report. If you feel that it would be helpful to your readers because of a large number of figures and/or tables, include a list of each of them in the front matter of your report. Note this list in the Contents along with the page number on which they appear. Use the heading "Tables" or "Figures", not "List of...". Indicate at the bottom of each list if it is to be printed with your report.

Even if a separate list is not necessary for your published report, a separate list of figure and table captions must be provided for final report preparation by TID. Place the list that is provided only for TID use at the end of your report production package, just before the distribution list.

NOTES

NOTES

SECTION 3

BODY OF REPORT

GENERAL

This section discusses the format of the main body of text for NRL publications. The discussions, examples, and guides in this section are intended to help authors who originate reports, secretaries who type the text, and compositors who prepare the reproduction copy. While the examples may appear to contain points governing format only, many of them such as tables and illustrations, are valuable as guides in preparing data for effective presentation. See Section 9, Samples, for page layouts of examples.

No attempt has been made here to cover every detail that could arise in the preparation of a publication for printing. Rather, the main points of current format requirements and other recurring problems are treated.

The content of the body (or text) is determined by the nature of the work being reported. It should include a statement of the problems, the background, approach to the problem, and discussion of the results, conclusions, and recommendations. Begin the body of the report on a right-hand page.

Classification Markings

For unclassified reports, no classification markings are required anywhere in the publication. For classified reports, in addition to classification markings described in this section, refer to Section 8, Classification Markings.

EXECUTIVE SUMMARY

NRL reports do not usually require an executive summary. For those that do, the following paragraphs may be used as a guideline.

Reports needing an executive summary are those which are apt to be read by high-level executives or senior military officers. Generally these reports are long and include considerable detail on important breakthroughs, research, or development. The higher level executives and managers usually have limited time and do not need to explore a document in depth. Therefore, an executive summary is prepared that highlights the information in each chapter or section that would be important to that readership, and it is presented as the executive summary. It must be brief and be able to stand alone without dependency on or reference to the rest of the report.

The executive summary is often printed on a different color paper so it stands out in physical appearance and is easily found without consulting the contents page. It is usually placed after the front matter (lower-case Roman numeral pages) preceding the main text (Introduction, etc.) and has distinctive page numbers such as E-1, E-2, E-3 . . . , etc. It can be removed from a report without causing any discontinuity in the report.

ABSTRACT

The abstract for an NRL Report or NRL Memorandum Report is printed on the DD Form 1473 and is not separately produced as part of the text. Conversely, most technical journals require a separate abstract as part of the submission.

The abstract must be carefully written. Readers identify the basic content of the document from its abstract and thus decide whether to read the entire document. The abstract will often be published by itself and therefore must be able to stand alone. It should contain no bibliographic, figure, or table references. Abstracts are generally single-paragraph in length and should not exceed 250 words.

INTRODUCTION

Preparing the Introduction

The introduction is very important and should be carefully thought out. It provides a statement of the problem, what you have tried to contribute by your research, and what types of tests and analyses were made. These *three* items are necessary for a good introduction and are discussed further in the following paragraphs.

1. *Problem*—Begin by describing enough of the background to show *where or how the problem arose and how important it is.* What is the Navy's interest in the project? If you do not know the background well enough, do whatever is necessary to give yourself sufficient background to compose an opening that will not confuse the reader with inaccurate or ambiguous statements. If an adequate review of the background would be too long to be included in the introduction, summarize it in the first section of the introduction, then provide a separate chapter for the detailed background at an appropriate point in the report.

2. *Contributions of your research*—Having stated where the problem exists, or, in general, what the background is, now state broadly *what it is that you have tried to contribute by your research* and along what general lines you have worked. Relate your contribution to those of previous workers. What was the status of the problem prior to your efforts?

3. *Approach*—The reader is now aware of what you have tried to do and why. It is usually desirable at this point to add a final portion to the introduction, in which you state more specifically *what types of tests and analyses were made*, the ranges of variables considered, and similar information that broadly defines the nature and extent of your work. The reader will thereby get an insight into the scope and thoroughness of your research and will know what to expect in the report. Also, if new, unusual, or special equipment was used, you may need to describe it in a separate section. If some particular ingenuity was involved, be sure that your presentation makes that clear. The reason is not that you must brag wherever possible, but that you must not present something new with so little emphasis (as if it were obvious or well known) that the contribution cannot be recognized. The same rule, of course, applies to any part of your report. A reader becomes bewildered when the discussion does not indicate what is old and what is new.

If a report is dependent on the reader's familiarity with fundamental theory, the author may help the reader by a brief review of theory related to the subject. References are also helpful. The best rule of thumb is to write for the reader who is professionally familiar with the general field in which you are writing but who may nevertheless be unacquainted with your particular specialty. In a highly technical or long report, the review of basic theory may require a separate section or an appendix.

The development of the introduction depends on the length and complexity of the report. The introduction should be kept in balance with the rest of the report. An introductory section which constitutes half of the report is obviously out of balance. The introduction should not be allowed to exceed

its functions. Remember that the introduction must provide a useful base from which to proceed into the narrative. It should point the way toward the project's objectives. Do not be vague, but be as brief and direct as possible.

One other consideration is the word "Introduction." Although most generally used to title this section, its use is not obligatory if a more satisfactory or descriptive word or phrase is available.

MAIN TEXT

Preparing the Text

The main body of the text describes in detail all unique aspects of the research that were performed. Carefully explain all elements involved in the research, including unusual equipment developed, new procedures followed, tests that were performed, etc. Be wary of ambiguous statements. Be sure that the results are clearly and logically stated. Reputable, scientific reporting should supply enough information in a useful manner that a qualified scientist, following the described procedures, can consistently duplicate the results.

Headings

General

The use of headings in reports aids both the reader and the writer. Obviously, using headings helps the reader to locate the information they're most interested in and shows them how that information is organized. Less obviously, headings are of great assistance to the writer. The writer must clarify an outline in order to define logical divisions and relationships within the report. Headings force the writer to plan the organization of the text.

Format

The text is divided into sections introduced by headings that denote the relative level of importance of the sectioned material. Thus, each time a particular section is further divided and becomes less important to the main thrust, a heading reflecting this diminished level is also used.

The heading format at NRL has been standardized into a style with an orderly breakdown according to the relative importance of the text material. It begins by making the two most important (highest) heads or headings centered heads. Then, in descending order, the next three headings are sideheads (flush left). The next heading level is indented and stands alone, but the final two levels are indented and run in with the paragraphs (separated from the paragraph material by a dash). These headings with their description and security markings (if required) are listed next in descending order as follows:

CAC (Center All Caps), TITLE FOLLOWED BY CLASSIFICATION (U)
CIC (Center Initial Caps), Title Followed by Classification (U)

1. (U) FLAC (Flush Left All Caps) **HEADING** (Bold)
2. (U) FLIC (Flush Left Initial Caps) **Heading** (Bold)
3. (U) FLIC *Heading* (Italic)
4. (U) **Indent Heading Initial Caps** (Bold)
5. (U) *Indent Heading Initial Caps* (Italic)—(U) Run in with paragraph
6. (U) *Indent heading* (Italic) Only first word initial caps—(U) Run in with paragraph

If your typing equipment cannot produce italics, underscore headings that are indicated above for italics. Headings do not have to be numbered.

Classification Marking

The location of classification marking of headings is illustrated above. Headings are marked according to their own classification and do not reflect the overall classification of the material which follows. Once a heading is identified, it becomes a paragraph for marking purposes, e.g., A. (U) Summary.

Footnotes

General

A footnote acknowledges the source of, or briefly comments on, information presented in the text.

Format

Sequential footnote reference marks are (*) asterisk, (†) dagger, and (‡) double dagger. Footnote reference marks follow all punctuation marks except a dash, but fall inside a closing parenthesis or bracket if applying only to matter within the parentheses or brackets.

Placement on Page

Footnotes are placed at the bottom on the page, in the order in which they are referred to in the text. A footnote cutoff rule, i.e., a typed line, 12 spaces long, is used to separate the text from the footnotes. The line is double spaced below the final line of text. Care must be taken in planning the page to ensure that the footnotes are completed 1/2-inch above the page number. When it is impossible to complete a footnote on the page to which it is keyed, it is continued at the bottom of the following page, below the cutoff rule, but above any other footnotes beginning on the new page.

References

General

A reference cites specific bibliographic material in support of information presented in the text. When more than three or four documents are cited in the text, they should be fully listed in the References section placed at the end of the text. When only one or two documents are cited, they may be shown as footnotes on the page where they are cited.

Unclassified, distribution unlimited reports may not contain references to classified reports.

Format (for referring to in text)

References are cited in the text by consecutive numbers enclosed in brackets [ ]. Start with [1] and number sequentially throughout the paper. If a reference is repeated, do not give it a new number, use the original reference number. When more than one reference is cited at a single point, separate the numbers by commas [1,3,14]. If they are part of a consecutive series, use a hyphen [1-8].

An alternative method is to refer to the author, date in the text, e.g., "Contamination of fuel tanks was examined in detail (May and Neihof 1982) ....", or "according to Goodman (1978)...". These references are indexed alphabetically by first author. For more than two authors, in the text use the name of the first followed by "et al." All authors are then cited in the References listing. Two or more references given together are separated by semicolons, e.g. (Harris et al. 1982; Gordon 1978; Mied 1977).

Either method is acceptable in NRL reports. However, the two methods may not be intermixed in any given report.

See Section 4, Back Elements, for details on preparing the reference list.

Figures (Illustrations)

General

The purpose of a figure (or illustration) is to supplement the text, call attention to details, or present ideas difficult to describe in writing. In general, visual presentation by means of charts or curves will put across your points more effectively than tables. (See Section 9, Samples.)

Considerable thought should be given to the question of how to plot your results so that your message will be easily grasped. Do not crowd too many curves onto one figure, but avoid leaving large, empty spaces. The reader should be able to easily identify each curve as it is discussed it in the text.

State clearly in the text what each figure shows and how the figure shows it. Avoid referring to a figure in so casual a manner that the reader must determine how the figure is related to your discussion.

Preparation Requirements

Figures must be neatly done. In many cases, they are professionally prepared by TID to ensure consistency and high quality. Figures in NRL Memorandum Reports or in other informal NRL publications may be prepared by the originating office. For instance, figures made by computerized plotters, or good quality photocopies may be used. Labels and titles should be appropriate to the size to which the figure will be reduced or enlarged. Be aware that multiple photocopying may change proportions.

Do not write on the front or back of figures, illustrations, or photographs with a ballpoint pen or any sharp instrument that will emboss them. Such marks will photograph and will appear on the final reproduced copy. If markings are necessary for identification, use a stick-on label that is marked before adhering, or write very lightly on the back of the figure with a pencil, away from the area that is to be reproduced.

A separate figure caption list must be provided with each report submitted for publication.

Callouts (Labels)

It is often helpful to call out (label) various parts of a figure or illustration. If space permits, this may be done directly on the figure itself. If the callouts are numerous or complicated, they may be keyed to a legend. Place full callouts horizontally, unboxed, near the item called out. Numbers referring to a legend should be placed in circles with arrows indicating the position.

Page Location

Figures follow the first text reference (on the same page, if possible) or they are grouped in numerical sequence following the final text page but before the references or bibliography.

Numbering and Titling

All figures are numbered and titled. Consecutive Arabic numbers are used. Captions are typed using an initial capital letter in the first word only, unless normally capitalized words or acronyms are used after the first word. If a figure caption is two lines long, the second line is centered, single-space, under the first caption line *including the figure number.* If the figure caption is three or more lines long, the lines are typed full-caption width, same as the first line of the caption *including the figure number.*

Position on Page

Every effort should be made to place figures vertically on the page so that the publication does not have to be turned. If a figure must be placed sideways on a page, turn it so that the bottom of the figure is at the right margin of the page so that it can be viewed by turning the page clockwise. More than one figure may be placed on a single page.

Referring to Figures in the Text

All figures must have a text reference. This reference will abbreviate "Figure" and use "Fig." (unless it is the first word in the sentence—in which case, spell out "Figure"), followed by the figure number (e.g., Fig. 3)

Spacing

If figures are inserted in the text, at least two lines of spacing are used between text and figures. Two lines of spacing are used between the bottom of the figure itself and the figure caption.

Foldouts

Because of the additional production costs involved, foldout figures should be avoided whenever possible. If foldouts must be used, TID will prepare them.

Photographs

Photographs are mounted by TID. Previously printed, color, or screened photographs should not be used as original copy because they do not reproduce as well as matte finish black-and-white photographs.

Classification Markings

In a classified publication, the classification of both the figure itself and its caption must be indicated. The preferred location of the classification of the figure is centered, in capital letters directly below the figure but above the caption. However, for spacing purposes it can be located either inside or outside the illustration area. The classification symbol of the figure caption appears immediately following the figure number and dash (actually in front of the caption).

Tables

General

A table is a systematic, condensed presentation of related data for ready reference. Tables must be done neatly. For all NRL Reports they are prepared by the Computerized Technical Composition Section. Tables in NRL Memorandum Reports or other informal NRL publications may be of lesser quality. For instance, computer printouts or photographically reproduced copies may be used if they are very clear. However, be aware that tables may be reduced in the reproduction process and thus become unreadable.

A note of caution on tables should be mentioned here. In general, visual presentation by means of charts or curves is more effective than tabular presentation. Some writers present numerical results only in the form of tables, often because they have studied the results so thoroughly that they can easily see the significant trends from the numbers alone. The reader, however, is much less familiar with the results and may fail to see from the tables the trends that seem so obvious to the author.

Tables should be kept as simple as possible so that the reader can easily grasp the meaning of the data. Avoid vertical and horizontal lines wherever spacing can be used effectively. A separate table caption list must be provided with each report submitted for publication.

Numbering

Tables are numbered consecutively throughout the report with Arabic numbers. Tables in the appendixes carry the designation of the appendix in which they appear, e.g., Table B2, Table C5, etc. (If there is only one appendix, it is referred to in the text as the appendix; tables in this appendix are labeled Table A1, Table A2, etc.)

Titling

The title of a table should briefly identify the table. It should not furnish background information nor describe the results illustrated by the table.

If a table title is more than one line, subsequent lines are centered under the complete first line of the title (including the table number) and are single-spaced. The table title is typed with initial capital letters. The table number is followed by a dash. Example:

Table 10 — Sample Weight Loss and Smoke Concentration
Data for Hydraulic Fluid

Referring to Tables in the Text

All numbered tables must have a text reference. The word "Table" is spelled out with initial capital letters followed by the table number, and presented sequentially. However, if a short table is run in with the text, it need not be numbered if it is not referred to later. It is called a text table and is introduced by a phrase or colon in the text.

Placement

Locate tables following and as near as possible to their first text reference. When a report contains only a few text pages and many tables, locate the tables in numerical sequence following the main body of the report.

Place tables so that they may be viewed without turning the publication sideways. If this is not possible, place each table so that the bottom of the table is at the right-hand margin of the page and the table can be read by rotating the page clockwise. See Section 9, Samples.

When tables continue on two or more pages, note the continuation and repeat the column headings on each page. Column headings need not be repeated on the second page when a long table is placed sideways on facing pages.

More than one table may be placed on a page. See Section 9, Samples.

Spacing

Tables are single spaced unless double spacing presents a more balanced page. Double spacing should be used between major sections or parts of a table.

Column Headings

Column headings in tables are initial caps unless acronyms or abbreviations are used.

Footnotes to Tables

Table footnotes immediately follow the table and need not show a separate level of security classification; they are considered to be an integral part of the table. However, in classified publications, make certain that the table classification is centered below the table footnotes. Footnotes are indicated in the table by (*) asterisk, (†) dagger, and (‡) double dagger. (See Section 9, Samples.)

Classification Markings

In a classified publication, all tables and table titles must indicate the level of classification, even if they are unclassified. The classification of the table is centered in capital letters immediately below the table. The classification symbol for the table title appears in parenthesis immediately following the table number and dash (actually in front of the title itself).

Equations (referring to in the text)

In the text, specific equations are referred to as Eq. ( ), unless this is the first word of a sentence, in which case, it is Equation ( ). For preparation guides, See Section 7, Mathematical Expressions.

CONCLUSIONS/CONCLUDING REMARKS

The Conclusions state concisely (seldom more than two sentences per conclusion) what you have concluded from your research. They should be written with little or no reference to the body of the report as a favor to those readers who proceed directly from the Introduction to the Conclusions in order to see what results were obtained. Another purpose for making Conclusions self-sufficient is to minimize the possibility of a misunderstanding if they are quoted.

Sometimes the research turns out in such a way that enumerating sharply drawn conclusions is practically impossible. In such cases, a short discussion of the problem, and what you learned or believe about it should be given under Conclusions. Sometimes, however, the original problem, as stated in the Introduction, remains essentially unanswered (as when the experimental technique turned out to be inappropriate, or the information obtained turned out to be less useful than originally expected). A frank discussion of the situation, possibly together with suggestions for future research, is preferable in such cases to drawing uninteresting or irrelevant conclusions. Such a final section is generally entitled Concluding Remarks.

Sometimes the technical report merely describes equipment or procedures, or it tabulates design data obtained by standard methods. Neither Conclusions nor Concluding Remarks is usually appropriate for such a paper. If a closing section is desired, it might be a Summary, in which the information is briefly sketched and the charts or tables containing the data are indicated.

RECOMMENDATIONS

At times, a technical report calls for more than conclusions, or it may need recommendations and not conclusions. Also, a sponsor may desire guidance in making decisions based on the outcome of the report. In such cases, a Recommendations section may be necessary to complete the main text satisfactorily.

Recommendations can be used to show that a need exists for more research on the subject of the report before any conclusions can be reached. They may also be used to point out that the R&D funding is, or has been, inadequate to produce the necessary solution to the problem—thus recommending more realistic funding. Recommendations may include advice that contractors be changed, that the present contractor is inadequate to do the job for various reasons which may be beyond the control of the contractor, e.g., too small, too new in the field, more expensive equipment or machines needed.

They may indicate that an entirely different approach or design is needed to effectively solve the problem—or that more time, effort, or money is needed on certain phases of the problem. Do not use this section as a forum for gripes or unsubstantiated opinions.

ACKNOWLEDGMENTS

An Acknowledgments section may be placed at the end of the formal text (before the References) to acknowledge the contributions of persons, other than coauthors, who have added substantially to the work. Recognition of assistance should be stated as simply as possible.

NOTES

SECTION 4

BACK ELEMENTS

The back elements in a report include mainly the references, bibliography, glossary, appendixes, and distribution list. Only the distribution list may be necessary in one report, yet all elements may be needed in another report. Other reports may need just one or two of them. A discussion of each follows.

REFERENCES

General

The purpose of the references section is to systematically list all of the documents specifically referred to in the body of the text.

