AFDTC PAMPHLET 83-2 AD-A238 548 31 MAY 1991

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SCIENTIFIC AND TECHNICAL INFORMATION

# HANDBOOK FOR TECHNICAL REPORT PREPARATION

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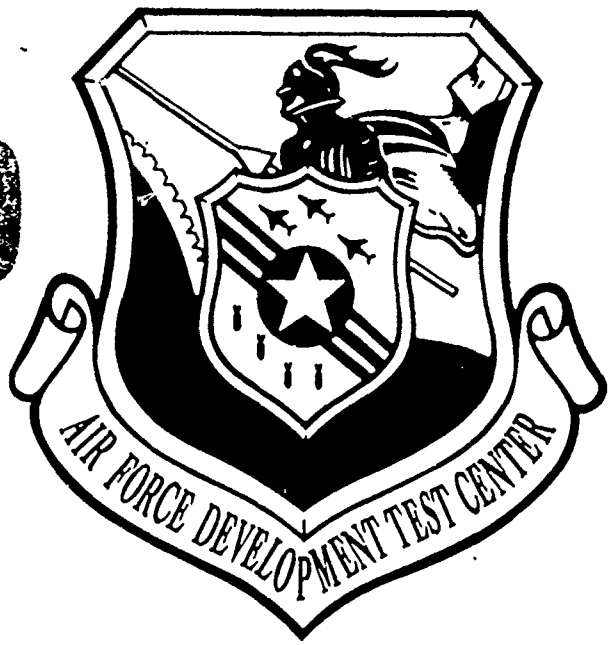


DEPARTMENT OF THE AIR FORCE
AIR FORCE DEVELOPMENT TEST CENTER (AFSC)
EGLIN AIR FORCE BASE, FLORIDA 32542-5000

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# REPORT DOCUMENTATION PAGE

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| 1. AGENCY USE ONLY (Leave blank) | 2. REPORT DATE | 3 REPORT TYPE AND DATES COVERED |
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| | 31 May 91 | N/A |

**4. TITLE AND SUBTITLE**

Handbook for Technical Report Preparation
Scientific and Technical Information

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**6. AUTHOR(S)**

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Program Manager, WL/MNOI, 882-4620

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

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**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**

**11. SUPPLEMENTARY NOTES**

**12a. DISTRIBUTION/AVAILABILITY STATEMENT**

Approved for public release;
distribution unlimited

**12b. DISTRIBUTION CODE**

**13. ABSTRACT** *(Maximum 200 words)*

The contents of this publication describes the organization and format of a technical report, and is a compilation of standards, manuals and regulations pretaining to technical report publication. Attachments 1 through 4 contain report preparation and processing requirements. Attachments 5 through 18 contain examples of report content and format.

**14. SUBJECT TERMS**

Technical Reports Program
Technical Publications
Technical Reports Preparation

**15 NUMBER OF PAGES**

38

**16 PRICE CODE**

| 17. SECURITY CLASSIFICATION OF REPORT | 18. SECURITY CLASSIFICATION OF THIS PAGE | 19 SECURITY CLASSIFICATION OF ABSTRACT | 20 LIMITATION OF ABSTRACT |
|---|---|---|---|
| Unclassified | Unclassified | Unclassified | UL |

## GENERAL INSTRUCTIONS FOR COMPLETING SF 298

The Report Documentation Page (RDP) is used in announcing and cataloging reports. It is important that this information be consistent with the rest of the report, particularly the cover and title page Instructions for filling in each block of the form follow It is important to ***stay within the lines*** to meet ***optical scanning requirements***.

**Block 1** Agency Use Only *(Leave blank)*

**Block 2.** Report Date. Full publication date including day, month, and year, if available (e g 1 Jan 88) Must cite at least the year

**Block 3.** Type of Report and Dates Covered. State whether report is interim, final, etc If applicable, enter inclusive report dates (e.g. 10 Jun 87 - 30 Jun 88).

**Block 4.** Title and Subtitle A title is taken from the part of the report that provides the most meaningful and complete information When a report is prepared in more than one volume, repeat the primary title, add volume number, and include subtitle for the specific volume On classified documents enter the title classification in parentheses.

