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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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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.

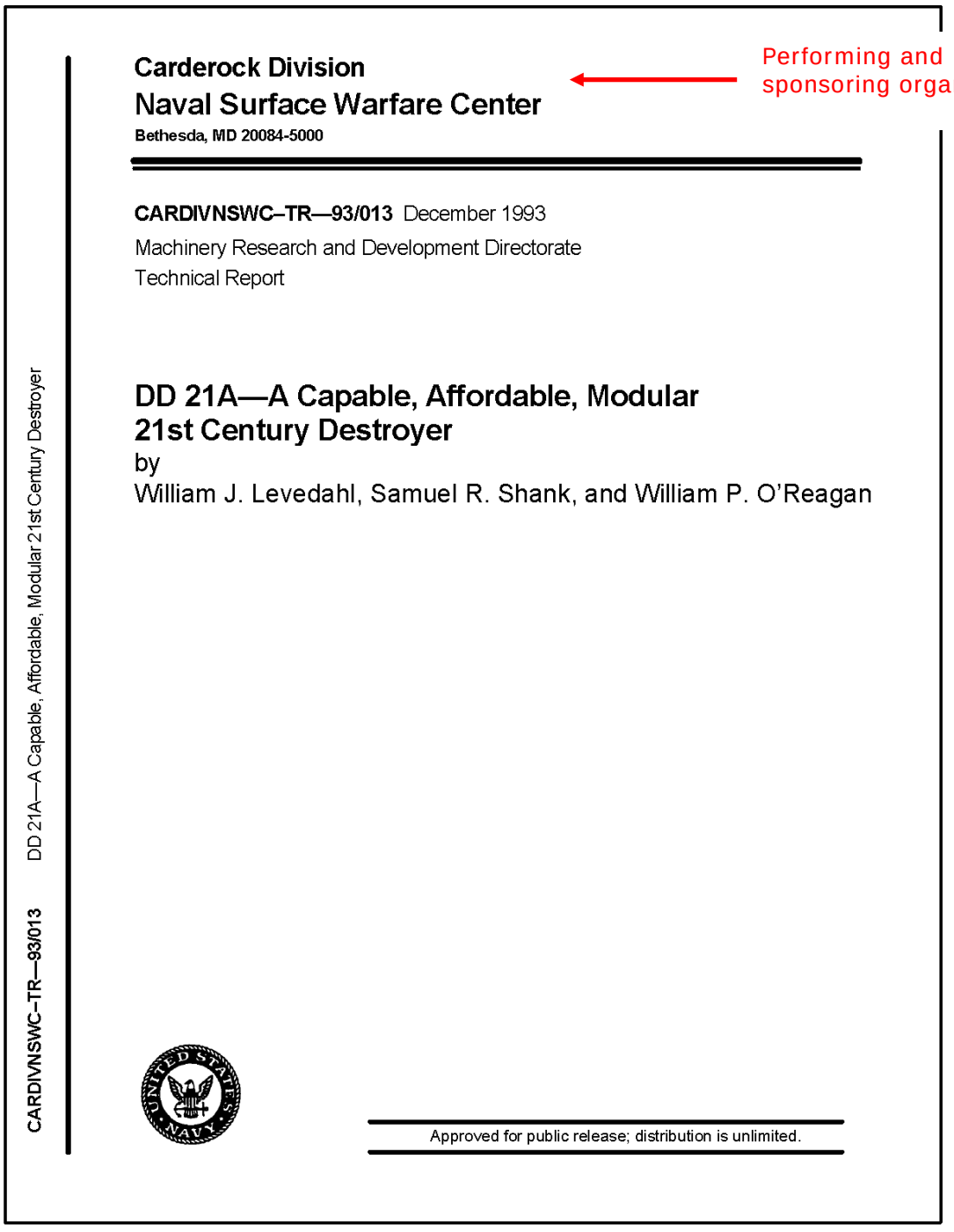

Figure 2a: Sample cover page for which the performing and sponsoring organizations are the same

