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Scientific and Technical Reports – Preparation, Presentation, and Preservation

Abstract: This Standard outlines the elements, organization, and design of scientific and technical reports, including guidance for uniform presentation of front and back matter, text, and visual and tabular matter in print and digital formats, as well as recommendations for multimedia reports.

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Contents

Contents (continued)

Contents (continued)

Contents (continued)

Figures

Tables

Foreword

(This Foreword is not a part of ANSI/NISO Z39.18-2005, *Scientific and Technical Reports – Preparation, Presentation and Preservation*. It is included for information only.)

This Standard provides guidelines about the preparation, presentation, and preservation of scientific and technical reports. Its purpose is to foster uniformity in these reports for ease of information retrieval while permitting diversity in presentation based on the rapidly changing environment driven by the growing digital environment. It also provides guidelines to aid in assuring permanent access to digital documents. The Standard does not provide guidance on other typical technical information products, such as journal articles, proposals, technical specifications, or technical and consumer manuals. This publication is a standard rather than a report and, therefore, does not follow in every particular the report format described. Moreover, the language of the Standard is couched in the indicative rather than the subjective mood ("is," not "shall" or "must"), which is typically used in standards.

Previously this Standard only addressed reports produced with paper and ink. While many reports are still produced in this manner, a growing number are "born digital" and distributed electronically. Additionally, scientific and technical reports may be created combining text, data streams, audio, video, and other media to produce complex, multimedia documents that can only exist digitally.

In developing this Standard, Committee AW recognized that the way a Technical Report is organized has evolved over the past 30 years from a content-based organization pattern to a user-based one. This Standard presents alternatives that should be used based on report purpose and presentation.

Committee AW recognizes that presentation is an important consideration. Reports that are in digital format, unlike paper and ink reports, can be presented in several ways depending on individual preferences and capabilities.

In the development of this Standard, Committee AW examined existing practices and conventions from a wide variety of organizations, institutions, and associations as reflected in the annotated *Bibliography* (Appendix A). These sources were chosen because they represent a variety of report producers and are available to the report-producing public. Where practices vary, committee members resolved the differences based on their collective experiences. Where appropriate, options are recommended to accommodate the widely varied needs of report producers. Because of this variety, not all the elements described are mandatory for a report, although the placement and sequence of report elements should be consistent. For example, federal agencies use a Report Documentation Page, but many academic and industrial report producers do not. The use and placement of Report Documentation Pages is considered optional by the Standard to accommodate local practices; therefore instructions for preparing them are given in Appendix E.

The Standard provides explicit guidance about bibliographic data elements that appear on covers and title pages (and, if used, Report Documentation Pages) of reports when they are printed or presented in image form. Compliance with these guidelines ensures thorough, consistent, and uniform bibliographic description and control of data essential to libraries, abstracting services, and other technical information organizations that acquire, store, and provide access to information resources. The Standard also provides explicit guidance about bibliographic data elements needed for reports produced in formats not requiring covers and title pages.

The Standard also describes the scope of each section of a report and offers principles for the effective communication of textual, visual, and tabular material. The establishment of technical writing standards is beyond the scope of this Standard; however, it does provide an extensive annotated bibliography of materials about technical writing and language usage and style (Appendix A).

The Standard includes basic requirements for publication formats, the use of figures and tables, and the presentation of numbers and units, formulas and equations, symbols, and abbreviations and acronyms. It does not offer specific advice about electronic publishing systems that enable users to design and produce reports using a computer, appropriate software, and a laser or laser-quality printer. Because report production and reproduction techniques use rapidly changing software products, they are not specified. Most software packages for page and report production provide instruction manuals for users. On the other hand, guidelines and considerations regarding digital publications are provided.

Reaffirmation

This standard underwent a periodic review and was reaffirmed by the NISO consensus body on February 1, 2010.

Suggestions for improving this Standard are welcome. They should be sent to the National Information Standards Organization, 3600 Clipper Mill Road, Suite 302, Baltimore, MD 21211, telephone: (301) 654-2512, email: nisohq@niso.org.

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Scientific and Technical Reports – Preparation, Presentation, and Preservation

1 General Information

1.1 Rationale for Revision

The previous version of this Standard, although recognizing the potential impact of electronic access and delivery of digital documents, was based on paper-based publication of scientific and technical reports. Changes in recent years have necessitated a shift in focus. The electronic milieu that the Internet offers cannot be viewed as only an extension of the paper-oriented world. In the past 30 years, the way a scientific or technical report is organized has evolved from a content-based to a user-based organization pattern. This evolution has been affected not only by advances in technology but also by changes in user requirements. In addition to recording the results of scientific and technical research, reports increasingly are used for management decision making. This use means the potential audience for technical reports and needed report production time may be far different than in the past. It also means that there is no single format that authors should use. Thus, this revised Standard presents alternatives based on report purpose and presentation.

Even the definition of what constitutes a scientific or technical report in terms of both content and format may vary from previous experience. Videos or other audio-visual media without written accompaniment may be considered scientific or technical reports. Multimedia presentations (e.g., PowerPoint™) are often submitted as reports and may include written remarks for each slide. Many reports now "born digital" include links to other documents, which creates a need for a persistent identifier (e.g., a Uniform Resource Name, URN) linking a report to a location even though the location may change. Significant differences in the publication process require consideration of issues like versioning and integrity of material in the digital environment.

Presentation of reports is an important consideration; those in digital format, unlike paper, can be presented in several ways depending on preferences and capabilities. This revision of the Standard recognizes that guidelines for presenting digital documents differ from those applicable to ingesting digital objects into a repository. This Standard recognizes that archiving of digital documents requires a different model and new terminology.

A further problem is that paper and electronic documents have different design constraints not easily reconciled in a single standard. Insofar as it is possible to do so, this Standard recommends a Document Type Definition (DTD), a set of rules for establishing the structure of reports that may be electronically processed through systems that include document imaging, optical character recognition, compression/decompression, and optical media storage of full text. The DTD provides suggested eXtensible Markup Language (XML), designed to improve an electronic publication's functionality by providing more flexible and adaptable information identification, delivery, and presentation.

1.2 Role of Standard

The guidelines in this Standard address issues related to creating, discovering, presenting, publishing, disseminating, maintaining, and preserving reports. Previous editions of the standard focused on reports printed on paper, but, with the increased availability of computers, paper is only one of the many media of publication a report can have. In addition, reports can now include digital sections as well as traditional printed text. This revised Standard attempts to accommodate the diverse forms reports can take. Report writers should refer to the many examples throughout the Standard as models to follow rather than using the Standard as a model.

1.3 Scope of Standard

This Standard will guide individuals and organizations in preparing reports. It is generally couched in terms of the traditional printed report because that medium is the most concrete and common example for readers to consider and visualize. However, the Standard is expressed in such a way that adapting to other means of publication (for example, electronic formats on the Web and CD-ROMs) is recognized.

Although this Standard necessarily has to consider means of distribution, facilitate methods of literature control, and accommodate methods of accessibility, it is not a standard for cataloging, describing, or preserving publications. Those roles are fulfilled by other standards, such as those associated with using MARC 21 records, Dublin Core, and evolving standards for persistent identification.

1.4 Audience of Standard

This Standard will prove valuable to researchers, scientists, and academics to document their research and results, provide consistent guidelines for creating reports, and assist in collaboration among organizations. Writers, editors, and publishers can use the Standard to provide consistency throughout their organizations and adopt uniform practices as needed. Information specialists in areas such as libraries, depositories, databases, and archives will find it helpful in categorizing, discovering, and maintaining information in a consistent fashion.

1.5 Best Practices

In keeping with quality standards and practices, this Standard contains examples of best practices used by authors who produce exemplary reports—that is, reports that provide information the user needs in a form and format the user can easily understand. Authors, however, must be aware that the best practices identified by this Standard are those judged to be so at the time the Committee developed it, and they should seek to identify other practices, not only within the user's organization but also within the user's discipline.

2 Referenced Publications

2.1 American National Standards

This Standard is intended for use in conjunction with the following American National Standards. When these standards are superseded by a revision approved by the American National Standards Institute, consult the revision.

ANSI/NISO Z39.9-1992 (R2001), *International Standard Serial Numbering (ISSN)*

ANSI/NISO Z39.14-1997 (R2002), *Guidelines for Abstracts*

ANSI/NISO Z39.23-1997 (R2002), *Standard Technical Report Number (STRN) Format and Creation*

ANSI/NISO Z39.84-2000, *Syntax for the Digital Object Identifier*

ANSI/NISO Z39.85-2001, *Dublin Core Metadata Element Set*

2.2 Other Standards

In addition to the ANSI standards, the following standards provide useful information for preparing reports:

IEEE/ASTM SI-10-2002, *Use of the International System of Units (SI): The Modern Metric System*

ISO 2108, *Information and documentation – International standard book numbering (ISBN)*

2.3 Other Publications

The following publications provide additional useful information for preparing reports.

Americans With Disabilities Act (ADA) of 1990. Public Law 101-336, 101st Congress.

Environmental Data Standards Council (EDSC). *Glossary*.
Available from: http://www.envdatastandards.net/section/glossary/

National Technical Information Service. *Report Documentation Page, Standard Form 298*. Washington, D.C.: NTIS, August 1998. Available from: http://www.ntis.gov/pdf/rdpform.pdf

Privacy Act of 1974. 5 U.S.C. § 552a.

Electronic and Information Technology, *Section 508 of the Rehabilitation Act of 1973*. 29 U.S.C. § 794 (d). [Popularly referred to as "Section 508."]

3 Key Concepts Incorporated in This Standard

3.1 Metadata

This Standard advocates provision for the capture of appropriate metadata in report preparation. Metadata refer to information about information or, equivalently, data about data. In current practice, the term has come to mean structured information that feeds into automated processes, and this definition is currently the most useful way to think about metadata. This definition further applies whether the publication that the metadata describes is in print or electronic form. In publishing, metadata can be classified according to a variety of specific functions, such as technical metadata for technical processes, rights metadata for rights resolution, preservation metadata for digital archiving, and descriptive metadata (metadata that characterizes the content itself).

3.2 Persistence

This Standard addresses the need for persistence in links that are incorporated in reports. A key component of the digital information infrastructure is a mechanism for addressing and locating digital objects on a network or in an archival system. The current addressing structure for the World Wide Web is based on the Uniform Resource Locator (URL). While the URL provides direct, efficient access, URL-only naming fails whenever the resources are moved or reorganized. The lack of persistence leads to “404” (file not found) errors, inhibiting access to information and causing problems when archiving material for long-term preservation and permanent access. These links should also be documented for accessibility in print format.

3.3 Interoperability

This Standard encourages the achievement of interoperability in report presentation. In paper-based publication of scientific and technical reports, interoperability, except for language differences and visual challenges, is achieved through a single publication medium. In the digital environment with its multiple types of media, even defining the concept of publishing is a challenge. Interoperability can be achieved at three levels: technical, content, and organizational. At the technical level, protocol and format should be consistent so messages can be exchanged. Content agreements cover data and metadata and include semantic agreements on interpreting messages. The organizational level of interoperability includes rules for access, for changing collections and services, payment, authentication, etc. While the URL protocol permits interoperability in addressing, it offers no interoperability regarding content.

3.4 Creation

This Standard recognizes that certain critical actions must be taken at the time a report is created. The initial stage of creating a report should include a thorough review of intellectual property rights, security issues, ease of repurposing the information, and consistent guidelines for software and file naming conventions. Given the collaborative nature of many reports, copyright should be established at the outset, and permission for using pre-existing material should be consistent with U.S. Copyright Office regulations. Potentially classified

material may require authentication for release to a limited audience. If the report is best served by being released through multiple channels and repurposed into multiple formats (for example, print and Web) or parsed for repurposing in other collaborative projects, production should include standards for coding the information for such use. Creators should capture metadata tied to producing the report, such as platform, operating system, software version, and consistent file-naming conventions and extensions when they create the report.

3.5 Discovery

This Standard emphasizes the importance of ensuring that reports will be discovered. Traditionally, the ability for the target audience to find and use scientific and technical reports produced solely in print format depended on governmental and commercial bibliographic databases or specific, specialized knowledge of primary resource producers. Reports produced in digital format should also enable discovery and access through the incorporation of appropriate associated metadata. Producers of reports should ensure that the report production workflow provides for metadata capture. Discovery is also enhanced by populating metadata with published, controlled vocabularies rather than ad hoc terminology for subjects.

Another discovery issue in a digital environment is the ability of a report to allow access to all potential audiences, including those with physical restrictions. A 1998 amendment to the Rehabilitation Act (29 U.S.C. 794d), popularly referred to as “Section 508,” requires U.S. Federal agencies to make their electronic and information technology accessible to people with disabilities. Other producers of scientific and technical reports should follow guidelines provided for this requirement for greatest accessibility. A further limit to access to be avoided is using proprietary software not commonly used by the primary target audience.

3.6 Presentation in Digital Format

This Standard recommends that reports in digital form be presented in a structured way. Some methods for structured representation of reports in digital form are the DTD, XML, and XSL. The DTD defines the format that reports should follow; XML maintains the report’s contents and structures; and XSL defines how to represent the report for different vehicles of display (e.g. desktop computer or PDA). Two main advantages of this approach are its automatic validation and its flexibility of representation. Also, the XML format is widely used and can be easily processed by computer programs. Figure 1 shows the relationship between an XML document, the DTD, and XSL.

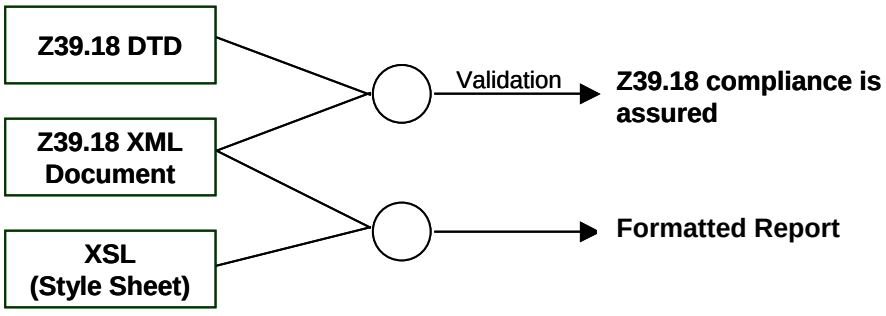

Figure 1: Components used in digital format representation

3.6.1 Document Type Definition (DTD)

A DTD defines the building blocks of a document using eXtensible Markup Language (XML). XML improves the functionality of the Web by providing more flexible and adaptable information identification, delivery, and presentation.

3.6.2 XML Document

The XML document contains the report with its metadata. Elements in an XML document should comply with the DTD provided (see Appendix F), which validates the document.

3.6.3 XSL (Style Sheet)

The XSL (eXtensible Style Sheet) provides a mechanism for presenting data available in an XML document. It provides formatting information and ordering of presentation (not always the same order as in the XML document) and can generate extra metadata, such as a table of contents, list of figures, etc. Multiple XSL sheets can be used for the same document to accommodate the needs of various communities: Web publication of reports, printed reports, etc.

3.7 Presentation

This Standard is cognizant of and reflects the requirements and limitations of different methods of publication. The concept of publication (literally, to make known to the public) changed drastically in the 1960s when computers were applied to the typesetting process. Suddenly, machine-readable electronic records were being produced along with traditional print. The subsequent development of new media, recording devices, codes of expression, and means of transmission made these electronic records eminently usable. Scientific, business, military, and government communities found these new media to be a convenient and economical means for distributing and storing information, including reports. As a result, we now see diverse ways of publishing data and information, from printed pages to CDs to analog and digital tapes to files accessible over the World Wide Web.

The prescriptions of this Standard are flexible enough to be adapted to a great variety of publication methods, both extant and yet to be discovered. However, it also recognizes that many users of a report find a printed version more convenient, portable, or permanent. Therefore, the Standard states that electronic publications be formatted so that standardized, usable print copies can be produced from any medium through common or specialized software. The Standard suggests producing reports that can be converted from medium to medium and format to format to allow ease of use and future migration.

3.8 Dissemination

This Standard encourages the effective dissemination of reports. It is important that scientific and technical reports be readily available to as broad an audience as allowed to facilitate research and to promote general education goals. Online access to information opens new arenas to find reports. Reports that can be easily identified and ordered by libraries and the general public through a variety of distribution channels (for example, wholesalers, library jobbers, and online retailers) support the sustainability of the information. Archiving reports on the Web with a unique identifier, and with an agency that can support their presence over

time, improves their long-term value. Therefore, creators of reports should envision a dissemination strategy at the outset of the project.

3.9 Access and Distribution

This Standard recognizes the importance of controlling access to some reports. Originating organizations have specific responsibilities to determine the distribution of reports. Classification/distribution information is provided by electronic labeling or in print. If physical marking of a report is not possible, identifying information must be accomplished by other means, such as metadata schema. Marking is the means of informing users of classified, or otherwise controlled, information about specific protection requirements for reports (for example, for internal use only). For print materials, this information should be easily visible on the cover or title page. For reports in a digital format, this information should be on the opening screen or other points of initial access.

Examples:

Approved for public release; distribution is unlimited.

Distribution authorized to DoD components only (reason, date). Other requests for this document shall be referred to (controlling office information).

3.10 Maintenance and Preservation

This Standard advocates adopting practices that ensure long-term preservation of reports. Compilers and publishers of scientific and technical reports can and should take action to ensure their efforts will be appreciated for as long as the reports have value to users. This requirement means that reports should be prepared using techniques and materials that enable discovery and usability over the long term. Continuing discovery is assured by associating a report with clear, distinct, and unchanging identifying information (descriptive metadata). Continuing usability is assured by adopting an easily navigated and navigable structure, including maintenance of internal and external links, and by using publishing techniques that withstand the test of time. Time-tested publishing techniques involve the appropriate choice of publishing medium, such as acid-free paper or polyester-based silver gelatin film. However, publishing increasingly involves producing digital products that can be migrated and shared across media, platforms, applications, and organizations. At the time the Committee developed this Standard, the most promising method for assuring continuing migration is employment of an XML DTD to encode electronic reports when produced.

Many complex, electronic scientific and technical reports are used to produce multimedia publications and presentations. In such cases, it is particularly important to use presentation standards and practices that not only enable the widest possible access at the time of report creation, but also ensure continuous availability of content and structure despite changes in the delivery environment. In cases of multimedia reports, it is desirable to preserve the original presentation media as well as the original content. When this preservation cannot be achieved, it is most important to preserve the content so that the original source material is preserved.

4 Components of Reports – Overview

4.1 Introduction

There are many possible patterns for organizing the components of reports. Some of these are referenced in Appendix D, *Model Formats for Organizing a Scientific or Technical Report*. These model formats allow for presenting information about the creation, structure, content, and availability of reports in a readily comprehensible manner. When not using traditional publishing channels, the author/creator should ensure this information is captured and available to potential readers/users.

4.2 Metadata

A scientific or technical report is an important information resource and, as such, requires effective information management. The body of the report, with its discussion of methods, results, and conclusions, is content. Any information that helps the user find, assemble, and properly attribute the report are metadata.

Metadata are a significant matter for this Standard because of the large amount and diversity of data represented. The quantity and diversity of report content and format presented information management challenges in an era when reports were published exclusively on paper; in the digital age these challenges have multiplied considerably. A scientific or technical report that does not take metadata into account has no readily-found identity and will not be used. To avoid this problem, compilers of reports must provide metadata in three broad classes: descriptive, structural, and administrative.

4.2.1 Descriptive Metadata

Descriptive metadata, such as cataloging information prepared following standards such as Dublin Core or MARC 21**,** convey information that helps the user find a report and distinguish it from other similar ones. Descriptive metadata are commonly used for resource discovery, such as author/title/subject searching, or grouping like objects for browsing. Such metadata include the title and creator (author), as well as any keywords or subject references.

4.2.2 Structural Metadata

Structural metadata explain the relationship between parts of multipart objects and enhance internal navigation. Such metadata include a table of contents or list of figures and tables.

4.2.3 Administrative Metadata

Administrative metadata support maintaining and archiving reports and ensure their long-term availability. Administrative metadata are needed for migration of data from one format to another and contain rights information used for access control. Such metadata include type and version of software used in preparing the report and rights-management requirements.

4.3 Components

The author/creator of a scientific or technical report must keep all metadata requirements in mind throughout report creation and should prepare the components to enable ready recognition of key descriptive, structural, and administrative information about the report.

Table 1 presents the standard components of scientific and technical reports in the traditional order of presentation. In reports organized in this manner, the listed components from cover through acknowledgments are commonly referred to as front matter, the components from summary through references are referred to as the body or text matter, and components from appendices through distribution list are referred to as back matter.

In the **Inclusion Status** column, the table indicates which components are *required* by this Standard, which are *optional*, and which are *conditional*. Finally, in the column headed **Function**, the table indicates the primary role served by the information conveyed in each component.

Table 1: Components of reports

	Component	Inclusion Status	Function
Front Matter	Cover	Optional	Descriptive metadata
	Title Section	Required	Descriptive metadata, such as Dublin Core elements: Identifier, Title, Creator, Publisher, Contributor, Date, and Language
	Notice Section	Conditional (include when needed to specify intellectual property rights or state restrictions on access or use)	Administrative metadata, such as the Dublin Core elements: Rights Management and Format
	Format Information Section	Conditional (include when the original is created in digital format)	Administrative metadata, such as Dublin Core element: Format
	Report Documentation Section	Conditional (include in reports prepared for federal governmental agencies)	Descriptive metadata, such as the Dublin Core elements: Title, Creator, and Publisher Source of administrative metadata, such as the Dublin Core element: Rights Management
	Abstract Section	Required	Descriptive metadata, such as the Dublin Core elements: Description, Subject, and Coverage
	Contents Section	Required	Structural metadata
	List of Figures and Tables	Conditional (include when there are more than 5 figures and/or tables)	Structural metadata
	Foreword	Conditional (include when background and context is needed)	Descriptive metadata
	Preface	Conditional (include when background and context is needed)	Descriptive metadata
	Acknowledgments	Conditional (include when significant)	Content

Table 1 (continued)

	Component	Inclusion Status	Function
Body or Text Matter	Summary	Required	Content
	Introduction	Required	Content
	Methods, Assumptions, and Procedures	Required	Content
	Results and Discussion	Required	Content
	Conclusions	Required	Content
	Recommendations	Conditional (include when purpose of report is to suggest a course of action)	Content
	References	Conditional (use if references are provided)	Structural metadata, such as the Dublin Core element: Relation
Back Matter	Appendices	Conditional (include when needed to supplement Results and Discussion)	Structural metadata
	Bibliography	Conditional (include when needed to amplify references)	Structural metadata
	List of Symbols, Abbreviations, and Acronyms	Conditional (include if symbols, abbreviations, or acronyms appear in any other component of the report; this section might appear as part of the front matter)	Structural metadata
	Glossary	Conditional (include if report incorporates terms unfamiliar to the intended audience)	Structural metadata
	Index	Conditional (include when needed to ensure that a user locates all references to a concept)	Structural metadata
	Distribution List	Conditional (include when needed to control access)	Administrative metadata, such as the Dublin Core element: Rights Management

5 Components of Reports – Details

This section provides guidance on organizing the following report components:

- Required elements, which are compulsory or mandatory when exchanging data
- Conditional elements, which are used under specified conditions when exchanging data
- Optional elements, which may be used when exchanging data [*definition from EDSC Glossary*]

5.1 Front Matter

Front matter consists of all materials preceding the main content and provides:

- a general idea of the purpose and scope of reports;
- background about, or a context for, reports; and

- lists for finding specific chapters, headings, figures, and tables.