**Block 5.** Funding Numbers To include contract and grant numbers; may include program element number(s), project number(s), task number(s), and work unit number(s). Use the following labels:

| | | | |
|---|---|---|---|
| C | - Contract | PR | - Project |
| G | - Grant | TA | - Task |
| PE | - Program Element | WU | - Work Unit Accession No |

**Block 6.** Author(s) Name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. If editor or compiler, this should follow the name(s)

**Block 7.** Performing Organization Name(s) and Address(es). Self-explanatory

**Block 8.** Performing Organization Report Number. Enter the unique alphanumeric report number(s) assigned by the organization performing the report.

**Block 9.** Sponsoring/Monitoring Agency Name(s) and Address(es) Self-explanatory

**Block 10.** Sponsoring/Monitoring Agency Report Number *(If known)*

**Block 11.** Supplementary Notes Enter information not included elsewhere such as. Prepared in cooperation with , Trans of , To be published in. When a report is revised, include a statement whether the new report supersedes or supplements the older report

**Block 12a.** Distribution/Availability Statement. Denotes public availability or limitations. Cite any availability to the public Enter additional limitations or special markings in all capitals (e.g. NOFORN, REL, ITAR).

- DOD - See DoDD 5230 24, "Distribution Statements on Technical Documents."
- DOE - See authorities.
- NASA - See Handbook NHB 2200 2
- NTIS - Leave blank

**Block 12b.** Distribution Code.

- DOD - Leave blank.
- DOE - Enter DOE distribution categories from the Standard Distribution for Unclassified Scientific and Technical Reports.
- NASA - Leave blank.
- NTIS - Leave blank.

**Block 13.** Abstract. Include a brief *(Maximum 200 words)* factual summary of the most significant information contained in the report

**Block 14.** Subject Terms Keywords or phrases identifying major subjects in the report.

**Block 15.** Number of Pages. Enter the total number of pages

**Block 16.** Price Code Enter appropriate price code *(NTIS only)*

**Blocks 17. - 19.** Security Classifications Self-explanatory Enter U.S Security Classification in accordance with U S Security Regulations (i e , UNCLASSIFIED) If form contains classified information, stamp classification on the top and bottom of the page

**Block 20.** Limitation of Abstract This block must be completed to assign a limitation to the abstract Enter either UL (unlimited) or SAR (same as report) An entry in this block is necessary if the abstract is to be limited If blank, the abstract is assumed to be unlimited

## FOREWORD

The contents of this pamphlet describe the organization and format of a technical report; however, it is presented in the Air Force pamphlet format. Attachments 1 through 4 contain report preparation and processing requirements, and attachments 5 through 18 contain examples of report content and format. These should be utilized in technical report preparation.

Glenn E. Messerli

GLENN E. MESSERLI, Colonel, USAF
Chief of Staff


| Accesion For | |
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| NTIS CRA&I | ☒ |
| DTIC TAB | ☐ |
| Unannounced | ☐ |
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DEPARTMENT OF THE AIR FORCE
Headquarters Air Force Development Test Center (AFSC)
Eglin Air Force Base, Florida 32542-5000

AFDTC PAMPHLET 83-2

31 May 1991

Scientific and Technical Information

# HANDBOOK FOR TECHNICAL REPORT PREPARATION

This publication is a compilation of standards, manuals, and regulations pertaining to technical report publications and incorporates all previous editorial guidance. It is designed to make technical report preparation and processing as simple as possible. Your conformance to this guidance will enhance the presentation of scientific and technical information. This publication applies to all AFDTC activities (except 3246 TESTW Test Reports), the Armament Directorate (WL/MN), and other ASD organizations located on Eglin AFB.



No. of Printed Pages: 38
OPR: WL/MNOI (Ms Wargo, 882 3213)
Approved By: Lt Col Loose
Editor: Mrs Litwack
Distribution: *F

# SECTION I

## INTRODUCTION

**1. TECHNICAL REPORT PROGRAM.** The Technical Reports Section (WL/MNOI) improves the flow of technical information, establishes mandatory format standards for technical reports (TRs), and emphasizes timely distribution for an orderly and rapid exchange of scientific and technical information. This office publishes WL/MN and Air Force Development Test Center (AFDTC) documents. All TRs are to be reviewed, approved, published, and distributed within 6 months after the completion of a project.