Requirements

A list of references must be included at the end of the main text if more than three or four documents are referred to in the text. For only a few citations, they may be presented at the bottom of the page where the citation occurs.

Location

The list of references immediately follows the text. It may begin on the final page of the text, or it may begin on a new page.

Classification Requirements

In unclassified, distribution unlimited reports, all references listed must pertain to unclassified documents only.

In classified reports, the classification of the title of each entry in the reference list is marked with the appropriate classification symbol in parenthesis after the title, indicating the classification of the title itself. Classification of the bibliographic entry is spelled out in initial caps in parenthesis, as the final item in the reference listing (followed by a period).

If the entire reference listing in a classified report is unclassified, place the following statement at the top of each page of references:

(This Listing Is Unclassified)

The page will carry the overall classification of the document, but the statement indicates that all entries are unclassified. Thus, it is not necessary to mark each entry individually.

No classification markings are required in unclassified reports.

Format*

References are cited in the text by consecutive numbers enclosed in brackets [ ]. Start with [1] and number sequentially throughout the report. If a reference is repeated, do not give it a new number, use the original reference number. When more than one reference is cited at a single point, separate the numbers by commas [1,3,14]. If the numbers are a consecutive series, use a hyphen [1-8].

An alternative method is to refer to the author, date in the text, e.g., "Contamination of fuel tanks was examined in detail (May and Neihof 1982)....", or "according to Goodman (1978)...". These references are indexed alphabetically by first author. For more than two authors, in the text use the name of the first followed by "et al." All authors then are cited in the References listing.

Two or more references given together in the text are separated by semicolons, e.g. (Harris et al. 1982; Gordon 1978; Mied 1977).

Each entry on the reference list is single-spaced, with double-spacing between entries. All authors are listed; use of the term *et al.* should be avoided in the reference listing.

Segments of each reference should be listed in the following order:

1. Author's initials, then last name,
2. Title of report, paper, or book,
3. Number of report (or name of publishing company),
4. Date of report (or publication year),
5. Page number(s), if applicable. (For more than one page, the listing pp. precedes the page numbers, e.g. pp. 15-36).

EXAMPLES

NRL Reports

- R.K. Stillings and H.E. Gerber, "Design and Fabrication of an Aerosol Concentrator," NRL Memorandum Report 4208, May 1980.

- (This listing shows how classification markings are handled.)
  P. Lanzano and J. C. Daley, "Elastic Deformations of a Rotating Spheroidal Earth Due to Surface Loads (U)," NRL Report 8410, June 1980, pp. 15-21 (Classification).

  Note: For publication date, day of the month is not used and month abbreviation is preferred, e.g. Sept. 1980, not September 15, 1980.

Scientific Laboratory/Government/Technical Reports

Note: In technical report citations, the corporate author may be of greater interest than the personal author. Depending on the situation, the corporate author, personal author, or title may be the first item in the listing.

- (corporate author, report number)
  David Taylor Ship R&D Center Report TM 28-82-15, "Evaluation of Selected Coalescer Filters and Prefilters at Pall Corporation Facilities," P. Strandell, 1982.

*Note to typist: If italics are not available, underscore title of publication.

- (personal author)
  K. Biba, J. Woodward, and G. Nibaldi, "A Kernel Based Secure UNIX Design," MTR-2709, MITRE Corp., Bedford, Mass., June 1973.

- (title)
  "Navigation Technology Satellite (NTS) Low Cost Timing Receiver," Goddard Space Flight Center Report X-814-77-205, Aug. 1977.

Journal Articles*

> Note: Titles of articles in journals may be omitted, but if one title is omitted, all must be omitted.

- R. L. Kaufmann, *J. Geophys. Res.* **85**(A4), 1713-1721 (1980).

- E. C. Hill, D. A. Evans, and I. Davies, "The Growth and Survival of Microorganisms in Aviation Kerosene," *J. Inst. Petroleum* **56**(3), 15-43 (1967). (56 refers to volume number, 3 refers to number 3 of that volume.)

> Note: Only standard abbreviations for journal titles should be used; if in doubt, spell out entire journal title. TID Editorial Section, x72782, has listings of standard abbreviations.

Proceedings*

- R. K. Royce, "An Approach to Shipboard HF Receiving Systems," Proceedings of the ECOM-ARO Workshop on Electrically Small Antennas, G. Goubau and F. Schwering, eds., May 6 and 7, 1976, U.S. Army Electronics Command, Fort Monmouth, N.J., Oct. 1976, pp. 189-198.

Books*

- (authors; no editor)
  S. D. Stearns, *Digital Signal Analysis* (Hayden Book Co., Inc., Rochelle Park, N.J., 1975), Ch. 8.

- (editor; no author)
  R. C. Weast, ed., *CRC Handbook of Chemistry and Physics*, 58th ed. (CRC Press Inc., Cleveland, Ohio, 1977), p. B-121.

- (author and editor)
  Z. Haskin, in *Mechanics of Composite Materials*, F. W. Wendt, H. Liebowitz, and N. Perrone, eds. (Pergamon Press, New York, 1967).

- (no personal author or editor)
  International Telephone and Telegraph Co., *Reference Data for Radio Engineers*, 6th ed. (Howard W. Sams and Co., Inc., Indianapolis, Ind., 1975), Ch. 29.

- (chapter)
  D. Casasent and H. J. Caulfield, "Basic Concepts," in *Topics in Applied Physics*, D. Casasent, ed. (Springer-Verlag, Berlin, 1978), Ch. 3, pp. 70-89.

*Note to typist: If italics are not available, underscore title of publication.

University Publications

- E. R. G. Ekert, "Mass Transfer Cooling of a Laminar Boundary Layer," Univ. of Minn. Tech. Note 14, June 1957, p. 10.

Theses and Dissertations

- D. B. Ross, "The Photolysis of Phenyl Alkyl Sulfide," Masters thesis, Columbia University, New York, 1970.

- S. S. Lam, "Packet Switching in a Multi-Access Broadcast Channel with Application to Satellite Communications in a Computer Network," Ph.D. dissertation, Department of Computer Science, University of California, Los Angeles Div., 1974.

References Using Ibid.*

> Note: Ibid. is the abbreviation for ibidem, meaning "in the same place." Ibid. takes the place of the author's name, the title of the work, and as much of the preceding material as is identical. The author's name is never used with ibid., nor is a title.

- I. M. Losh, *Diaries and Correspondence* **1**, 150 (1979).

- Ibid., **2**, 175.

- Ibid., p. 176. [The same vol. no. as the preceding note.]

Patents

R. L. Robinson, Jr., "Fixed Geometry Test Source Assembly for Gas Flow Proportional Counters," U.S. Patent 3,538,327, 1970.

Material Accepted for Publication but Not Yet Published

- (book)
  J. Medlin, *A Study of World Pollution* (Midway Press, Chicago, forthcoming) (or "in press," or "in publication" or "publication pending.").

- (Journal article)
  B. Bernard, "Dynamic Social Networks," *Connections*, in press.

Papers Presented at Conferences or Symposia (Not Appearing in Proceedings)

- I. R. Goodman, "A General Model for the Multiple Target Correlation and Tracking Problem," presented at the 18th IEEE Conference on Decision and Control, Ft. Lauderdale, Fla., Dec. 1979.

Private Communication

> Note: Use of this is discouraged as the information may not be readily available to readers.

- P. Jones, National Bureau of Standards, Boulder, Colo., private communication, Dec. 1980.

*Note to typist: If italics are not available, underscore title of publication.

Pamphlets

- S. Katzoff, "Clarity in Technical Reporting," NASA Pamphlet No. SP-7010, Washington, D.C., 1964.

- "Don't Talk—Communicate," Navy Publications and Printing Service (NPPS) Pamphlet NAVPUB P3150-1 (2-78), Dept. of the Navy, Washington, D.C.

Brochures

- "A Brief Look at NRL," (brochure), Naval Research Laboratory, Washington, D.C., 1978.

- "The World Below a Micron," (brochure) NRL 2600-0019-6/81-500, Naval Research Laboratory, Washington, D.C., 1981.

News Article

- V. Cohn, "Experts See Race for Lunar Sample," The Washington Post, Washington, D.C., July 14, 1969, p. A1.

Memorandum

- J. S. Barrowman, "Lockheed RPM2 Program Usage," Memorandum to Flight Performance Section files, NASA-Langley Space Flight Center, Langley, Va., Feb. 8, 1966.

Computer Programs*

A reference to a computer program, package, language, system, etc., all collectively known as software, should include, in general:

- The fully spelled-out title, except for the common ones such as BASIC, FORTRAN, COBOL.

- The identifying detail, such as version, level, release number, or the date.

- In parentheses, the short name or acronym (where applicable) and any other information necessary for specific identification.

- The city and name of the person, company, or organization having the proprietary rights to the software.

The following examples suggest how to make the names of computer programs into printed entries:

- FORTRAN H-extended Version (or Ver.) 2. 3. White Plains, N.Y.: IBM.

- Houston Automatic Spooling Priority II Ver. 4.0 (HASP II 4.0). White Plains, N.Y.: IBM.

- International Mathematical Subroutine Library Edition 8 (IMSL 8). Houston, Tex.: International Mathematical Subroutine Library, Inc.

- Operating System/Virtual Storage Rel. 1.7 (OS/VS 1.7). White Plains, N.Y.: IBM.

- Statistical Package for the Social Sciences Level M Ver. 8.1 (SPSS Lev. M 8.1) Chicago: SPSS.

*Reprinted from *The Chicago Manual of Style*, Thirteenth Edition, Revised and Expanded, 16.182, pp. 482-483, by permission of the University of Chicago Press. ©1969, 1982 by The University of Chicago.

BIBLIOGRAPHY

The purpose of a bibliography is to list documents consulted by the author but not specifically referred to in the text. A bibliography is optional, and most technical reports do not have them. In a bibliography, the name of a personal author standing first is inverted, thus placing the last name first, then a comma followed by the first name initial, and next, the middle initial, if desired. The entries are arranged in alphabetical order by author's name instead of in the order of citation in text as are the entries of a reference list. A complex or lengthy bibliography may be divided into general subjects or classifications, with the entries alphabetized within these classifications.

Except for inversion of the first author's name, the format for individual entries is the same as that described for references.

GLOSSARY

The glossary is an alphabetical listing of definitions of specialized terms. In reports that are written for both technical and nontechnical readers, a glossary permits the definition of technical terms for the nontechnical reader while not interrupting the technical reader who is familiar with the terms.

Location

The glossary is placed immediately after the references at the end of the report. It must be listed in the table of contents.

Spacing

The glossary is typed single-spaced.

Classification Markings

If the publication is *classified*, and the entire glossary is *unclassified*, place the following statement in parentheses at the top of the first page: (This Glossary Is Unclassified). This indicates that no classification markings appear anywhere in the glossary. The page that the glossary is printed on, however, must retain a page classification that reflects the highest classification used in the entire report (placed top and bottom on each page).

If the publication is *classified* and any of the abbreviations, acronyms, symbols, or terms in the glossary are *classified*, each item will be preceded by its classification symbol in parentheses.

APPENDIXES

Appendixes contain supplementary information that supports the main body of the publication but is not an integral part of it. Supporting information, such as detailed specifications, complicated mathematical derivations, or similar material that should be recorded but is of little interest to the average reader also should be placed in appendixes. An appendix usually contains some text but occasionally contains only a series of equations, tables, or figures.

Referring to Appendixes in the Text

Each appendix must be called out in the body of the report. Each is given a title and listed in the Contents. A single appendix is referred to as the Appendix. Two or more are referred to as Appendix A, Appendix B, etc.

Numbering Tables, Figures, and Equations

Tables, figures, and equations are numbered with the letter designation of the appendix in which they occur, e.g., Fig. A1, Table B3, Eq. (C5), etc. Tables, figures and equations in the Appendix (single appendix) are referred to as Table A1, Fig. A1, Eq. (A1), etc.

Location

Appendixes are placed immediately after the References. Each appendix begins on a new page. If there is no reference material, they follow the conclusion of the main text.

Classification Markings

Each appendix carries its own classification markings, which may not be the same as the classification of the main body of the publication. Frequently, the only part of a publication that is *unclassified* is the appendixes. If this is the case, a statement may be placed at the top of each unclassified appendix in parentheses as follows: (This Appendix Is Unclassified), indicating that no classification markings appear anywhere in the appendix. Thus, the appendix stands on its own and can be pulled out and used as a separate unclassified document.

Conversely, if the only part of a publication that is *classified* is the appendix, then it is completely copymarked, heading by heading and paragraph by paragraph, to show the classification of each classifiable part. Also, each page of the publication including appendix pages must carry a page classification that reflects the highest classification used in the entire report (placed top and bottom on each page).

DISTRIBUTION LIST

The distribution list must be included, and it is the final item in the report production package. Distribution lists are not automatically printed and bound with the report, but this can be done if desired. Indicate on the route sheet that the distribution list is to be printed and bound with the report.

All Defense Nuclear Agency (DNA)-sponsored reports are required to have their distribution lists printed and bound with the report.

Format

The distribution list is prepared separately from the text. It should be typed single-spaced, with double-spacing between each entry. It must specify the recipient and number of copies to be sent to each addressee. Complete mailing addresses are required; Zip codes must be included. Internal distribution (within NRL) must be listed by code. External addressees are followed by internal addressees on the distribution list.

The report name, author(s), and code are placed at the beginning of the distribution list. See Section 9, Samples.

NOTES

SECTION 5

TECHNICAL SPECIFICATIONS

GENERAL

NRL Reports are phototypeset. If not prepared by the Computerized Technical Composition Section, manuscripts should be typed double-spaced on plain white bond paper.

NRL Memorandum Reports are prepared for direct reproduction on typing guides available from Stationary Supply, Bldg. 71.

REPRODUCIBLE OR CAMERA-READY COPY

Reproducible copy consists of text and illustration pages that have been corrected, laid out, and made ready for reproduction. For reproducible copy, *original* typewritten text and tables, original computer printouts, and original line drawings are preferred. Submit original photographs rather than screened (halftone) reproductions when practical. Do not crop or mask photographs. This will be done by TID during the final layout process before the report is sent to the printer. Only reproduced matter that will be legible in microform is acceptable.

Typing guides for reproducible copy (NRL-NDW 5216/2617, NDW-NRL 5216-2618, and NDW-NRL 5216-2619) are available from the Stationary Supply, Bldg. 71. The guides are unmarked for unclassified reports but labeled secret or confidential for classified reports. Use of the proper guide is required.

Caution: Do not write on the front or back of photographs with a ballpoint pen or use any sharp instrument that will emboss them. Such marks will photograph and will appear on the final reproduced copy. If written markings are necessary for identification purposes, write outside of the image area so that acceptable reproduced copy can be obtained or use a stick-on label that is marked before adhering.

TYPE

Use standard type size, 10 or 12 point (10 or 12 pitch on typewriters/word processors), or equivalent, for text. Special type, such as all capital letters, script, etc., may be used for headings, titles, equations, and emphasis.

PAGE LAYOUT

Text will be reproduced on both sides of all pages, except as otherwise prescribed in this guide and in large sectionalized reports where it may be more convenient and practical to begin sections or chapters on right-hand pages.

TEXT IMAGE AREA

The total image area of the reproducible copy for text, footnotes, tables, and/or illustrations with captions is 6-1/2 × 9 inches.

SPACING AND INDENTIONS

Whenever possible use single-spacing between lines for NRL Memorandum Reports. With single spacing, double-space between paragraphs. For material with superscripts and subscripts, precluding the use of single-spaced copy, use 1-1/2 spacing throughout with triple spacing between paragraphs. Indent all paragraphs five spaces.

HEADINGS

(See Section 3, Body of Report, Main Text Section.)

PAGINATION

Number all pages in the front matter by using lowercase Roman numerals starting with i on the first page which is the DD Form 1473.

Number the main text and the remainder of the publication by using Arabic numbers starting with 1, on a right-hand page, at the bottom center. When more practical, such as in the preparation of large handbooks, compound sectionalized pagination (1-1, 1-2, etc.) can be used. Center compound page numbers at the bottom of the page. Separate volumes must be numbered independently. Right-hand pages are odd-numbered pages, and left-hand pages are even-numbered pages. Every odd-numbered page must be backed up with an even-numbered page. In a classified report, however, certain left-hand pages may be left entirely blank. But in so doing, the previous right-hand page (the flip side) must be annotated below the page number with the phrase: "(Page _ blank).

Page 1 begins with the title, centered, all caps. This is followed, two spaces below, by the INTRODUCTION or other section heading. No author(s), abstract, or other information appears on Page 1. Text begins immediately after the title. This format is the same for both NRL Reports and NRL Memorandum Reports.

COLOR

The use of color increases costs. Government printing regulations require that all multicolor printing contributes ***demonstrable value*** toward achieving a greater fulfillment of the ultimate end-purpose of the printed item. ***Demonstrable value*** for multicolor printing includes items in the following categories:

- Maps and technical diagrams where additional color is necessary for clarity.
- Object identification (medical specimens, diseases, plants, flags, uniforms, etc.).
- Safety programs, fire prevention, savings bonds programs, and competitive areas of personnel recruiting.
- Areas where clearly identifiable savings can be soundly predicated on multicolor use.
- Printing for programs required by law, whose relative success or failure is in direct ratio to the degree of public response, and where that response can be logically attributable to the number of colors planned and the manner in which they are proposed to be used.
- Color for promotional or motivational purposes such as programs concerning public health, safety, consumer benefits; or to encourage utilization of Government facilities such as programs for social security, medicare, and certain areas of need for veterans would come within this category.

If your need for color reproduction satisfies one of the above categories, provide a signed justification for its use with your report production package.

Multicolor printing which does not meet the *demonstrably valuable* contribution requirement includes, but is not exclusively limited to, the following categories:

- Printed items where additional color is used primarily for decorative effect.
- Printed items where additional color is used primarily in lieu of effective layout and design.
- *Printed items where additional color is used excessively, i.e., four colors when two or three will fulfill* the need; three colors when two are adequate; two colors when one is adequate.
- Printed items where the use of color reflects the lack of careful, competent advance planning.

Often screens, crosshatching, reverses, dots, or similar techniques can be effective substitutes for color.

FOLDOUTS

Whenever possible, because of the added expense involved, avoid the use of oversize illustrations that must be folded. Often a large illustration can be divided to appear on facing pages. When foldouts cannot be avoided, TID will prepare them.

PRINTING

Most NRL reports are printed on an offset printing press. This entails photographing the final, corrected reproducible or camera-ready copy. The platemaker in the print shop (either at NRL or at a contractor's print shop) photographs each page onto either a paper or metal plate which is photosensitive. A paper plate (or master) is usually used for short press runs (up to approximately 100 copies). They deteriorate rapidly when used over this limit. A metal plate is used for all jobs over a certain minimum, usually anything over 100 impressions. The metal plate, which resembles heavy aluminum foil, is made of zinc, magnesium, or copper and is good for several thousand copies before any noticeable deterioration sets in.