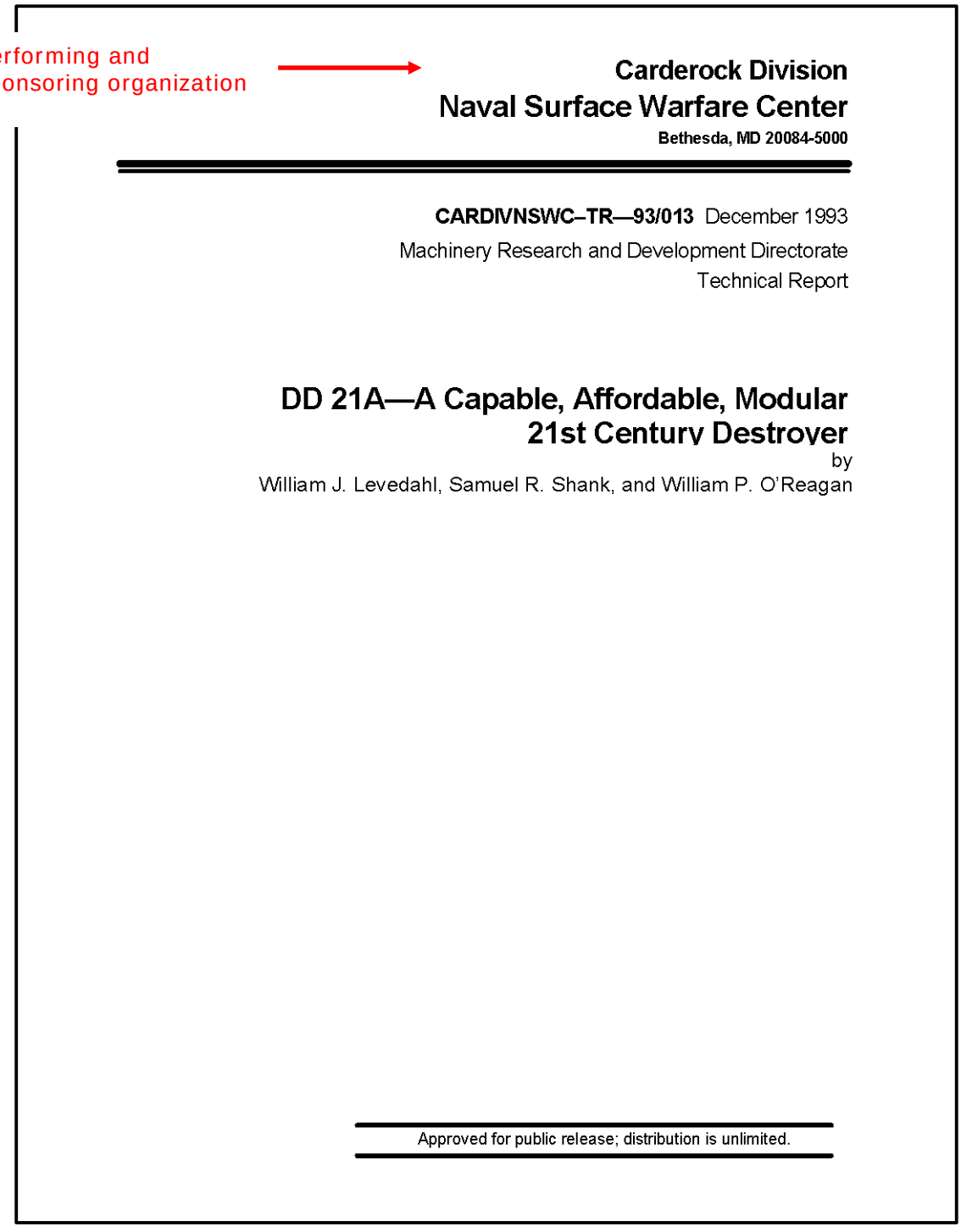

Figure 2b: Sample title page for which the performing and sponsoring organizations are the same