It also provides information needed for cataloging in bibliographic databases and digital libraries. A discussion of the purpose and scope of each element of front matter follows and suggests best practices for the location of such information.

5.1.1 Cover

Although considered an optional component, a cover provides physical protection for a print report and displays major metadata elements for resource discovery. Electronic versions of reports, especially in PDF, often include a cover to replicate the look of the print version. A cover identifies the report number, title, author(s), and any distribution limitations. If classified or proprietary information appears in a report, a notice on the cover indicates that such material is included. The best practices for including data elements of a report cover are as follows:

- Report number (can also be on the back cover, or on both)
- Report title and subtitle, if used (should be the same on the cover, title page, and report documentation page)
- Title and numbering of series, if the report is issued in a series (can also be on the back cover, or both)
- Author, principal investigator, editor, and/or compiler
- Publisher (the organization that assumes responsibility for publication, which may or may not be the same as the sponsoring organization)
- Date of publication (optional; can defer to the title page or to the copyright page)
- Distribution limitations
- Sponsoring organization of published research
- A bar code or other indication of the International Standard Book Number (ISBN) or International Standard Serial Number (ISSN) and the price (optional). This information is usually included on the back cover of the report as well and may facilitate managing inventory.
- Technical requirements (for example, video, audio, digital)
- Subject

Legal or policy considerations of the sponsoring organization may require using additional data elements.

5.1.2 Title Section

The required title section indicates the subject and content of the report and provides information needed for description and bibliographic control of, and access to, a report. These data are critical to discover, acquire, store, and provide access to information resources. If the performing and sponsoring organizations are different entities, the title section clearly identifies the different responsibilities (that is, performance and sponsorship). The information in the cover and title section must be consistent; if an optional Report Documentation Page is used, its bibliographic data must also be consistent with the information in the cover and title section. The recommended data elements of a title section are as follows:

- Report number
- Report title and subtitle, if used (should be the same on the cover, title page, and report documentation page)
- Title and numbering of series, if the report is issued in a series
- Author, principal investigator, editor, and/or compiler, with the primary creator listed first, per standard library cataloging practice
- Performing organization (author/creator affiliation)
- Publication data, including place of publication, publisher (which may or may not be the same as the sponsoring organization), and date (may also defer to the copyright page)
- Type of report and period covered, where applicable (conditional)
- Contract or grant number, where applicable (may defer to the copyright page)
- Sponsoring or issuing organization (if different than the performing organization)
- Subject descriptors (e.g., keywords)

Figures 2a and 2b show a sample cover and title page for which the performing and sponsoring organizations are the same. Figures 3a and 3b show a sample cover and title page for which the performing and sponsoring organizations are different. Legal or policy considerations of the organization for which a report is prepared may require using additional data elements in these sections.

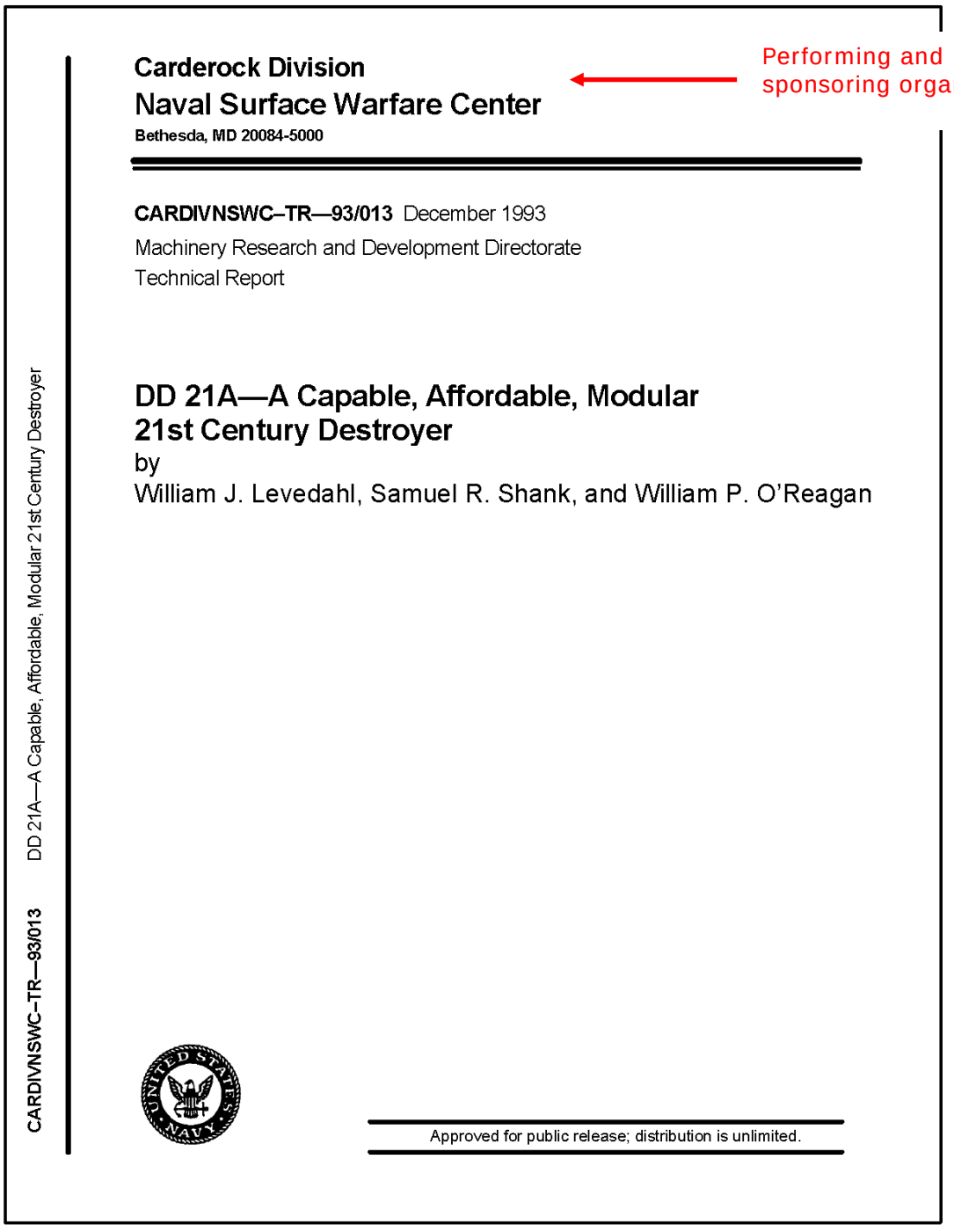

Figure 2a: Sample cover page for which the performing and sponsoring organizations are the same

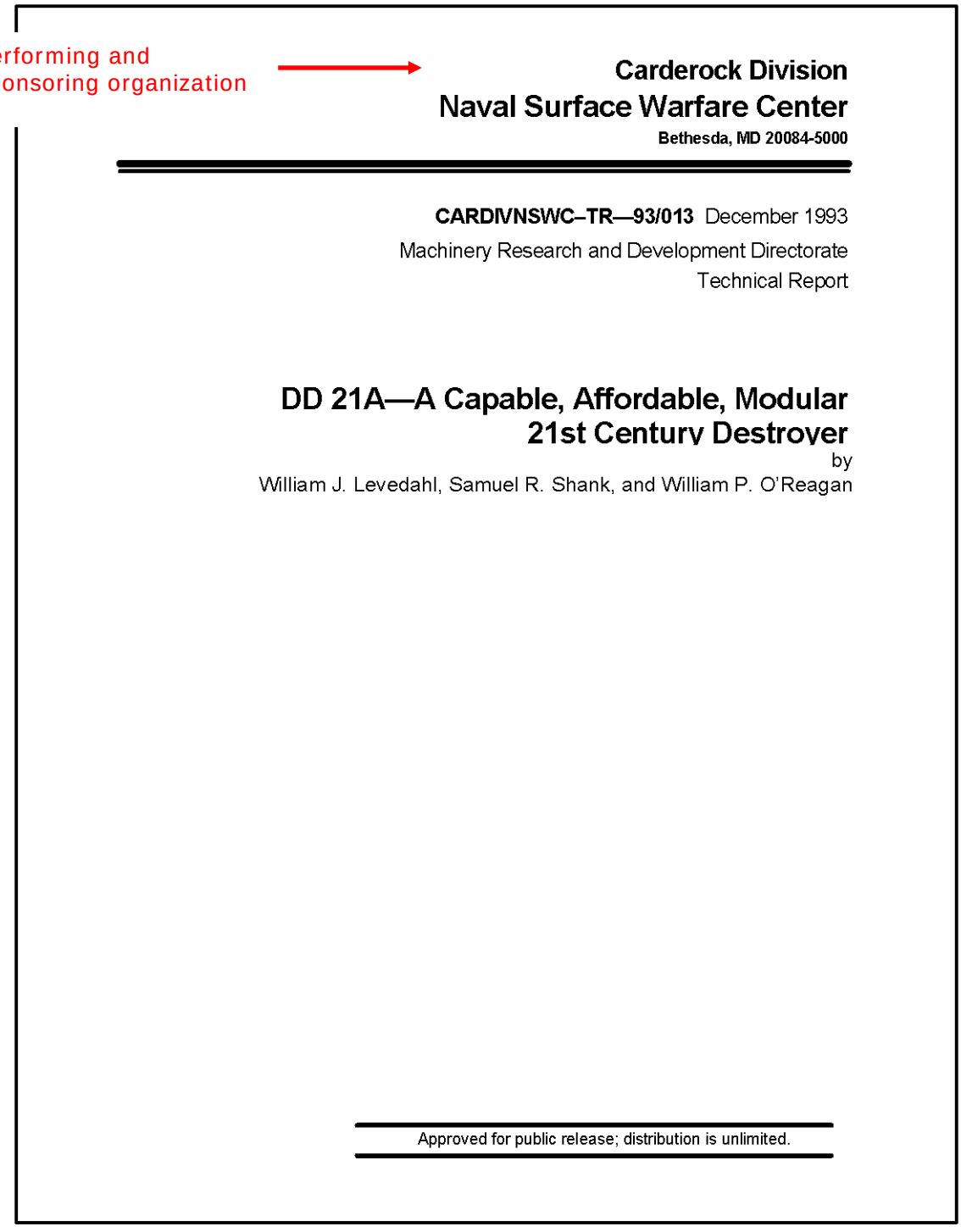

Figure 2b: Sample title page for which the performing and sponsoring organizations are the same

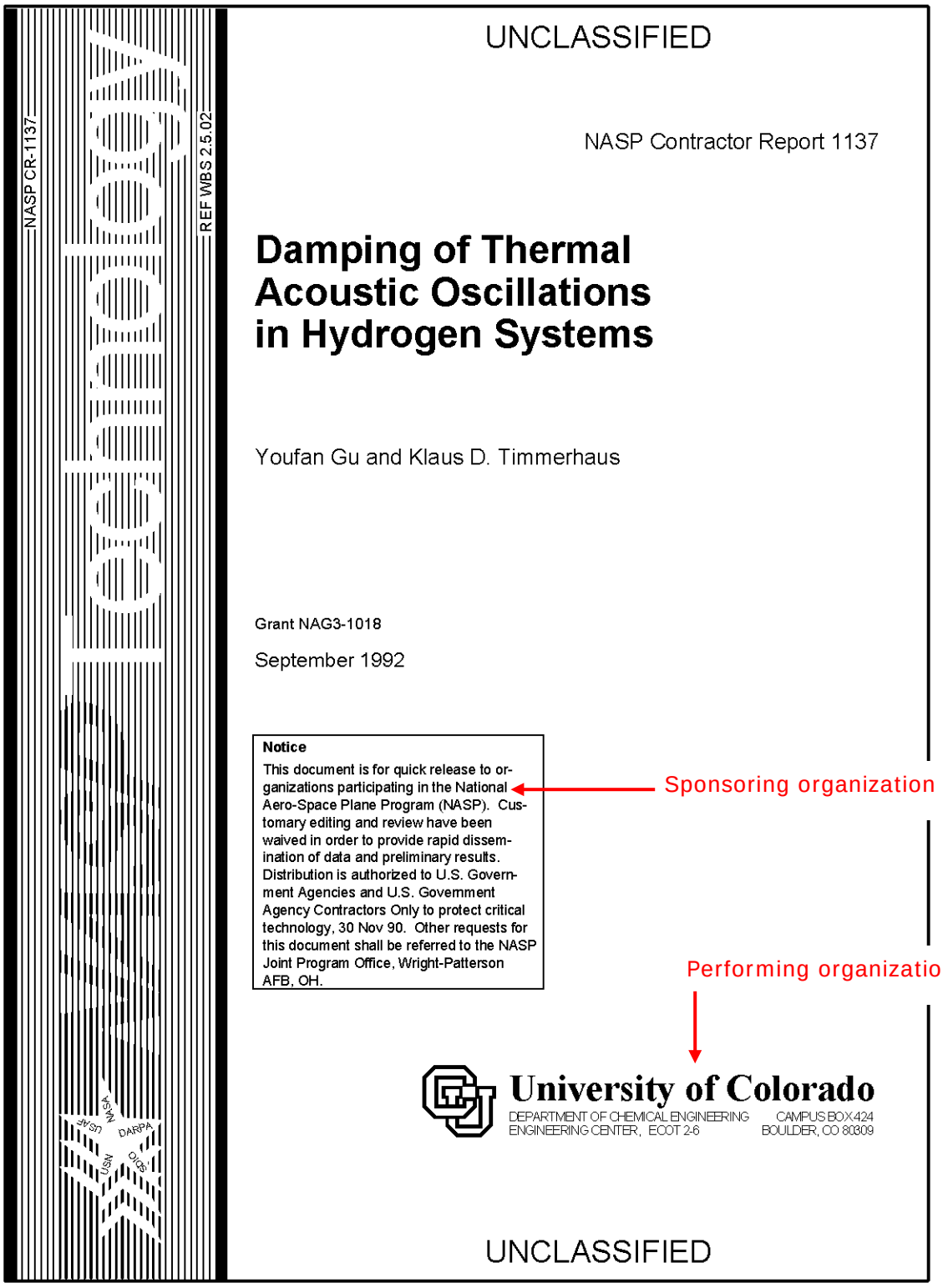

Figure 3a: Sample cover for which the performing and sponsoring organizations are different

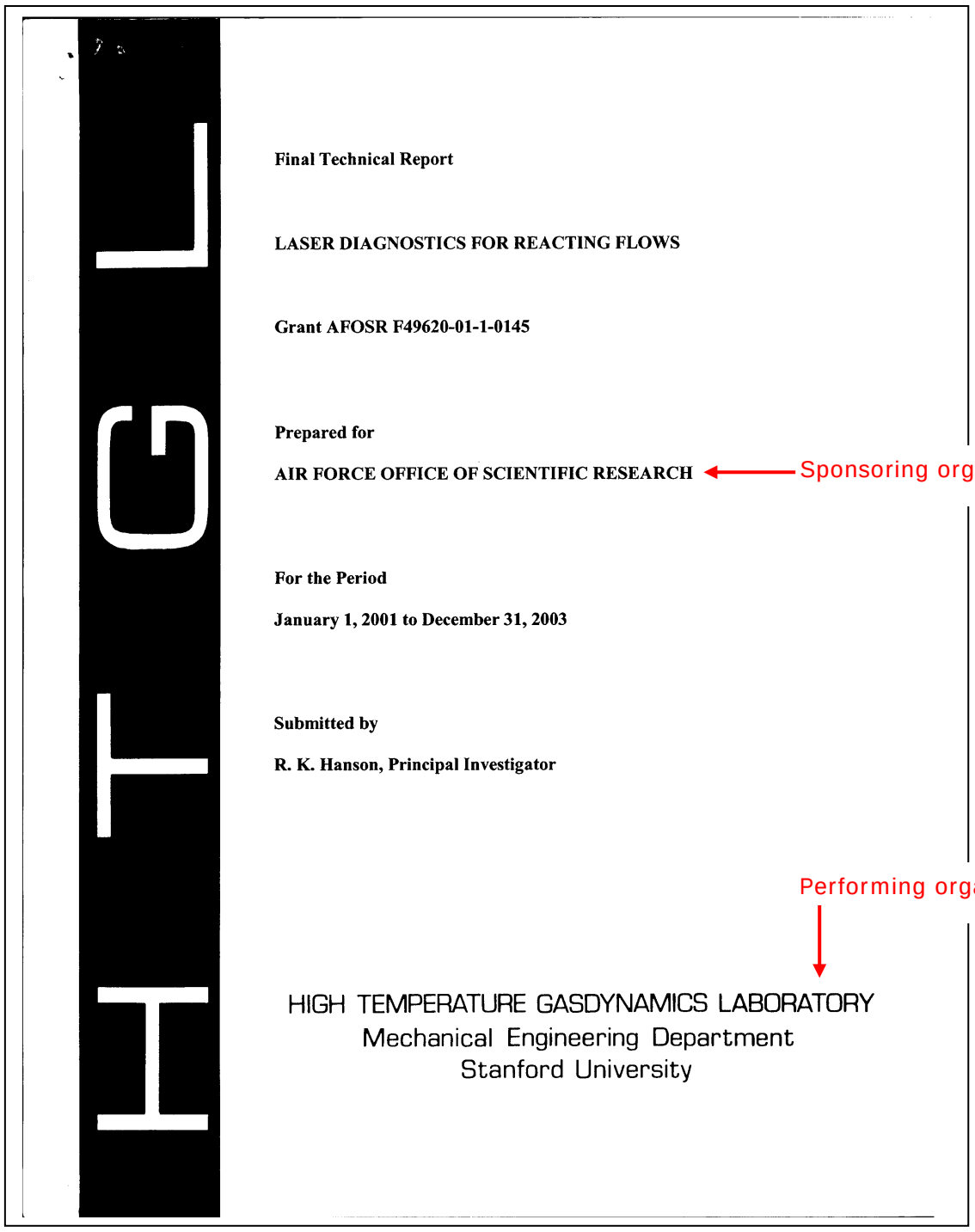

Figure 3b: Sample title page for which the performing and sponsoring organizations are different

5.1.2.1 Report Number

Each report requires a report number unique within the organization that appears in a consistent location for each document in a series. A report number is composed of an alphanumeric report code (2-16 characters) and, if desired, a numeric sequential group (1-14 digits indicating the year and sequence of report issuance). Different sponsoring and performing organizations usually assign separate report numbers; so a report may have multiple numbers. These numbers should appear together in a prominent location in the front matter. ANSI/NISO Z39.23-1997 (R2002), *Standard Technical Report Number (STRN) Format and Creation,* provides guidance on establishing and using standard scientific and technical report numbers.

5.1.2.2 Title and Subtitle

The title is especially important in abstracting, cataloging, indexing, and referencing a report and for informing potential readers of the content. A subtitle may be added to further define the contents. The words of the title and subtitle define and limit the topic of the report and appear on the cover, title section, and optional Report Documentation Page, using exactly the same wording. In creating the title of a report, a creator using best practices:

- selects words that distinguish the report from any other on the same general topic rather than writing, “Report on…”
- uses a distinctive subtitle for clarity if the report is one in a series or a supplement to previously published work (information about the period covered—for example, month, quarter, or year—may be included in the subtitle of reports in series); and
- spells out abbreviations and acronyms.

When a report consists of more than one volume (or binding), the title is repeated in a separate title section, and each separate volume is identified by an Arabic number and a volume title or subtitle.

Example:

Interstellar and Interplanetary Dust
Volume 2: Supernova Isotopic Enrichments

5.1.2.3 Author(s) / Creator(s)

The author/creator of a report is reserved for the person or persons responsible for originating the scientific or technical information or the text of the report and who can effectively defend the content of the report to a peer group. The primary author/creator is always identified first. Identifying an editor is justified when the editor has applied subject matter expertise in preparing the report.

An author’s/creator’s name appears on the cover (see 5.1.1) and title section (see 5.1.2) and, if used, the Report Documentation Page in identical form. The preferred order is first name, middle name or initial, surname. Academic degrees are not given. However, authors/creators or contributors can identify themselves by their job titles in the organization (Jane R. Doe, Cost Analyst; Jack T. Doe, Head, Research and Development Division) or by their functions as contributors (Jane R. Doe, Principal Investigator; Jack T. Doe, Compiler). If these titles are used, they should be used consistently within an organization or series. In cases of multiple authors/creators from different organizations, the names appear with their organizational affiliations.

5.1.2.4 Performing and Sponsoring Organizations

The performing organization conducts research; the sponsoring organization funds research and usually, but not always, controls report publication and distribution. The performing and sponsoring organization may be the same. Reports that present the results of research done under contracts or grants identify both a performing and a sponsoring organization if different. In such cases, the name of the sponsoring organization, the performing organization (or other responsible units), and the complete address(es) appear on the title section. If there are multiple sponsoring organizations, each is listed and the functions of each are identified.

5.1.3 Notice of Distribution/Access Restrictions

5.1.3.1 Copyright

Some organizations may opt to use a traditional copyright page common within the publishing industry. The copyright section may include the following information, if available:

- The complete name of the sponsoring organization, including the contract number authorizing the research, and/or any organizations providing funding for the report
- Library of Congress Cataloging-in-Publication (CIP) Data
- An ISBN and/or ISSN
- The country in which the report was produced
- Permission for use of proprietary information, such as photo credits
- The mission statement of the producer, trademark information, and any disclaimers from the producer
- A copyright symbol, year, and the name of the copyright holder
- Authority to copy the contents or require permission from the producer prior to copying. While federal government publications may be freely copied by the public, a request for permission allows the publisher to track the uses of the report.
- The name, complete address, and phone number of the producer and how additional copies of the report may be obtained; a Web or email address, or both, may be included. Copyrights on reports are not always formally registered; material prepared for the U.S. Government is usually available for public dissemination without copyright.

The order of appearance is not important so long as all elements appear. The recommended location is the verso (back) of the title page. If these elements are included on the copyright page, it is at the discretion of the publisher if they are included in other sections of the front matter.

5.1.3.2 Distribution Limitations / Notices

When necessary to call attention to certain aspects of a report, such as its security classification, restricted distribution, or proprietary information, appropriate notices appear on the cover and title section. For example, a notice may alert the reader that a particular report is:

- a presentation of preliminary findings subject to revisions, or
- a formal draft or a working paper intended to elicit comments and ideas.