Xerographic reproduction is also used for some NRL reports of very short run (from one to less than 100 copies). Good quality xerographic copies are hard to tell from offset printed copies by the average observer and save money compared to short-run offset printing costs. However, some reports limit its use, especially those having high-resolution halftone photographs or very detailed artwork, that do not print well in the copying process. In such cases, the photographs or artwork must be done by some other process and collated into the final product.

BINDING

NRL Reports are bound by a variety of methods, e.g., sidestitch, perfect bind (glue-bind), or saddlestitch with two staples (depending on the thickness of the document). NRL Memorandum Reports are generally stapled at the left margin.

Sometimes, a binding called Velo-bind is used on reports that are not intended to be taken apart (high security classification, handouts, short life expectancy, etc.). This binding is composed of two plastic strips fastened together on the outside of the document by plastic nails (usually three or more) running through holes punched in the printed pages. After the binding edge of the document is compressed, the plastic nails are cut off and heat sealed, thus binding the pages together. This method has some disadvantages. Velo-bound documents do not stack neatly nor do they fit nicely into bookshelves because of the plastic strips on the outside of the cover extending down the entire bind, giving each document a sort of pie shape. Another disadvantage is the relatively high cost of these plastic binding devices.

Other special types of bindings are available upon request for specific requirements.

NOTES

SECTION 6

COPYRIGHTS AND TRADEMARKS

COPYRIGHT

Under the United States Copyright Law of 1978, original works of authorship (published or unpublished) are automatically copyrighted when fixed in any tangible medium or expression. Registration with the Copyright Office is not required for the copyright to come into effect. The copyright endures for the life of the author, plus 50 years. However, works prepared by U.S. Government employees as part of their official duties are not copyrightable. Contact the Patent Counsel (Code 2004, x73427) if you have questions regarding your research and copyrights.

The owner of a copyright is entitled to control certain uses of his or her copyrighted work, including reproduction of the copyrighted work and public distribution of these copies. Accordingly, a publisher wishing to publish an article in a journal must obtain a transfer of the right of publication from the author. Such a transfer request is now a matter of routine for most publishers of scientific journals.

However, as noted above, a publication prepared by an employee of the U.S. Government as part of that person's official duties cannot be copyrighted (17 U.S.C. 105). Accordingly, a Department of Navy employee cannot execute any document which expressly or impliedly asserts a copyright in a work, or which purports to transfer copyright if the work was prepared as part of the employee's official duties. See NRL Instruction 5870.6 for additional details.

Most publishers who request a transfer of rights from an author have a place on their transfer form for Government employees to sign, with the author's signature certifying that the work is that of the U.S. Government and is not protected by U.S. Copyright. If the publisher's transfer form does not contain a section thereon for U.S. Government employees, it may not be signed. Instead, the author must provide a written statement certifying:

> "I am a U.S. Government employee. This work (identify the work) was produced as part of my official duties. Thus, it is a work of the U.S. Government and is not protected by copyright.
>
> Signature _____
> Date _____

Regarding the use of previously copyrighted materials in Navy publications, such copyrighted materials shall not knowingly be included in Navy publications or other works without license or consent of the copyright owner or his agent. The Publications Control Center (Code 2630.1, x73508) is responsible for processing requests to use copyrighted materials. See NRL Instruction 5870.1E for further information. Forms for requesting permission to use copyrighted material are available at the TID Service Desk. (See sample at end of this section.)

Classified documents may be reproduced only as provided by security regulations, and a limiting statement in the document may forbid its distribution or reproduction in whole or in part, except under prescribed conditions.

Even if material that you wish to reproduce has not actually been copyrighted, courtesy requires that you give credit in every instance. If you plan to quote extensively from a publication that is not protected by copyright or to use tabular or graphic material from it, you should obtain written permission from the author in advance, even though this is not required by law.

The inclusion of proprietary data developed by a private company at its own expense and not while under Government contract is prohibited in an NRL publication unless written permission from the originating company is obtained to use or publish the data.

WHAT NOT TO COPYRIGHT

The following may not be copyrighted:

- Government-originated material. Writing done by Government employees as part of their official duties cannot be copyrighted. Government material may be copied in NRL publications.
- Titles. Titles cannot be copyrighted.
- Work originated by others. Material written by one person cannot be copyrighted by another as his work.

FAIR USE

Small sections of copyrighted material may be quoted in NRL publications if they are properly credited. Standard footnote procedure is used to credit authors of copyrighted material.

PARAPHRASING

NRL publications that contain paraphrased information must credit the source of information.

ROYALTIES

If the use of copyrighted material is in the best interest of the Government, the copyright owner must be contacted. Permission to reprint the material is often granted without charge. However, if a charge is required, the copyright owner must specify the amount and method of reimbursement. To make a royalty payment, a procurement request (stub requisition) is initiated, specifying the copyright owner as the suggested supplier. For further information about royalities, contact the Patent Counsel.

ADDITIONAL COPYRIGHT INFORMATION

The Publications Control Center of TID (Code 2630.1, x73508) provides assistance in matters of copyright, courtesy, and proprietary data, referring matters to the office of the Patent Counsel when necessary.

If you would like additional information on copyrights, you may write to the Copyright Office, Library of Congress, Washington DC 20559.

TRADEMARKS

A trademark is a word, phrase, or symbol that is used to identify a product. As such, it is the property of the firm using the mark in commerce. Marks for indicating a protected item include:

TM — unregistered trademark
SM — unregistered service mark (equivalent to a trademark except for services rather than goods)
® — trademark or service mark registered with the U.S. Patent Office

In NRL publications, it is not necessary to use these symbols if the trademark is capitalized. Some common trademarks used in NRL publications include:

Celanese (acetate/nylon/polyester/rayon/triacetate)
Celluloid (thermoplastic)
Dictaphone (dictating machine)
Ditto (duplicators, copiers, supplies)
Energine (cleaning fluid)
Ethyl (antiknock compound)
Eveready (batteries)
Fiberglas (glass fibers)
Formica (laminated plastic)
Kodak (film and cameras)
Lucite (acrylic resin)
Masonite (hardboard products)
Nitonol
Plexiglas (acrylic plastic)
Pliobond (adhesive cement)
Pliofilm (moistureproof film)
Polaroid (photographic equipment)
Pyrex (heat-resistant glassware)
Styrofoam (plastic foam)
Teflon (Fluorocarbon resins)
Teletype (teletypewriter and other equipment)
Thiokol (liquid polymers)
Univac (computers)
Videotape (recording tape)
Videoscan (document reader)
Xerox (electrostatic copiers)

TRADEMARKS IN THE TEXT

Proper usage of trademarks requires that they be capitalized at all times. Use the trademark as an adjective, not a noun; the noun that follows the trademark is not capitalized, e.g., Ditto duplicator.

AVOIDING TRADEMARKS

Government specifications require that trademarks and trade names not be used unless a specific need is present. A generic term is one that describes a group or class of products. Generic terms have no trademark protection. Some examples of generic terms include:

camera
copier
fiber
hardness tester
oscilloscope
thermocouples

Further information about trademarks can be obtained by writing to:

Trademark Operations
Patent and Trademark Office
Washington, DC 20231

PERMISSION TO USE COPYRIGHTED MATERIAL
NDW-NRL 5870/2664 (5-77)

NRLINST 5870.1E
12 February 1980

Date: _____

From: Code _____

To: Code 2630.1

Subj: Permission to use copyrighted material; request for

1. The information required for preparation of subject request is given below.

a. Publisher: _____

Address: _____

_____

b. Title of publication: _____

_____ Year: _____

c. Article or chapter reference: Title: _____

_____

Vol. no. _____ Pages _____ to _____. Material to be used: Figure or table numbers, page numbers: _____

_____

_____

_____

d. If the journal requests that the authors be notified, please give authors' names and addresses:

e. To be used in NRL publication: _____

entitled: _____

_____

Authors: _____

_____

_____

Number of copies to be printed: _____ Classification: _____

2. Two copies of the front matter of the original publication showing the copyright statement are attached. Also attached are two copies of the title page of the book or journal, the title page of the article, and of the pages containing the material to be reproduced.

_____
Originator of Request

NOTES

NOTES

GREEK ALPHABET

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	o	Psi	Ψ	ψ
Theta	Θ	θ	Pi	Π	π	Omega	Ω	ω

MATHEMATICAL SYMBOLS

$=$	equal to	$\pm$	plus or minus
$\neq$	not equal to	$\propto$	varies as
$\approx$	approximately equal to	∞	infinity
$\equiv$	identical with	∇	nabla
$\not\equiv$	*not identically equal*	$\therefore$	therefore
$\Leftrightarrow$	equivalent to	$\because$	since, because
::	equal to, in proportion	. . .	and so forth (in relation to sequence)
$<$	less than	$' \; '' \; '''$	prime, double prime, triple prime
$>$	greater than	!	factorial
$\leq$	less than or equal to	$\lvert \; \rvert$	absolute value of quantity within the bars
$\geq$	greater than or equal to	$\rightarrow$	approaches the limit
$\angle$	angle	$\int$	integral sign
$\perp$	perpendicular to	Σ	sigma, summation
$\parallel$	parallel to	∂	curly *d*, partial differential
$\surd$	radical sign, root	lim	limits of
$\times$ or $\cdot$	multiplied by		
: or /	ratio of, proportion		

SECTION 7

MATHEMATICAL EXPRESSIONS

GENERAL

Mathematical expressions that are directly reproduced (as in most NRL Memorandum Reports) must be typed. Most NRL branches, sections, or programs can produce typed mathematical expressions particularly if they have access to word processors with an equation capability and a dual printwheel printer. Those that do not should use rub-off sheets having preprinted numbers and symbols, or they can have TID's Computerized Technical Composition (CTC) section prepare the mathematics and text.

Any unusual symbols should be defined when first used, or included in a separate list. Make opening or closing parentheses, brackets, and braces the same height as the tallest expression they enclose. Separate the numerator from the denominator with a line as long as the longer of the two. Center both numerator and denominator on the line.

PLACEMENT

Indent or center displayed equations. Break multiple-line equations before an equal, plus, minus, or multiplication sign and keep whole terms intact, if possible. Align a group of separate but related equations by the equal signs, and indent or center the group as a whole. When possible, place short equations, which are not part of a series or are not identified by a number, in the text rather than on a separate line.

NUMBERING

Number equations that are part of a series, or that are referred to in the text, consecutively using Arabic numbers. When section or chapter numbers are used in a report, equation numbers may be preceded by the number of the section or chapter in which they appear. Enclose each equation number in parentheses at the right margin on the last line of the equation to which it refers. Number equations within appendixes by prefixing them with the appendix designation, e.g., A1, A2, ... B1, B2, ... etc.

SUBSCRIPTS AND SUPERSCRIPTS

Place subscripts and superscripts half a line below or half a line above the main line. If you have word processing with quarter line spacing capability, you may use quarter lines spacing as necessary to set up your equations. Place sub-subscripts half a line below subscripts. Examples:

- $N = (T/K_6)^2$
- $P_{N_O} = AK_1T$
- $P_{NO} + 2P_{N_i}/U = \gamma$

If a term has both a subscript and a superscript, place the superscript directly above the subscript. Example:

$$Z_i^2 = XYZ$$

If the superscript is a number but not a notation of power, enclose it in parentheses. Example:

$$Z^{(2)}$$

RELATION AND OPERATION SYMBOLS

Allow one space before and after a "relation" symbol (=, <, >, or any combination thereof) and before and after an "operation" symbol (+, −, ±, ×, ·, or +). When a fraction bar appears before or after an operation symbol, leave one space between the fraction bar and the symbol. Examples:

$$a\frac{x+y}{z} + b\frac{y+x}{x} + \frac{yz}{ac}(x+z)\, x \leqslant y \leqslant z$$

However, when a sign is an adjective describing a quality, it is closed up with the letter, number, etc., to which it applies. Example: $-a + -b = +c$

Do not leave space before or after operation and relation symbols in subscripts and superscripts, or above or below large $\sum$ or $\prod$, or in limits for integrals. Examples:

- $l = ar^{n-1}$
- $e^{2x-y} = 2$
- $5^{x^2-3} = 5^{y-4}$
- $\sum_{i=1}^{n} p_i dx_i$
- $\int_{-3}^{4} (25 - x^2)^{1/2}\, dx = 31.6$

FUNCTIONS

Allow one space before and after logarithmic abbreviations (log, ln, exp), trigonometric abbreviations (sin, cos, tan, cot, sec, csc), and hyperbolic abbreviations (sinh, cosh, tanh, coth, sech, csch). Examples:

$$x = a \sin \alpha$$

$$y = b \operatorname{sech} \beta - c \log z \exp (2\omega t - \xi)$$

$$y = b \ln z$$

Close up a differential symbol (d), a partial derivative symbol (∂), or a difference symbol (Δ), to the letter or expression to which it belongs. Leave a space before the differential when it follows a mathematical term or expression. Examples:

- $d(\tan v) = \sec^2 v\, dv$
- $d(uv) = u\, dv + v\, du$
- $\frac{\partial^3 u}{\partial x^2 \partial y} = \frac{\partial}{\partial x} \frac{\partial^2 u}{\partial x\, \partial y}$
- $\Delta y = f(x)\Delta x$

If the integral ($\int$) has limits, set the lower limit before the upper limit and have what follows clear the longer limit. Examples:

$$\int_0^{\pi/2} \sin^2 ax\, dx \qquad \int_{-\pi/2}^{0} \sin^2 ax\, dx$$

GROUPING

The signs of grouping are pairs of parentheses (), brackets [], and braces {}. Both parts of a pair must be the same height, and they must be just high enough to enclose the highest and lowest parts of the material between them. Examples:

$$\left[3 + \frac{c^3}{a - x_{i_2} + y^2}\right] \left[1 - \frac{(x - y/d)^2}{z}\right]^2 U = S\{S[2(K_7 Z - 1)] + K_4\}$$

Do not add any space between parenthetical expressions. Example:

$$(x + y)[a - c(b + d)]$$

FRACTIONS

In displayed material, the line separating the numerator from the denominator of a fraction must be exactly as long as the longer term; the shorter term must be centered with respect to the line. Examples:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$X_C = \frac{1}{2\pi fC}$$

In text, all simple fractions should be typed on one line of text, with the diagonal used in place of the horizontal line. If the numerator or denominator contains a plus sign or a minus sign, that half of the fraction should be enclosed in parentheses. If there is a mathematical term after the fraction, enclose the fraction in parentheses and place the term directly after the last parenthesis. Examples:

	Displayed (optional)	In Text (required)
Fraction alone:	$\frac{x}{y}$	x/y
	$\frac{x+y}{a}$	$(x + y)/a$
	$\frac{x}{y+z}$	$x/(y + z)$
	$\frac{v+x}{y+z}$	$(v + x)/(y + z)$
Letters before a fraction:	$a\frac{x}{y}$	ax/y or $a(x/y)$
	$a\frac{x+y}{z}$	$a(x + y)/z$
	$a\frac{x}{y+z}$	$ax/(y + z)$

	Displayed (optional)	In Text (required)
Letters before a fraction:	$(a+b)\frac{x}{y}$	$(a+b)x/y$
	$a\frac{2}{y}$	$2a/y$
	$a\frac{1}{x+y}$	$a/(x+y)$
Letters after a fraction:	$\frac{x}{y}a$	$(x/y)\,a$ or ax/y
	$\frac{x-y}{z}\,(a+b)$	$[(x-y)/z]\,(a+b)$ or $(a+b)(x-y)/z$
	$\frac{x}{y+z}\,(a+b)$	$[x/(y+z)](a+b)$ or $x(a+b)/(y+z)$

Negative exponents may be used to eliminate fractions. Example:

D^{-1} for $\frac{1}{D}$.

OTHER SYMBOLS

The radical sign ($\sqrt{}$) must extend downward and to the right far enough to span the expression within. The main line within the radical sign must be even with the main line outside the sign. Example:

$$x+\sqrt{a-\frac{1}{x^2+3}}=0$$

Fractional exponents may be used to eliminate radical signs. Example:

$(1-AB)^{1/2}$ for $\sqrt{1-AB}$.

For multiplication, use the centered dot ($\cdot$) or the multiplication sign ($\times$) rather than the letter X. Examples:

$$i\cdot i=j\cdot j=k\cdot k=1 \qquad\qquad i\times i=j\times j=k\times k=0$$

An ellipsis (three dots in a series), showing omission or continuation, should be on the line. Examples:

$$1/(1-x)=1+x+x^2+\ldots \qquad\qquad \phi(z_1,\ z_2,\ \ldots,\ z_n)=0$$

For a large $\sum$ or a large $\prod$, limits above and below the symbol should be centered and should be clear of preceding or following symbols. Examples:

$$x=\sum_{k=2(5b-3)}^{5b}(ka+b) \qquad\qquad \prod_{i=1}^{10}(3i-2)$$

DISPLAYED SINGLE EQUATIONS

A single unnumbered equation should be centered as shown below. Double-space between the last line of the text and the topmost symbol in the equation and double-space between the bottommost symbol and the first line of the continued text. Example:

$$a = \frac{2 + x_1^2/b}{5} - \frac{7}{3 - x_2^2/c}$$

If an equation is numbered, the equation number, in parentheses, is placed just within the right-hand margin. Example:

$$3 + 5x + 2y - 4z + x^2 - 9y^2 + 2z^2 = 2ab \tag{1}$$

Always allow at least 1/2-inch between the equation and the equation number.

If an equation is too long to fit on one line, it should be broken approximately in half before an equal sign, a plus sign, or a minus sign. Example:

$$5x + 2y - 4z\,x^2 - 9y^2 + 2z^2 - 3x^3 - y^3 + z^3$$
$$= a + 2b - 5c + 6a^2 - 3b^2 + 4c^2 - 3ab + 2cd - d$$

For a numbered equation, the same rule applies; and the equation number is placed on the last line of the equation:

$$5x + 2y - 4z + x^2 - 9y^2 + 2z^2 - 3x^3 - y^3 + z^3$$
$$- x^4 + 2y^4 - 3z^4 = a + 2b - 5c + 6a^2 + bc \tag{2}$$

If the equation has to be broken into more than two parts, each part should be at least half the width of the page but not more than three quarters of the width. The equation is broken before equal signs, plus signs, minus signs, multiplication signs, or division signs. Start the first part at paragraph indention, and double-indent each succeeding part. Lines below an equal sign should be aligned to the right of the equal sign. If the equation is numbered, allow for the equation number to the right of the last part. Example:

$$\frac{5x - 4z}{a} + \frac{x - 3y + 5z}{b} - 6x + 3 + 4z$$
$$= \frac{3x - y + 3z}{a^2} - \frac{4x - 2y + 5z}{b^2} - 6 + 4x - 2y + 2z$$
$$+ \frac{2x + 3y - 2z}{abc} \tag{3}$$

When "where" comes after a displayed equation, put it flush left. Place the defining terms at paragraph indention. Double-space between the "where" and the first defining term as well as between the terms. Examples:

$$V = \frac{\pi a}{3}(R^2 + r^2 + Rr),$$

where

V is the volume of the frustum of a right circular cone,

a is altitude,

R is the radius of the base, and

r is the radius of the top.