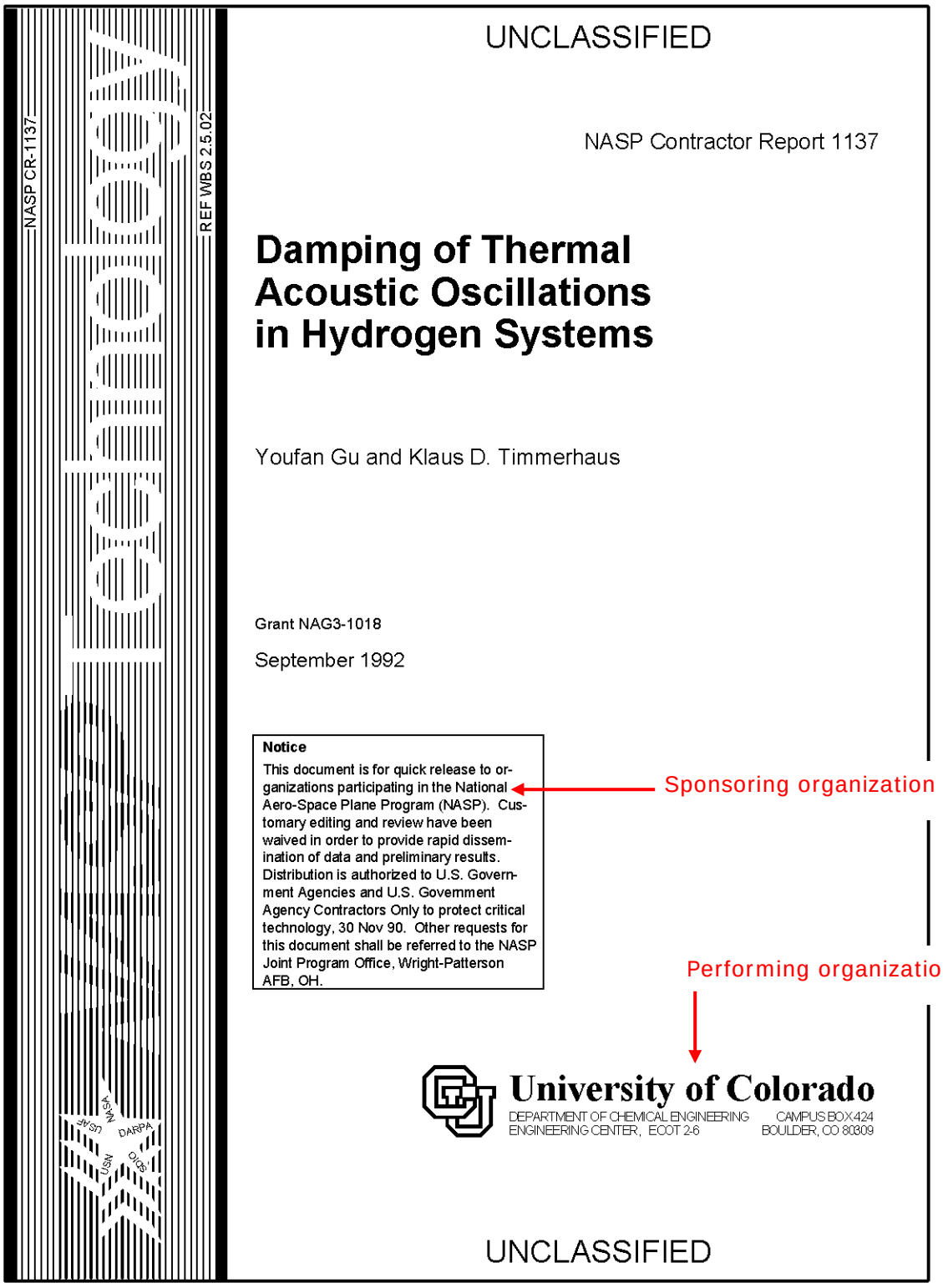

Figure 3a: Sample cover for which the performing and sponsoring organizations are different