If disclaimers or similar notices are needed, they appear on the inside front cover or the optional copyright page that follows the title page of a printed report. Notices may also alert the reader to certain legal conditions, for example, using brand or trade names in the report.

Generic terms are preferable to brand or trade names if scientific and technical accuracy can be maintained in using them.

A disclaimer may or may not be appropriate for government-generated reports. It is the responsibility of each organization to determine the appropriate notice for the reports it produces and to coordinate these decisions with the appropriate legal counsel. Government classified material will have specific regulations; producers should follow the regulations applicable to their government agency.

Figure 4 shows a sample cover with a notice of restricted distribution. Figure 5 illustrates a cover with no distribution restrictions.

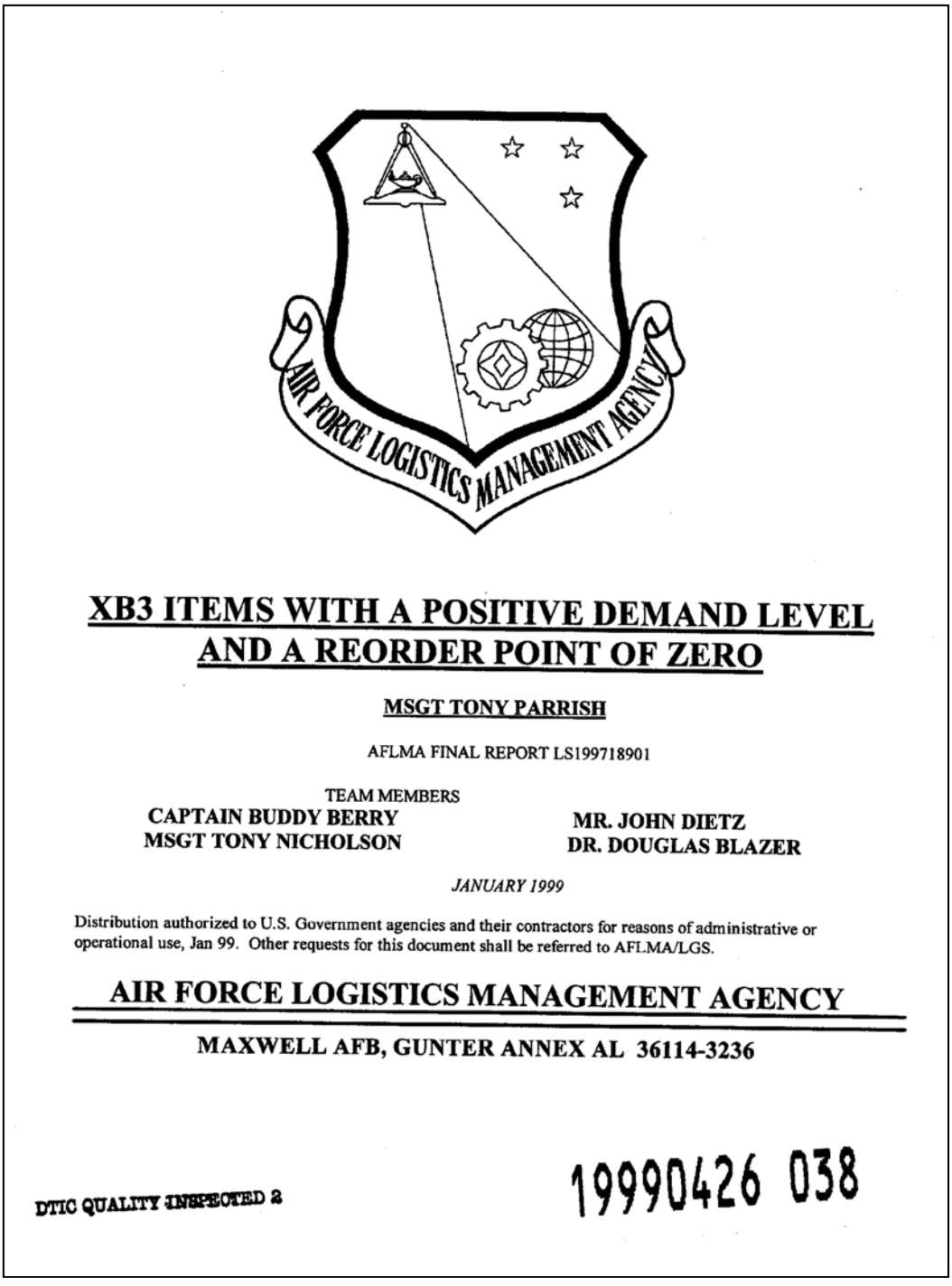

Figure 4: Sample page with a notice of restricted distribution

AFRL-VA-WP-TP-2003-315

UAV TASK ASSIGNMENT WITH TIMING CONSTRAINTS

Corey Schumacher
Phillip Chandler
Meir Pachter

JULY 2003

Approved for public release; distribution is unlimited.

AIR VEHICLES DIRECTORATE
AIR FORCE RESEARCH LABORATORY
AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OH 45433-7542

20030822 055

Figure 5: Sample page with no distribution restrictions

5.1.4 Format Information

Reports produced in digital format should provide easily-accessible metadata describing the programs used in producing the report. Creators of reports should also consider the original and on-going accessibility of items requiring unique or specialized hardware or software not normally used by their primary audience.

5.1.5 Report Documentation Page

Agencies within the federal government use a Report Documentation Page (e.g., a National Technical Information Service bibliographic data sheet or Standard Form 298) in addition to a title section. It is an optional component for academic and industrial reports.

Appendix E shows a sample Report Documentation Page containing all pertinent bibliographic data about the report (including keywords or identifiers) necessary for librarians, information specialists, and others concerned with information processing and handling. An abstract of 200 words or fewer is an integral part of this section. Some federal agencies require that reports prepared for them under contract or grant include a Report Documentation Page and specify its location. Academic and industrial report producers that use a report documentation page frequently place it as the final component of back matter. A Report Documentation Page is not listed in the table of contents unless it appears as back matter; however, it is paginated whether it appears as front or back matter. Instructions for completing a report documentation page appear in Appendix E of this Standard.

5.1.6 Abstract

An abstract, a required component, presents a concise (approximately 200 words, although the length may vary; there may be restrictions in some automated databases) informative statement of the purpose, scope, methods, and major findings of the report, including results, conclusions, and recommendations. The informative abstract retains the tone and scope of the report but omits the details. The abstract typically appears in a separate section between the title section and table of contents, although reports that use a Report Documentation Page include the abstract as bibliographic data entered on the form. Because abstracts are also published by abstracting services to assist potential readers in determining if they are interested in the report, an abstract is independent of the rest of the report. An abstract contains no undefined symbols, abbreviations, or acronyms and makes no reference to references or illustrative material. ANSI/NISO Z39.14-1997 (R2002), *Guidelines for Abstracts*, the standard for preparing informative abstracts, provides examples of abstracts as well as guidance on their presentation and style.

An executive summary (see 5.2.1) may be used as an alternative to an abstract and includes information similar to an abstract, but in slightly more detail. An executive summary should not exceed 10 pages, dependent on the length of the report.

5.1.7 Contents

The required contents section identifies the heading and location of, or link to, each major section of the front matter (excluding the title page and the contents section itself), the content, and the back matter. A contents section helps readers understand the organization and scope of a report. Headings in a table of contents are worded, spelled, punctuated, and numbered, if used, exactly as they are in the report. Creators should consider that page

numbers of digital items may not be static and alternate methods of efficient access may be needed. Figure 6 shows a sample contents section.

Contents

Figure 6: Sample table of contents section

It is useful to include a list of subheadings in the contents section at the beginning of each major report section that is more than 20 pages in length. Subheadings are also helpful for understanding complex material; however, not all levels of headings need to be listed in the contents section. First- and second-level headings may suffice. However, if any subheading of a given level is listed in the table of contents, all subheadings of that level must be included. (See also 6.4, *Designation,* for an explanation of page numbering.) Organizations may opt for a variation in the order of the table of contents. For instance, a preface may follow the title page to set the context of the report and precede the table on contents.

5.1.8 List(s) of Figures and Tables

If a report contains more than five figures or tables, or some combination totaling more than five, a list of figures and/or tables is required. If a report contains fewer than five figures or tables, a list is optional. Figures and tables in the table of contents are numbered, worded, spelled, and punctuated exactly as they are in the report. The lists of figures and tables, titled “Figures” and “Tables,” respectively, follow the contents section. If the table of contents fills only half a page, the lists of figures and tables may follow the table of contents on the same

page. If lists of figures and tables are included in a report, all figures and tables are listed with their corresponding locations. A list of figures precedes a list of tables. If a report has many figures and few tables or few figures and many tables, they can be combined into a single list ("Figures and Tables") with figures preceding tables.

5.1.9 Foreword

The foreword is a conditional introductory statement that presents background material or places in context a report that is part of a series. It is written by an authority in the field other than the creator of the report. The name and affiliation of the creator of the foreword follow the last paragraph. A foreword and a preface are not interchangeable, and the information in them is not redundant. If both are included, the foreword precedes the preface.

5.1.10 Preface

A preface is a conditional introductory statement that announces the purpose and scope of the report and acknowledges the contributions of individuals not identified as authors/creators or editors. Sometimes a preface specifies the audience for which a report is intended; it may also highlight the relationship of the report to a specific project or program. Material that is necessary for understanding the report belongs in the introduction not the preface.

A preface is usually written by the author/creator, editor, or other party responsible for the report. The name and affiliation do not appear at the end of the preface unless there might be doubt about its authorship. The preface follows the lists of figures and tables and optional foreword and begins a separate section titled "Preface."

5.1.11 Acknowledgments

Acknowledgments of technical assistance that contributed to the content of the report are made at an appropriate place in the preface or in the text; however, lengthy acknowledgments are often made in a conditional section titled "Acknowledgments." This section follows the preface, in which case the preface does not contain acknowledgments. If there is no preface, "Acknowledgments" follows the contents section (or list(s) of figures and tables and foreword).

5.2 Body Matter

The body is the part of the report in which the creator describes methods, assumptions, and procedures, then presents and discusses the results and draws conclusions and recommends actions based on those results. The organization of a report depends on its subject matter and audience as well as its purpose. (See Appendix D for sample organizational models.) Thus, the organization of the content may vary widely and the organization of the report may be divided into sections or chapters. Information on the content follows.

5.2.1 Summary

A summary is a required component of a report. It clearly states the key points of the report—including the problem under investigation, the principal results and conclusions, and a recommended course of action for decision makers. The summary differs from the abstract (see 5.1.6) in purpose, audience, and length. Because the summary restates key points, material not included in the text does not appear in the summary. Introductory material

(purpose, scope, and organization), descriptive material (nature and method of investigation), and the most important results and conclusions are summarized, with emphasis on the findings of the research and recommendations.

Although a summary depends on the content in that it introduces no new information, it is independent from the user's point of view; therefore, all symbols, abbreviations, and acronyms are defined, and unusual terms are explained. A summary does not contain references or cross-references to other sections of the report.

If a print report exceeds 50 pages, a separate executive summary is often prepared for a management-level audience. An Executive Summary is a non-technical presentation that provides an adequate level of detail for decision makers needing a basic understanding of a research problem and the major findings but who do not plan to read the report in its entirety. Some Executive Summaries contain fiscal and political implications of the recommendations or results; such indications are frequently not a part of the report. Some organizations may opt to place the summary as the last component of the front matter instead of the first component of the text.

5.2.2 Introduction

The required introduction provides readers with general information they need to understand more detailed information in the rest of the report. It introduces the subject, purpose, scope, and way the author/creator plans to develop the topic. The introduction also indicates the audience for the report: who is expected to read it and act on its recommendations or review its findings (this information may also be included in the preface). The introduction does not, however, include findings, conclusions, or recommendations.

The statement of the subject defines the topic and associated terminology and may include the theory behind the subject, its historical background, its significance, and a review of pertinent literature. The statement of the purpose indicates the reason for the investigation; the statement of the scope indicates the extent and limits of the investigation. The author/creator's plan for developing the report usually presents a narrative outline of the body.

5.2.3 Methods, Assumptions, and Procedures

A description of the methods, assumptions, and procedures used in an investigation is a required component. A succinct explanation of them enables readers to evaluate the results without referring extensively to the references. The description should be complete enough that a knowledgeable reader could duplicate the procedures of the investigation. The system of measurement (for example, metric or English) is identified. If the research included apparatus, instruments, or reagents, a description of the apparatus, the design and precision of the instruments, and the nature of the reagents are explained in this required section of text. (See also 6.5, *Units and Numbers*.)

5.2.4 Results and Discussion

A required component of the report, results and their discussion can be presented in the same or in separate sections. The results section presents the findings based on the methods. The discussion section indicates the degree of accuracy and the significance of the results of the research described. Specific values used to substantiate conclusions appear in the body. Supporting details not essential to an understanding of the results appear in an appendix. Sometimes a section, "Presentation of Results," includes figures and tables and

their captions (titles). Such figures and tables appear as close as possible following their discussion in the text. The discussion accounts for the results but does not interpret them. (See also 6.2, *Visual and Tabular Matter*.)

5.2.5 Conclusions

The required conclusions section interprets findings that have been substantiated in the discussion of results and discusses their implications. The section introduces no new material other than remarks based on these findings. It includes the author's/creator's opinions and is written to be read independently of the text. The section could include a summary of the conclusions from similar studies, a conclusion based solely on the current results, or an overall conclusion. The following examples could be appropriate titles for this section:

- **Conclusions** – if deductions independent of specific conditions of the investigation are made
- **Restatement of Results** – if factual findings specific to the particular investigation are given
- **Concluding Remarks** – if opinions are included in addition to findings and conclusions

5.2.6 Recommendations

The conditional recommendations section presents a course of action based on the results and conclusions of the study. Types of studies for which recommendations are often made include tests and experiments, field trials, specific design problems, feasibility studies, and market appraisals. Recommendations might include additional areas for study, alternate design approaches, or production decisions. Specific recommendations are presented in a numbered or bulleted list that is introduced by an informative lead-in sentence. Recommendations may also be included within the conclusions section.

5.2.7 References

The conditional references section, if used, appears as the last section of the body and begins on a new page in print publications. This section may also be called "Sources," "Works Cited," or "Bibliography," depending on the nature of the referenced materials.

To help readers use and assess referenced materials, all references include the following elements: name of author(s)/creator(s), title of referenced work, and publication data or digital-access information. If a government document is referenced, the National Technical Information Service (NTIS) number is included, when available, to facilitate user access to the report.

References are prepared according to the accepted practice of the discipline of the primary author/creator of a report. (See also Appendix A.3, *Style Manuals and Guides*.) Three basic reference forms, each with its own advantage, are commonly used for reports. The number-identification system of citing material allows readers to locate references easily in a printed document. For this form, references are numbered consecutively with Arabic numbers in order of their first appearance in the text keyed to appropriate places in the text and fully identified in the successively numbered list of references.

In the second form of referencing, the author-date format, authors' names, and dates of publication or creation are cited in the text in parentheses and keyed to an alphabetically arranged list of references. The author-date style helps readers to associate facts and ideas with their originators and date of origin.

In the third form of referencing, publications may be noted in the context of a footnote, endnote, or referenced link within a report and the complete bibliographic reference, which can also include the title, author/creator, publisher, date, and location of the publisher, including specific page numbers with a document (for example, a journal article), may be included in the back matter in a bibliography.

If figures and tables are obtained from referenced material, the sources are identified in source or credit lines that are part of the figure(s) or table(s). A source or credit line contains adequate descriptive data to enable readers to verify the location of the original figure(s) or table(s). If the figure or table is used in its complete presentation (that is, both content and form), “Source” would be an appropriate lead-in to the citation. If either the content or form is modified, “Adapted from” would be appropriate lead-in wording. Such sources are not further identified in the list of references unless an additional reference to them appears in the text of the report. (See also 6.2, *Visual and Tabular Matter*.)

References may include information gathered from a Web page or site. Most citations of material from Internet sources should follow rules for journal articles.

Example:

Virillio, Paul, "Speed and Information: Cyberspace Alarm!" CTHEORY,
URL: http://www.freedonia.com/ctheory/, September 27, 1995.

The URL or other path information appears instead of the volume and number cited for a conventional journal. It is frequently useful to the reader to know the date when the material was accessed. In such cases, “Accessed [date]” would be appropriate wording.

Examples:

Bailey, C. W., "Electronic Serials and Related Topics: A Brief Discourse,"
message to multiple recipients of list VPIEJ-L (VPIEJ-L@VTVM1.BITNET), April 23, 1992.

Carlyle, Paul, "Do Electronic Journals Make Sense?" message distributed on Internet
by Paul Carlyle, RAND, June 1995 (e-mail carlyle@rand.org).

For other views on game theory, see Sadim Adan,
http://www.unkx.com/xxx.yyy, last modified September 19, 1995.
Accessed November 17, 1999.

5.3 Back Matter

The back matter supplements and clarifies the body of the report (for example, appendices), makes the body easier to use (for example, glossary, lists of symbols, abbreviations and acronyms, and index), and shows where additional information can be found (for example, bibliography). Some organizations consider the reference section to be part of the back matter; if the pages following the front matter are numbered sequentially, it is immaterial to the reader if the reference or bibliography section is part of the body or the back matter.

5.3.1 Appendices

Appendices contain information that supplements, clarifies, or supports the content. These conditional components of back matter also contain material that might otherwise interfere with an orderly presentation of ideas in the body. Placing detailed explanations, supporting data, or long mathematical analyses in appendices shortens the text and makes it easier to

read. However, information essential to the purpose of the report should appear in the text. For example, in a report about a new mathematical analysis, the detailed derivation of equations belongs in the text, while other subjects, such as those that follow, appear in appendices:

- Detailed explanations and descriptions of test techniques and apparatus
- Content of other documents (for example, standard test procedures, laws, and management instructions)
- Extensive data in the form of figures or tables
- Computer listings of programs, input, and output
- Mathematical analyses

Other components of back matter (for example, bibliographies) do not appear in appendices.

Appendices usually follow the references or last section of the text. For print publications, each appendix begins on a new, right-hand page and has a title that appears below the appendix designation.

Example:

Appendix B
Complementary Energy Principle

Each appendix is referred to in the text. If the report contains more than one appendix, each is identified with a capital letter (Appendix A, Appendix B, etc.) in the order mentioned in the report. A single appendix is labeled, “Appendix.” Similar items may be combined to avoid creating unnecessary appendices. For example, several sample forms can be combined in a single appendix and labeled “Sample Forms” rather than each being identified as a separate appendix.

Although figures and tables are best integrated into the text following their initial mention, figures, tables, or other graphics of secondary importance that provide back-up data should be combined into an appendix. In appendices, figures precede tables, with both groups arranged in numerical sequence.

5.3.2 Bibliography

A conditional section, a bibliography lists additional sources of information not referenced in the text. If a bibliography is included in addition to the list of references (part of the text), the bibliography follows the appendix(es). A bibliography is unnecessary if the references in the text constitute a complete list of sources of information. Bibliographic entries are usually arranged alphabetically by author/creator, but any logical order may be used if it is explained and is consistent. In print publications (or electronic reports that maintain the "page" look and feel), the bibliography section begins on a new page and is titled, “Bibliography.”

5.3.3 List(s) of Symbols, Abbreviations, and Acronyms

If there are numerous symbols, abbreviations, and acronyms in a report (more than five that are not readily recognized as standard in the field), or if there is a chance that readers will not understand them, a report requires a list of all symbols, abbreviations, and acronyms with an explanation of each. The list of symbols, abbreviations, and acronyms begins on a new page in print publications. (See also 6.9, *Symbols, Abbreviations, and Acronyms*.) Some

organizations may include this section as part of the front matter to ensure that the reader is quickly aware of its existence.

5.3.4 Glossary

A conditional section, the glossary is a list of terms defined and explained to facilitate a reader's comprehension of the report when numerous terms requiring definition are used. The glossary is part of the back matter, and glossary terms may also be defined at their first mention. Glossary terms are arranged in alphabetical order with each on a separate line followed by its definition. The glossary section, titled "Glossary," begins on a new page in print publications. Some organizations may include this section as part of the front matter to ensure that the reader is quickly aware of its existence.

5.3.5 Index

An index is an alphabetical listing of all major topics discussed in a report. An index is optional in short reports (fewer than 50 print pages), but reports of 50 pages or more usually contain one to help readers locate specific information. An index entry cites the page or location where the topic can be found, affording readers quick reference on a particular topic. An index may identify and locate information, indicate its nature and scope, identify related entries, and clarify relationships between entries. The arrangement and level of detail of the index are determined by the structure of the report, its target audience, and its anticipated uses.

The most common type of index for a report is the subject index in which subjects are presented alphabetically. Other types of indexes (for example, name index, number, and code index) may also be used. They are placed before the subject index in the back matter.

In preparing an index, the number and kind of access points (entry locations) and the information level of indexable matter (for example, abstract or concrete) are determined. Each index entry has a heading (first element) and a locator (page, section number, or linking information) where information about the entry is found. Terms used as report headings are included in the index. The index contains all terms likely to be sought by the intended audience.

5.3.6 Distribution List

If included, the distribution list follows the index (or glossary, if there is no index). The list indicates the complete mailing address of the individuals and organizations receiving copies of the report and the number of copies received. The Privacy Act of 1974 forbids federal agencies from listing the names and home addresses of individuals, so in a government report a distribution list contains business addresses only. Distribution lists provide a permanent record of initial distribution. In the case of classified reports, restricted-distribution reports, and reports containing proprietary data, such lists are extremely valuable as they can be used later for communicating instructions regarding handling and classification downgrading. A distribution list is also useful if errata are discovered and changes are issued to correct a report. (See also 6.12, *Errata*.)

6 Presentation and Display

This section discusses standard methods for ensuring consistency in presentation: designing visual and tabular matter; formatting; presenting units, numbers, formulas, and equations; incorporating footnotes, endnotes, references, and bibliographic entries; preparing lists of symbols, abbreviations, and acronyms; formatting glossaries and indexes; and correcting errata after publication. Within each subsection, a distinction is made between rules applicable to all reports regardless of mode of publication (e.g., paper, CD-ROM, or Web) and rules applicable to reports published in paper form.

6.1 Subordination

6.1.1 General

Indicate subordination of ideas by using headings and subheadings to divide the report into manageable sections, call attention to main topics, and signal changes in topics. Most reports require no more than five levels of headings.

Consistency of presentation is important in showing subordinate relationships. Many reports use a decimal numbering system to show relationships and to simplify extensive cross-referencing. An alternate format for subordination uses a progression of fonts. Indicate headings and subheadings by bold font with initial capital letters for principal words. Indicate primary headings by using a larger font than that used for non-primary headings. Align primary and secondary headings flush with the left column of text and run in other headings with indented text.

6.1.2 Print-Specific Guidelines

Begin each major section on a new page.