If the terms are defined by equations, the equations should also be started at paragraph indention.

DISPLAYED SERIES OF EQUATIONS

If two or three equations in a series (no text in between) are short and do not have different equation numbers, they can all be put on one line; allow 1/2-inch between the equations, and center the series. Example:

$$x = \sin\theta, \qquad y = \cos\theta, \qquad z = \tan\theta$$

For longer equations, use a different line for each equation, starting each equation at paragraph indention and placing commas. Example:

$$A_1 = 1 + b + z,$$

$$B = 3B + 10C,$$

and

$$C_{12} = 2B - 12D + 1.$$

Between displayed equations, a transitional word, such as "and," "or," "then," "hence," or "therefore," should be *flush left on a line by itself.*

EQUATIONS IN TEXT

In text, *do not break an equation* at the end of a line. If necessary, display the equation.

PUNCTUATION OF DISPLAYED EQUATIONS

When a displayed equation is part of a sentence, normal punctuation should be used. Examples:

In this case, let

$$P_{N_2} = (T/K_6)^2.$$ (End of sentence)

However, when

$$P_{N_2} = \sqrt{a + b},$$ (Comma separation)

another variability is implied. In addition, if

$$P_{N_2} = \frac{\sqrt{c + d}}{e},$$ (Comma separation)

where c and d are not finite and e . . .

The use of semicolons at the end of a displayed equation should be avoided by rephrasing the sentence preceding so that the equation completes the sentence.

LETTERS USED AS TERMS

When typing isolated single-letter terms (such as *a, b, c*) in text, the letter should be underscored to distinguish it as a mathematical term so it will be set in italic. Example:

If a were a parameter, then c would be . . .

Greek letters and mathematical or special symbols are not underscored.

EXPONENTS ON LINE

The exponent may be typed on line in parentheses or brackets after the abbreviation *exp*. Example:

$$\exp\,[-(a - bd_x^2)] \text{ for } e^{-(a - bd_x^2)}.$$

NOTES

SECTION 8

CLASSIFICATION MARKINGS

GENERAL

Classification marking guidelines in this section conform to *Executive Order* 12356, *National Security Information* and to *NRLINST* 5510.40, *NRL Security Manual* (which is the basic reference and guide for handling classified information and for the proper safeguarding of information).

These guidelines are written in concert with Code 1221 and are intended to provide originators of classified documents with the most recent procedures for security markings. Though the explanations here are extensive, it is impractical to try to include every situation. Therefore, consult the Publications Branch in cases of conflict or topics not covered. Note that if the report is unclassified, no markings are required.

Samples for markings are illustrated in Section 9, Samples.

EXECUTIVE ORDER 12356

Executive Order 12356 went into effect on August 1, 1982, making Executive Order 12065 invalid. The new Executive Order recognizes that it is essential that the public be informed concerning the activities of its Government, but that the interests of the United States and its citizens require that certain information concerning the national defense and foreign relations must be protected against unauthorized disclosure.

The 6- and 20-year declassification/review time limits of Executive Order 12065 have been eliminated, which means that original classification authorities will now classify information as long as required by national security considerations.

All classified material transmitted outside NRL must be properly marked and carry a classification authority line and declassification/downgrading notation.

MAJOR POINTS COVERED

Levels of Classification and Symbols

The overall security classification of each publication is determined by the highest classification of the material contained therein. This security classification shall be conspicuously marked or stamped at the top left and bottom right of the outside front cover and each interior right-hand (odd-numbered) page in capital letters in a type that is larger than that used in the text of the document. It shall also be so marked at the top right and bottom left of the outside rear cover and each interior left-hand (even-numbered) page.

In all classified documents, each section, part, paragraph, subparagraph, illustration, table, heading, caption, etc., shall be marked to reflect its own classification or the fact that it is unclassified.

The symbols (TS) for top secret, (S) for secret, (C) for confidential, and (U) for unclassified are used. When appropriate for classified paragraphs, the symbols (RD) for restricted data and (FRD) for formerly restricted data shall be added. When a paragraph also contains critical nuclear weapons design information (CNWDI), the markings are shown as (S-RD)(N), for secret-restricted data (nuclear).

Classified foreign government information incorporated into NRL documents will be identified by a marking on the cover or first page with the notation "THIS DOCUMENT CONTAINS FOREIGN GOVERNMENT INFORMATION." Specific portions of such documents will be appropriately identified, for example: (UK-C), (CAN-S), (AUS-C), indicating United Kingdom, Confidential; Canada, Secret; or Australia, Confidential.

NATO Information

Any NRL document containing NATO information must include a statement, on the cover or first page, "THIS DOCUMENT CONTAINS NATO INFORMATION." Each paragraph which contains NATO information must be individually marked, e.g. (NATO-S) or (NATO-C). The "classified by" lines are the same as for U.S. documents with foreign government information.

Classifying Authority and Statements

The "Review on" provision will no longer be used. Where source material or classification guides show that specific information is to be reviewed for downgrading/declassification at some future time, the term "Originating Agency Determination Required" or "OADR" will be shown following the "Declassify on:" line. This term will be used unless a specific downgrading or declassification date or event can be determined.

FRONT MATTER

Cover

Classification

The outside front and back covers are marked, top and bottom, with the overall classification of the publication. Inside covers shall not contain classification markings if they are otherwise free of printed matter.

Number Printed

On top secret and secret documents, TID shall include the total number of copies printed and the particular copy number assigned to the document.

Title

The cover title shall ALWAYS be unclassified and shall be marked with the appropriate symbol (U).

Classification Authority and Declassification Information

Each classified document shall show on its face: the office of origin, the classification authority, the date of preparation, date of classification, and a specific date for declassification *or* Originating Agency Determination Required (OADR).

Distribution Statements

Managers and performers of research, development, test, and evaluation (RDT&E) are responsible for assigning an appropriate distribution statement to each scientific and technical information (STI) document. This statement enables DoD components, including the Defense Technical Information Center (DTIC), to properly provide their products and services to authorized STI users.

The following distribution statements are authorized for use on DoD technical documents:

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

a. This statement may be used only on unclassified documents that have been cleared for public release by competent authority in accordance with DoD 5230.9.

b. Documents with this statement may be made available or sold to the public including foreign nationals, companies, and governments, and may be exported without a license.

c. This statement may never be used on technical documents that formerly were classified, without a positive determination of such releasibility by the DoD controlling office prior to release.

d. THIS STATEMENT SHALL NOT BE USED ON CLASSIFIED DOCUMENTS.

DISTRIBUTION STATEMENT B: Distribution limited to U.S. Government agencies only; (fill in reason) (date). Other requests for this document must be referred to (insert controlling DoD office).

a. This statement may be used on unclassified documents, or on classified documents if necessary to ensure distribution limitation in addition to need-to-know requirements imposed by DoD 5200.1-R, or in the event the document is declassified.

b. Reasons for imposing Distribution Statement B include:

Foreign Government Information	To protect and limit distribution in accordance with the desires of the foreign government that furnished the technical information. Information of this type is normally classified at the CONFIDENTIAL level or higher in accordance with DoD 5200.1-R.
Proprietary Information	To protect information not owned by the U.S. Government and not protected by a contractor's "limited rights" statement, but received with the understanding that it may not be transmitted outside the U.S. Government.
Test and Evaluation	To protect results of test and evaluation of commercial products or military hardware, when such disclosure may cause unfair advantage or disadvantage to the manufacturer of the product.
Contractor Performance Evaluation	To protect information in management reviews, records of contract performance evaluation, or other advisory documents evaluating programs of contractors.
Export Limitations	Document contains information that may be released to foreign nationals by U.S. Government agencies only when approved by competent authority, or contains information that would require an export license if foreign release is intended.
Administrative/Operational Use	To protect technical or operations data or information from automatic dissemination under the International Exchange Program or by other means. This includes publications required solely for official use or strictly for administrative or operational purposes. This statement may be applied to manuals, pamphlets, technical orders, technical reports, and other publications containing valuable technical or operational data.

DISTRIBUTION STATEMENT B: (Continued)

Software Documentation	Release only in accordance with the provisions of DoD Instruction 7930.2.
Specific Authority	To protect information not specifically included in the above reasons and discussions, but which requires protection pursuant to valid documented authority such as Executive Orders, classification guidelines, Export Administration Regulation (EAR), International Traffic in Arms Regulations (ITAR), DoD or DoD Component regulations or policy guidance. When filling in the reason, cite "Specific Authority (identification of valid documented authority)."

DISTRIBUTION STATEMENT C: Distribution limited to U.S. Government agencies and their contractors; (fill in reason) (date). Other requests for this document shall be referred to (insert controlling DoD office).

a. May be used on unclassified documents, or on classified documents if necessary to ensure distribution limitations in addition to need-to-know requirements imposed by DoD 5200.1-R, or in the event the document is declassified.

b. Reasons for imposing Distribution Statement C include:

Critical Technology	To protect information and technical data which advance the state-of-the art or describe new technology in an area of significant or potentially significant military application, or relates to a specific military deficiency of a potential adversary. This control on critical technology will allow early dissemination to the U.S. Government and its domestic contractors in a manner that will ensure compliance with the International Traffic in Arms Regulations (ITAR) and Export Administration Regulations (EAR).
Administrative/Operational Use	Same as under Distribution Statement B.
Specific Authority	Same as under Distribution Statement B.

DISTRIBUTION STATEMENT D: Distribution limited to DoD and DoD contractors only; (fill in reason) (date). Other requests shall be referred to (insert controlling DoD office).

a. May be used on unclassified documents, or on classified documents if necessary to ensure distribution limitation in addition to need-to-know requirements imposed by DoD 5200.1-R, or in the event the document is declassified.

b. Reasons for imposing Distribution Statement D include:

Premature Dissemination	To protect information on system or hardware in the developmental or concept stage, which must be protected to prevent premature dissemination.
Software Documentation	Same as under Distribution Statement B.
Critical Technology	Same as under Distribution Statement C.
Specific Authority	Same as under Distribution Statement B.

DISTRIBUTION STATEMENT E: Distribution limited to DoD Components only; (fill in reason) (date). Other requests must be referred to (insert controlling DoD office).

a. May be used on unclassified documents, or on classified documents if necessary to ensure DoD distribution limitation in addition to need-to-know requirements imposed by DoD 5200.1-R, or in the event the document is declassified.

b. Reasons for imposing Distribution Statement E include:

Foreign Government Information	Same as under Distribution Statement B.
Premature Dissemination	Same as under Distribution Statement D.
Software Documentation	Same as under Distribution Statement B.
Critical Technology	Same as under Distribution Statement C.
Specific Authority	Same as under Distribution Statement B.

DISTRIBUTION STATEMENT F: Further dissemination only as directed by (insert controlling DoD office) (date) or higher DoD authority.

a. Normally used only on classified documents, but may be used on unclassified documents when specific authority exists.

b. Distribution Statement F is used when the DoD originator determines that information is subject to special dissemination limitation specified by paragraph 4-505, DoD 5200.1-R.

c. When a classified document assigned Distribution Statement F is declassified, the statement shall be retained until the controlling DoD office assigns the proper distribution statement from this interim policy.

In addition to the distribution statement, the following notice(s) may be used on all documents assigned Distribution Statement B, C, D, E, or F.

WARNING

INFORMATION SUBJECT TO EXPORT CONTROL LAWS

This document may contain information subject to the International Traffic in Arms Regulation (ITAR) or the Export Administration Regulation (EAR) of 1979 which may not be exported, released, or disclosed to foreign nationals inside or outside the United States without first obtaining an export license. A violation of the ITAR or EAR may be subject to a penalty of up to 10 years imprisonment and a fine of $100,000,000 under 22 U.S.C. 2778 or Section 2410 of the Export Administration Act of 1979. Include this notice with any reproduced portion of this document.

DESTRUCTION NOTICE

For classified documents, follow the procedures in DoD 5200.1-R, Chapter IX or DoD 5220.22-M, "Industrial Security Manual," paragraph 19. For unclassified documents, destroy by any method which precludes reconstruction of the document.

CONTRACTOR-IMPOSED DISTRIBUTION STATEMENTS

Section IX of the Defense Acquisition Regulations (DAR) stipulates control procedures for contractor-controlled technical information in which the Government has limited rights. In this case, the approved statement in the DAR must appear on all copies of each document. Unmarked or improperly marked technical documents supplied by a contractor will be handled pursuant to the DAR. Limited rights information will be assigned Distribution Statement B.

The limited rights statement shall remain in effect until changed or cancelled under contract terms or with the permission of the contractor, and until the controlling DoD office notifies recipients of the document that the statement may be changed or cancelled. Upon cancellation of the statement, the distribution, disclosure, or release of the technical document will then be controlled by its security classification, or, if unclassified, by the appropriate statement selected from those authorized for use on DoD technical documents.

DD Form 1473 — Report Documentation Page

The overall classification of the document (if classified) is indicated in the upper left corner and the lower right corner of the DD Form 1473. The page classification (if classified) shall be indicated on the line provided.

In a classified document, even if the DD Form 1473 is unclassified, paragraphs within the unclassified abstract are always marked (U).

Classification symbols follow title and subtitle of classified publications (although, in most instances, these shall be unclassified).

On classified documents, when there is no continuation onto the other side of the DD Form 1473, notation should be stated at the bottom below the page number ("Page ii blank").

If possible, the abstract of a classified report should be unclassified, and the abstract of an unclassified report should consist of information releasable to the public. Each paragraph of the abstract is preceded by the proper classification symbol in parentheses if the overall classification of the document is confidential or higher.

Foreword and Preface

Forewords and prefaces are not often used in NRL publications. Should one or the other be used in a classified publication, the classification symbol of the heading must follow the centered heading, and each subsequent paragraph must be preceded by its appropriate classification symbol. Remember, the classification of the heading is *not* indicative of the overall classification of the material that follows.

Contents

The centered heading for Contents in classified publications is followed by its classification symbol: CONTENTS (U).

The caption or heading in the body of the Contents containing classified material is followed in the listing by the appropriate classification symbol.

If there is an unclassified appendix in a classified document, this is indicated as follows:

APPENDIX A — An Alternate Preamplifier Approach
(This Appendix Is Unclassified) 9

Lists of Figures and Tables

In classified reports, figure captions or table titles appearing in lists of figures and tables are marked with a classification symbol following the entry.

Page Classification

The overall classification of NRL Reports shall be displayed at the upper left and lower right corners of odd-numbered pages and at the upper right and lower left corners of even-numbered pages. TID will apply these markings.

The overall classification of Memorandum Reports shall be displayed at the upper left and lower right corners on all pages.

Blank Pages

Blank sheets (blank both front and back) are not used. When any major division or distinctive section or part of a classified publication concludes on the front side (right-hand side) of a sheet, the back of the page (left-hand side) will be left blank so the next major part can begin on a right-hand page. The printed front page will contain the following notation at the bottom center of the page beneath the page number to indicate that the next page is blank.

page number → __

(Page __ Blank)

Right-hand-side foldouts bear the classification (top and bottom) and the page number. Under the page number appears the notation "(Page __ Blank)." The reverse side of foldouts is always blank.

BODY

Headings

Every heading in a classified report is marked by placing the appropriate classification symbol in parentheses as indicated in Table 1.

Remember, headings are marked according to their own classification and do not reflect the overall classification of the material that follows. Once a heading is identified by some means, it becomes a *paragraph* for marking purposes. This is true even for such obviously unclassified headings as: INTRODUCTION (U), SECTION 1 (U), and Appendix A (U).

Run-in headings are not regarded as part of the paragraph and carry their own classification. Thus, the classification symbol for the main paragraph thought is placed in parentheses before the paragraph text (as shown in Table 1).

Text Listings

When a paragraph introduces a list of items, all having the same classification, the individual items listed are not marked. However, when individual items in a listing are complete thoughts and have different classifications, each item is individually marked, preceding the item.

Table 1 — Security Marking of Headings

Level	Acronym	Meaning	Example
	CAC	Center, All Caps	DESIGN MANUAL FOR TRANSDUCERS (U)
	CIC	Center, Initial Caps	Section I. Basic Theory (U)
1	FLAC (bold)	Flush left, all caps, bold	**(U) INTRODUCTION**
2	FLIC (bold)	Flush left, initial caps, bold	**(U) Test Program Details**
3	FLIC (Italic)	Flush left, initial caps, Italic	*(U) Solar Heaters*
4	IIC* (bold)	Indent, initial caps, bold	**(U) Passive Type**
5	IICRI* (Italic)	Indent, initial caps, run in with text, Italic	*(U) Masonry Walls* — (U) Run in with paragraph and . . .
6	IRI* (Italic)	Indent, initial cap first word only, run in with text, Italic	*(U) Brick walls* — (U) Run in with paragraph and . . .

*These acronyms are not commonly used in editing or graphic services because head levels infrequently subdivide down to these levels.

Running Heads

Each page of an NRL Report, except the front and rear covers and the DD Form 1473, is given a running head to identify that page with the report. Normally, in reports, the right-hand page contains the report number and the left-hand page contains the surnames of the author or authors. These are affixed by TID and are given no classification marking.

Paragraphs

The classification of each paragraph of a classified publication is marked at the beginning of the paragraph. The appropriate symbol — (U), (C), or (S) — is set at the normal paragraph indentation and is followed by one space and the first word of the text.

In a classified report, when a paragraph is continued on a new page, the first line of the new page shall carry a classification statement for the continued paragraph. For example,

((C) paragraph continues)
The classification statement is on the first line, the text follows on the next line and continues...

In a classified report, each numbered paragraph carries the classification symbol after the number.

The lead-in paragraph that introduces numbered or lettered subparagraphs is preceded by the symbol representing the highest classification of the lead-in paragraph plus the subparagraphs.

Footnotes

Footnotes, except for references, are preceded by the appropriate classification symbol. If a footnote runs over to the next page, the classification symbol is repeated on the new page before the text is continued.

Figures, Tables, Charts, and Graphs

For figures and tables in classified publications, the classification of the caption as well as the figure or table is shown. This procedure is followed even though the classification of the caption and the figure or table are the same; however, effort should be made to keep the caption unclassified.