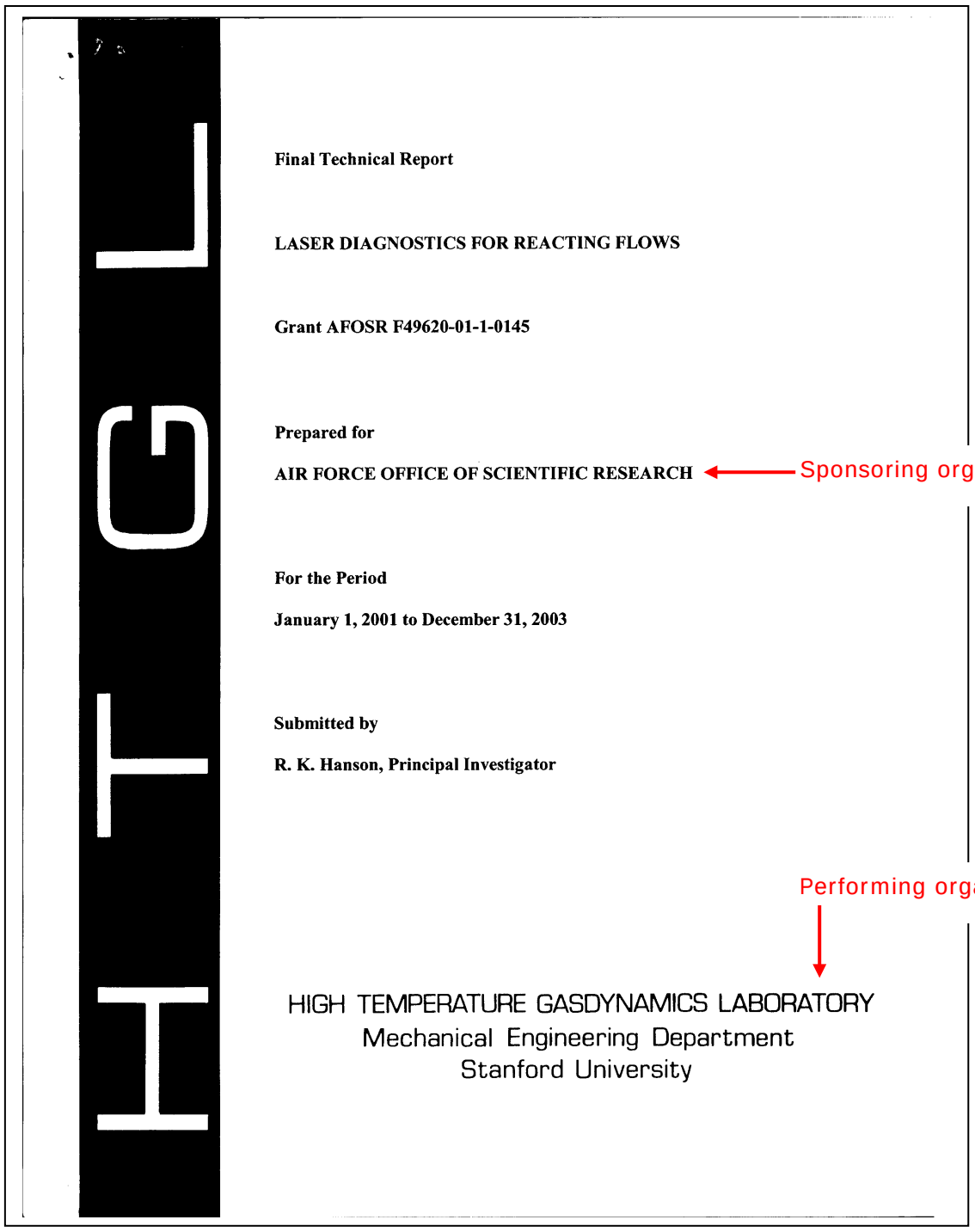

Figure 3b: Sample title page for which the performing and sponsoring organizations are different

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.