6.1.3 Non-Print-Specific

In the digital environment, delineate sections in a way that is easy to understand and access, with full links included as required.

6.2 Visual and Tabular Matter

6.2.1 General

Many of the data in reports are presented in figures and tables as well as in the text. Figures provide visual representations in the form of graphs, line drawings, diagrams, photographs, etc. Tables arrange large amounts of quantitative data in an ordered space. Follow these guidelines to ensure that figures and tables are effectively integrated with the text of a report:

- Mention each figure and/or table in the text.
- Locate each figure or table near, but never before, its first mention in the text of print reports. Provide an interior link between the mention of a figure or table and its place in a digital document if not on the same screen as the text.
- If a figure or table is central to the comprehension of the text, include it in the text. If

figures or tables provide only supplementary information, place them in an appendix (see also 5.3.1). Mention any material in an appendix in the text; otherwise it lacks context.

- Ensure that the amount of text discussion associated with each figure or table adequately reflects its importance to the report, the level of complexity of the information illustrated or tabulated, and the level of knowledge of anticipated readers. Figure legends can be used to provide further explanation.
- Number figures in the text with consecutive Arabic numbers (for example, Figure 1, Figure 2). Number those pertaining only to appendices consecutively for each appendix (for example, Figure A1, Figure A2, Figure B1). Number tables consecutively and independently of figures, with Arabic numbers (for example, Table 1, Table 2,…Table 8). If an appendix contains its own tables in addition to tables in the text, identify and number the appendix tables consecutively after the text tables (for example, Table 22, Appendix Table A1). If there is more than one appendix, begin table numbers again in each (for example, Table A1, Table A2, Table B1, Table B2).
- Provide a descriptive title for figures and tables to aid in comprehension and to be used in the front matter list of figures and tables.

6.2.1.1 Print-Specific Guidelines

Adopt vertical rather than horizontal orientation for figures and tables so they can be viewed without turning a printed page sideways. If possible, redesign oversized figures or tables that fold in to fit a standard 8-1/2 x 11-inch page with vertical orientation. If a figure or table cannot be redesigned to fit on a page vertically, turn the image counterclockwise to fit the page. If a figure or table cannot be reduced to fit a standard page, redesign it to fit two facing pages.

6.2.1.2 Non-Print-Specific

If possible, format visual material so it can be viewed on a single screen at normal resolution, taking into consideration the variations found in viewing items on the Web through different browsers.

6.2.2 Figures

Figures (for example, graphs and charts, diagrams, photographs, schematic drawings, etc.) play a significant role in presenting and clarifying technical ideas. (See also Appendix A.7, *Graphic Arts*.) Normally, a figure should emphasize one main idea and show no more than is necessary. Figures should have informative titles (captions) that summarize the figure and, as needed, callouts that clearly and concisely identify each part. The figure number and title should appear below the figure. The title describes the content without giving background information, results, or comments about the figure. The placement and alignment of callouts should be consistent within the report. Callouts are best placed horizontally and unboxed, and straight lines (leaders) connect callouts to the part(s) identified in a figure. Any symbols, abbreviations, or acronyms that appear in figures or tables but not in the text should be explained in a key or defined in a caption. Identify footnotes to figures independently of text footnotes using superscript, lowercase letters beginning with “a” in each figure. If using lowercase letters leads to ambiguity, as with chemical or mathematical formulas, use a sequence of symbols (*, †, ‡, §, ||, #, **, etc.). The type of figure used depends on the type of information being presented: graphs show relationships among data; diagrams portray relationships among components; photographs realistically depict general appearance; and drawings emphasize essential elements and omit unnecessary details.

The purpose of a figure, its reproducibility, and convenience of location for report readers are factors in preparation. Line art, original photographs, and digital image files are preferable for

reproduction. Color is often necessary for comprehension. If not, its use should be carefully considered because of limited reproducibility as well as cost. Figure 7 shows an example of color substitutes: screens, crosshatching, patterned lines or similar techniques are effective substitutes for color.

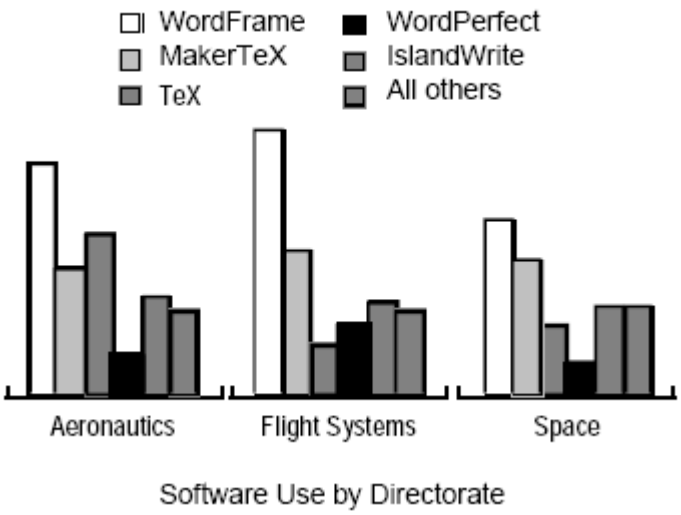

Figure 7: Example of graphic devices used as color substitutes

Gauge graphic techniques to viewing capabilities. Choose symbols, letters, and lines that are legible at the lowest likely resolution used by readers. Position letters and numbers on graphs and charts so they can be easily read from the bottom and right-hand side of the graphical representation. When graphs represent trend curves, place tick marks along the axes to indicate the required degree of approximation. If highly accurate readings are needed, use grid lines (or, better, use a table). Crop and size photographs to show only significant details. To ensure legibility, the minimum acceptable line weight for drawings is 8 points (3 mm). Do not use graphic devices such as borders, frames, title blocks, and background tones unless their use significantly improves clarity.

6.2.3 Tables

6.2.3.1 General

Tables present detailed facts or statistics concisely in row-and-column format. A formal table has a table number and title placed above the data. The title describes the content without giving background information, results, or comments about the table. The first principle words of the title should reflect the content of the first column. The row head and column heads identify the tabulated data that appear in the body or cells of the table.

Identify footnotes to tables independently of text footnotes using superscript, lowercase letters beginning with “a” in each table. If using lowercase letters leads to ambiguity, as with chemical or mathematical formulas, use a sequence of symbols (*, †, ‡, §, ||, #, **, etc.). Assign footnote letters in left-to-right and top-to-bottom order; place footnotes below the bottom line of the table. If a table or data in a table was obtained from a reference source,

include a source line that identifies the reference. (See also 5.2.7, *References*.) Figure 8 shows the parts of a table.

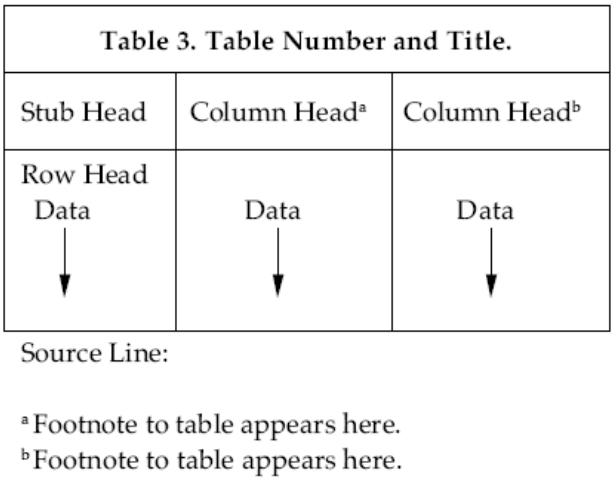

Figure 8: Nomenclature for the parts of a table

Indicate units of measurement in the table title, the column heads, or in a note. If presented in the column heads, place units and symbols in parentheses and do not repeat them in the columns. If data are unavailable for a particular cell, use a dash to fill the vacancy.

Use horizontal rules to separate a table from the title and row heading and column heads from the body of the table. Use vertical rules to separate columns if needed to ease reading/viewing of tabular material.

6.2.3.2 Print-Specific Guidelines

To enable print presentation of tables with multiple columns, it may be necessary to continue tabular columns on successive pages. If adopting this approach, repeat the table number and title, row head, and column head and note the continuation. Do not carry a table over unless at least two rows or columns will be included. Do not display a row across more than one page.

6.2.3.3 Non-Print-Specific

Format tables so they can be viewed on a single screen at normal resolution, taking into consideration the variations found in viewing items on the Web through different browsers.

6.3 Presentation Format

The physical appearance of a report, both text and graphics, constitutes format. The goal of any format is to enhance readability and comprehension by providing visual uniformity and a consistent subordination of ideas. Decisions about report formats should be based on principles of graphic design, keeping in mind format choices may be limited by contract specifications, in-house requirements, or the equipment used for publication or display. (See also Appendix A.7, *Graphic Arts*.)

6.3.1 General

6.3.1.1 Line Length

Ragged right margins make reading easier. Avoid excessively ragged right margins by using a standard and a minimum line length. The minimum line length is 2 to 3 12-point characters (8 to 13 mm) shorter than the standard line length. A line ends with the word falling nearest the standard length, but does not exceed the standard length by more than two characters. For example, a single column of text intended for continuous reading (as opposed to reference material) may be presented in standard lines equivalent to 40 to 43 picas (169 to 182 mm) wide. To minimize ragged right margins, a recommended minimum line length is equivalent to 38 picas (161 mm). If a report is presented in double-column format, the image area includes the space necessary to separate the columns, 1 to 2 12-point characters (4 to 8 mm). A recommended minimum line length for double columns is 20 12-point characters (85 mm) per column with 2 additional 12-point characters (8 mm) between each column, a total of 42 12-point characters (178 mm).

6.3.1.2 Font Choice

A font size and style should be clearly legible.

For report text, including mathematical notations, a 10- or 12-point (4- or 5-mm) serif font is the most comfortable font for readers. Smaller sizes can be used for non-text matter (for example, footnotes and indexes); however, 8 points (3 mm) is the smallest acceptable size for non-text matter.

The availability and appearance of specialized characters for symbols, formulas, and equations are important considerations in selecting a font.

6.3.2 Print-Specific

6.3.2.1 Image Area

The space allotted on a page or screen for textual, visual, or tabular matter is the image area. Observing a standard image area ensures the information on a page will not be lost during printing and binding. The normal image area on U.S. standard paper that is 8-1/2 by 11 inches (216 by 279 mm) is 7-1/8 by 9-3/16 inches (182 by 233 mm) or, in type-setting terminology, 43 by 55 picas. The image area includes headers and footers, if used, and page numbers. For lead pages (for example, stand-alone material, such as the foreword or table of contents, and the first page of a chapter) subtract 1 inch (25 mm) from the top of the image area.

6.3.2.2 Margins

Margins set off the image area, which includes headers and footers. Although they are proportional, margins are not equal on all sides. By printing convention, the top margin is the narrowest, usually 1 inch (25 mm), and the outer margin is wider. The bottom margin is wider than both top and outer margins. To accommodate binding, the inner or gutter margin is the widest. The default margins for most word processing software observe these printing conventions.

6.3.2.3 Paper and Ink

Use U.S. standard size (8-1/2 by 11 inches (216 by 279 mm)) acid-free paper to produce paper copies of scientific and technical reports. Color, smoothness, and weight are factors in selecting paper. Type is most easily read against an off-white, uncoated stock; however, halftone illustrations (photographs) printed on coated paper are superior to those printed on uncoated. To ensure legibility and reproducibility, use black ink.

6.3.2.4 Printing Equipment

A laser or laser-quality printer with a minimum 300-dpi (dots per inch) resolution produces acceptable camera-ready copy for text and line work. If photographs or high-resolution graphics are included electronically in a report, use a printer with 600-dpi or higher resolution to print them.

6.4 Designation

6.4.1 General

For ease of use and reference, delimit and uniquely identify segments of a report. For traditional paper reports, the segments are usually pages. For reports published in digital form, they may be pages, but are more likely to be paragraphs or screens.

Once the segments of a report have been determined, use consecutive Arabic numbers to designate them. When reproducing appendix information from another source, retain the designation of the original source in addition to designation for inclusion in the appendix. If a report is divided into sections or chapters because of its length or scope, number the text, exclusive of front matter and back matter, sequentially from one part to the next.

6.4.2 Print-Specific

Place page numbers in the same place on each page (for example, bottom right) or in a consistent place on mirror-image pages (for example, upper outer corner). Do not place hyphens, parentheses, or other punctuation marks around page numbers.

Number front matter with consecutive lowercase roman numerals. Do not show page numbers on the cover or title page, but consider the title page as page i. Begin a table of contents on a new odd-numbered right-hand page.

Begin the text of each volume of a multivolume report on a new page 1.

The structure and nature of a report govern the optional use of headers and footers in the text. Do not place headers and footers on lead pages, on the first page of the table of contents, or in the preface. Use running headers to help locate information in long, complex reports.

When running headers appear on right-hand pages, use the last text heading on the page as the header. When running headers appear on left-hand pages, use the first text heading to appear as the header. If using section titles as headings, use them as running headers throughout the section. Running headers used for a section of notes in the back matter should show inclusive page numbers where the relevant references are found (for example, Notes to Pages 23-31).

6.5 Units and Numbers

Present standard units of measurement clearly, concisely, and consistently in reports. The preferred standard for units is the International System of Units (SI). If another system is used, the corresponding SI units may appear in parentheses. If two systems of measurement are used, indicate the systems in the “Methods, Assumptions, and Procedures” section and in a statement at the beginning of the list of symbols, abbreviations, and acronyms. (See also 5.2.3, *Methods, Assumptions, and Procedures*.)

Abbreviate units used with specific numbers (for example, 3.7 m) except where a potential exists for misinterpretation; otherwise, spell out units. For SI units derived from proper names, show the symbols in initial capital letters (for example, Hz and N); use lowercase letters for units that are spelled out (for example, hertz and newtons). Write SI symbols in singular form; IEEE/ASTM SI-10-2002, *American National Standard for Use of the International System of Units (SI): The Modern Metric System*, provides detailed information on using SI symbols and units.

Always use Arabic numbers to express units of measurement and time in mathematical expressions, decimals, percentages, and proportions. For other expressions, the following apply:

- If a sentence contains only one number and it is greater than nine, indicate it as a numeral; if a number is nine or less, spell it out.
- Always spell out a number at the beginning of a sentence.
- Use numerals for a group of two or more numbers if one of them is 10 or greater (for example, a capacitor having 3 leads, 2 pairs of controls, and 12 settings).
- The same guidelines apply to ordinal numbers, but treat ordinals and cardinals separately if they appear together (for example, the 5th and 14th groups, containing six and seven items, respectively).
- Use Arabic numbers for all numbering systems (page and section, table, figure, and reference numbers), except for roman-numeral pagination of front matter (for example, page iii).

6.6 Formulas and Equations

Present formulas and equations in sentence form and punctuate them for clarity and consistency; however, do not begin a sentence with a formula or equation.

Clarify complicated mathematical formulas and derivations by defining symbols below the formula or derivation or as is customary in the discipline, relating equations to one another and describing the physical reality represented by the mathematics. Chemical symbols need not be defined unless the author/creator chooses to do so for clarification. Use marginal notes to identify modifications of symbols (for example, prime marks) and to distinguish between the letter “O” and “0” (zero); the letter “l” and the number “1”; the letter “x” and the multiplication sign ($\times$). Clearly indicate superscripts and subscripts.

Include brief formulas and equations as part of the text if the formula or equation fits on one line. If a formula or equation is displayed set off from the text, center or indent it, depending on its length. For consistent presentation and cross-referencing in a report with extensive notation, display and number all equations. Italicize formulas and equations, whether included as part of the text or displayed.

Enclose equation numbers in parentheses at the right-hand margin with a minimum of 1/4 inch between the last term in the equation and the equation number. Place the equation number on the same line of a single-line equation and on the last line of a multi-line equation.

If a long formula or equation does not fit on a single line, break it before an operational sign (plus, minus, times, integral, etc.) or after an expression enclosed with parentheses, brackets, etc.

Use an extra line space between the lines when a formula or equation is carried over because of its length. A number of computer software packages supporting the presentation of equations automatically provide correct line spacing. An example of a multi-line equation split to fit on a page is shown in Figure 9.

$$\int_0^a \int_0^b E(\eta,\xi)\, N\!\not(\eta,\xi)\, d\eta\, d\xi$$
$$= -\left\{ \int_0^a \int_0^b \left[\frac{\partial F}{\partial \eta}\frac{\partial N\!\not}{\partial \eta} + \frac{\partial F}{\partial \xi}\frac{\partial N\!\not}{\partial \xi} - \tilde{K}_x M\left(\frac{\partial F}{\partial \eta}\frac{\partial N\!\not}{\partial \eta} + \frac{\partial F}{\partial \xi}\frac{\partial N\!\not}{\partial \xi} \right) - 3\tilde{K}_x\left(\frac{\partial M}{\partial \eta}\frac{\partial F}{\partial \eta} N\!\not \right) + \frac{\partial M}{\partial \xi}\frac{\partial F}{\partial \xi} N\!\not \right.\right.$$
$$+ K^2(3K_x - \tilde{K}_x^3)MFN\!\not + K^2(\tilde{K}_x^2 - 1)FN\!\not$$
$$\left.\left. - 3K^2\tilde{K}_x^2 MFN\!\not + K^2\tilde{K}_x^3 M^3 FN\!\not \right] d\eta\, d\xi \right\}$$

Figure 9: Sample multi-line equation with extra space before and after

Define chemical symbols if definition enhances their comprehension. Use close spacing for chemical symbols, numbers, or line bonds in a formula. Chemical equations may be run in or displayed set off from text. Use roman (English) type rather than italics to form chemical symbols. If displayed, they should be numbered in sequence, and the equation numbers placed to the right of the reaction. Number chemical equations consecutively and independently of mathematical equations.

If a chemical equation is too long to fit on one line, break it after the arrow. Align the first element of the runover line with the last element of the preceding line. Leave extra line spacing between the lowest part of the first line and the highest part of the next line. An example of a chemical equation broken after the arrow is shown in Figure 10:

$$Co(NH_3)_6^{3+} + 6H_3O^+ \rightleftharpoons$$
$$Co(H_2O)_6^{3+} + 6NH_4^+ \qquad K_c \simeq 10^{20}$$

Figure 10: Sample chemical equation spread over two lines

6.7 Footnotes or Endnotes

Include footnotes or endnotes in a report only to clarify information in the text; keep them as brief as possible. To avoid preparing footnotes or endnotes, incorporate material into the text by enclosing it in parentheses or placing it in a separate paragraph.

Use superscript Arabic numbers to key notes to the portion of the text they clarify. Number notes consecutively through the text; place footnotes at the bottom of the page on which each occurs and place endnotes at the end of the section of text they clarify. If a footnote runs longer than its page margin, complete the footnote at the bottom of the subsequent page, preceding any footnote(s) for that page. If a footnote clarifies tabular information, use a superscript sequence of lowercase letters or symbols to avoid confusion with text footnotes. (See also 6.2.3, *Tables*.)

6.8 References and Bibliographic Entries

Indent the first line of a reference and align subsequent lines flush with the left margin. Align entries in a bibliography flush left without paragraph indentation. If a bibliographic entry runs longer than a single line, uniformly indent subsequent runover lines. Alternatively, maintain a flush left placement and enter a blank line between bibliographic entries.

6.9 Symbols, Abbreviations, and Acronyms

6.9.1 General

Spell out symbols, abbreviations, and acronyms at their first use in the text to ensure that readers understand them. However, do not define standard mathematical notation, chemical symbols (unless needed for clarification; see: 6.6), and known abbreviations of measurement unless the potential exists for misinterpretation. Write out an acronym the first time it is used in the text, and include it in a list of symbols, abbreviations, and acronyms. Use symbols that are standard in the discipline of the report. Appendix A, *Selected Annotated Bibliograph*y, A.6, *Standards and Symbols*, includes standards for symbols used in many disciplines. If no standard has been established for a concept, consult related scientific or technical literature for a symbol in general use. When they occur in lists, present symbols, abbreviations, and acronyms in descending order, as follows:

- Numbers
- Roman (English) alphabet capital letters
- Roman (English) alphabet lowercase letters
- Greek alphabet capital letters
- Greek alphabet lowercase letters
- Subscripts
- Superscripts
- Special notes

If a symbol, abbreviation, or acronym has more than one definition, separate the explanations by a semicolon and explain each definition at its first use in the report.

6.9.2 Print-Specific

Display symbols, abbreviations, and acronyms and their definitions in two columns with the abbreviations and acronyms listed in alpha-numeric order and aligned with the left margin. Begin each entry on a new line, followed in the second column by its definition. Leave adequate space between the longest symbol, abbreviation, or acronym and its definition and align the rest of the entries in the list(s) accordingly.

6.10 Glossary Entries

Arrange glossary entries in alphabetical order and align them with the left margin. Uniformly indent subsequent lines or maintain flush left with the left margin and enter a blank line between glossary entries. Begin each definition with a capital letter and end it with a period.

6.11 Index Entries

6.11.1 General

Always use lower case unless an entry begins with a proper name; indent entries uniformly for each level of modification. Indent runover lines deeper than the deepest subentry.

6.11.2 Print-Specific

It is customary to arrange index entries on printed pages so they appear single-spaced in a two- or three-column format.

6.11.3 Non-Print-Specific

Best practice is to provide links between index terms and what they reference.

6.12 Errata

6.12.1 General

If errors severe enough to cause misunderstanding are discovered too late for correction prior to the distribution of a report, send an errata sheet or update that identifies the report and the error(s) to initial and subsequent recipients.

Identify an error in the text by line; identify an error in a formula or an equation by number and the correction noted. The following form is used for corrections:

Page	Reads	Should Read
37, line 5	cosine of the angle	sine of the angle

or

Paragraph	Reads	Should Read
5.12, line 2	cosine of the angle	sine of the angle

6.12.2 Print-Specific

For printed reports, insert the errata sheet immediately following the cover.

6.12.3 Non-Print-Specific

When errors are corrected in a digital environment, notice of the version being accessed should be included in the metadata.

Appendix A
Selected Annotated Bibliography

(This appendix is not part of ANSI/NISO Z39.18-2005, *Scientific and Technical Reports – Preparation, Presentation and Preservation*. It is included for information only.)

A.1. General

This annotated bibliography is intended to help authors and editors organize, design, and publish reports. The bibliography is extensive but not exhaustive. The absence of a particular publication is no reflection of its quality or usefulness. The list is simply a starting point for the user to begin to build a professional reference collection or consult a particular source to answer a question. Using a particular source depends on factors such as personal preference, subject matter, and the specific needs of the user.

The bibliography is divided into seven categories:

- A.2: Writing, usage, style, grammar, and English language dictionaries
- A.3: Style manuals and guides
- A.4: Specialized dictionaries, encyclopedias, and handbooks
- A.5: Technical writing materials
- A.6: Standards and symbols
- A.7: Library reference materials
- A.8: Graphic arts
- A.9: Typography and publication design

Reasonable attempts were made to identify and include the classic or standard sources for each category. Several sources and numerous individuals were consulted in compiling the bibliography. Each citation was verified for correctness, most recent edition, and availability. To the best of our knowledge, no out-of-print sources were included.