The figure or table caption is marked immediately following the figure or table number. Examples:

Fig. 1 — (U) The exact potential energy curves of the H_2^+ quasimolecule

Table 12 — (U) Control Capabilities of "C" Processor Software

The classification of the figure or table itself appears in capital letters centered below the figure or table. (The classification of a figure may appear within the figure itself, if this presents a balanced appearance.)

Text Tables

A text table is used to introduce simple tabular matter directly into the discussion; it is not numbered and it is not referenced elsewhere in the text. In a classified publication, the text table and the paragraph that introduces it are considered a single unit and the classification symbol is shown only at the beginning of the paragraph.

CONCLUDING MATTER

Acknowledgments

It is a rare circumstance when it becomes necessary to publish a classified acknowledgment. However, in a classified document, each entry on the contents page must be marked with the appropriate classification symbol (U) following the entry. Furthermore, each paragraph in the acknowledgment must be marked with its classification symbol.

References and Bibliographies

In a classified publication, the heading of the listing itself is (U) References or (U) Bibliography. Each individual entry must be numbered. Unclassified entries are not marked. The classification of the title itself of the classified entry is marked immediately following the title as (S), (C), (U), etc. The classification of the reference itself is indicated in initial cap style, preceding the final entry on the listing (the date). Example:

3. C. E. Landwehr, "Best Available Technologies for Computer Security (U)," NRL Report 8554 (Secret), Dec. 1981.

Classified documents are *not* to be included in reference lists (or bibliographies) in publications bearing Distribution Statement A.

Glossary

In a classified publication, the classification of the glossary must be shown. When all items in the list are of the same classification, a symbol precedes the heading to indicate the classification; the symbol following the heading is the classification of the heading itself, thus:
(C) GLOSSARY (U)

Distribution Lists

Distribution lists are unclassified and are normally not printed as part of the publication. For the exception where the list is published with the report, the list is numbered consecutively with the report and begins on a right-hand page. The pages are given the overall classification of the report. The heading is marked: DISTRIBUTION LIST (U).

Appendixes (Unclassified)

Unclassified appendixes to classified documents may be printed as separate documents if desired; page and item classification markings are omitted in this case. However, almost all appendixes are bound in the parent document and, having been bound together, remain together. Thus, an unclassified appendix in a classified document must bear page security markings reflecting the highest security classification used in the document. If the appendixes are unclassified, they must begin on a right-hand page and a statement is placed at the top of the first page in parentheses that states: (This Appendix Is Unclassified). Also, the Contents page shall be marked to indicate the appropriate classification of an unclassified appendix.

UNCLASSIFIED MATERIAL

Normally, unclassified documents shall not be marked or stamped "Unclassified." Exceptions include instances when it would be essential to state that such material has been examined with a view to imposing a security classification and it has been determined that classification is not required. Example:

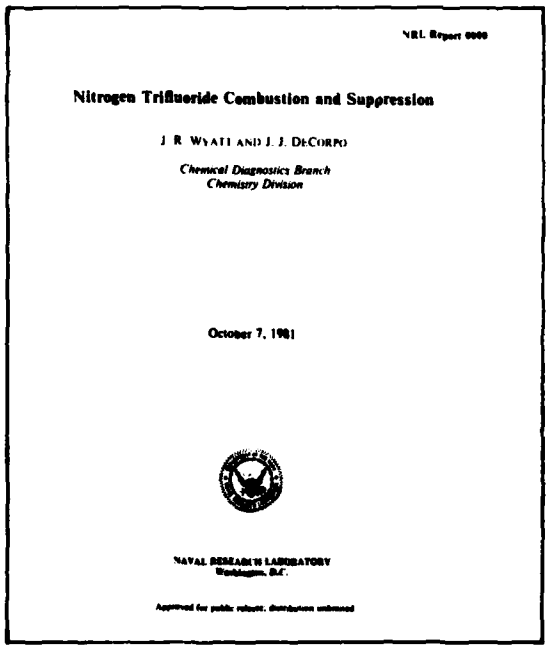
(This Page Is Unclassified)

NOTES

NOTES

SECTION 9

SAMPLES



NRL Report 0000

Nitrogen Trifluoride Combustion and Suppression

J. R. WYATT AND J. J. DECORPO

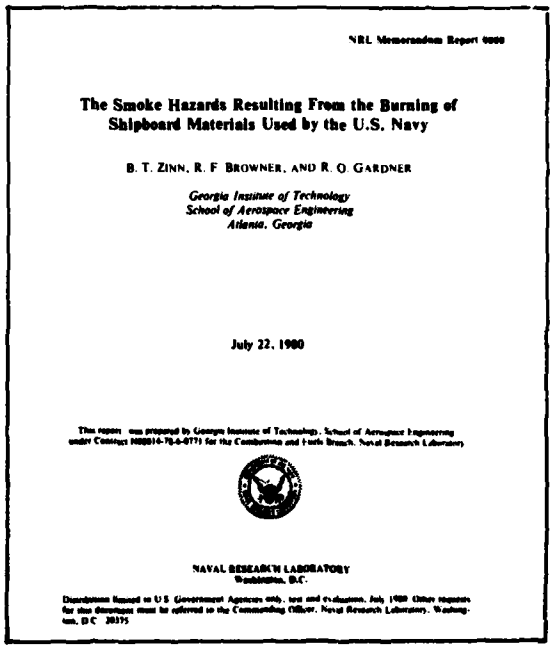
Chemical Diagnostics Branch
Chemistry Division

October 7, 1981

NAVAL RESEARCH LABORATORY
Washington, D.C.

Approved for public release; distribution unlimited

NRL Report



NRL Memorandum Report 0000

The Smoke Hazards Resulting From the Burning of Shipboard Materials Used by the U.S. Navy

B. T. ZINN, R. F. BROWNER, AND R. O. GARDNER

Georgia Institute of Technology
School of Aerospace Engineering
Atlanta, Georgia

July 22, 1980

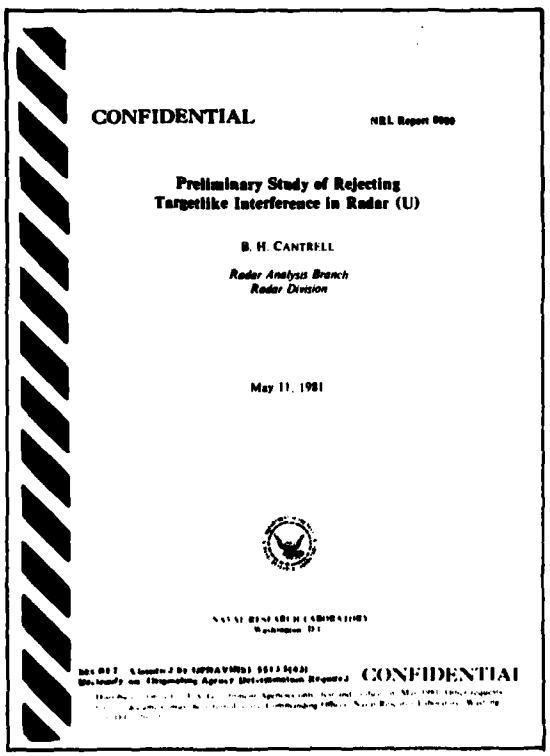
This report was prepared by Georgia Institute of Technology, School of Aerospace Engineering under Contract N00014-76-A-0771 for the Combustion and Fuels Branch, Naval Research Laboratory

NAVAL RESEARCH LABORATORY
Washington, D.C.

Distribution limited to U.S. Government Agencies only; test and evaluation; July 1980. Other requests for this document must be referred to the Commanding Officer, Naval Research Laboratory, Washington, D.C. 20375

NRL Memorandum Report

Unclassified Reports



CONFIDENTIAL

NRL Report 0000

Preliminary Study of Rejecting Targetlike Interference in Radar (U)

B. H. CANTRELL

Radar Analysis Branch
Radar Division

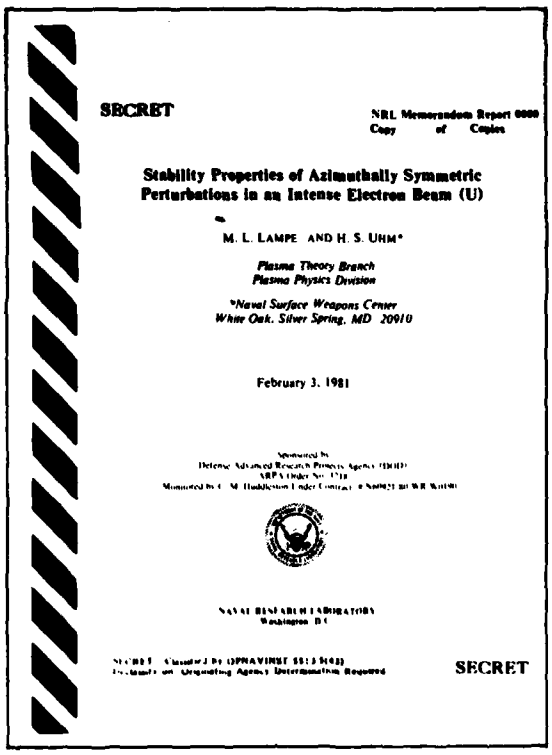
May 11, 1981

NAVAL RESEARCH LABORATORY
Washington, D.C.

Declassified by OPNAVINST 5513.1H(3)
Declassify on: Originating Agency's Determination Required

CONFIDENTIAL

NRL Report



SECRET

NRL Memorandum Report 0000
Copy of Copies

Stability Properties of Azimuthally Symmetric Perturbations in an Intense Electron Beam (U)

M. L. LAMPE AND H. S. UHM*

Plasma Theory Branch
Plasma Physics Division

**Naval Surface Weapons Center*
White Oak, Silver Spring, MD 20910

February 3, 1981

Sponsored by
Defense Advanced Research Projects Agency (DOD)
ARPA Order No. 4131
Monitored by C. M. Huddleston Under Contract # N00021-80-WR-80101

NAVAL RESEARCH LABORATORY
Washington, D.C.

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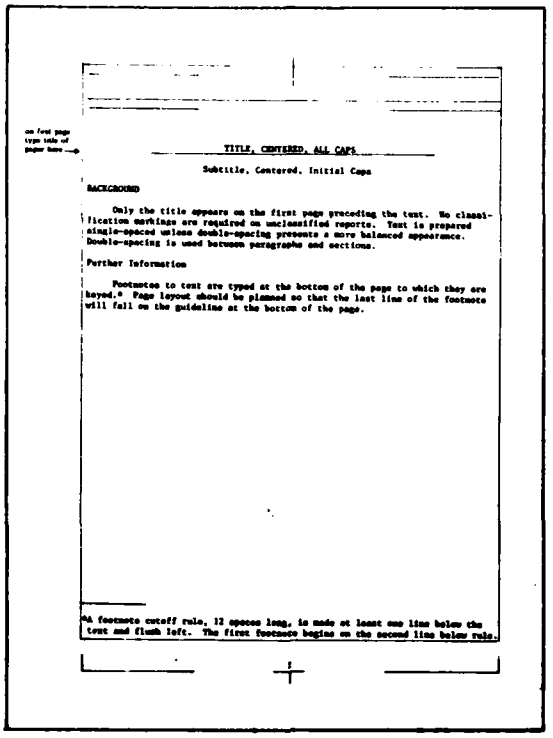
Declassify on: Originating Agency's Determination Required

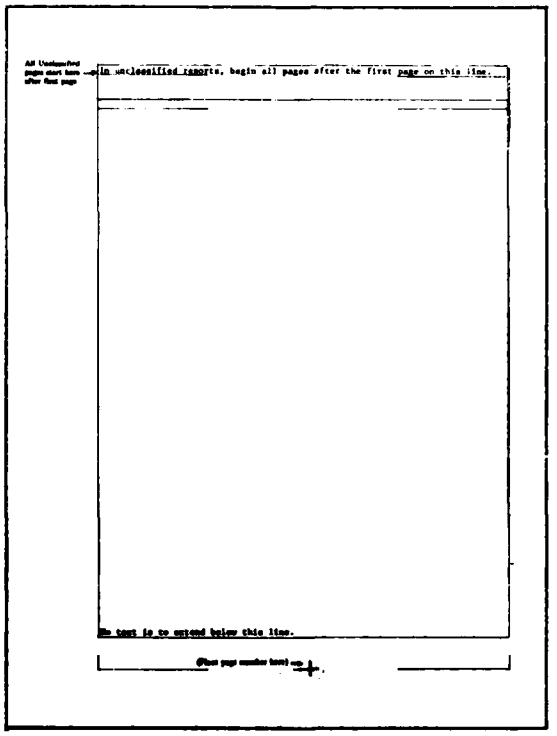
SECRET

NRL Memorandum Report

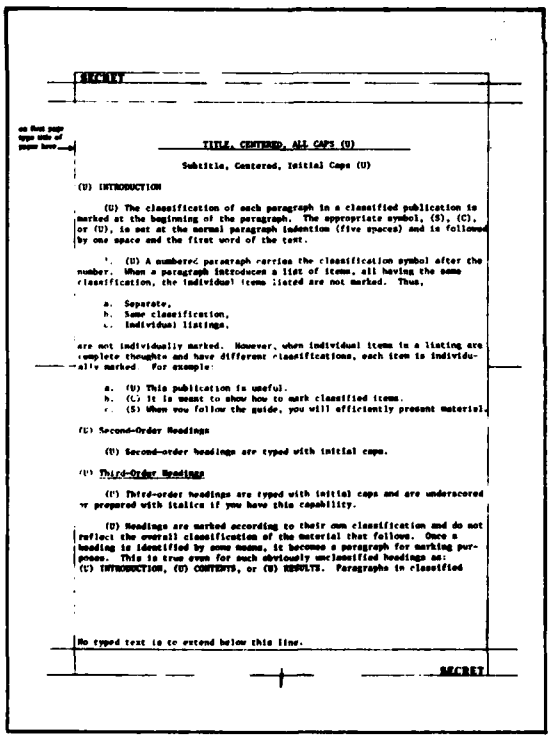
Classified Reports

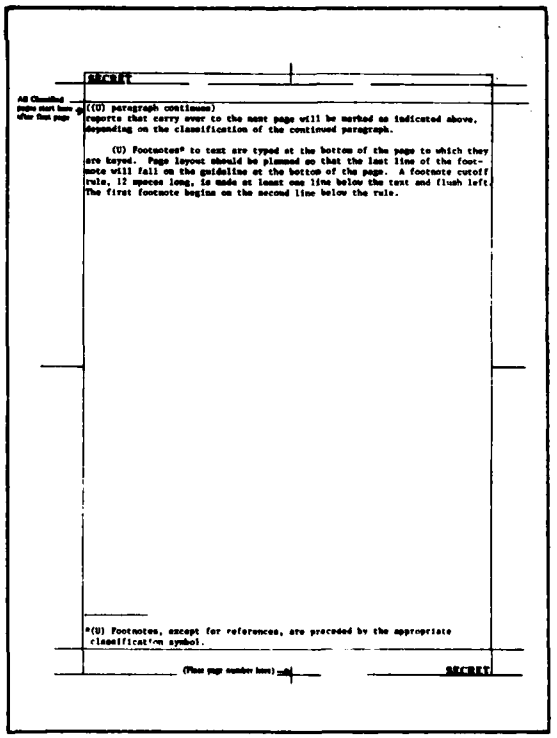
Sample 1 — NRL Report Covers





Unclassified





Classified

Sample 2 — Page layout for Memorandum Report using Typing Guide

CONTENTS

UNCLASSIFIED PUBLICATION

CLASSIFICATION

CONTENTS (U)

CLASSIFICATION

CLASSIFIED PUBLICATION

Sample 3 — Contents page

FIGURES (U)

TABLES (U)

Sample 4 — Listing of Figures, Tables

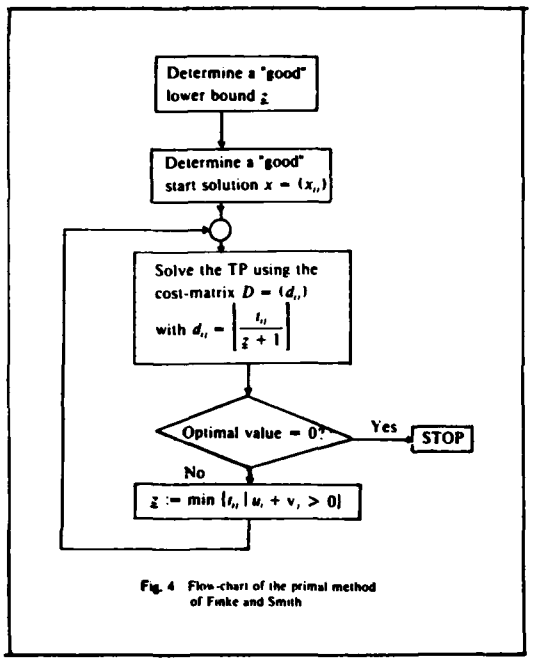


Fig. 4 Flow-chart of the primal method of Finke and Smith

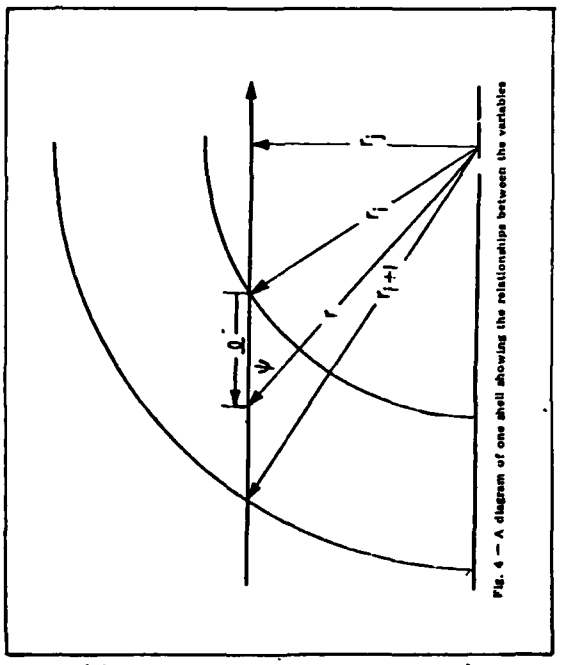


Fig. 4 — A diagram of one shell showing the relationships between the variables

(Showing sideways position on a page)