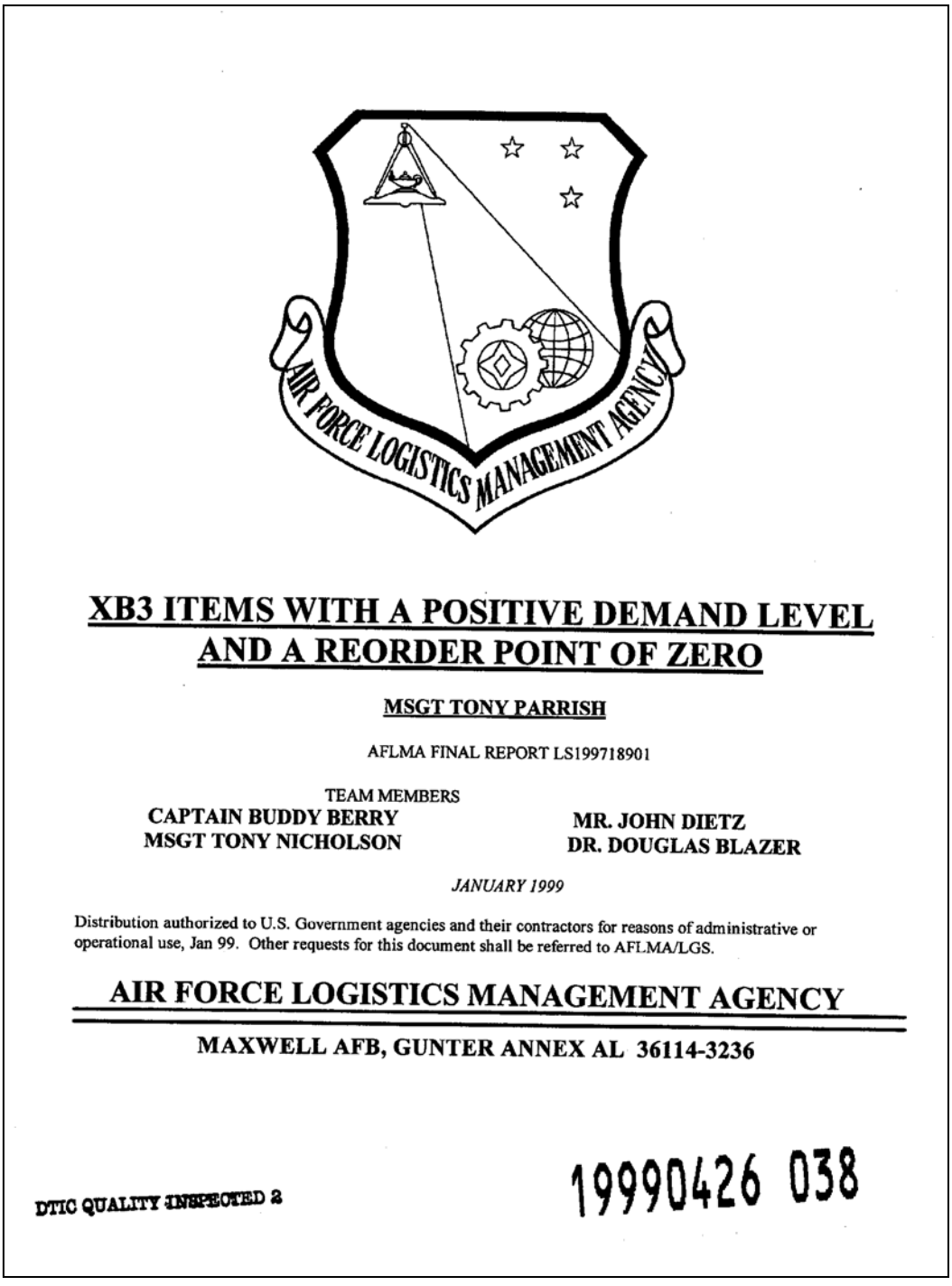

Figure 4: Sample page with a notice of restricted distribution

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.

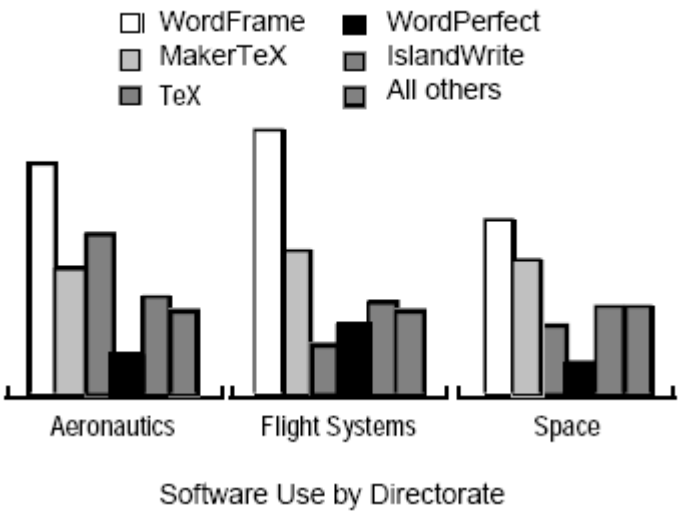

Figure 7: Example of graphic devices used as color substitutes

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.

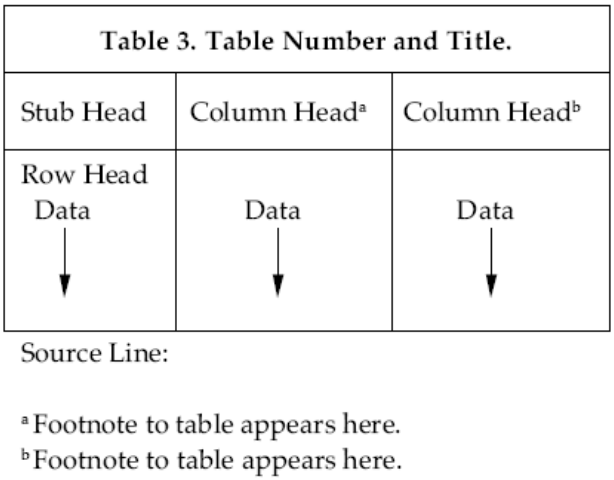

Figure 8: Nomenclature for the parts of a table

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).

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)