A.2. Writing, Usage, Style, Grammar, and English-Language Dictionaries

Barzun, Jacques, *Simple and Direct: A Rhetoric for Writers*, rev. ed., New York: Harper and Row, 1994.
A thorough discussion of faults in prose and their remedies. Proceeds from word choice through sequence and linkage, tone, meaning, structure, and revision.

Bernstein, Theodore M., *Bernstein's Reverse Dictionary*, 2nd ed., New York: Times Books, 1988.
Essential for the word-conscious reader and writer. Takes you from definition to word.

Bernstein, Theodore M., *The Careful Writer: A Modern Guide to English Usage*, New York: Atheneum, 1965.
An alphabetically arranged list of usages, good and bad, with a discussion of why they should be embraced, tolerated, or shunned. A guide for manuscript editors.

Bernstein, Theodore M., *Miss Thistlebottom's Hobgoblins: The Careful Writer's Guide to the Taboos, Bugbears, and Outmoded Rules of English Usage*, New York: Simon and Schuster, rev. ed., 1991.
A discussion of invalid and outmoded rules commonly applied to prose and usage. A guide for both writers and editors.

DeVries, Mary A., *The New American Dictionary of Abbreviations*, New York: Penguin Books, 1991.
Provides extensive coverage of standard abbreviations and their definitions.

Ebbitt, Wilma R. and David R. Ebbitt, *Index to English*, 8th ed., NY: Oxford University Press, 1990.
A comprehensive reference book that includes articles on grammar, parts of speech, sentence structure, diction, punctuation, mechanics, logic, rhetoric, and style. Arranged alphabetically.

Follett, Wilson, *Modern American Usage: A Guide*, revised by Erik Wensberg, New York: Hill and Wang, 1998.
A dictionary of usage containing essays on a number of questions of concern to authors and editors.

Fowler, H. W., *A Dictionary of Modern English Usage*, 2nd ed., revised by Ernest Gowers, New York: Greenwich House, 1991.
A classic work on English usage offering guidance to both writers and editors. There is a 3rd edition edited by R. W. Burchfield, *The New Fowler's Modern English Usage*, 3rd ed., Oxford: Clarendon Press, 1996.

Hodges, John C. and Cheryl Glenn, *Hodge 's Harbrace College Handbook*, 15th ed., NY: Heinle, 2003.
A standard college grammar book. A comprehensive, yet concise, summary of grammar and usage.

Keene, Michael L., and Katherine H. Adams, *Easy Access: with APA Update,* 3rd ed., New York: McGraw-Hill, 2002.
An excellent grammar handbook. Has sections on "Common Writing Problems" and "The Basics From A to Z." A handy reference to questions about grammar or word usage.

Mager, Nathan H., and Sylvia K. Mager, *Prentice-Hall Encyclopedic Dictionary of English Usage*, 2nd ed., Englewood Cliffs, N.J.: Prentice-Hall, 1992.
A combination dictionary, grammar guide, and style manual. Contains over 15,000 entries listed alphabetically and gives accepted rules, styles, and usage.

McArthur, Tom, Ed., *Concise Oxford Companion to the English Language*, New York, NY: Oxford University Press, 1998.
Short articles cover virtually every aspect of language such as grammar, literary terms, linguistics, rhetoric, style, sexist language, child language acquisition, and the history of the language. Covers the period from the Roman era to the 1990s.

O'Hare, Frank, and Robert Funk, *The Modern Writer's Handbook*, 5th ed., Boston: Allyn and Bacon, 2000.
Comprehensive in coverage. Includes a full treatment of writing and research processes; focused on user-friendly features to promote reader self-help in writing and revision.

Roget's International Thesaurus, 6th ed., revised by Robert L. Chapman, New York: HarperCollins, 2001.
A classic dictionary of synonyms that indexes relationships among words. A guide for word choice by authors and editors.

Strong, William, *English Matters!,* Danbury, Conn.: Grolier Educational, 2000.
A nontechnical resource for a variety of questions related to the English language. Presented in 10 (small) volumes. Introduces, defines, and discusses keywords and phrases relevant to the study of English. Arranged alphabetically. Includes spelling and vocabulary, grammar and usage, thinking skills, mechanics and punctuation, research, test-taking, and words commonly confused.

Strunk, William, Jr., and E. B. White, *The Elements of Style*, 4th ed., Boston: Allyn and Bacon, 1999.
A short classic offering practical advice on achieving a clear writing style. A good resource for both authors and editors.

Pickett, Joseph, ed., *The American Heritage Dictionary*, 4th ed., Boston: Houghton Mifflin, 2001.
A standard American dictionary that provides a thorough discussion of usage.

Trimmer, Joseph F., *Writing with a Purpose,* 14th ed., Boston: Houghton Mifflin, 2003.
A standard college writing book. Covers various elements of the writing process including planning, revising, paragraph development, sentence patterns, diction, and tone and style.

Truss, Lynne, *Eats, Shoots & Leaves: The Zero-Tolerance Approach to Punctuation*, New York: Gotham Books, 2004.

A sometimes hilarious book that definitively makes the case that punctuation matters and tells the reader how to ensure that he or she is doing the job properly.

Webster's 11th New Collegiate Dictionary, Springfield, Mass.: Merriam-Webster, 2003.

Prepared after the parent work, the collegiate represents the later thinking of the editors on the principles of word division and frequently departs from the divisions given in the unabridged version.

Webster's Third New International Dictionary of the English Language, Unabridged, Springfield, Mass.: Merriam-Webster, 1993.

A standard dictionary for the spelling of English words and a basic reference for any editorial office or library.

A.3. Style Manuals and Guides

Anderson, James D. *Guidelines for Indexes and Related Information Retrieval Devices*. Bethesda (MD): National Information Standards Organization; 1997. Report No: NISO TR02 1997. ISBN: 1-880124-36-X. Available from: http://www.niso.org/standards/resources/tr02.pdf

Cathcart, M. E., *STI Handbook: Guidelines for Producing, Using, and Managing Scientific and Technical Information in the Department of the Navy (A Handbook for Navy Scientists and Engineers on the Use of Scientific and Technical Information),* San Diego, Calif.: Office of Naval Technology, 1992.

Provides specific guidelines for U.S. Navy authors on preparing reports. Prepared for the Office of Naval Technology by the Naval Command, Control and Ocean Surveillance Center, RDT&E Division, San Diego, CA.

Huth, Edward J., Ed., *Council of Biology Editors, Scientific Style and Format*, 6th ed., New York: Cambridge University Press, 1994.

A style manual including sections on grammar, writing style, and indexing. Especially useful for authors of works in special fields of biology. Provides guidance on the treatment of mathematical and statistical information and abbreviations.

Dodd, Janet S., Ed. *The ACS Style Guide*. Washington, D.C.: American Chemical Society, 1997.

A comprehensive description of the scientific literature and its production, including its economic-legal nexus. Most importantly, a compendium of guides to editorial decisions involving a large array of the typographic expression of scientific concepts.

Hansen, Wallace R., Ed., *Suggestions to Authors of the Reports of the United States Geological Survey*, 7th ed., S/N 024-001-03010-1, Washington, D.C.: U.S. Government Printing Office, 1991.

A guide providing detailed information on specific geological expressions and references to works in the field. Contains a short grammar section.

Harvard Law Review et al., *The Bluebook: A Uniform System of Citation*, 17th ed., Cambridge, Mass.: The Harvard Law Review Association, 2000.

Provides guidance for legal writing. Gives citation form for cases, statutes, government documents, books, and other printed materials.

Howell, John Bruce, *Style Manuals of the English-Speaking World: A Guide*, Phoenix: Oryx Press, 1983.

Describes 231 style manuals and guides of over 5 pages in length. Divides them into general, subject (20 disciplines), manuals and styles related to disabled people, and guidelines on avoiding sexist language.

ISO Technical Committee ISO/TC 184, Industrial automation systems and integration, Subcommittee SC4, Industrial data, *SC4 Supplementary directives – Rules for the structure and drafting of SC4 standards for industrial data*, ISO TC184/SC4/SC4 N1217:2001(E), 2001-11-01. Available from: http://www.tc184-sc4.org/SC4_Open/SC4_Standards_Developers_Info/Files/SC4N1217.pdf

This document was developed to provide guidelines for the content, layout, and style for the standards developed by ISO TC184/SC4. Many of the recommendations are equally applicable to technical reports.

Li, Xia; and Nancy B. Crane, *Electronic Styles: A Guide to Citing Electronic Information*, Medford, N.J.: Information Today, 1996.

Presents basic forms for the kinds of information being cited and recommends the types of elements to be included and the order of their presentation. Covers citations of full-text and bibliographic databases, electronic conferences and bulletin board services, electronic mail, and computer programs. Generally follows APA style with some modifications.

National Information Standards Organization, *Bibliographic References*, ANSI/NISO Z39.29-2005, Bethesda, Maryland: NISO, 2005.

NISO standard providing rules, guidelines, and examples for the creation of bibliographic references to numerous types of print, audiovisual, and electronic materials, both published and unpublished, arranged in fifteen broad categories.

Rubens, Philip, Ed., *Science and Technical Writing: A Manual of Style*, 2nd ed., New York: Routledge, 2001.

A comprehensive style guide that covers science, technical, medical, corporate, and business writing; graphic and electronic design; and training and education.

Skillin, Marjorie E., Robert M. Gay, et al., *Words into Type*, 3rd ed., Englewood Cliffs, N.J.: Prentice-Hall, 1974.

Covers the entire publishing process from writing through printing and binding. Includes particularly useful sections on grammar, word usage, and style. Extensive coverage of typography.

Slade, Carole, *Form and Style: Theses, Reports, Term Papers*, 12th ed., Boston: Houghton Mifflin, 2002.

Covers such topics as the elements of a thesis, style and usage, and typing the paper. Provides guidance on quotations, bibliographic format, and references.

Swanson, Ellen, *Mathematics into Type: Copyediting and Proofreading of Mathematics for Editorial Assistants and Authors,* rev. ed., Providence, R.I.: American Mathematical Society, 1999.

Includes instructions on all phases of producing a book or an article in the field of mathematics. Covers such elements as the preparation and submission of a manuscript, editing and marking, design and typesetting, proofreading, and page makeup.

U.S. Government Printing Office, *Style Manual*, 2000 rev. ed., S/N 2100-0068, Washington, D.C.: U.S. Government Printing Office, 2000.

A general style guide for preparing government publications. Contains details not found elsewhere regarding treatment of foreign currency, political divisions, plant and insect names, and other specialized expressions.

University of Chicago Press, *The Chicago Manual of Style*, 15th ed., Chicago: University of Chicago Press, 2003.

A widely used and referenced style manual. Includes detailed sections on mathematical copy, treatment of foreign languages, preparation of indexes, and distinctive treatment of words.

A.4. Specialized Dictionaries, Encyclopedias, and Handbooks

American Society for Testing and Materials, *Annual Book of ASTM Standards*, Philadelphia: American Society for Testing and Materials, annual serial.

The official standard of the ASTM. A reference for the definitions used in the field of testing and materials.

Anderson, Kenneth N., Lois E. Anderson, and Walter D. Glanze, Eds., *Mosby's Medical, Nursing, and Allied Health Dictionary*, 6th ed., New York: Elsevier Science, 2001.

Provides large, easy-to-read type; strict alphabetical organization; comprehensive definitions for major diseases, disorders, and procedures; detailed drug entries; and the *Color Atlas of Human Anatomy*. Offers full-color illustrations throughout. Also gives language-translation guides; a tabular atlas of human anatomy and physiology; lists of leading health problems; and guidelines for nutrition, pediatrics, pharmacology, communicable diseases, and nursing diagnoses.

Considine, Douglas M., Ed., *Van Nostrand's Scientific Encyclopedia*, 8th ed., New York: Van Nostrand Reinhold, 1995.

An alphabetical arrangement of terms used in science and technology. A useful work for both the scientist and the lay person. Contains approximately 16,500 entries.

Dirckx, John H., Ed., *Stedman's Concise Medical Dictionary for the Health Professions*, 4th ed., Baltimore: Williams & Wilkins, 2001.

Abridged counterpart to *Stedman's Medical Dictionary* (see below). Emphasizes allied health sciences. Offers pronunciations for every defined term, images, tables, and appendices.

Dorland's Illustrated Medical Dictionary, 30th ed., New York: Elsevier Science, 2003.

A traditional source for checking spelling and meaning of medical and health-related terms.

Hampel, Clifford A., and Gessner G. Hawley, *Glossary of Chemical Terms*, 2nd ed., New York: Van Nostrand Reinhold, 1982.

Provides extensive coverage of chemical terminology.

Hawley's Condensed Chemical Dictionary, 14th ed., revised by Richard S. Lewis, Sr., New York: Van Nostrand Reinhold, 2002.

A detailed reference work on the chemical industry. Contains technical descriptions of chemicals, raw materials, and processes; definitions of chemical compounds, phenomena, and terminology; and identification of trademarked products and their manufacturers.

James, Robert C., and Glenn James, *Mathematics Dictionary*, 5th ed., New York: Chapman and Hall, 1992.

Defines mathematical terms and phrases; includes tables, formulas, mathematical symbols, and vocabularies giving English equivalents of mathematical terms in French, German, Russian, and Spanish.

Kirk-Othmer Encyclopedia of Chemical Technology, New York: John Wiley and Sons, 1999.

Contains comprehensive review of major individual chemicals, classes of chemicals, and chemical processes and technologies.

Lide, David R., Ed., *CRC Handbook of Chemistry and Physics*, 84th ed., Boca Raton, Fla.: CRC Press, 2003.

A classic handbook of chemistry and physics. Includes mathematical and chemical tables and tables of physical constants and organic and inorganic compounds.

The Oxford Dictionary for Scientific Writers and Editors, New York: Oxford University Press, 1991.

A clear and concise style guide for the publication of scientific information. Covers physics, chemistry, botany, zoology, biochemistry, genetics, immunology, microbiology, astronomy, mathematics, and computer science. Gives guidance on spellings, punctuation, abbreviations, prefixes and suffixes, units and quantities, and symbols.

Parker, Sybil P., et al., Eds., *McGraw-Hill Dictionary of Scientific and Technical Terms*, 6th ed., New York: McGraw-Hill, 2003.

A dictionary defining over 100,000 terms from the sciences and engineering fields. Entries do not include syllabification, pronunciation, or etymological information. Includes several useful appendixes. See also Parker, Sybil P., et al., Eds., *McGraw-Hill Dictionary of Bioscience*, 2nd ed., New York: McGraw-Hill, 2003; *McGraw-Hill Dictionary of Chemistry*, New York: McGraw-Hill, 2003; *McGraw-Hill Dictionary of Computer and Electrical Engineering*, New York: McGraw-Hill, 2004; *McGraw-Hill Dictionary of Earth Science*, 2nd ed., New York: McGraw-Hill, 2003; *McGraw-Hill Dictionary of Engineering*, 2nd ed., New York: McGraw-Hill, 2003; *McGraw-Hill Dictionary of Geology and Mineralogy*, New York: McGraw-Hill, 2003; *McGraw-Hill Dictionary of Mathematics*, New York: McGraw-Hill, 2003; *McGraw-Hill Dictionary of Physics*, 3rd ed., New York: McGraw-Hill, 2003; *McGraw-Hill Dictionary of Environmental Science*, New York: McGraw-Hill, 2003.

International Bureau of Weights and Measures, *The International System of Units (SI)*, Barry N. Taylor, Ed., Gaithersburg, MD: U.S. Department of Commerce, Technology Administration, National Institute of Standards and Technology, 2001.

Presents the basics of SI (International System of Units), metric conversion techniques, and proper abbreviations.

Stedman, Thomas Lathrop, *Stedman's Medical Dictionary*, 27th ed., Baltimore: Lippincott Williams & Wilkins, 2000.

The standard authority on medical language cited in the major works on reference materials. Provides a comprehensive, current, and accurate medical lexicon to medical and allied health professionals. This latest edition includes Terminologia Anatomica, Genus Finder, and Anatomy Tables.

A.5. Technical Writing Material

Anderson, Paul V., *Technical Writing: A Reader-Centered Approach*, 5th ed., Boston, Mass: Heinle, 2003.
This student text covers the writing process in seven sections: defining objectives, planning a report, drafting it, evaluating and revising it, superstructures (formats), and special activities such as oral presentations. Includes a handbook.

Alred, Gerald J., Charles T. Brusaw, and Walter E. Oliu, *Handbook of Technical Writing*, 7th ed., Boston: Bedford/St. Martin's Press, 2003.
This alphabetically arranged handbook covers usage, parts of speech, types of technical writing, format and graphics, writing and rhetorical principles, and mechanics.

Clements, Wallace, and Robert Berlo, *The Scientific Report: A Guide for Authors*, Washington, D.C.: Society for Technical Communication, 1984.
Divided into two parts: advice for the writer and aids for the writer. Includes such topics as effective writing, the components of a report, graphics (including tables), footnotes and references, abbreviations, spelling, rules for writing numbers, and rules for presenting mathematical expressions.

Day, Robert A., *How to Write and Publish a Scientific Paper*, 5th ed., Phoenix: Oryx Press, 1998.
A book on writing and publishing primary research papers in scholarly journals. Anecdotal discussion provides a biological sciences editor's view of articles written by professionals already in the field.

Day, Robert A., *Scientific English: A Guide for Scientists and Other Professionals*, 2nd ed., Phoenix: Oryx Press, 1995.
A book devoted to clarity and accuracy in technical writing.

Houp, Kenneth W., et al., *Reporting Technical Information*, 10th ed., New York: Oxford University Press, 2001.
Six discrete sections: Part I covers the basics; Part II treats techniques; Part III covers document design; Part IV applies principles to numerous correspondence and report products; Part V covers oral reports; and Part VI is a handbook of errors and punctuation rules in technical writing.

Markel, Mike, *Technical Communicatio*n, 7th ed., Boston: Beford/St. Martin's, 2004.
Standard technical report writing textbook.

Michaelson, Herbert B., *How to Write and Publish Engineering Papers and Reports*, 3rd ed., Phoenix: Oryx Press, 1990.
Details the process of engineering writing and the preparation of formal papers and reports for publication.

Montgomery, Scott L., *The Chicago Guide to Communicating Science*, Chicago, IL: University of Chicago Press, 2003.
This text guides writers who wish to communicate science through crafting many scientific communication forms. The Guide covers reading science as a precursor to writing well about science; explains how materials are reviewed; creating such forms as the scientific paper, review articles, book reviews, reports, proposals, and oral presentations.

Tichy, H. J., *Effective Writing for Engineers, Managers, and Scientists*, 2nd ed., New York: John Wiley and Sons, 1988.
Emphasizes the writing process in five sections: steps to better writing, standards of correctness, style, advice on common forms, and the role of an editor.

Robert, and Mary Fran Buehler, *The Levels of Edit*, 2nd ed., Arlington, Va.: Society for Technical Communication, 1992.
One of the best known books on editing and a must for the aspiring editor.

Weisman, Herman M., *Basic Technical Writing*, 6th ed., Englewood Cliffs, N.J.: Prentice-Hall, 1997.
Covers basic expository techniques, correspondence, and report writing. Separate chapters cover organizing data, report format elements, mechanics and documentation, and graphics.

Weiss, Edmond H., *The Writing System for Engineers and Scientists*, Englewood Cliffs, N.J.: Prentice-Hall, 1982.
Describes a system for writing about technical information. The system is composed of five parts: the system overview, planning, design guidelines, the draft, and editing and reproduction.

Wilkinson, Antoinette M., *The Scientist's Handbook for Writing Papers and Dissertations*, Englewood Cliffs, N.J.: Prentice-Hall, 1991.

Begins by reviewing scientific research methods and then traces the way a scientific article evolves (introduction, methods, results, discussion). Also covers many types of visuals and how to publish an article.

A.6. Standards and Symbols

A.6.1. Standards

Association for Information and Image Management, *American National Standard – Microfiche*, ANSI/AIIM MS5-1992 (R1998), New York: ANSI, 1991.

Institute of Electrical and Electronics Engineers and American Society for Testing and Materials, *Use of the International System of Units (SI): The Modern Metric System,* IEEE/ASTM SI-10-2002, New York: ANSI, 2002.

International Electrotechnical Commission, *Preparation of Documents Used in Electrotechnology*, 1st ed., IEC 61082, Geneva: IEC, 1991-1997.

Provides rules for location and installation documents mainly used for installation work. Covers different systems and objects such as arrangements or installation drawings for site, buildings and equipment, installation drawings or diagrams for site or buildings and drawings for location on or in components.

International Electrotechnical Commission, *Designations for Signals: 7 Connections*, 1st ed., IEC-61175, Geneva: IEC, 1993.

Gives rules for the composition of designations and names that identify signals and connections in electrotechnical and related fields.

International Organization for Standardization, *International Terminology Standards – Preparation & Layout*, 1st ed., ISO-10241, Geneva: ISO, 1992.

International Organization for Standardization, *Technical Drawings – Item References*, 1st ed., ISO-6433, Geneva: ISO, 1981.

International Organization for Standardization, *Information & Documentation – Guidelines for the Content, Organization & Presentation of Indexes*, 2nd ed., ISO-999, Geneva: ISO, 1996.

International Organization for Standardization, *Documentation – Bibliographic References – Content, Form & Structure*, 2nd ed., ISO-690, Geneva: ISO, 1987.

National Information Standards Organization, *Standard Technical Report Number (STRN) Format and Creation*, ANSI/NISO Z39.23-1990, New York: ANSI, 1990.

National Information Standards Organization, *Guidelines for Abstracts*, ANSI/NISO Z39.14-1997 (R2002), New York: ANSI, 2002.

Procedures for the Transfer of Federal Scientific, Technical, and Engineering Information to NTIS under Public Law 102-245, Section 108, Federal Register 59 (1), January 3, 1994.

Outlines procedures for federal agencies to transfer to NTIS unclassified scientific, technical, and engineering information resulting from federally funded research and development activities.

A.6.2. Graphic Symbols

American Society of Mechanical Engineers, *American National Standard – Graphic Symbols for Fluid Power Diagrams*, ANSI Y32.10-1967 (R1987), New York: ANSI, 1987.

American Society of Mechanical Engineers, *American National Standard – Graphic Symbols for Plumbing Fixtures for Diagrams Used in Architecture and Building Construction*, ANSI Y32.4-1977 (R2004), New York: ANSI, 2004.

American Society of Mechanical Engineers, *American National Standard – Graphic Symbols for Railroad Maps and Profiles*, ANSI Y32.7-1972 (R2004), New York: ANSI, 2004.