Unclassified figures

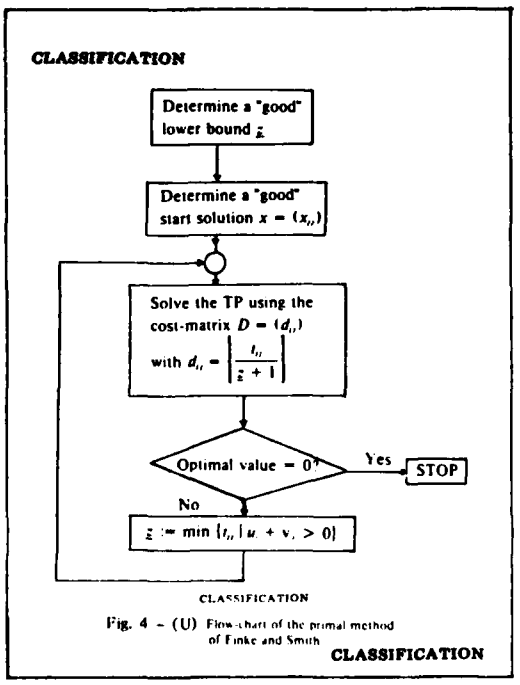


Fig. 4 – (U) Flow-chart of the primal method of Finke and Smith

CLASSIFICATION

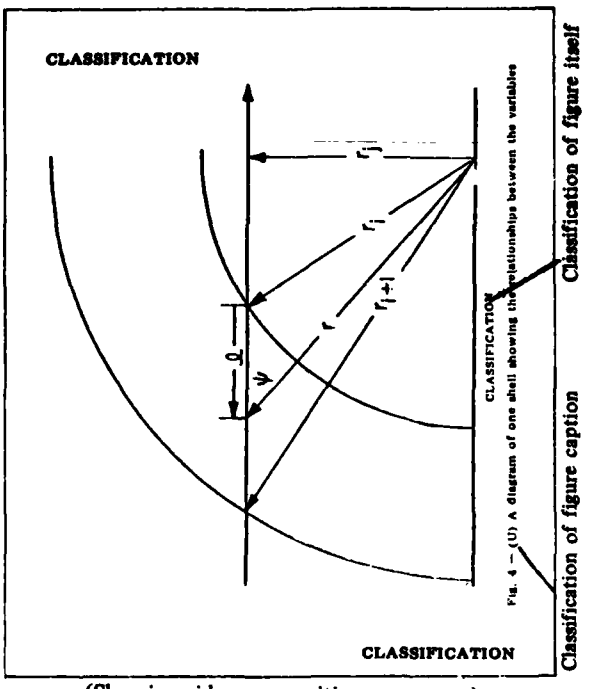


Fig. 4 – (U) A diagram of one shell showing the relationships between the variables

CLASSIFICATION

(Showing sideways position on a page)

Classified figures

Sample 5 — Figures

Table 3—Smoothed Wind Speeds and Directions Measured Aboard USNS LYNCH During the Drogue Experiment

Date (Julian Day)	Time (Universal Time)	Speed (kt)	Direction (Degree)
290	1900	16.56	37.04
	2100	17.07	36.18
	2300	17.20	40.65
261	0100	16.82	49.19
	0300	16.31	58.10
	0500	16.00	64.27
	0700	15.44	67.77
	0900	14.47	71.51
	1100	12.85	78.71
	1300	11.16	90.23
	1500	10.41	100.79
	1700	9.79	108.29
	1900	8.64	118.75
	2100	7.64	131.12
	2300	7.17	132.94

Table 10 — Sample Weight Loss and Smoke Concentration Data for Hydraulic Fluid

Mode	Ventilation Air Temperature (°C)	Peak Mass Loss Rate (mg/cm²-s)	Peak Volume Fraction* (ppm)	Total Particulate Volume* (cm³)	$\frac{\Gamma}{\Gamma_{25}}$
Nonflaming†	25	0.14	0.83	0.32	–
Flaming	25	5.6	4.54	3.61	1.00
Flaming	100	9.8	4.11	2.60	0.72
Flaming	300	11.1	5.58	2.68	0.74

*Based on m_R = 1.50 – 0.0*i* for nonflaming combustion and m_R 1.57 – 0.56*i* for flaming combustion at a standard flow rate of 425 l/min.
†During the initial nonflaming phase; spontaneous ignition occurred 5.9 minutes after initiation of exposure.

Unclassified Table

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Table 3 – (U) Smoothed Wind Speeds and Directions Measured Aboard USNS LYNCH During the Drogue Experiment

Date (Julian Day)	Time (Universal Time)	Speed (kt)	Direction (Degree)
290	1900	16.56	37.04
	2100	17.07	36.18
	2300	17.20	40.65
261	0100	16.82	49.19
	0300	16.31	58.10
	0500	16.00	64.27
	0700	15.44	67.77
	0900	14.47	71.51
	1100	12.85	78.71
	1300	11.16	90.23
	1500	10.41	100.79
	1700	9.79	108.29
	1900	8.64	118.75
	2100	7.64	131.12
	2300	7.17	132.94

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Table 10 – (U) Sample Weight Loss and Smoke Concentration Data for Hydraulic Fluid

Mode	Ventilation Air Temperature (°C)	Peak Mass Loss Rate (mg/cm²-s)	Peak Volume Fraction* (ppm)	Total Particulate Volume* (cm³)	$\frac{\Gamma}{\Gamma_{25}}$
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*Based on m_R = 1.50 – 0.0*i* for nonflaming combustion and m_R 1.57 – 0.56*i* for flaming combustion at a standard flow rate of 425 l/min.
†During the initial nonflaming phase; spontaneous ignition occurred 5.9 minutes after initiation of exposure.

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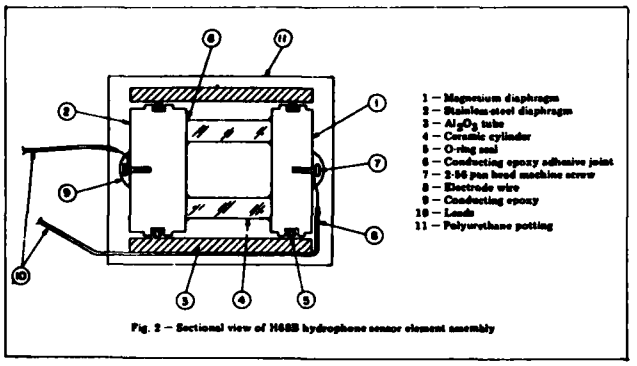

Fig. 2 — Sectional view of H68B hydrophone sensor element assembly

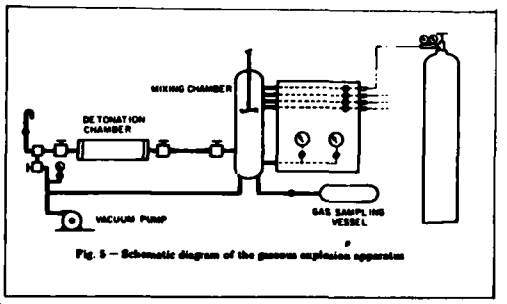

Fig. 5 — Schematic diagram of the gaseous explosion apparatus

Sample 7 — Methods of displaying callouts

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(This Appendix is Unclassified)

Appendix A

DERIVATIVES OF THE UNPERTURBED POTENTIAL

We must obtain the partial derivatives of the unperturbed potential $V_0(r, \theta)$ pertaining to hydrostatic equilibrium with respect to both variables r and θ. For this purpose, we refer to formula (27) in Ref. A1, in which reference the said potential was determined in terms of the mean radius a which characterizes an equipotential surface. More specifically, let

$$r = a[1 + qf_{21}(a)P_2(\cos\theta)] + \cdots \tag{A1}$$

be the equation of an equipotential surface to first-order terms in the rotational parameter

$$q = \frac{\omega^2 a_1^3}{3Gm_1} = \frac{\omega^2}{4\pi G\bar{\rho}_0(a_1)}, \tag{A2}$$

where a_1 is the mean radius of the outermost surface and where the nondimensional function f_{21}, a solution of the Clairaut equation, represents the spheroidal deformation. In Ref. A1 the potential $V_0(r, \theta)$ was determined along an equipotential surface $r(a, \theta)$ as a function of a:

$$V_0[r(a, \theta); \theta] = \psi_0(a). \tag{A3}$$

We use this function $\psi_0(a)$ to calculate the required derivatives. This can be achieved most expeditiously by recalling a well-known expansion theorem due to Lagrange (see, for example, Ref. A2), which states: if the variables a and r are implicitly related according to the relation

$$a = r + q\phi(a),$$

then

$$F(a) = F(r) + q\phi(r)\frac{\partial F(r)}{\partial r} + \cdots, \tag{A4}$$

where F stands for a generic function. Equation (A1) reveals that

$$\phi(a) = -af_{21}(a)P_2(\cos\theta), \tag{A5}$$

and this leads to

$$\psi_0(a) = \psi_0(r) + q[-rf_{21}(r)P_2(\cos\theta)]\frac{\partial \psi_0}{\partial r} + \cdots$$

$$= 4\pi G\left[\frac{1}{3}r^2\bar{\rho}_0(r) + \int_r^{r_1}\rho_0(r)r\,dr\right]$$

$$+\frac{1}{3}\omega^2 r^2 A^*(r)P_2(\cos\theta) + \frac{1}{3}\omega^2 r^2 + \cdots. \tag{A6}$$

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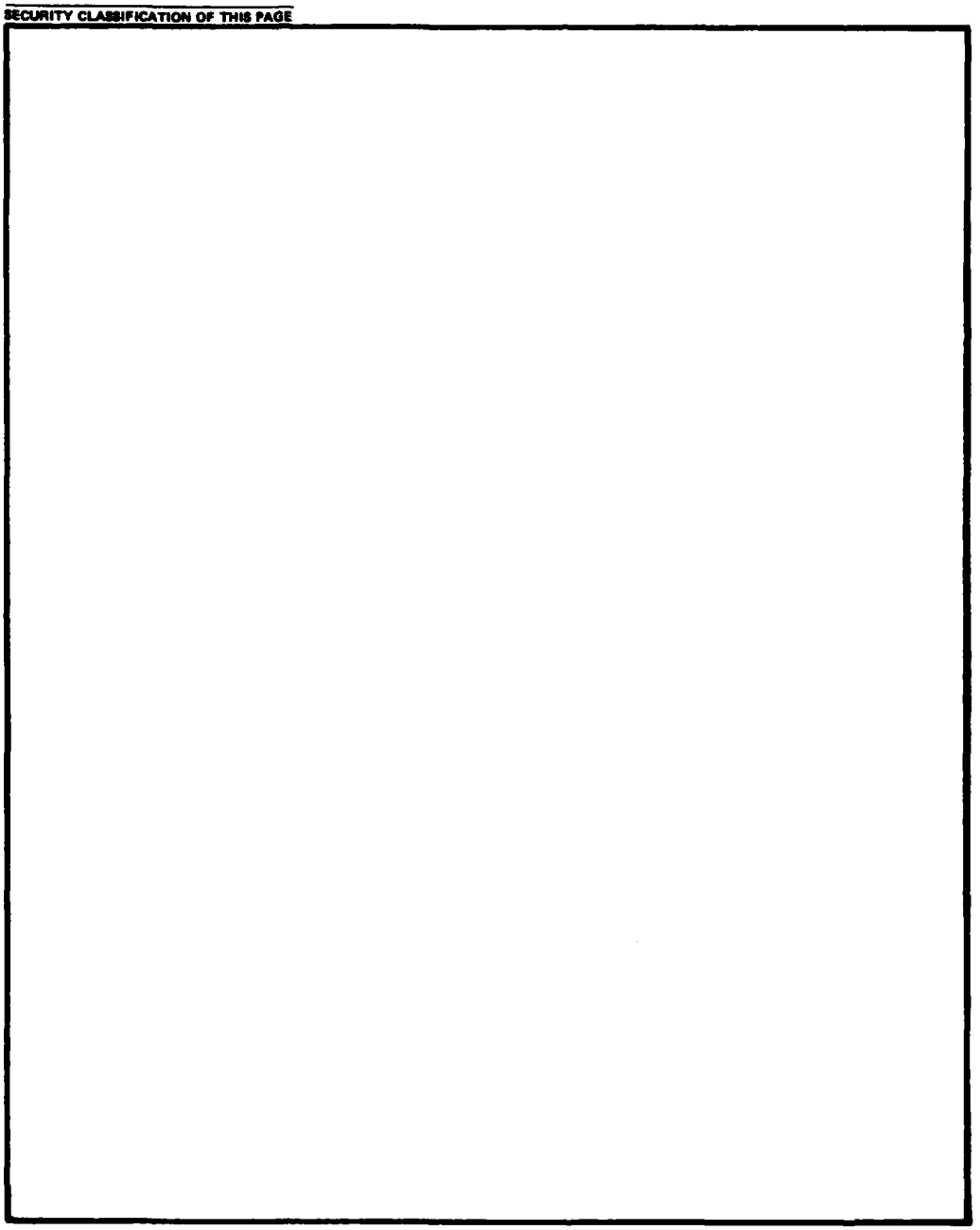

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SECTION 12

WORD LISTS

Standards for the form or usage of words are difficult to establish, because the English language itself is not static. As our language evolves, words now capitalized may lose the capital, hyphens may be added between two words, or hypenated words may become one word. Under such conditions of development, one is likely to see words and phrases employed with various spellings. However, some degree of consistency is desirable from the point of view of both the author and the reader.

The list which follows serves as a guide for current spelling, capitalization, and compounding of words which commonly appear in NRL and ONR reports, Definitions generally are not provided; acceptable dictionaries are found in every office. A number of prefixes and suffixes are included with comments on how they are compounded.

Generally, if several forms of a word are possible, the shorter spelling (acknowledgment, traveling) and the closed form (percent, overall) are preferred, The names of projects and operations have only the first letter of each word capitalized: Project Cirrus, Operation Deepfreeze. Words which have been formed from the first letters of other words (acronyms) often initially appear in an all-capital form and are later reduced to lowercased letters (loran, radar).

Letters prefixed to words are generally combined with hyphens, as in 0-ring, I-beam, and S-shaped, but exceptions are x axis, y direction, x ray, K band, F region, and X cut.

abovedeck
above-mentioned (um)
abscissa
absorbance
absorptance
accessible
accessory
acetylene
acknowledgment
actuate
acyclic
adaptable
adaptation
adapter
addendum
adiabatic
admissible
admittance
adsorbable
adsorbate (n)
adsorbent (adj)
adsorption
aerator
aerial
aerology
aerospace
A-frame
afterburner
agenda (pl. form but sing. mng)
aging
agitate
air base
air-based (um)
airborne
airbrush
airburst
airbus
air coach
air-conditioned (um)
air conditioner (n)
air-cool (v)
air-cooled (um)
air-core transformer
aircraft-to-surface (um)
aircrew
air-drop (v)
airdrop (n)
air-dropped (um)
airfield
airflow
airfoil
air force
airframe
airfreight
air gap
air line (hose for air)
airline (n, adj)
air lock (n)
air port opening for air)
airport (n, adj)
airship
airspace
airspeed
airstrip
airtight
air time
airway
Alfvén
algorithm
align
alkali
all-weather (um)
alnico
alright
amidships
ammeter
ampersand
amphibious
amplifier
amplify
amplidyne
amplitude-modulate (v)
ampoule
analog
ancillary
angle-tracking (um)
angular
anion
anneal
annular
anode
anomalous (adj)
anomaly
Antarctic Circle
antenna, antennae (biology)
antenna, antennas (radio)
anti...(combines to form one word
except before "i", cap. words,
or words already hyphenated:
anti-icing, anti-American,
anti-open-shop)
a priori
aqueous
aperture
apex, apexes
apogee
appendage
appendix, appendixes

arc
arc over (v)
arc-over (n)
arithmetic
arrester
Arrhenius
arsenal
asbestos
ascend
aspect
astrology
astronaut
astronomical
asymmetric
asymmetrical
asymptote
asynchronous
athwartships
attenuator
audio frequency (n)
audible
avast
avoirdupois weight
audiogram
audiometer
audiovisual
auto...(combines to form one word, except before "o": auto-oscillation)
axis, axes (use lower-case letter and no hyphen for graph, as in x axis, cap. ltr, no hyphen for crystals)
auxiliary
Avogadro
axisymmetric
azimuthal

back-coupled (um)
backfitted
back matter
backscatter
backswing
backup (n), back up (v)
backward
bacterium, bacteria
ball-and-socket joint
ball cock
ballpoint
band (use cap. letter and no hyphen for: X band, S band)
band center
band gap
bandpass
bandspread
band stop
bandwidth
barnacle
baseline
bathythermogram (record)
bathythermograph (instrument)
Baumé
beamformer
beamwidth
beat frequency (n)
beat-frequency (um)
Beaufort scale
benthic
benzene, benzol
Bernoulli trial
Bessel functions
Bessemer
bevel, beveled
bi-level
biodegradable
biweekly
bioelectric
blackbody
black box
blackout
blow off (v)
blue-pencil (v)
blueprint
Bohr theory
boil off (v)
boiloff (n, adj)
bolometer
Boltzmann's constant
bombproof
bona fide
Bose
Bourdon
breadboard
break down (v)
breakdown (n,adj)
breakup (n), break up (v)
breakdown (n,adj)
bremsstrahlung
bridged-T network
Brillouin
Brinell hardness
brinelling
broadband (adj)
broadside array
build up (v)
buildup (n)
built-up (um)
bulk shielding
Bunsen burner
buoyancy

buret
burn out (v)
burnout (n)
burnthrough (adj)
bus bar
bypass (v, n, adj)
by-product
byte

calendar
camouflage
cancel, canceled, canceler, cancellation
cannot
capacitance
capital assets
capital letter
Capitol Hill
caret
carrier-based
Cartesian coordinate
cascade
cascode
cassette
catalog
catastrophic
catalysis
catalyze
cathode-coupled
cathode follower(n)
cathode-follower (um)
cathode-loaded (um)
cathode ray
cathode-ray tube (n)
Cauchy
cellular
centerline
center-to-center
centrifugal
Cerenkov, Cherenkov
cesium
chain-reacting pile
Charpy V-notch
chassis (sing. and pl.)
Chebyshev (also Tschebycheff)
chemiluminescence
chemisorb
chemosynthesis
close-up
coaxial
cobalt-60 (also ^{60}Co)
cold-roll (v)
cold-rolled (um)
cold-work (v)
collimate
collinear
Colpitts oscillator
concomitant
consistent
controlled
converge
cooperate
coordinate
corundum
corollary
cool-flame (um)
copilot
Coulomb's law
count down (v)
countdown (n,adj)
counter...(combines to form one word except when modifying a compound noun: counter electromotive force)
co-worker
crisscross
criterion, criteria
crossarm
cross-check (v, n)
crosscorrelation
crosshair
crosshatched
crosslink (n,v)
crosslinked (adj)
cross-modulation
crossover (n, adj)
cross-reference
cross section (n)
cross-section (v)
cross-sectional (um)
cross term
crystallize
crytallographic
cumulant
cumulus
cure-all
cut (use cap. letter and no hyphen for crystals: X cut)
cut off (v)
cutoff (n, adj)

data (pl.)
D Day
dead time
deadweight
de Broglie
deceleration (not "deacceleration")
decuplet

deemphasis (radio)
deice
deicing
de-ionized
dependence
de-spin
detectable
determinant
diabatic
diagonalizable
diagrammed
diagrammatic
dineutron
di-pion
Dirichlet
discernible
discrete
disk
divergences
direct-couple (v)
direct-coupled (um)
dissociation
Doppler

· · · down (combines to form one word for nouns and adj.: countdown, shutdown)
drier (a chemical additive)
drive shaft
down-spin
drop out (v)
dropout (n,adj)
dryer (equipment)
Du Mont
du Pont
dustproof
dust-tight

early-warning (um)
east
Eastern standard time (EST)
echelle
echoes
echo-range (v)
echo-ranging (n, um)
effect
eigenfunction
eigenvalue
eikonal
electro...(combines to form one word)
electron micrograph
endfire array
endproduct
end product
E region
ensure
ergodic
étalon
exercised
explicitly
extremal
eyepiece

Faddeev
fall time
Faraday effect
farfield
feedback
feedline
fermion
ferroelectric
ferrous
Feynman
feedthrough
Fiberglas (tm)
fiber glass
fire control (n)
fire-control (um)
fireproof
fitted
fix-tuned
flammable (preferred to "inflammable")
flareup
flashback
flat-top antenna
fleet (but, 7th Fleet)
flowchart
flow rate
fluxmeter
fly-by
focused
· · · fold (combines to form one word if the figure is spelled out: fourfold; otherwise, 16-fold)
foreword (a preface)
formula, formulas
Fortran
forward (adj,adv,v)
Foster scanner
Fourier
Fourier integral, series
freeze-dry
freeze-out
frequency-modulate (v)
Friedel
fulfillment
fuse (electricity)

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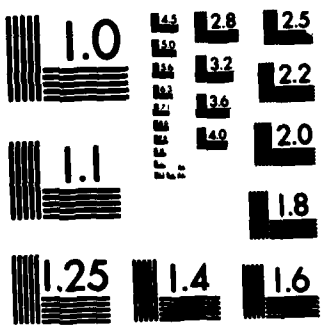

fuze (ordnance)

γ-cerium
gamma ray
gasdynamic
gases
gauge
gastight
Gaussian
gearbox
gerade
glass-fiber (um)
glovebox
glycerin
go/no-go
gray
Greenwich mean time (GMT)
Grüneisen
guideline
gyrocompass
gyro frequency
gyro mechanicm

hadrodynamics
half-cycle
half-life
half-space
half-wavelength
half-wave-spaced (um)
halfway
half-width (n, um)
handsheet
hard-drawn
Hartley oscillator
Harveyized (steel)
heat-treat (v)
heat treatment
Heaviside
heightfinder (n)
heightfinding (um)
Helmholtz
Hertz antenna
Hertzian
heuristically
higher-molecular-weight (um)
high cost
high-frequency (um)
high-pass
histogram
Hohlraum
holddown clamp
homolog
Hooke's law
horsepower

hybridization
hydrodynamics
hydrogenic
Hylleraas
hypersonic (speed only)
hysteresis

iconoscope
impedance-matching (um)
inadvertently
inasmuch as
index, indices (math)
indices
indispensable
infinitesimal
inflowing
infrared
infrasonic (not subsonic)
input
inscattering
in situ
in-state
integro-differential
intensity-modulate (v)
inter...(combines to form one word
except before cap. letters:
inter-American)
inter-ion
intermediate-frequency (um)
interstitialcy
in vacuo
isotropic
intra...(combines to form one word
except before a, u, and cap.
letters: intra-atomic,
intra-urethral, intra-European)

Johnson noise
Joule's law
judgment

Kelvin (scale)
kilo...(combines to form one word)
Kirchhoff's law
klystron
Kramers
Kronecker

labeled
Laguerre
Landé
Langevin
Langmuir

Laplace's equation
Laplace transform
Laplacian (operator)
Larmor
Laue
lead-in (n,um)
Lebesgue
Le Chatelier
left-handed (um)
lemma
Lie
lifetime
lighter-than-air craft
lightweight
light-year
· · · like (combines to form one word)
line of sight (n)
line-of-sight (um)
line shape
line shift
linewidth
Liouville
liquefy
Lissajous figure(s)
lobe-switching (um)
lobewidth
lock-in
locknut
lock washer
long-time (um)
loran
loudspeaker
louver
low-frequency (um)
low-pass (um)
lowercase letters

macro...(combines to form one word)
Madelung
magnetoinductive
makeup (n,adj)
manageable
man-made
material
materiel (equipment)
matrix, matrices (math)
maximum, maxima
maxwell (unit)
Maxwellian
Maxwell's rule
mean life
measurable
medium-frequency (um)
medium-weight (um)
mega...(combines to form one word)
Meissner circuit
memorandum, memoranda
metastable
micro...(combines to form one word: microorganism, but microhm)
mid...(combines to form one word except before a cap. word: mid-Atlantic)
milli...(combines to form one word)
minelayer
minesweeper
minimum, minima
mismatch
mockup (n)
moiré
mold (v,n)
mole (not mol)
monatomic
mono...(combines to form one word)
monochromator
monotonic
Mössbauer
movable
multi...(generally combines to form one word except before "i": multi-input)

nameplate
narrowband
naval
Navy
nearby
nearfield
Néel
neoprene
newton (unit)
Newtonian
Newton's law
non...combines to form one word except before cap. letters: non-Greek)
north-northeast
nose cone (n)
noticeable
N-pole
nucleus, nuclei
nylon

occurrence
occurring
· · · off (combines to form one word: tradeoff)

offboard
off-center (um)
off-diagonal
off-line (um)
off-resonance
oiltight
onboard
on-line (um)
open-circuited
ordinate
ortho state
orthorhombic
organometallic
orthicon
outflowing
outgas
output
out-state
over..(combines to form one word: overreach, overall)

Padé
pairwise
parallelepiped
parallel-resonant circuit
parametrize
para state
passband (n)
path length
payload
peak width
payout
Peltier effect
pentaatomic
pentagrid
permalloy
permittivity
perovskite
Petri
phenomenon, phenomena
phosphorous (acid)
phosphorus (element)
photo...(combines to form one word, except photo-offset)
picketboat
pickup
piezoelectric
piggyback
pinpoint (n,v)
pipeline
pipet
Pitot
pitot tube
Planck's constant
plane-parallel
plane-polarized wave
plan-position indicator
play back (v)
playback (n)
plug-in (um)
Poincaré
polaron
Pomeranchuck
polystyrene
Pomeranchuk
position finding (n)
position-finding (um)
post...(combines to form one word except before a cap. word: post-Renaissance)
power pack
power plant
Poynting
power plant
pre...(combines to form one word except before a cap. word: preempt, pre-American)
preceding
previously mentioned
principal (adj, foremost; n, governing head)
principle (n, rule or doctrine)
printout
pro...(combines to form one word except before "o" or a cap. word: pro-oceanic, pro-American)
procedure
proceeding
programmed
propellant (n, adj)
propeller
pseudo...(generally combines to form one word with scientific nouns and adjectives but is a separate word before nontechnical nouns; hyphened when second element is cap.: pseudo-Babylonian)
pseudoeigenfunction
pulse-code modulation
pulse jet (n)
pulse-jet (um)
pulse length
pulse modulate
pulse-position modulation
pulse-recurrence frequency
pulse-repetition frequency
pulse-time modulation
pulse width

pushbutton
push-pull

quadrupole
quasi (usually a separate word directly before nouns)
quaternary
queuing

radioactive
radiocarbon
radio frequency
radio-frequency (um)
radioisotope
radiosonde
radio wave (n)
radiowave (um)
radius, radii
radome
ramjet (n)
range finding (n)
range-finding (um)
range finder (n)
range-height (um)
range marker
range tracking (n)
trange-tracking (um)
rat race
re...(combines to form one word except to avoid ambiguity: re-form, re-cover)
read in (v)
readin (n,adj)
read out (v)
readout (n,adj)
real time (n)
real-time (adj)
Reaumur (scale)
recurrence
red shift
reenter
reevaluate
reexamine
referred
reflectance
reinforced
relative-heading indicator
relevant
resistivity
reststrahl(ung)(en)
résumé
retro rocket (n)
Reynolds
Riemann
ripcord
rise time
rocketborne
rock salt
roentgen-equivalent-man
roentgen-equivalent-physical
root-mean-square (um)
rubber shock-mounted
rutherford (unit)

sagitta
sawtooth (n,adj)
scan, scope (use cap. letter and hyphen: B-scan, B-scope)
Schottky
Schrödinger
Scyllac
seawater
sea state
seaway
sector-scan (um)
Segré
self...(use a hyphen when the first part of a compound expression: self-explanatory)
selsyn
semi...(combines to form one word except before "i" or a cap. word: semi-independent, semi-Gothic)
series-resonant circuit
series-shunt (um)
servo (n,adj)
servoamplifier
servo control
servo generator
servo indicator
servomechanism
servomotor
servo system
setscrew
setup (n,adj)
set up (v)
shipborne
ship-to-shore (um)
shock mount (n)
shock-mount (v,um)
shockproof
shock wave
shoreline
short circuit (n)
short-circuit (v,um)
short-time
short time constant

ships, U.S. Navy (USS New Jersey, or *USS New Jersey)*
ships, U.S. Navy (armed, combatant, or support - USS noncombatant - USNS)
shutdown (n,adj)
sidearm
sideband
side-by-side (um)
side lobe (n)
sidereal
signal-to-noise ratio
silicone
silver solder (n)
silver-solder (v,um)
sine wave
sinusoidal
sizable
slit width
snorkel
snorkeled
snorkeling
solenoid
Soller
space-time
spatial
spherocylindrical
splashproof
S-pole
spot weld (n)
spot-weld (v,um)
square-law (um)
stand by (v)
standby (n,adj)
standing wave
standing-wave ratio
standoff insulator
standoff jammer
start-stop (um)
startup (n,adj)
stationary (fixed)
stepwise
stochastic
stoichiometric
Stokes
stop band
stylus, styli
sub...(combines to form one word except before a cap. word; but, sub-subcommittee)
subband
sulfur
super...(combines to form one word except before a cap. word: super-Navy)
superhigh frequency
supersede
supersonic (speed only)
suppressor
surface-active (um)
synchro (n,adj)
synchrocyclotron
synchro repeater
synchroscope
synchrotron

tachyon
takeoff
takeup
talkdown
target-following (n,um)
Tchebycheff (also Chebyshev)
TEM mode
TE mode
temperature-sensitive (um)
tetraatomic
thermistor
threshold
thyratron
time of fall
time of flight (n)
time-of-flight (um)
time of rise
TM mode
tokamak
topflight
torpedos
toward
trade off (v)
tradeoff (n,adj)
trans...(combines to form one word except before a cap. word: trans-Ural)
transformer-coupled
transit time
transmit-receive
transmittance
transmitter-receiver
transverse-electric-magnetic mode
transverse-electric mode
transversity
traveling
triatomic

troubleshooting
tr tube
tuned radio frequency (n)
tuned-radio-frequency (um)
tunneling
turbojet
turboprop
turboramjet
turnoff (n,adj)
turn-on (n,um)
two thirds
two-thirds (fraction, or um)
· · · type (generally uses a hyphen as part of a compound expression: sodium-type glass)

U-boat
ultra...(combines to form one word except before "a", cap. words., or in Latin expressions: ultra-academic, ultra-American, ultra mare)
ultrasonic (frequency only)
ultraviolet
umklapp
un...(combines to form one word, except un-ionized, and before a cap. word: un-American)
ungerade
un-ionized
up...(generally combines to form one word, but hyphen is used in three-word modifiers: up-and-down, also, up-anchor as a verb)
uppercase letters
up-spin
usable
U-shaped
U-tube

vacuum
Van de Graaff
van der Waals
van't Hoff
V-beam
VE Day
vertices
very-high-frequency (um)
vice versa
viscous
VJ Day
voltage standing-wave ratio
voltmeter
vortices
warhead

waterborne
water-soluble (um)
watertight
wattmeter
waveform
wavefront
wave function
waveguide
wave height
wavelength
wavemeter
wave motion
wave number
wave packet
wave shape
wave vector
Wheatstone bridge
wholly
· · · wide (combines to form one word)
wide band (n)
wideband (adj)
Wien bridge
wingnut
wind tunnel
windup
· · · wise (combines to form one word)
worthwhile
worldwide
write-in (n,um)
wurtzite

x axis
x ray (n)
x-ray (v,um)

Yagi array
y axis

zeros
zeroth
zinc blende

SIMPLER WORDS AND PHRASES*

Official writing does *not* demand big words or fancy phrases. Write naturally—in the words you speak with. Those words are usually small. The guts of English are in its small, often one-syllable, words. Not only do they save typing and reading time, they make writing livelier and ideas clearer.

Instead of	*Try*
accompany	go with
accomplish	carry out, do
accomplish (a form)	fill out
accordingly	so
accrue	add, gain
accurate	correct, exact, right
achieve	do, make
actual	real
additional	added, more, other
address	discuss
addressees are requested	(omit), please
adjacent to	next to
advantageous	helpful
advise	recommend, tell
afford an opportunity	allow, let
aircraft	plane
anticipate	expect
a number of	some
apparent	clear, plain
appear	seem
appreciable	many
appropriate	(omit), proper, right
approximately	about
as a means of	to
ascertain	find out, learn
as prescribed by	under
assist, assistance	aid, help
attached herewith is	here's
attempt	try
at the present time	now
be advised	(omit)
be responsible for	handle
benefit	help
by means of	by, with
capability	ability, can
category	class, group
caveat	warning
close proximity	near
cognizant	aware, responsible
combined	joint
comply with	follow
component	part
comprise	form, include, make up
concerning	about, on
conclude	close, and
concur	agree
confront	face, meet
consequently	so
consolidate	combine, join, merge
constitutes	is, forms, makes up
construct	build
contains	has
continue	keep on
contribute	give
current	(omit)
deem	think
delete	cut, drop
demonstrate	prove, show
depart	leave
designate	appoint, choose, name
desire	wish
determine	decide, figure, find
develop	grow, make, take place
disclose	show
discontinue	drop, stop
disseminate	issue, send out
do not	don't
due to the fact that	due to, since
echelons	levels
effect	make
elect	choose, pick
eliminate	cut, drop, end
employ	use
encounter	meet
encourage	urge
endeavor	try
ensure	make sure
enumerate	count
environment	(omit)
equitable	fair

*Prepared by the Department of English, U.S. Air Force Academy

Instead of	*Try*
equivalent	equal
establish	set up, prove, show
evaluate	check, rate, test
evidenced	showed
evident	clear
examine	check, look at
exhibit	show
expedite	hurry, rush, speed up
expeditious	fast, quick
expend	pay out, spend
expense	cost, fee, price
expertise	ability, skill
explain	show, tell
facilitate	ease, help
factor	reason, cause
failed to	didn't
feasible	can be done, workable
females	women
final	last
finalize	complete, finish
for a period of	for
for example	such as
forfeit	give up, lose
for the purpose of	for, to
forward	send
function	act, role, work
furnish	give, send
herein	here
however	but
identical	same
identify	find, name, show
immediately	at once
impacted	affected, changed, hit
implement	carry out, do, follow
in accordance with	by, following, under
in addition	also, besides, too
in an effort to	to
inasmuch as	since
in a timely manner	on time, promptly
inception	start
in conjunction with	with
in consonance with	agree with
incorporate	blend, join, merge
incumbent upon	must
indicate	show, write down
indication	sign
initial	first
initiate	start

Instead of	*Try*
in lieu of	instead of
in order that	for, so
in order to	to
in regard to	about, concerning, on
inter alia	(omit)
interface with	deal with, meet
interpose no objection	don't object
in the amount of	for
in the course of	during, in
in the event that	if
in the near future	soon
in view of	since
in view of the above	so
it is	(omit)
it is essential	must
it is recommended	we recommend
it is requested	please, we request
justify	prove
legislation	law
liaise with	coordinate, talk with
limited number	few
limitations	limits
locate	find
location	place, scene, site
magnitude	size
maintain	keep, support
majority	greatest, longest, most
methodology	method
minimize	decrease, lessen, reduce
modify	change
monitor	check, watch
month of	(omit)
nebulous	vague
necessitate	cause, need
non-concur	disagree
notify	let know, tell
not later than	by
numerous	many, most
objective	aim, goal
obligate	bind, compel
observe	see
obtain	get
on a ___ basis	(omit)
operate	run, work
operational	working

Instead of	*Try*
optimum	best, greatest, most
option	choice, way
parameters	limits
participate	take part
perform	do
permit	let
personnel	people, staff
pertaining to	about, of, on
point in time	point, time, now
portion	part
position	place, put
possess	have, own
practicable	practical
preclude	prevent
prepared	ready
previous	earlier, past
previously	before
prioritize	rank
prior to	before
probability	chance
procedures	rules, ways
proceed	do, go on, try
proficiency	skill
programmed	planned
promulgate	announce, issue
provide	give, say, supply
provided that	if
provides guidance for	guides
provisions of	(omit)
purchase	buy
purpose is to	(omit)
pursuant to	by, following, under
reason for	why
recapitulate	sum up
reduce	cut
reflect	say, show
regarding	about, of, on
relating to	about, on
relocation	move
remain	stay
remainder	rest
remuneration	pay, payment
render	give, make
request	ask
require	must, need
requirement	need
reside	live
retain	keep
review	check, go over

Instead of	*Try*
selection	choice
shall	will
shortfall	shortage
similar to	like
solicit	ask for
state	say
state-of-the-art	latest
subject	the, this, your
submit	give, send
subsequent	later, next
subsequently	after, later, then
substantial	large, real, strong
sufficient	enough
take action to	(omit), please
task	ask
terminate	end, stop
that	(omit)
therefore	so
there are	(omit), exist
therein	there
there is	(omit), exists
thereof	its, their
this command	us, we
timely	prompt
time period	either one)
transmit	send
transpire	happen, occur
-type	(omit)
until such time as	until
(the use of	(omit)
utilize, utilization	use
validate	confirm
value	cost, worth
verbatim	word for word, exact
viable	practical, workable
vice	instead of, versus
warrant	call for, permit
whenever	when
whereas	since
with reference to	about
with the exception of	except for
witnessed	saw
your office	you
/	and, or

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SECTION 13

STANDARD ABBREVIATIONS

Abbreviations can often be utilized to serve a useful and acceptable purpose. However, much wasted time and frustration may be experienced by your readers if they have to look up terms when you use unfamiliar abbreviations. It is good writing practice to always define abbreviations when you introduce them in the manuscript.