American Society of Mechanical Engineers, *American National Standard – Graphical Symbols for Process Flow Diagrams in the Petroleum and Chemical Industries*, ANSI Y32.11-1961 (R1985), New York: ANSI, 1985.

American Society of Mechanical Engineers, *American National Standard – Symbols for Mechanical and Acoustical Elements as Used in Schematic Diagrams*, ANSI Y32.18-1972 (R2003), New York: ANSI, 2003.

American Welding Society, *American National Standard – Symbols for Welding, Brazing, and Nondestructive Examination*, ANSI/AWS A2.4-1998, New York: ANSI, 1998.

Institute of Electrical and Electronics Engineers, *American National Standard – Graphic Symbols for Electrical Wiring and Layout Diagrams Used in Architecture and Building Construction*, ANSI Y32.9-1972 (R1989), New York: ANSI, 1989.

Institute of Electrical and Electronics Engineers, *American National Standard – Graphic Symbols for Electrical and Electronics Diagrams (Including Reference Designation Letters)*, ANSI/IEEE 315-1975 (R1993), New York: ANSI, 1993.

Institute of Electrical and Electronics Engineers, *Supplement to ANSI Graphic Symbols for Electrical and Electronics Diagrams*, ANSI/IEEE 315A-1986, New York: ANSI, 1986.

Institute of Electrical and Electronics Engineers, *American National Standard – Graphic Symbols for Grid and Mapping Diagrams Used in Cable Television Systems*, ANSI/IEEE 623-1976 (R1988), New York: ANSI, 1988.

Institute of Electrical and Electronics Engineers, *American National Standard – Graphic Symbols for Logic Functions*, ANSI/IEEE 91-1984 (R1994), New York: ANSI, 1994.

Institute of Electrical and Electronics Engineers, *Supplement to IEEE Standard for Graphic Symbols for Logic Functions*, ANSI/IEEE 91A-1991 (R1994), New York: ANSI, 1994.

Institute of Electrical and Electronics Engineers, *American National Standard – Reference Designations for Electrical and Electronics Parts and Equipment*, ANSI/IEEE Y32.16-1975 (R1988), New York: ANSI, 1988.

Instrument Society of America, *American National Standard – Instrumentation Symbols and Identification*, ANSI/ISA S5.1-1984 (R1992), New York: ANSI, 1992.

International Electrotechnical Commission, *Graphic Symbols for Diagrams [online database],* 2nd ed., IEC-60617, Geneva: IEC, 2001–.

Contains graphical symbols to represent components, logic, and other aspects of electrical, electronic, and electromechanical devices. Part 1 from the first edition was withdrawn. Parts 2 to 13 have been incorporated into a database that currently includes some 1400 symbols. The database is the official source of IEC 60617 and replaces the previous published version.

International Electrotechnical Commission, *Graphic Symbols for Use on Equipment [online database]*, IEC-417, Geneva: IEC, 1997.

Establishes uniform graphical symbols, their graphic form, meaning, and application. These graphical symbols are placed on equipment or parts of equipment of any kind in order to instruct the persons handling the equipment as to its use and operation; they are also placed on sites and ways where people may assemble, or move, giving them instructions, such as prohibitions, warnings, rules or limits, for their behavior. They are used in pictorial reproductions, such as plans, drawings, maps, diagrams, and similar documents. For use in information processing and retrieval systems, a coded designation is applied to each of the symbols in this publication. Symbols from the previous print version of the standard have been incorporated into a database. The database also includes symbols from ISO-7000 (see below).

International Organization for Standardization, *Graphic Symbols for Use on Equipment – Index and synopsis*, 3rd ed., ISO-7000:2004, Geneva: ISO, 2004.

National Fire Protection Association, *Standard for Fire Safety Symbols*, ANSI/NFPA 170-2002, New York: ANSI, 2002.

A.6.3. Letter Symbols

Institute of Electrical and Electronics Engineers, *American National Standard – Letter Symbols and Abbreviations for Quantities Used In Acoustics*, ANSI/IEEE 260.4-1996 (R2002), New York: ANSI, 2002.

Institute of Electrical and Electronics Engineers, *Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering*, ANSI/IEEE 280-1985 (R2003), New York: ANSI, 2003.

Institute of Electrical and Electronics Engineers, *Standard Letter Symbols for Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units)*, ANSI/IEEE 260.1-2004, New York: ANSI, 2004.

Institute of Electrical and Electronics Engineers, *Mathematical Signs and Symbols for Use in Physical Sciences and Technology*, ANSI/IEEE 260.3-1993, New York: ANSI, 1993.

International Electrotechnical Commission, *Letter Symbols to be Used in Electrical Technology*, IEC-60027-1, Geneva: IEC.

Gives letter symbols for quantities and units used in electrical technology, and rules for their use and combination. Also specifies alphabets, subscripts, singularity functions, distributions and letter styles:
Part 1: General (6th ed., 1997)
Part 2: Telecommunications and Electronics (2nd ed., 2000)
Part 3: Logarithmic Quantities & Units (3rd ed., 2002)
Part 4: Symbols for Quantities to Be Used for Rotating Electrical Machines (1st ed., 1985)

International Organization for Standardization, *Technical Product Information – Lettering – Part 0: General requirements*, 1st ed., ISO-3098-0, Geneva: ISO, 1997.

International Organization for Standardization, *Code for the Representation of Names of Languages*, 1st ed., ISO-639, Geneva: ISO, 1988-2002.

International Organization for Standardization, *Codes for the Representation of the Names of Countries,* ISO-3166, Washington, D.C.: NISO; Geneva: ISO, 1997-1999.

A.7. Library Reference Material

American Chemical Society Chemical Abstracts Service, *Chemical Abstracts Service Source Index, 1907-1999 Cumulative*, Columbus, Ohio: Chemical Abstracts Service, 1999.

Lists the standard (preferred) abbreviations for titles of journals in the biological and physical sciences. Gives former title, if any; language of publication; publication history; publisher's address, price, and the like.

Auger, Charles P., *Information Sources in Grey Literature*, 4th ed., New Providence, N.J.: Bowker-Saur, 1998.

Describes how grey literature (publications that are not distributed through normal bookselling channels, such as theses, reports, translations, and conference proceedings) is produced, collected, and catalogued. Explains how to identify, locate, and acquire such material in various subject disciplines that rely heavily on this type of literature, such as business and economics, education, and science and technology.

Bowker's Books in Print, New York: R. R. Bowker, annual. Available online at http://www.booksinprint.com/bip/.

The standard listing of books issued by American publishers in author-title-series formats. Useful for checking bibliographies and notes. An editorial office should have access to the current edition, plus at least a selection of earlier volumes.

Cremmins, Edward T., *The Art of Abstracting*, 2nd ed., Arlington, Va.: Information Resources Press, 1996.

Focuses on procedure for writing and editing abstracts. Also intended as a textbook on abstracting. Includes a glossary and annotated bibliographies on abstracting and thinking and cognition.

Guidelines for Descriptive Cataloguing of Reports: A Revision of the COSATI Standard for Descriptive Cataloging of Government Scientific and Technical Reports, Washington, D.C.: CENDI Cataloging Committee (Commerce, Energy, NASA, Defense Information), 1985. Available from NTIS, Springfield, VA 22161 as PB 86-112349.

This is an update of the COSATI guidelines for descriptive cataloging of scientific and technical reports. The COSATI guidelines have been followed by the major federal information processing agencies since the early 1960s.

Nimmer, Melville B., and David Nimmer, *Nimmer on Copyright,* New York: LEXIS Publications, 2000. Looseleaf, continually updated.

The most comprehensive, authoritative, and up-to-date publication on the subject of U.S. copyright law.

Patry, William F., *Copyright Law and Practice,* Washington, D.C.: BNA Books, 2004.

A standard work on copyright law. Intended as an update to Latman's *The Copyright Law*, it turned out to be five times the size of the original. Has a new organization but the same clarity of style and expression.

Patry, William F., *The Fair Use Privilege in Copyright Law*, 2nd ed., Washington, D.C.: BNA Books, 1995.

A focus on the use of copyrighted material that falls outside copyright royalty protection.

Strong, William S., *The Copyright Book: A Practical Guide,* 5th ed., Cambridge, Mass.: M.I.T. Press, 1999.

A succinct and well-written analysis of the law and a practical guide to its application.

A.8. Graphic Arts

Baird, Russell N., et al., *The Graphics of Communication: Methods, Media, and Technology*, 6th ed., Fort Worth, Tex.: Harcourt Brace Jovanovich, 1993.

A textbook in the graphic arts that covers all aspects of preparing documents for reading. Emphasis is on the visual elements, including design, typography, images, color, print media, newsletters, magazine and newspaper design, public relations, and television graphics. A concluding section discusses print production and electronic desktop publishing.

Beach, Mark, and Eric Kenly, *Getting It Printed: How to Work with Printers and Graphic Imaging Services to Assure Quality, Stay on Schedule and Control Costs*, 3rd ed., Cincinnati, Ohio: North Light Books, 1999.

An analysis of printing production steps from planning through delivery. Sections focus on topics such as typesetting, photographs, paper and ink, and printing methods. Chapters include checklists designed to cut production time and monitor quality control and production costs.

Greenwald, Martin L., and John C. Luttropp, *Graphic Design and Production Technology*, Upper Saddle River, N.J.: Prentice-Hall, 2001.

Covers the cross-disciplinary skills required by designers and publication-production personnel, providing information on production aspects important for digital and nonimpact printing. Discusses step-by-step graphic design, image generation, and what happens to an image when it leaves the computer screen.

Harris, Robert L. *Information Graphics: A Comprehensive Reference: Visual Tools for Analyzing, Managing, and Communication*, Atlanta, GA: Management Graphics, 1996

A comprehensive guide to developing and using graphics to present information effectively in visual formats. The book helps authors prepare a variety of information visuals for operational purposes.

International Paper Company, *Pocket Pal: A Graphic Arts Production Handbook*, 19th ed., New York: International Paper Company, 2003.

Covers most aspects of publishing from printing to binding in language that is easy to understand. Color separation, halftones, imposition, and practically every other aspect of publishing are described. Revised periodically to reflect developments in the graphic arts.

Kepes, Gyorgy, *Language of Vision*, Dover, New York, 1995.

Analyzes the effect of visual language on the structure of human consciousness, in particular how the elements of line and form are perceived and how innovative types of perspective can lead to more dynamic representations in art.

Knuth, Donald E., *The T$_E$Xbook*, Reading, Mass.: Addison-Wesley, 1986.

A handbook about T$_E$X, the typesetting system intended for publications that contain mathematics. Using T$_E$X format, an author or editor can produce computerized mathematical copy comparable to printing.

Parker, Robert C., *Looking Good in Print: A Guide to Basic Design for Desktop Publishing*, 5th ed., Polygraph Press Books, 2003.

A textbook that carries the reader through the design and production processes. Chapters on type, graphic design, effective visuals, common pitfalls, and creating a variety of print products.

Pipes, Alan, *Production for Graphic Designers*, 3rd ed., Upper Saddle River, N.J.: Prentice-Hall, 2001.

Up-to-date resource on production technology and methods for graphic design. Provides advice for preparing artwork for printers, creative typography in the digital environment, and working with text and graphics in computerized and conventional workflows. Special treatment of e-books, preflight checking, color management, and future print technologies.

Sawyer, Stanley A., and Steven G. Krantz, *A T$_E$X Primer for Scientists,* Boca Raton, Fla.: CRC Press, 1995.

An introduction to writing and preparing papers, reports, articles, and books with T$_E$X. Designed for scientists, engineers, mathematicians, and technical staff. Discusses the necessary tasks required to prepare equations and text.

Tufte, Edward R., *The Visual Display of Quantitative Information*, rev. ed., Cheshire, Conn.: Graphics Press, 2001.

Presents and illustrates the theory and practice of graphically representing quantitative data. Focuses on charts and graphs that display numerical information.

Tufte, Edward R., *Envisioning Information*, Cheshire, Conn.: Graphics Press, 1990.

Extensively illustrates the presentation of information in graphic form. Emphasizes maps and cartography.

Tufte, Edward R., *Visual Explanations: Images and Quantities, Evidence and Narrative*, Cheshire, Conn.: Graphics Press, 1997.

A third volume in his series of books on information display; this one centers on dynamic data (information that changes with time).

A.9. Typography and Publication Design

Bringhurst, Robert, *The Elements of Typographic Style*, 2nd ed., Point Roberts, Wash.: Hartley & Marks, 1996.

Concerned with choosing the correct typeface; striving for rhythm, proportion, and harmony; combining type fonts and families; designing pages; using graphic elements like section heads, subheads, footnotes, and tables; adjusting type to improve legibility; and employing special characters, including punctuation and diacritical marks.

Carter, Rob, Ben Day, and Philip Meggs, *Typographic Design: Form and Communication*, 2nd ed., New York: Van Nostrand Reinhold, 1993.

Covers typographic heritage and fundamentals, problem-solving approaches, responsible design, legibility factors and type specimens. Provides a comprehensive overview of typographic-design fundamentals that includes the most important innovations of the past decade as well as desktop publishing, digital type, and bit-mapped design.

Craig, James, and William Bevington, *Designing with Type: A Basic Course in Typography*, 4th ed., Watson-Guptill Publications, New York, 1999.

The basics of typography; good for the beginner.

Dowding, Geoffrey, *Finer Points in the Spacing & Arrangement of Type*, 3rd ed., London: Wace, 1966.

The ideas promoted by this slim volume are essential to well-set type. Emphasizes the importance of close word-spacing, ragged margins, and carefully hyphenated text. Provides invaluable advice on setting titles and drop caps.

Hart's Rules for Compositors and Readers at the University Press, Oxford, 39th ed., Oxford: Oxford University Press, 1983.

First published in 1893, Hart's is a prime resource for those wanting to disseminate ideas. It provides guidance on matters such as alternate spellings, punctuation, capitalization, italicization, and abbreviations. Although intended for British authors, it offers guidance to anyone producing documents in paper or electronic forms.

Hendel, Richard, *On Book Design*, New Haven, Conn.: Yale University Press, 1998.

A detailed description of the creative process of book design; illustrated with many examples; seeks the most effective visual presentation of words. Not a strict set of rules for book design, but a philosophy of design for many types of books.

Hochuli, Jost, and Robin Kinross, *Designing Books: Practice and Theory*, London: Hyphen Press, 1996.

An anthology of book design. Defines the fundamental and constituent parts of books and the processes by which they are made. Covers specialist terminology; format; page proportions; choice of typeface; categories of books; and recurring design problems, such as title pages, tables of contents, and bibliographies. Each topic is considered in a page or two. Heavily illustrated with diagrams and examples.

Lawson, Alexander S., and Dwight Agner, *Printing Types: An Introduction*, rev. ed., Boston: Beacon Press, 1990.

Covers the history and development, nomenclature, and classification of typefaces and provides a key to type identification.

McLean, Ruari, *The Thames and Hudson Manual of Typography*, London: Thames and Hudson, 1980.

Examines what makes a legible publication, taking into account typefaces, line length, use of space, and cultural background. Covers book design from the parts of a book to the merits of asymmetrical or centered typography to proofer's marks.

Tschichold, Jan, *The New Typography: A Handbook for Modern Designers*, Berkeley, Calif.: University of California Press, 1995.

Ranges from theoretical discussions of typography to practical considerations in the design of publications. One of the best typographic how-to books ever published. It is the definitive treatise on book and graphic design in the machine age. An invaluable source of working principles for the practicing designer.

Appendix B
Glossary

(This appendix is not part of ANSI/NISO Z39.18-2005, *Scientific and Technical Reports –Preparation, Presentation and Preservation*. It is included for information only.)

Term	Definition
Administrative metadata	Administrative metadata support maintaining and archiving reports and ensure their long-term availability. Administrative metadata are needed for migration of data from one format to another and contain rights information used for access control. Such metadata include type and version of software used in preparing the report and rights-management requirements. *See also*: Rights metadata
Americans with Disabilities Act (ADA)	Public Law 101- 336, 101st Congress, enacted July 26, 1990. The ADA prohibits discrimination and ensures equal opportunity for persons with disabilities in employment, state and local government services, public accommodations, commercial facilities, and transportation. *See also*: Section 508
Best practice	Guide and documentation to describe and standardize the use of processes that best support a community's needs.
Data element	A discrete component of data or metadata.
Descriptive metadata	Metadata that are used for the indexing, discovery, and identification of a resource.
Digital document	“Digital document definition: where the view of a document version relevant for the requirements of one (of possibly multiple alternative) applications is represented using a digital representation format, such as a digital file.” (ISO 10303, *Industrial Automation Systems and Integration*)
Digital Object Identifier (DOI®)	A DOI (Digital Object Identifier) is a persistent identifier given to a Web file or other Internet document so that if its Internet address changes, users will be redirected to its new address. The DOI is an implementation of the CNRI Handle System®, in which the term "DOI" is used instead of "Handle" to describe the identifiers. DOI syntax is defined in ANSI/NISO Z39.84. *See also*: Uniform Resource Name (URN)
Document-Type Definition (DTD)	In SGML or XML, a formal description of the components of a specific document or class of documents. DTDs provide a formal grammar used for machine processing (parsing) of documents expressed in SGML or XML. A DTD description includes: the containers or elements that make up the document (for example, paragraphs, headings, list items, figures, tables, etc.); the logical structure of the document (for example, chapters containing sections, etc.); additional information associated with elements —known as attributes (for example, identifiers, date stamps, etc.).
Dublin Core	The Dublin Core Metadata Element Set is a set of 15 descriptive semantic definitions that represents a core set of elements likely to be useful across a broad range of disciplines. Dublin Core metadata supplement existing methods for searching and indexing Web-based metadata, regardless of whether the corresponding resource is an electronic document or a "real" physical object. Described in ANSI/NISO Z39.85.

Term	Definition
eXtensible Markup Language	*See*: XML
eXtensible Stylesheet Language	*See*: XSL
Ingest	The external interface that accepts information into an archive. This process may include staging information to prepare for full acceptance, confirmation of receipt, and validation. OAIS contains the services and functions that accept Submission Information Packages from Producers, prepares Archival Information Packages for storage, and ensures that Archival Information Packages and their supporting Descriptive Information become established. Accession (traditional archives) = Ingest
International Standard Book Number (ISBN)	The International Standard Book Number (ISBN) uniquely identifies books and book-like products published internationally. Every ISBN consists of a set number of digits (ten prior to a revision in 2004), and whenever it is printed it is preceded by the letters ISBN. The number is divided into four parts of variable length, each part separated by a hyphen. Described in ISO 2108.
International Standard Serial Number (ISSN)	The International Standard Serial Number (ISSN) uniquely identifies a serial title regardless of language or country in which it is published. An ISSN is eight digits long and always displayed this way: ISSN 1234-5679. The first seven digits serve as the title number and the eighth is a check digit, which provides an efficient means for discovering transcription errors. Described in ISO 3297 and ANSI/NISO Z39.9.
MARC 21	MARC is the acronym for MAchine-Readable Cataloging. It defines a data format that emerged from a Library of Congress led initiative begun thirty years ago. MARC became USMARC in the 1980s and MARC 21 in the late 1990s. It provides the mechanism by which computers exchange, use, and interpret bibliographic information and its data elements make up the foundation of most library catalogs used today.
Metadata	Literally, "data about data," metadata include data associated with either an information system or an information object for purposes of description, administration, legal requirements, technical functionality, use and usage, and preservation. *See also*: Administrative metadata, Descriptive metadata, Preservation metadata, Rights metadata, Structural metadata, Technical metadata, Use metadata
Multimedia	Materials, documents, or products, such as World Wide Web pages, CD-ROMs, or components of digital libraries, archival information systems, and virtual museums that use any combination of text, numeric data, still and moving images, animation, sound, and graphics.
Open Archival Information System (OAIS)	The Open Archival Information System (OAIS) reference model is a conceptual framework for an archival system dedicated to preserving and maintaining access to digital information over the long term. The reference model increases awareness and understanding of concepts relevant for archiving digital objects, especially among nonarchival institutions; elucidate terminology and concepts for describing and comparing data models and archival architectures; expand consensus on the elements and processes endemic to digital information preservation and access; and create a framework to guide the identification and development of standards. Described in: http://public.ccsds.org/publications/archive/650x0b1.pdf

Term	Definition
Preservation metadata	Metadata related to the preservation management of information resources, for example, metadata used to document, or created as a result of, preservation processes performed on information resources.
Rights metadata	A form of administrative metadata dealing with rights management statements, including ownership statements, licenses, permissions, etc.
Section 508	Section 508 refers to a statutory section in the Rehabilitation Act of 1973 (found at 29 U.S.C. 794d). Congress significantly strengthened section 508 in the Workforce Investment Act of 1998. Its primary purpose is to provide access to and use of Federal executive agencies' electronic and information technology (EIT) by individuals with disabilities. The statutory language of Section 508 can be found at http://www.section508.gov/. The Access Board http://www.access-board.gov wrote the Section 508 standards and is the U.S. federal agency responsible for developing and enforcing accessibility requirements. *See also*: Americans with Disabilities Act (ADA)
Structural metadata	Information used to display and navigate digital resources; also includes information on the internal organization of the digital resource. Structural metadata might include information such as the structural divisions of a resource (that is, chapters in a book) or sub-object relationships (such as individual diary entries in a diary section).
Style Sheets	Style sheets describe how documents are presented on screens, in print, or perhaps how they are pronounced. By attaching style sheets to structured documents on the Web (for example XML), authors/creators and readers can influence the presentation of documents without sacrificing device-independence or adding new XML tags. *See also*: XSL
Technical metadata	Metadata created for, or generated by, a computer system, relating to how the system or its content behaves or needs to be processed.
Uniform Resource Name (URN)	Also referred to as "Universal Resource Name/Number." A unique, location-independent identifier of a file available on the Internet. The file remains accessible by its URN regardless of changes that might occur in its host and directory path. For information about Internet addressing, Described in: http://www.w3.org/Addressing/Addressing.html. *See also*: Digital Object Identifier (DOI®)
Use metadata	Metadata, generally automatically created by the computer, that relate to the level and type of use of an information system.
USMARC	*See*: MARC 21
XML	XML is eXtensible Markup Language, a project of the World Wide Web Consortium (W3C); the development of the specification is being supervised by their XML Working Group. It is designed to improve the functionality of the Web by providing more flexible and adaptable information identification. It is called extensible because it is not a fixed format like HTML (a single, predefined markup language). Instead, XML is actually a metalanguage—a language for describing other languages—which allows customized markup languages for limitless different types of objects. XML can do this because it's written in SGML (ISO 8879), the international standard metalanguage for text markup systems.

Term	Definition
XSL	XSL (eXtensible Stylesheet Language) is a language for expressing stylesheets for XML objects. It consists of two parts: a language for transforming XML objects, and an XML vocabulary for specifying formatting semantics. The originality and power of XSL is more general than just describing how XML items should be presented; it allows, as well as describes, how these objects can be transformed into other objects. The part of XSL dealing with document transformation is called XSLT. The part of XSL dealing with formatting objects is called XSL-FO. XSL and XSLT are currently working drafts of the World Wide Web Consortium (W3C).