The following abbreviations have been standardized for use in NRL publications. Additional information on abbreviations useful to DoD employees is found in Section E (pp. X-19 - X-31) of the Department of the Navy Correspondence Manual (SECNAVINST 5216.5B).

absolute	abs	complementary metal oxide semiconductor	CMOS
alternating-current	ac	center of gravity	c.g.
altitude	alt	center of mass	c.m.
amplitude modulation	AM	centimeter-gram-second (system)	cgs
analog-to-digital	A/D	chapter	Chap., Ch.
anno Domini	A.D.	chemically pure	cp
ante meridiem	a.m.	circular error probability	CEP
antilogarithm	antilog	coefficient (in subscript)	coef
aperture ratio 16	*f*/16	cologarithm	colog
approximate (*in subscript*)	*approx*	*combat information center*	CIC
arccosecant	arccsc	Company	Co.
arccosine	arccos	complex conjugate	c.c.
arccotangent	arccot	*confer* (compare)	cf.
arcsecant	arcsec	confidence limits	C.L.
arcsine	arcsin	constant	const
arctangent	arctan	contact potential difference	cpd
argument	arg	continuous-wave	cw
atmosphere	atm	Corporation	Corp.
audio-frequency	AF	cosecant	csc
automatic frequency control	AFC	cosine	cos
automatic gain control	AGC	cotangent	cot
automatic volume control	AVC	cubic	cu
average (in subscript)	av	curl	$\nabla\times$
backward-wave-oscillator	BWO		
Bardeen-Cooper-Schrieffer	BCS		
beat frequency oscillator	BFO	deoxyribose nucleic acid	DNA
binary coded decimal	BCD	determinant	det
bits per second	bps or b/s	deviation	dev
body-centered-cubic	bcc	diameter	diam
boiling point	bp	digital-to-analog	D/A
Brinell hardness number	BHN	digital voltmeter	DVM
byte — a number of bits (often 8 bits)	B	direct-current	dc
		direction finder (or direction finding)	DF
calculated (in subscript)	calc	disintegration per second	dis/s
cathode-ray tube	CRT	divergence	div

e — base of the natural logarithm	e
east	E
edition	ed.
effective radiated power	ERP
elastic (in subscript)	el
electromagnetic unit	emu
electromotive force	emf
electron paramagnetic resonance	EPR
electron spin resonance	ESR
electronic countercountermeasures	ECCM
electronic countermeasures	ECM
electronic data processing	EDP
electronic intelligence	ELINT
electronic warfare support measure	ESM
entropy unit	eu
equation	Eq.
equations	Eqs.
equivalent weight	eq wt
error function	erf
error function (complement of)	erfc
estimated standard deviation	e.s.d.
et alii (and others)	*et al.*
exempli gratia (for example)	e.g.
experiment(al) (in subscript)	expt
exponential	*e*, exp
extremely high frequency	EHF
extremely low frequency	ELF
f number — If the f number is 7, the abbreviated form is	f/7
face-centered-cubic	fcc
fast Fourier transform	FFT
field effect transitor	FET
figure	Fig.
figures	Figs.
fiscal year — written lower case when spelled out, as in fiscal year 1984, but capitalized when abbreviated, as FY 1984	
for example	e.g.
Fortran — commonly used for FORTRAN. However, if a report uses all-capital acronyms for other computer languages, use FORTRAN	
fracture analysis diagram	FAD
fracture transition — elastic	FTE
frames per second	fps
freezing point	fp
frequency-modulation	FM
frequency-shift keying	FSK
full-shear temperature	FST
gradient	grad
gravity, standard acceleration of	g
ground-control approach	GCA
Greenwich mean time	GMT
heat-affected zone	HAZ
heavy section steel technology	HSST
Hermitian conjugate	H.c.
heightfinding	HF
hexagonal-close-packed	hcp
high-frequency	HF
hyperbolic cosecant	csch
hyperbolic cosine	cosh
hyperbolic cotangent	coth
hyperbolic secant	sech
hyperbolic sine	sinh
hyperbolic tangent	tanh
hyperfine structure	hfs
ibidem (in the same place)	*ibid.*
identification, friend or foe	IFF
id est (that is)	i.e.
imaginary part	Im
Incorporated	Inc.
inelastic (in subscript)	inel
infrared	IR
inside diameter	i.d.
intermediate frequency	IF
International Critical Tables	ICT
laboratory (in subscript)	lab
laser	use all small letters
latitude	lat
least significant bit	LSB
limit	lim
linear combination of atomic orbitals	LCAO
local oscillator	LO
local oscillator frequency	LOF
lofar — word that has replaced acronym for low frequency analysis and recording	
logarithm (base 10)	log
logarithm (natural, base *e*)	ln
longitude	long
longitudinal-acoustic	LA
longitudinal-optic	LO
loran — word that has replaced the acronym for long-range navigation	
low frequency	LF
magnetic anomaly detection	MAD
magnetohydrodynamics	MHD
magnetomotive force	mmf
magnetoplasmadynamics	MPD
Mark	Mk

maximum	max	relative humidity	RH
medium frequency	MF	relative to	re
melting point	mp	resistance capacitance	RC
metal-oxide semiconductor	MOS	resistance inductance	RL
meter-kilogram-second (system)	mks	ribonucleic acid	RNA
minimum	min	room temperature	RT
molecular equivalent	mol-eq	root-mean-square	rms
molecular orbital	MO		
molecular weight	mol-wt	secant	sec
most significant bit	MSB	section	Sec.
moving-target indicator	MTI	sections	Secs.
		selective identification feature	SIF
north	N	Series	Ser.
negative-positive-negative	npn	signal-to-noise ratio	S/N
nota bene (mark well)	N.B.	signum function	sgn
not determined	N.D.	silicon-controlled rectifier	SCR
nuclear magnetic resonance	NMR	single sideband	SSB
number	No.	sine	sin
		sound surveillance system	SOSUS
observed (*in subscript*)	obs	south	S
of order less than	$o(\ )$	specific gravity	sp gr
of the order of	$O(\ )$	specific heat	sp ht
outside diameter	o.d.	square	sq
		standard	std
page	p.	standard temperature and pressure	STP
pages	pp.	standing-wave ratio	SWR
Part	Pt.	superhigh frequency	SHF
phase modulation	PM	Supplement	Suppl.
plan-position indicator	PPI	*Système International*	SI
post meridiem	p.m.		
positive-intrinsic-negative	pin	tangent	tan
positive-negative	pn	temperature	temp
positive-negative-positive	pnp	tensile strength	TS
potential difference	PD	theory, theoretical (in subscript)	theor
precipitate	ppt	time modulation	TM
probable error	pe	total (in subscript)	tot
pulse-code modulation	PCM	trace	tr, Tr
pulses per second	pps	transmit-receive	TR
pulse position modulation	PPM	transverse-acoustic	TA
pulse-repetition frequency	PRF	transverse-electric	TE
pulse repetition interval	PRI	transverse-electromagnetic	TEM
pulse-repetition period	PRP	transverse-magnetic	TM
pulse-time modulation	PTM	transverse-optic	TO
pulse width	PW	traveling-wave tube	TWT
quantum electrodynamics	QED		
quod erat demonstrandum (which was to be demonstrated)	Q.E.D.	ultimate tensile strength	UTS
		ultrahigh-frequency	UHF
		ultraviolet	UV
radio-frequency	RF	United States Pharmacopoeia	U.S.P.
random-phase approximation	RPA		
ratio analysis diagram	RAD		
real part	Re	variable-frequency oscillator	VFO
reference	Ref.	vacuum-tube voltmeter	VTVM
references	Refs.	valence band	VB

versus	vs	Wentzel-Kramers-Brillouin	WKB
very high frequency	VHF	west	W
very low frequency	VLF		
videlicet (that is to say, namely)	viz.	x unit	xu
viscosity	visc		
voltage standing-wave ratio	VSWR	yield point	YP
Volume	Vol.	yield strength	YS

STATE	ABBREVIATION	2-CHARACTER
Alaska	None	AK
Alabama	Ala.	AL
Arizona	Ariz.	AZ
Arkansas	Ark.	AR
California	Calif.	CA
Colorado	Colo.	CO
Connecticut	Conn.	CT
Delaware	Del.	DE
District of Columbia	D.C.	DC
Florida	Fla.	FL
Georgia	Ga.	GA
Hawaii	None	HI
Illinois	Ill.	IL
Indiana	Ind.	IN
Idaho	None	ID
Iowa	None	IA
Kansas	Kans.	KS
Kentucky	Ky.	KY
Louisana	La.	LA
Maine	None	ME
Maryland	Md.	MD
Massachusetts	Mass.	MA
Michigan	Mich.	MI
Minnesota	Minn.	MN
Mississippi	Miss.	MS
Missouri	Mo.	MO
Montana	Mont.	MT
Nebraska	Nebr.	NB
Nevada	Nev.	NV
New Hampshire	N.H.	NH
New Jersey	N.J.	NJ
New Mexico	N. Mex.	NM
New York	N.Y	NY
North Carolina	N.C.	NC
North Dakota	N. Dak.	ND
Ohio	None	OH
Oklahoma	Okla.	OK
Oregon	Oreg.	OR
Pennsylvania	Pa.	PA
Rhode Island	R.I.	RI
South Carolina	S.C.	SC
South Dakota	S. Dak.	SD
Tennessee	Tenn.	TN
Texas	Tex.	TX
Utah	None	UT
Vermont	Vt.	VT
Virginia	Va.	VA
Washington	Wash.	WA
Wisconsin	Wis.	WI
West Virginia	W. Va.	WV
Wyoming	Wyo.	WY
Canal Zone	C.Z.	CZ
Guam	None	GU
Puerto Rico	P.R.	PR
U.S. Virgin Islands	V.I.	VI

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SECTION 14

UNITS OF MEASURE ABBREVIATIONS

Use the following standard symbols (or abbreviations) for units of measure. To "define" a symbol, spell it out the first time it appears in manuscript, as in "6 LU (Lorentz units)." Units marked with asterisks are official units of the *Système International* of metric units. SI units are preferred. Also consult American Society for Testing and Materials (ASTM) publication E380, Standards for Metric Practice.

amagat	spell out
*ampere	A
ampere hour	A·h, A h
ampere turns per meter	At/m
angstrom	use 0.1 nm
astronomical unit	AU (0.14959789 Tm)
atmosphere, standard	atm
atomic mass unit	amu
atomic percent	at. %
atomic time unit	atu (define)
atomic unit	a.u.
atomic weight	at. wt
attofarad	aF
bar	spell out
barn	b
*becquerel	Bq
billion electron volt	use GeV
biot	Bi
bits per second	bps or b/s
bohr	spell out
British thermal unit	Btu
calorie	cal
*candela	cd
candlepower	cp
centimeter	cm
centipoise	cP (use 1 mPa s)
centistokes	cS (1 m/s^2)
*coulomb	C
counts per minute	cpm (define), counts/min
counts per second	counts/s
cubic centimeter	cm^3
curie	Ci
cycle	spell out
cycles per second	*Hz, cps, c/s
day	d or spell out
debye	D
decibel	dB
decibel above 1 mW	dBm
degree (plane angle)	°, deg
degrees Baumé	°B
degrees Celsius (centigrade)	°C
degrees Fahrenheit	°F
degrees Kelvin	°K, °K
disintegrations per minute	dis/min
disintegrations per second	dis/s
dyne	dyn
electromagnetic unit	emu
electrons per atom	e/at.
electrons per cubic centimeter	e/cm^3
electron unit	e.u.
electron volt	eV
electrostatic unit	esu
erg	spell out (use 10^{-7} J)
faraday	F
*farad	F
fathom	spell out (use 1.8288 m)
femtometer	fm
fermi	fm
fissions per minute	fpm (define)
foot	ft
foot-candle	fc
foot-lambert	fL
foot-pound	ft·lb, ft lb
frames per second	fps
franklin	Fr
gal	Gal
gallon	gal
gauss	G (use 0.1 mT)
gibbs	spell out
gigacycles per second	GHz, Gc/s

giga-electron-volt	GeV
gigahertz	GHz
gigavolt	GV
gilbert	Gi
gram	g
gram-atom	g-at.
gram-atomic-weight	g at. wt
gram equivalent weight	gew
gram formula weight	gfw
*gray	Gy
hartree	spell out or use E_h
hectare	ha
hectogram	hg (define)
*henry	H
*hertz	Hz
horsepower	hp
hour	h
inch	in.
inch-pound	in.-lb
*joule	J
kilobyte	kb
*kelvin	K
kilocalorie	kcal
kilocycles per second	kHz, kc/s
kilo-electron-volt	keV
kilogauss	kG
*kilogram	kg
kilogram force	kgf
kilogram meter	kg·m, kg m
kilohertz	kHz
kilohm	kΩ
kilojoule	kJ
kilokelvin	kK
kilometer	km
kilo-oersted	kOe
kiloparsec	kpc
kiloton	kt (define)
kilovolt	kV
kilovolt ampere	kV·A, kV A, kVA
kilowatt	kW
kilowatt hour	kW·h, kW h, kWh
lambert	L
langmuir	L (define)
liter	l
Lorentz unit	LU (define)
*lumen	lm
lumens per watt	lm/W
*lux	lx
maxwell	Mx
megacycles per second	MHz, Mc/s
mega-electron-volt	MeV
megahertz	MHz
megarad	Mrad
megavolt	MV
megawatt	MW
megohm	MΩ
*meter	m
meters of water equivalent	mwe, m (w.e.) (define)
mho—use sieman	U
microampere	μA
microampere hour	μA·h, μA h
microcoulomb	μC
microfarad	μF
microhenry	μH
microhm	μΩ
micrometer	μm
micron	μ
microns of mercury	μ Hg
microsecond	μs
mil	spell out
mile	mi or spell out
milliampere	mA
millibarn	mb
millicurie	mCi
milli-electron-volt	meV
milligram	mg
millihenry	mH
millikelvin	mK
millimeter	mm
millimeters of mercury	mm Hg
million electron volt	MeV
millitorr	mTorr
millivolt	mV
minute (time)	min
minute (plane angle)	′
molal (concentration)	m
molar (concentration)	M
*mole	*mol
mole percent	mol %, mole %
mole percent metal	MPM (define)
month	spell out
nanobarn	nb
nanometer	nm
nanosecond	ns
nautical mile	nmi
neper	Np
neutrons per fission	n/f
neutrons per second	n/s
*newton	N
normal (concentration)	N

oersted	Oe
*ohm	Ω
ohm centimeter	Ω·cm, Ω cm
ohms per square	Ω/sq, Ω/□
ounce	oz
parsec	pc
parts per million	ppm
*pascal	Pa
percent	%
picofarad	pF
picosecond	ps
poise	P
pound	lb
pound-force per square inch	lb/in.^{2}
pounds per square inch absolute	psi
pounds per square inch gauge	psig
pound-foot	lb-ft
pound-inch	lb-in.
rad	spell out
*radian	rad
radiation length	r.l. (define)
reciprocal ohm	*S, mho
revolutions per minute	rpm
revolutions per second	rev/s, rps
roentgen	R
rydberg	Ry
*second (time)	s
second (plane angle)	″
shake	spell out and define
*siemens	S
*steradian	sr
stokes	S (use 0.0001 m^2/s)
tera-electron-volt	TeV
terahertz	THz
*tesla	T
ton	t, or spell out
torr	Torr
townsend	Td (define)
unified atomic mass unit	u
*volt	V
volt ampere	VA
volt-ampere, reactive (unit of relative power in SI units)	var
volume percent	vol %
volt-coulomb	VC
*watt	W
watt hour	Wh
watt second	Ws
*weber	Wb
webers per square meter	Wb/m^2
week	spell out
weight percent	wt. %
Weisskopf unit	W.u. (define)
x-ray unit	xu (define)
year	yr

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PROOFREADERS' MARKS

Marks	Explanation
⊙	Insert period at point indicated by caret.
^	Insert comma at point indicated by caret.
⊙	Insert colon at point indicated by caret.
^	Insert semicolon at point indicated by caret
/=/	Insert hyphen at point indicated by caret
/em/	Insert 1-em dash at point indicated by caret.
?/	Insert question mark at point indicated by caret.
!/	Insert exclamation mark at point by caret.
✓	Insert apostrophe at point indicated by caret.
✓✓	Enclose in quotation marks as indicated by carets.
rom	Reset encircled matter in roman (regular) type.
lc	Reset crossed-out letter or encircled matter in lower-case type.
ital	Reset underscored matter in *italic* type.
sm caps	Reset double-underscored matter in SMALL CAPITALS.
caps	Reset triple-underscored matter in CAPITALS.
bf	Reset matter thus underscored in boldfaced type.
⊖	Delete letter, letters, or words which are crossed out.
^	Insert the marginal addition at point indicated by caret.
#	Insert space where indicated by caret.
⊂	Delete space. Draw the word together.
9	Turn inverted letter which is encircled.
x	Broken letter. Encircled letter must be replaced.
wf	Wrong font.
tr	Transpose letters or words as indicated.
stet	Let it stand as it is. Disregard all marks above the dots.
eq #	Equalize spacing where indicated by carets.
[	Move left to point indicated.
]	Move right to point indicated.
⌊	Lower to point indicated.
⌈	Raise to point indicated.
]C[	Center
⊥	Push down space which is showing up
(sp)	Spell out all encircled words.
¶	Start a new paragraph at point indicated by caret.
No ¶	Should not be a separate paragraph. Run in.
□	Indent 1 em
=	Out of alignment. Straighten.
Out, see copy	Set from copy the words which were left out and insert as indicated
?	Query to author. (Encircled in red.)

COPYEDITING SYMBOLS AND TERMS

The Symbol or Term	How Used	Its Meaning
' '	"Deadlines"	Note the quotation marks
=	John Smith	Set in small capitals
~	city editor	Set bold face
—	reporter	Set in italics
,	John, James	Note comma
⊙ x	the end⊙ the end x	Note period
more (or) ↓		Story is not completed
(30) (or) #		Story is completed
no ¶	no ¶ The city room	Do not paragraph
¶ ⌊ ⌋	¶ The ⌊The ⌋The	Paragraph
⌐¬	The room city	Transpose words
∿	abl	Transpose characters
stet	book is not	Restore the text
⊂	Stoker street	Join separated matter
=	Note here	Delete matter crossed out
s		Make it a capital letter
/		Make it a small letter
⊂	Re porter	Close up
|	city desk	Separate
^	the beat	Insert letter or word
⊙	(ave.)	Spell out
⊙	(avenue)	Abbreviate
⊙	(nine)	Make it a digit
⊙	(9)	Spell it out
] [	The city room is in the rear of the building, he learned.	Indent on both margins