Appendix C
Dublin Core Data Elements

(This appendix is not part of ANSI/NISO Z39.18-2005, *Scientific and Technical Reports –Preparation, Presentation and Preservation*. It is included for information only.)

Element Name: Title

Label:	Title
Definition:	A name given to the resource.
Comment:	Typically, Title will be a name by which the resource is formally known.

Element Name: Creator

Label:	Creator
Definition:	An entity primarily responsible for making the content of the resource.
Comment:	Examples of Creator include a person, an organization, or a service. Typically, the name of a Creator should be used to indicate the entity.

Element Name: Subject

Label:	Subject and Keywords
Definition:	A topic of the content of the resource.
Comment:	Typically, Subject will be expressed as keywords, key phrases, or classification codes that describe a topic of the resource. Recommended best practice is to select a value from a controlled vocabulary or formal classification scheme.

Element Name: Description

Label:	Description
Definition:	An account of the content of the resource.
Comment:	Examples of Description include, but are not limited to: an abstract, table of contents, reference to a graphical representation of content or a free-text account of the content.

Element Name: Publisher

Label:	Publisher
Definition:	An entity responsible for making the resource available
Comment:	Examples of Publisher include a person, an organization, or a service. Typically, the name of a Publisher should be used to indicate the entity.

Element Name: Contributor

Label:	Contributor
Definition:	An entity responsible for making contributions to the content of the resource.
Comment:	Examples of Contributor include a person, an organization, or a service. Typically, the name of a Contributor should be used to indicate the entity.

Element Name: Date

Label:	Date
Definition:	A date of an event in the lifecycle of the resource.
Comment:	Typically, Date will be associated with the creation or availability of the resource. Recommended best practice for encoding the date value is defined in a profile of ISO 8601 [W3C Date and Time Formats] and includes (among others) dates of the form YYYY-MM-DD.

Element Name: Type

Label:	Resource Type
Definition:	The nature or genre of the content of the resource.
Comment:	Type includes terms describing general categories, functions, genres, or aggregation levels for content. Recommended best practice is to select a value from a controlled vocabulary (for example, the DCMI Type Vocabulary). To describe the physical or digital manifestation of the resource, use the FORMAT element.

Element Name: Format

Label:	Format
Definition:	The physical or digital manifestation of the resource.
Comment:	Typically, Format may include the media-type or dimensions of the resource. Format may be used to identify the software, hardware, or other equipment needed to display or operate the resource. Examples of dimensions include size and duration. Recommended best practice is to select a value from a controlled vocabulary (for example, the list of Internet Media Types [MIME] defining computer media formats).

Element Name: Identifier

Label:	Resource Identifier
Definition:	An unambiguous reference to the resource within a given context.
Comment:	Recommended best practice is to identify the resource by means of a string or number conforming to a formal identification system. Formal identification systems include, but are not limited to, the Uniform Resource Identifier (URI) (including the Uniform Resource Locator (URL)), the Digital Object Identifier (DOI), and the International Standard Book Number (ISBN).

Element Name: Source

Label:	Source
Definition:	A Reference to a resource from which the present resource is derived.
Comment:	The present resource may be derived from the Source resource in whole or in part. Recommended best practice is to identify the referenced resource by means of a string or number conforming to a formal identification system.

Element Name: Language

Label:	Language
Definition:	A language of the intellectual content of the resource.
Comment:	Recommended best practice is to use *Tags for the Idenfitication of Language*s, RFC 3066, which, in conjunction with ISO639, Codes for the representation of names of languages, defines two- and three-letter primary language tags with optional subtags. Examples include "en" or "eng" for English, "akk" for Akkadian, and "en-GB" for English used in the United Kingdom.

Element Name: Relation

Label:	Relation
Definition:	A reference to a related resource.
Comment:	Recommended best practice is to identify the referenced resource by means of a string or number conforming to a formal identification system.

Element Name: Coverage

Label:	Coverage
Definition:	The extent or scope of the content of the resource.
Comment:	Typically, Coverage will include spatial location (a place name or geographic coordinates), temporal period (a period label, date, or date range), or jurisdiction (such as a named administrative entity). Recommended best practice is to select a value from a controlled vocabulary (for example, the Getty Thesaurus of Geographic Names) and to use, where appropriate, named places or time periods in preference to numeric identifiers such as sets of coordinates or date ranges.

Element Name: Rights

Label:	Rights Management
Definition:	Information about rights held in and over the resource.
Comment:	Typically, Rights will contain a rights management statement for the resource, or reference a service providing such information. Rights information often encompasses Intellectual Property Rights (IPR), Copyright, and various Property Rights. If the Rights element is absent, no assumptions may be made about any rights held in or over the resource.

Appendix D
Formats for Organizing a Scientific or Technical Report

(This appendix is not part of ANSI/NISO Z39.18-2005, *Scientific and Technical Reports -Preparation, Presentation and Preservation*. It is included for information only.)

The way a scientific or technical report is organized has evolved over the past 30 years from a content-based organization pattern to a user-based organization pattern. What follows are three outlines typical for reports that solve problems, make recommendations, etc., presented in historical order. These patterns are included for illustration; they do not necessarily conform to all of the requirements and recommendations in this Standard.

Traditional Pattern

Front matter
- Title page
- Table of Contents (includes list of appendix materials)
- List of Illustrations/Figures
- Abstract

Body of report
- Problem/background
- Methodology to solve
- Results
- Discussion
- Conclusion/Summary/Recommendations

Back matter
- References
- Index
- Appendix materials

Modified Traditional (intermediate pattern)

Front matter
- Title page
- Table of Contents (includes list of appendix materials)
- List of Illustrations/Figures
- Executive Summary (approximately 10% of body of report)

Body of report
- Problem/background
- Methodology to solve
- Results
- Discussion
- Conclusion/Summary/Recommendations

Back matter
- References
- Index
- Appendix material

Modern

- Front matter
- Title page
  - Table of Contents (includes list of appendix materials)
  - List of Illustrations/Figures
- Executive Summary (ranges from 3-15 pages)
  - Background/Problem
  - Methods
    - Rarely appear
    - Reader assumes writer is competent professional
    - Executives typically do not care about details
    - At most, 1-2 sentences
    - Used to make your results credible
  - Solutions, recommendations, conclusions
  - Implications
    - Political
    - Fiscal
- Appendix materials—for example
  - Background/Statement of problem/Assignment
  - Methods used to solve problem
  - Results
  - Discussions
  - Conclusion
- Indices (usually more than one)

Appendix E
Report Documentation Page, Standard Form (SF) 298

(This appendix is not part of ANSI/NISO Z39.18-2005, *Scientific and Technical Reports – Preparation, Presentation and Preservation*. It is included for information only.)

REPORT DOCUMENTATION PAGE — *Form Approved OMB No. 0704-0188*

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

1. REPORT DATE (DD-MM-YY)	2. REPORT TYPE	3. DATES COVERED (From - To)
July 2003	Conference Paper Preprint	

4. TITLE AND SUBTITLE
UAV TASK ASSIGNMENT WITH TIMING CONSTRAINTS

5a. CONTRACT NUMBER
In-house

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER
N/A

6. AUTHOR(S)
Corey Schumacher and Phillip Chandler (AFRL/VACA)
Meir Pachter (AFIT/ENG)

5d. PROJECT NUMBER
N/A

5e. TASK NUMBER
N/A

5f. WORK UNIT NUMBER
N/A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Control Theory Optimization Branch (AFRL/VACA) Control Sciences Division Air Vehicles Directorate Air Force Research Laboratory, Air Force Materiel Command Wright-Patterson Air Force Base, OH 45433-7542	AFIT/ENG

8. PERFORMING ORGANIZATION REPORT NUMBER
AFRL-VA-WP-TP-2003-315

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Air Vehicles Directorate
Air Force Research Laboratory
Air Force Materiel Command
Wright-Patterson Air Force Base, OH 45433-7542

10. SPONSORING/MONITORING AGENCY ACRONYM(S)
AFRL/VACA

11. SPONSORING/MONITORING AGENCY REPORT NUMBER(S)
AFRL-VA-WP-TP-2003-315

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES
To be presented at the AIAA Guidance Navigation and Control Conference, Austin, TX, August 11-14, 2003.
This material is declared a work of the U.S. Government and is not subject to copyright protection in the United States.

14. ABSTRACT
This paper addresses the problem of task allocation for wide area search munitions. The munitions are required to search for, classify, attack, and verify the destruction of potential targets. We assume that target field information is communicated between all elements of the swarm. We generate a tour of optimal assignments for each vehicle using a Mixed Integer Linear Program, or MILP format. MILP can assign tasks that look infeasible, due to timing, by adding time to a UAV's path, and vehicle paths are then recalculated to match the required arrival times. The MILP formulation with variable arrival times provides an optimal solution to multiple-assignment problems for groups of UAVs with coupled tasks involving timing and task order constraints.

15. SUBJECT TERMS
task allocation, cooperative control, wide area search munitions

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT:	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON (Monitor)
a. REPORT	b. ABSTRACT	c. THIS PAGE			Phillip Chandler
Unclassified	Unclassified	Unclassified	SAR	14	19b. TELEPHONE NUMBER (Include Area Code) (937) 255-8680

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39-18

INSTRUCTIONS FOR COMPLETING SF 298

1. REPORT DATE. Full publication date, including day, month, if available. Must cite at least the year and be Year 2000 compliant, e.g. 30-06-1998; xx-06-1998; xx-xx-1998.

2. REPORT TYPE. State the type of report, such as final, technical, interim, memorandum, master's thesis, progress, quarterly, research, special, group study, etc.

3. DATES COVERED. Indicate the time during which the work was performed and the report was written, e.g., Jun 1997 - Jun 1998; 1-10 Jun 1996; May - Nov 1998; Nov 1998.

4. TITLE. Enter title and subtitle with volume number and part number, if applicable. On classified documents, enter the title classification in parentheses.

5a. CONTRACT NUMBER. Enter all contract numbers as they appear in the report, e.g. F33615-86-C-5169.

5b. GRANT NUMBER. Enter all grant numbers as they appear in the report, e.g. AFOSR-82-1234.

5c. PROGRAM ELEMENT NUMBER. Enter all program element numbers as they appear in the report, e.g. 61101A.

5d. PROJECT NUMBER. Enter all project numbers as they appear in the report, e.g. 1F665702D1257; ILIR.

5e. TASK NUMBER. Enter all task numbers as they appear in the report, e.g. 05; RF0330201; T4112.

5f. WORK UNIT NUMBER. Enter all work unit numbers as they appear in the report, e.g. 001; AFAPL30480105.

6. AUTHOR(S). Enter name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. The form of entry is the last name, first name, middle initial, and additional qualifiers separated by commas, e.g. Smith, Richard, J, Jr.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES). Self-explanatory.

8. PERFORMING ORGANIZATION REPORT NUMBER. Enter all unique alphanumeric report numbers assigned by the performing organization, e.g. BRL-1234; AFWL-TR-85-4017-Vol-21-PT-2.

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES). Enter the name and address of the organization(s) financially responsible for and monitoring the work.

10. SPONSOR/MONITOR'S ACRONYM(S). Enter, if available, e.g. BRL, ARDEC, NADC.

11. SPONSOR/MONITOR'S REPORT NUMBER(S). Enter report number as assigned by the sponsoring/ monitoring agency, if available, e.g. BRL-TR-829; -215.

12. DISTRIBUTION/AVAILABILITY STATEMENT. Use agency-mandated availability statements to indicate the public availability or distribution limitations of the report. If additional limitations/ restrictions or special markings are indicated, follow agency authorization procedures, e.g. RD/FRD, PROPIN, ITAR, etc. Include copyright information.

13. SUPPLEMENTARY NOTES. Enter information not included elsewhere such as: prepared in cooperation with; translation of; report supersedes; old edition number, etc.

14. ABSTRACT. A brief (approximately 200 words) factual summary of the most significant information.

15. SUBJECT TERMS. Key words or phrases identifying major concepts in the report.

16. SECURITY CLASSIFICATION. Enter security classification in accordance with security classification regulations, e.g. U, C, S, etc. If this form contains classified information, stamp classification level on the top and bottom of this page.

17. LIMITATION OF ABSTRACT. This block must be completed to assign a distribution limitation to the abstract. Enter UU (Unclassified Unlimited) or SAR (Same as Report). An entry in this block is necessary if the abstract is to be limited.

Standard Form 298 Back (Rev. 8/98)

Appendix F
XML DTD and Sample XSL (Style Sheet)

(This appendix is not part of ANSI/NISO Z39.18-2005, *Scientific and Technical Reports -Preparation, Presentation and Preservation*. It is included for information only.)

This is a proposed DTD and sample XSL developed for *NISO Z39.18, Scientific and Technical Reports -Preparation, Presentation and Preservation,* by Jianfeng Tang (tang_j@cs.odu.edu) at Old Dominion University, supervised by Prof. Kurt Maly (maly@cs.odu.edu) and Prof. Mohammad Zubair (zubair@cs.odu.edu)

The DTD does not proscribe the details of complex objects such as tables, equations, or figures and does not include the rules for footnotes or callouts. It does handle the need for, and matching of, instances of the objects being created and referenced.

```
<!--  ANSI/NISO Z39.18 scientific and technical reports DTD -->


<!-- Typical usage:

<!DOCTYPE Z39-18 SYSTEM "z39.18.dtd">
        <Z39-18>
        ...
         </Z39-18>
-->

<!-- This is the top level element  -->
<!ELEMENT Z39-18 (front_matter,body,back_matter) >

<!-- Front Matter  -->
<!ELEMENT front_matter
(metadata,cover?,noticesection?,format?,reportdocument?,copyrightpage?,foreword?,prefac
e?,ackno*)>
<!-- title section can be generated from metadata -->
<!-- contend section, list of tables, list of figures can be generated by XSL -->

<!-- general metadata  -->
<!ELEMENT metadata (report_no, title,subtitle?, seriesinfo?, creator*,  abstract,
perform_org*, sponsor_org*, publishinfo?, type?, coverage*, contract_no*, subject*,
copyright?, distribution?, language?, code?, cover?, copyrightpage?, reportdocument?)>

<!-- specific metadata for cover page in addtion to
report_no, title, subtitle, seriesinfo, creator, publishinfo/publisher,
publishinfo/date
-->
<!ELEMENT cover (price?, tech_requirement?, limitation?, notice?)>
<!ELEMENT price (#PCDATA)>
<!-- Technical requirements  in cover page (e.g.for example, video, audio, digital)
-->
<!ELEMENT tech_requirement (#PCDATA)>
<!-- distribution limitation -->
<!ELEMENT limitation (#PCDATA)>
<!ELEMENT notice (#PCDATA)>

<!-- format section -->
<!ELEMENT format (#PCDATA)>
```

```
<!-- specific metadata for copyrightpage in addition to sponsor_org, code
-->
<!ELEMENT copyrightpage (cipdata?, country?, usepermission?, mission?, rightholder?,
authority?, producer?)>
<!-- Library of Congress Cataloging-in-Publication (CIP) Data -->
<!ELEMENT cipdata (#PCDATA)>
<!--   The country in which the report was produced -->
<!ELEMENT country (#PCDATA)>
<!--  Permission for use of proprietary information -->
<!ELEMENT usepermission (#PCDATA)>
<!--  The mission statement of the producer, trademark information, and any disclaimers
from the producer -->
<!ELEMENT mission (#PCDATA)>
......<!--  A copyright symbol, year, and the name of the copyright holder -->
<!ELEMENT rightholder (#PCDATA)>
<!--  Authority to copy the contents  -->
<!ELEMENT authority (#PCDATA)>
......<!ELEMENT producer (name,address?,telephone?,webaddress*,emailaddress*)>
<!ELEMENT name (#PCDATA)>
<!ELEMENT address (#PCDATA)>
<!ELEMENT webaddress (#PCDATA)>
<!ELEMENT emailaddress (#PCDATA)>

<!-- metadata for report document page in addition to date, type, coverage, title,
subtitle, contract_no, creator, perform_org, report_no, sponsor_org, distribution,
abstract, subject -->
<!-- Detailed information about Standard Form 298
is available at http://www.navysbir.com/SF298.doc -->
<!ELEMENT reportdocument (form_no, grant_no?, program_no?, project_no?, task_no?,
work_unit_no?, sponsor_acronym*, sponsor_report_no?, notes?, classification?,
abstract_limitation?, pages?, person_name?, telephone? )>
<!-- form number -->
<!ELEMENT form_no (#PCDATA)>
<!-- grant number -->
<!ELEMENT grant_no (#PCDATA)>
<!-- program element number  -->
<!ELEMENT program_no (#PCDATA)>
<!-- project number -->
<!ELEMENT project_no (#PCDATA)>
<!-- task number -->
<!ELEMENT task_no (#PCDATA)>
<!-- work unit number -->
<!ELEMENT work_unit_no (#PCDATA)>
<!-- Sponsor's acronym -->
<!ELEMENT sponsor_acronym (#PCDATA)>
<!-- sponsoring agancy report number -->
<!ELEMENT sponsor_report_no (#PCDATA)>
<!-- supplementary notes -->
<!ELEMENT notes (#PCDATA)>
<!-- security classification for report, abstract, and this page-->
<!ELEMENT classification (reportclass, abstractclass, thispageclass)>
<!ELEMENT reportclass (#PCDATA)>
<!ELEMENT abstractclass (#PCDATA)>
<!ELEMENT thispageclass (#PCDATA)>
<!-- limitation of abstract -->
<!ELEMENT abstract_limitation (#PCDATA)>
<!-- number of pages -->
<!ELEMENT pages (#PCDATA)>
<!-- name of responsible person -->
<!ELEMENT person_name (#PCDATA)>
<!-- telephone number -->
<!ELEMENT telephone (#PCDATA)>
```

```
<!-- notices section -->
<!ELEMENT noticesection (header,paragraph*)>

<!ELEMENT foreword (header,paragraph*)>
<!ATTLIST foreword label ID #IMPLIED>

<!ELEMENT preface (paragraph*)>
<!ATTLIST preface label ID #IMPLIED>

<!-- acknowledge -->
<!ELEMENT ackno (paragraph*)>
<!ATTLIST ackno label ID #IMPLIED>

<!--report number -->
<!ELEMENT report_no (#PCDATA)>

<!--report title -->
<!ELEMENT title (#PCDATA)>

<!--report subtitle -->
<!ELEMENT subtitle (#PCDATA)>

<!--Information about report series -->
<!ELEMENT seriesinfo (#PCDATA)>
<!--   .......   Definition:  author, principal investigator, editor, compiler.
 ..................................................................... -->
<!ELEMENT creator (#PCDATA)>
<!--publish data in title section -->
<!ELEMENT publishinfo (place*,publisher*,date?)>
<!--   Definition:  publish date -->
<!ELEMENT date (#PCDATA)>

<!--    Subject and Keywords -->
<!ELEMENT subject ((keyword*|category*))*>
<!ELEMENT keyword (#PCDATA)>
<!ELEMENT category (#PCDATA | category)*>

<!-- abstract in front_matter -->
<!ELEMENT abstract (#PCDATA)>

<!--  An entity responsible for making the resource available  -->
<!ELEMENT publisher (#PCDATA)>

<!--   Definition:  A language of the resource. -->
<!ELEMENT language (#PCDATA)>

<!--  ..   Definition:  The extent or scope of the content of the resource. -->
<!ELEMENT coverage (#PCDATA)>
<!ELEMENT copyright (#PCDATA)>

<!--distribution limit -->
<!ELEMENT distribution (#PCDATA)>

<!--bar code, isbn or issn -->
<!ELEMENT code (#PCDATA)>
<!ATTLIST code type (barcode|isbn|issn) #REQUIRED>
<!-- end of front matter group -->

<!-- body -->
 <!ELEMENT body (summary, introduction, (methods | assumptions | procedures )+,
  results, conclusions, recommendations?, references) >
<!ELEMENT summary (section)>
<!ELEMENT introduction (section)>
```

```
<!ELEMENT methods (section)>
<!ELEMENT assumptions (section)>
<!ELEMENT procedures (section)>
<!ELEMENT results (section)>
<!ELEMENT conclusions (section)>
<!ELEMENT recommendations (section)>

<!ELEMENT references (header,reference*)>
<!-- label: an unique identifier references section -->
<!ATTLIST references label ID #IMPLIED>
<!ELEMENT reference (#PCDATA)>
<!ATTLIST reference label ID #IMPLIED>

<!ELEMENT section (header,(paragraph | figure | table | equation | informalequation |
inlineequation | section)*)>
<!-- label: an unique identifier for this section -->
<!ATTLIST section label ID #IMPLIED>

<!ELEMENT header (#PCDATA)>
<!ELEMENT paragraph ((text | inlineequation | crossref | list | pagenumber | citation
| indexterm | inlinegraphic )*)>
<!-- group of list -->
<!ELEMENT list (listitem+)>
<!-- each list in the list group -->
<!ELEMENT listitem ((text | inlineequation | crossref | pagenumber | citation |
 indexterm | inlinegraphic )*)>
<!-- used for table, figure, etc. -->
<!ELEMENT crossref (#PCDATA)>
<!-- The identifier for the table, figure, or other element which it cited to -->
<!ATTLIST crossref reflabel IDREF #REQUIRED>

<!-- a citation in the body of the document -->
<!ELEMENT citation (#PCDATA)>
<!-- reflabel: the identifier for the cited reference -->
<!ATTLIST citation reflabel IDREF #REQUIRED>

<!-- index term in the body of the document -->
<!ELEMENT indexterm (#PCDATA)>
<!ATTLIST indexterm label ID #REQUIRED>

<!-- just for display purpose -->
<!ELEMENT pagenumber (#PCDATA)>

<!-- general text -->
<!ELEMENT text (#PCDATA)>

<!ELEMENT table (caption?,graphic+)>
<!ATTLIST table float CDATA #IMPLIED
    label ID #IMPLIED
     pgwide  CDATA #IMPLIED>

<!ELEMENT figure (caption?,graphic+)>
<!ATTLIST figure float CDATA #IMPLIED
     label ID #IMPLIED
     pgwide  CDATA #IMPLIED>

<!--  The meaning of the attributes for graphic and inlinegraphic is compliant with
DocBook standard,
 ...http://www.oasis-open.org/docbook/documentation/reference/html/docbook.html
-->
<!ELEMENT graphic (#PCDATA)>
<!ATTLIST graphic srcedit CDATA #IMPLIED
```

```
 format (GIF| JPEG) #IMPLIED
 fileref CDATA #IMPLIED
 align (left|center|right) #IMPLIED
 width CDATA  "80%"
 depth CDATA #IMPLIED
 scale CDATA #IMPLIED
 scalefit CDATA #IMPLIED>

<!-- graphic should keep in the same line of its surrounding texts -->
<!ELEMENT inlinegraphic (#PCDATA)>
<!ATTLIST inlinegraphic srcedit CDATA #IMPLIED
    format (GIF| JPEG) #IMPLIED
    fileref CDATA #IMPLIED
    width CDATA  "80%"
    depth CDATA #IMPLIED
    scale CDATA #IMPLIED
    scalefit CDATA #IMPLIED>

<!ELEMENT caption (#PCDATA)>

<!-- an equation is a formal mathematical equation (with an optional title). -->
<!ELEMENT equation (caption?,alt?,graphic+)>
<!ATTLIST equation label ID #IMPLIED>

<!-- informalequation is usually a mathematical equation or
a group of related mathematical equations. -->
<!ELEMENT informalequation (alt?,graphic+)>

<!-- inlineequations are expressions that occur in the text flow. -->
<!ELEMENT inlineequation (alt?,graphic+)>
<!ELEMENT alt (#PCDATA)>

.. <!-- ********************************************************************* -->
.... <!ELEMENT back_matter (appendix*, los*, bibliography?, glossary?, index?,
 distribution_list?) >

<!ELEMENT appendix (header,(section)*) >
<!ATTLIST appendix label ID #IMPLIED>

<!ELEMENT bibliography (header,paragraph*) >
<!ATTLIST bibliography label ID #IMPLIED>
<!-- list of symbol, abbrev. , acronym, etc -->
<!ELEMENT los (header,losentry*) >
<!ATTLIST los label ID #IMPLIED>
<!-- one entry of the list -->
<!ELEMENT losentry ((losterm|lossym),losdef) >
<!-- term to be defined -->
<!ELEMENT losterm (#PCDATA) >
<!-- symbol to be defined -->
<!ELEMENT lossym (graphic) >
<!-- the definition of the term or the symbol -->
<!ELEMENT losdef (#PCDATA) >

<!ELEMENT index (header,indexentry*) >
<!ATTLIST index label ID #IMPLIED>
<!-- one entry of index -->
<!ELEMENT indexentry (#PCDATA) >
<!ATTLIST indexentry reflabel IDREF #REQUIRED>

<!-- distribution list -->
<!ELEMENT distribution_list (paragraph*) >

<!ELEMENT glossary (header,glossarydiv+) >
```

```
<!ATTLIST glossary label ID #IMPLIED>
......<!-- A  section of a glossary. A Glossary might be divided into sections
   in order to group terms, perhaps alphabetically. -->
<!ELEMENT glossdiv (header,glossentry*) >
<!-- An entry of glossary     -->
......<!ELEMENT glossentry (glossterm,acronym?,abbrev?,(glosssee|glossdef+)) >
<!ATTLIST glossentry id ID #IMPLIED >
<!-- the definition of the term is available from another term. i.e,
they have the same definition. -->
<!ELEMENT glosssee (#PCDATA) >
<!ATTLIST glosssee otherterm IDREF #IMPLIED >
<!ELEMENT glossdef (paragraph,glossseealso*) >
<!ATTLIST glossdef subject CDATA #IMPLIED>
<!-- glossary term   -->
<!ELEMENT glossterm (#PCDATA) >
<!ATTLIST glossterm baseform CDATA #IMPLIED >
<!ELEMENT acronym (#PCDATA) >
<!ELEMENT abbrev (#PCDATA) >
<!-- see also, used when terms have some relationships -->
<!ELEMENT glossseealso (#PCDATA) >
<!ATTLIST glossseealso otherterm IDREF #IMPLIED >
```

SAMPLE XSL (STYLE SHEET)

```
<xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
                 xmlns:fo="http://www.w3.org/1999/XSL/Format"
                version='1.0'>

<xsl:template match ="Z39-18">
       <body>
              <xsl:apply-templates select ="front_matter"/>
              <xsl:apply-templates select ="body"/>
              <xsl:apply-templates select ="back_matter"/>
       </body>
</xsl:template>
<xsl:template match="front_matter">
       <xsl:apply-templates/>
       <!-- Display Table of Content -->
       <DIV STYLE="background-color:yellow; color:white; padding:4px">
       <SPAN STYLE="font-weight:bold; color:black">
       <b><h2><P ALIGN="CENTER">TABLE OF CONTENTS</P></h2></b></SPAN>
       </DIV>
       <xsl:for-each select="//body/*/section| //body/references|
//back_matter/appendix| //back_matter/los| //back_matter/bibliography|
//back_matter/glossary| //back_matter/index">
       <em><P><UL><L1>
       <a>
       <xsl:attribute name="href">
       #<xsl:value-of select="@label"/>
       </xsl:attribute>
       <xsl:value-of select = "header"/>
       </a>
       <xsl:for-each select="section">
       <em><P><UL><L2>
       <a>
       <xsl:attribute name="href">
       #<xsl:value-of select="@label"/>
       </xsl:attribute>
       <xsl:value-of select = "header"/>
       </a>
       </L2></UL></P></em>
       </xsl:for-each>
       </L1></UL></P></em>
```

```
       </xsl:for-each>

       <!-- Display List of Figures -->
       <DIV STYLE="background-color:yellow; color:white; padding:4px">
       <SPAN STYLE="font-weight:bold; color:black">
       <b><h2><P ALIGN="CENTER">LIST OF Figures</P></h2></b>
       </SPAN>
       </DIV>
       <xsl:for-each select="//body//figure">
       <em><P><UL><L1>
       <a>
       <xsl:attribute name="href">
       #<xsl:value-of select="@label"/>
       </xsl:attribute>
       <xsl:value-of select = "caption"/>
       </a>
       </L1></UL></P></em>
       </xsl:for-each>
       <!-- Display List of Tables -->
       <DIV STYLE="background-color:yellow; color:white; padding:4px">
       <SPAN STYLE="font-weight:bold; color:black">
       <b><h2><P ALIGN="CENTER">LIST OF Tables</P></h2></b>
       </SPAN>
       </DIV>
       <xsl:for-each select="//body//table">
       <em><P><UL><L1>
       <a>
       <xsl:attribute name="href">
       #<xsl:value-of select="@label"/>
       </xsl:attribute>
       <xsl:value-of select = "caption"/>
       </a>
       </L1></UL></P></em>
       </xsl:for-each>
       <!-- Display List of Tables -->
       <DIV STYLE="background-color:yellow; color:white; padding:4px">
       <SPAN STYLE="font-weight:bold; color:black">
       <b><h2><P ALIGN="CENTER">LIST OF Equations</P></h2></b>
       </SPAN>
       </DIV>
       <xsl:for-each select="//body//equation">
       <em><P><UL><L1>
       <a>
       <xsl:attribute name="href">
       #<xsl:value-of select="@label"/>
       </xsl:attribute>
       <xsl:value-of select = "@label"/>
       </a>
       </L1></UL></P></em>
       </xsl:for-each>
</xsl:template>

<xsl:template match ="preface">
       <h3 ALIGN="CENTER" style="background-color:gray">
       <xsl:apply-templates select="header"/>
       </h3>
       <xsl:apply-templates select="paragraph"/>
</xsl:template>

<xsl:template match ="metadata">
       <DIV STYLE="background-color:teal; color:white; padding:4px">
       <SPAN STYLE="font-weight:bold; color:white">
       <h1> Metadata </h1>
```

```
       </SPAN>
       </DIV>
       <xsl:apply-templates select ="report_no"/>
       <xsl:apply-templates select ="title"/>
       <xsl:apply-templates select ="seriesinfo"/>
       <xsl:apply-templates select ="creator"/>
       <xsl:apply-templates select ="abstract"/>
       <xsl:apply-templates select ="perform_org"/>
       <xsl:apply-templates select ="sponsor_org"/>
       <xsl:apply-templates select ="publishinfo/place"/>
       <xsl:apply-templates select ="publishinfo/publisher"/>
       <xsl:apply-templates select ="publishinfo/date"/>
       <xsl:apply-templates select ="type"/>
       <xsl:apply-templates select ="coverage"/>
       <xsl:apply-templates select ="contract_no"/>
       <xsl:apply-templates select ="subject"/>
       <xsl:apply-templates select ="copyright"/>
       <xsl:apply-templates select ="distribution"/>
       <xsl:apply-templates select ="code"/>
       <xsl:apply-templates select ="cover"/>
       <xsl:apply-templates select ="copyrightpage"/>
       <xsl:apply-templates select ="reportdocument"/>
</xsl:template>

<xsl:template match
="seriesinfo|creator|type|coverage|contract_no|subject|copyright|distribution|language"
>
       <title> <xsl:value-of select="node()"/> </title>
       <table border="0"  cellspacing="0" cellpadding="0">
       <tr><td width="160" valign="top" bgcolor="#E5E5E5">
       <b><i><xsl:value-of select="local-name()"/></i></b></td>
       <td  bgcolor="#FFFFFF">
       <xsl:apply-templates/>
       </td>
       </tr>
       </table>
</xsl:template>

<xsl:template match ="cover|reportdocument|copyrightpage">
       <p>addition information for <xsl:value-of select="local-name()"/>
       </p>
       <ul>
       <xsl:for-each select="*">
       <li>
       <xsl:value-of select="local-name()"/> : <xsl:value-of select="."/>
       </li>
       </xsl:for-each>
       </ul>
</xsl:template>

<xsl:template match ="code">
       <title> <xsl:value-of select="node()"/> </title>
       <table border="0"  cellspacing="0" cellpadding="0">
       <tr><td width="160" valign="top" bgcolor="#E5E5E5">
       <b><i>Code(<xsl:value-of select="@type"/>)</i></b></td>
       <td  bgcolor="#FFFFFF">
       <xsl:value-of select="."/>
       </td>
       </tr>
       </table>
</xsl:template>

<xsl:template match ="report_no">
```

```
       <title> <xsl:value-of select="node()"/> </title>
       <table border="0"  cellspacing="0" cellpadding="0">
       <tr><td width="160" valign="top" bgcolor="#E5E5E5">
       <b><i>Report Number</i></b></td>
       <td  bgcolor="#FFFFFF">
       <xsl:apply-templates/>
       </td>
       </tr>
       </table>
</xsl:template>

<xsl:template match ="title">
       <title> <xsl:value-of select="node()"/> </title>
       <table border="0"  cellspacing="0" cellpadding="0">
       <tr><td width="160" valign="top" bgcolor="#E5E5E5">
       <b><i>Title</i></b></td>
       <td  bgcolor="#FFFFFF">
       <xsl:apply-templates/>
       </td>
       </tr>
       </table>
</xsl:template>

<xsl:template match ="publisher">
       <title> <xsl:value-of select="node()"/> </title>
       <table border="0"  cellspacing="0" cellpadding="0">
       <tr><td width="160" valign="top" bgcolor="#E5E5E5">
       <b><i>Publisher</i></b></td>
       <td  bgcolor="#FFFFFF">
       <xsl:apply-templates/>
       </td>
       </tr>
       </table>
</xsl:template>

<xsl:template match ="date">
       <title> <xsl:value-of select="node()"/> </title>
       <table border="0"  cellspacing="0" cellpadding="0">
       <tr><td width="160" valign="top" bgcolor="#E5E5E5">
       <b><i>Date</i></b></td>
       <td  bgcolor="#FFFFFF">
       <xsl:apply-templates/>
       </td>
       </tr>
       </table>
</xsl:template>

<xsl:template match ="abstract">
       <title> <xsl:value-of select="node()"/> </title>
       <table border="0"  cellspacing="0" cellpadding="0">
       <tr><td width="160" valign="top" bgcolor="#E5E5E5">
       <b><i>Abstract</i></b></td>
       <td  bgcolor="#FFFFFF">
       <xsl:apply-templates/>
       </td>
       </tr>
       </table>
</xsl:template>

<xsl:template match ="perform_org">
       <title> <xsl:value-of select="node()"/> </title>
       <table border="0"  cellspacing="0" cellpadding="0">
       <tr><td width="160" valign="top" bgcolor="#E5E5E5">
```

```
       <b><i>Performing Organization</i></b></td>
       <td  bgcolor="#FFFFFF">
       <xsl:apply-templates/>
       </td>
       </tr>
       </table>
</xsl:template>

<xsl:template match ="sponsor_org">
       <title> <xsl:value-of select="node()"/> </title>
       <table border="0"  cellspacing="0" cellpadding="0">
       <tr><td width="160" valign="top" bgcolor="#E5E5E5">
       <b><i>Sponsor</i></b></td>
       <td  bgcolor="#FFFFFF">
       <xsl:apply-templates/>
       </td>
       </tr>
       </table>
</xsl:template>

<xsl:template match ="place">
       <title> <xsl:value-of select="node()"/> </title>
       <table border="0"  cellspacing="0" cellpadding="0">
       <tr><td width="160" valign="top" bgcolor="#E5E5E5">
       <b><i>Publishing Place</i></b></td>
       <td  bgcolor="#FFFFFF">
       <xsl:apply-templates/>
       </td>
       </tr>
       </table>
</xsl:template>


<xsl:template match ="subject">
       <table border="0"  cellspacing="0" cellpadding="0">
       <tr><td width="160" valign="top" bgcolor="#E5E5E5">
       <b><i>Subject</i></b>
       <td  bgcolor="#FFFFFF">

       </td>
       </td>
       </tr>
       </table>
       <table border="0"  cellspacing="0" cellpadding="0">
       <tr><td width="160" valign="top" bgcolor="#E5E5E5">
       <b><i></i></b></td>
       <td  bgcolor="#FFFFFF">
       <em><b>Categories:</b></em>
       <xsl:apply-templates select ="category"/>
       </td>
       </tr>
       </table>
       <table border="0"  cellspacing="0" cellpadding="0">
       <tr><td width="160" valign="top" bgcolor="#E5E5E5">
       <b><i></i></b></td>
       <td  bgcolor="#FFFFFF">
       <em><b>Keywords:</b></em>
       <xsl:apply-templates select ="keyword"/>
       </td>
       </tr>
       </table>
</xsl:template>
```

```
<xsl:template match ="category">
       <xsl:value-of select="node()"/>
       <xsl:if test="category">
                                /
       <xsl:apply-templates select ="category"/>
       </xsl:if>
</xsl:template>

<xsl:template match ="keyword">
       <xsl:value-of select="node()"/>
       <xsl:if test="position() &lt; last()">
                                    ,
       </xsl:if>
</xsl:template>

<xsl:template match ="descrioption">
       <xsl:apply-templates select ="abstract"/>
</xsl:template>


<xsl:template match ="creation">
       <b><em>Creation:</em></b>
       <xsl:apply-templates/>
</xsl:template>

<xsl:template match ="lastmodefied">
       <b><em>  Last modefied:</em></b>
       <xsl:apply-templates/>
</xsl:template>

<!-- ********************************************************************** -->
<xsl:template match ="body">
       <DIV STYLE="background-color:teal; color:white; padding:4px">
       <SPAN STYLE="font-weight:bold; color:white">
       <h1> Document </h1>
       </SPAN>
       </DIV>
       <h1><P ALIGN="CENTER"><xsl:value-of select="//metadata/title"/>
       </P></h1>
       <xsl:apply-templates />
</xsl:template>

<xsl:template match
="summary|introduction|methods|assumptions|procedures|results|conclusions|recommendatio
ns">
       <xsl:apply-templates select="section"/>
</xsl:template>

<xsl:template match ="section">
       <a>
       <xsl:attribute name="name">
       <xsl:value-of select="@label"/>
       </xsl:attribute>
       </a>
       <xsl:apply-templates/>
</xsl:template>

<xsl:template match ="header">
       <xsl:choose>
       <xsl:when test="count(ancestor::node()/header) =  1">
       <h2>
       <xsl:value-of select="node()"/>
       </h2>
```

```
       </xsl:when>
       <xsl:when test="count((ancestor::node()/header)) =  2">
       <h3>
       <xsl:value-of select="node()"/>
       </h3>
       </xsl:when>
       <xsl:when test="count(ancestor::node()/header) =  3">
       <h4><xsl:value-of select="node()"/></h4>
       </xsl:when>
       <xsl:otherwise>
       <h5><xsl:value-of select="node()"/></h5>
       </xsl:otherwise>
       </xsl:choose>
</xsl:template>

<xsl:template match ="paragraph">
       <P>
       <xsl:apply-templates/>
       </P>
</xsl:template>

<xsl:template match ="pagenumber">
       <br/>
       <DIV STYLE="background-color:teal; color:white; padding:4px">
       <SPAN STYLE="font-weight:bold; color:white">
       <center>
       --- End of Page <xsl:value-of select="node()"/> ---
       </center>
       </SPAN>
       </DIV>
</xsl:template>
<xsl:template match ="list">
       <ul>
       <xsl:for-each select="listitem">
       <li><xsl:value-of select="."/></li>
       </xsl:for-each>
       </ul>
</xsl:template>

<xsl:template match ="figure">
       <a>
       <xsl:attribute name="name">
       <xsl:value-of select="@label"/>
       </xsl:attribute>
       </a>
       <P ALIGN="CENTER">
       <xsl:apply-templates select="graphic"/>
       </P>
       <P ALIGN="CENTER">
       <xsl:apply-templates select="caption"/>
       </P>
</xsl:template>

<xsl:template match ="equation">
       <a>
       <xsl:attribute name="name">
       <xsl:value-of select="@label"/>
       </xsl:attribute>
       </a>
       <xsl:apply-templates select="graphic"/>
</xsl:template>

<xsl:template match ="inlineequation">
```

```
      <xsl:apply-templates select="graphic"/>
</xsl:template>

<xsl:template match ="table">
      <a>
      <xsl:attribute name="name">
      <xsl:value-of select="@label"/>
      </xsl:attribute>
      </a>
      <P ALIGN="CENTER">
      <xsl:apply-templates select="caption"/>
      </P>
      <P ALIGN="CENTER">
      <xsl:apply-templates select="graphic"/>
      </P>
</xsl:template>

<xsl:template match ="graphic">
      <img>
      <xsl:attribute name="src">
      <xsl:value-of select="@fileref"/>
      </xsl:attribute>
      <xsl:attribute name="width">
      <xsl:value-of select="@width"/>
      </xsl:attribute>
      </img>
</xsl:template>

<xsl:template match ="caption">
      <xsl:value-of select="node()"/>
</xsl:template>

<xsl:template match ="references">
      <a>
      <xsl:attribute name="name">
      <xsl:value-of select="@label"/>
      </xsl:attribute>
      </a>
      <xsl:apply-templates select="header"/>
      <xsl:apply-templates select="reference"/>
</xsl:template>
<xsl:template match ="index">
      <a>
      <xsl:attribute name="name">
      <xsl:value-of select="@label"/>
      </xsl:attribute>
      </a>
      <xsl:apply-templates select="header"/>
      <xsl:apply-templates select="indexentry"/>
</xsl:template>

<xsl:template match ="crossref|citation">
      <a>
      <xsl:attribute name="href">
      #<xsl:value-of select="@reflabel"/>
      </xsl:attribute>
      <xsl:value-of select="."/>
      </a>
</xsl:template>

<xsl:template match ="indexentry">
      <p>
      <a>
```

```
       <xsl:attribute name="href">
       #<xsl:value-of select="@reflabel"/>
       </xsl:attribute>
       <xsl:value-of select="."/>
       </a>
       </p>
</xsl:template>

<xsl:template match ="reference">
       <P>
       <L1>
       <a>
       <xsl:attribute name="name">
       <xsl:value-of select="@label"/>
       </xsl:attribute>
       </a>
       <xsl:value-of select="node()"/>
       </L1>
       </P>
</xsl:template>

<xsl:template match ="indexterm">
       <a>
       <xsl:attribute name="name">
       <xsl:value-of select="@label"/>
       </xsl:attribute>
       </a>
       <SPAN  STYLE="font-weight:bold; color:red">
       <xsl:value-of select="node()"/>
       </SPAN>
</xsl:template>

<xsl:template match="back_matter">
       <xsl:apply-templates/>
</xsl:template>

<xsl:template match ="los">
       <a>
       <xsl:attribute name="name">
       <xsl:value-of select="@label"/>
       </xsl:attribute>
       </a>
       <xsl:apply-templates select="header"/>
       <table>
       <xsl:for-each select="losentry">
       <tr>
       <td><b><xsl:value-of select="losterm"/></b></td>
       <td><xsl:value-of select="losdef"/></td>
       </tr>
       </xsl:for-each>
       </table>
</xsl:template>

<xsl:template match="appendix">
       <a>
       <xsl:attribute name="name">
       <xsl:value-of select="@label"/>
       </xsl:attribute>
       </a>
       <h3 ALIGN="CENTER" style="background-color:gray">
       Appendix <xsl:apply-templates select="@label"/>:<xsl:apply-templates
select="header"/>
       </h3>
```

```
      <xsl:apply-templates select="section"/>
</xsl:template>

<xsl:template match="bibliography|index">
      <a>
      <xsl:attribute name="name">
      <xsl:value-of select="@label"/>
      </xsl:attribute>
      </a>
      <xsl:apply-templates />
</xsl:template>

<xsl:template match="glossary">
      <a>
      <xsl:attribute name="name">
      <xsl:value-of select="@label"/>
      </xsl:attribute>
      </a>
      <h3 ALIGN="CENTER" style="background-color:gray">
      Glossary :<xsl:apply-templates select="header"/>
      </h3>
      <xsl:apply-templates select="glossdiv"/>
</xsl:template>

<xsl:template match="glossdiv">
      <p>....</p>
      <p> ----
      <b><xsl:apply-templates select="header"/></b> ---
      </p>
      <xsl:apply-templates select="glossentry"/>
      <p>....</p>
</xsl:template>
<xsl:template match="glossentry">
      <p><b><xsl:value-of select="glossterm"/></b><xsl:apply-templates
select="acronym"/></p>
      <blockquote>
      <xsl:apply-templates select="abbrev"/>
      <xsl:apply-templates select="glossdef"/>
      <xsl:apply-templates select="glosssee"/>
      </blockquote>
</xsl:template>

<xsl:template match="glossdef">
      <xsl:apply-templates select="paragraph"/>
      <xsl:apply-templates select="glosssseealso"/>
</xsl:template>


<xsl:template match="glosssee">
      <p>Please see definition of <b><xsl:value-of select="@otherterm"/></b></p>
</xsl:template>

<xsl:template match="acronym">
      (<b><xsl:value-of select="."/></b>)
</xsl:template>

<xsl:template match="abbrev">
      <p>Abbrev. <b><xsl:value-of select="."/></b></p>
</xsl:template>

<xsl:template match="glosssseealso">
      <p>See also <b><xsl:value-of select="@otherterm"/></b></p>
</xsl:template>
```

```
<!-- ********************************************************************** -->
</xsl:stylesheet>
```

Index

This is a subject index to the conceptual and practical terms of report organization and design. It covers only the Standard itself. The front matter and appendixes are not indexed. The index refers readers to section, figure (f.), and table (t.) numbers, not page numbers. Section numbers referring to passages of significant interest or length are set in bold face type. *Compiled by Jane L. Cohen*