**2. TECHNICAL REPORT PREPARATION.** Before you begin work on a TR, review attachment 1 to see what elements are mandatory for a report. Do not overestimate the reader's knowledge of the subject matter, since all readers will not be experts in the field of interest. Write in acceptable English and do not use cliches, pet phrases, and the jargon common to a field of interest. When choosing a word, select it for meaning and connotation.

a. **In-House Reports.** Reports resulting from in-house projects will be prepared by those organizations responsible for the work. Thirty days after the project has been completed, a 1 1/2 or double-spaced, typed draft approved by the branch or division chief/deputate will be submitted with the sample letter of transmittal (attachment 2) to WL/MNOI for editing and illustrating. Artwork (line drawings, charts, graphs, etc.) may be submitted as rough, but complete, sketches. Photographs will be continuous tone black and white glossy prints. An approved master distribution list will be submitted with the draft. WL/MNOI will assign a TR number, prepare the artwork, and compose the report for reproduction. After the division chief's signature is affixed to the notice page, the report will be printed and distributed.

b. **Contractor-Prepared Reports:**

(1) The project engineer/program manager (PE/PM) will include Data Item DI-MISC-80711 in the contract and tailor the Contract Data Requirements List (CDRL) to substitute AFDTCP 83-2 in lieu of ANSI Z39.18. The PE/PM will maintain a suspense file on contract completion dates. If a draft report has not been received within the time specified in the contract, the PE/PM will draft a letter, as soon as possible, for the procuring contracting officer's signature, stating that the draft is delinquent and must be submitted to WL/MN within 10 days after receipt of the delinquency notification. The PE/PM will send a copy of this notification to WL/MNOI.

(2) At the completion of the technical tasks assigned under a contract, the contractor will provide a copy of the draft technical report to the PE/PM for review and approval by WL/MNOI personnel. The PE/PM will review the draft report for technical accuracy and completeness, and make any changes prior to submission to WL/MNOI for editing. This technical review should be completed within 15 working days. The draft must be approved by the branch or division chief/deputate and submitted with a letter of transmittal. At this time a TR number will be assigned to the draft.

(3) The editorial review will be completed in 30 days. If the report is acceptable, the edited copy will be returned to the PE/PM who will, within 5 days, forward the edited copy to the contractor for preparation of a camera-ready copy. The camera-ready copy and edited draft must be returned by the contractor to the PE/PM within 30 days after the contractor has received the edited, technically approved draft.

(4) The PE/PM will maintain a suspense file on camera-ready copy due dates. If the camera-ready copy has not been received within the allotted time, the PE/PM will notify the procuring contracting officer (PCO) in writing, as soon as possible, that the camera-ready copy is delinquent. The PCO will be requested to write the contractor, as soon as possible, that the camera-ready copy is delinquent and must be submitted to WL/MNOI within 10 days after receipt of the delinquency notification. The PCO will also be requested to send a copy of the notification to WL/MNOI and to the

PE/PM If the draft or camera-ready copy does not meet contractual requirements or satisfy the quality control inspection, it will be returned to the contractor for reaccomplishment and the review and processing cycle will begin anew.

## SECTION II

## FRONT MATTER

Front matter pages will be numbered consecutively with a lower case Roman numeral which will be centered 1 inch from the bottom of the page. Even-numbered pages are left-hand pages; odd-numbered pages are right-hand pages (this also applies throughout the report).

3. **FRONT COVER.** The front cover will be prepared by WL/MNOI and will include the following information:

a. **Report Number.** The report number will be assigned after the draft has been accepted by the PE/PM and is submitted to WL/MNOI for editing.

b **Title and Subtitle.** The report title shall indicate clearly and briefly the subject of the report. If a TR contains volumes or parts, each will have a subtitle.

c. **Authors.**

d. **Performing Agency.** The contractor's complete address including the zip code will be shown. List no more than two levels of an organizational hierarchy on in-house reports.

e. **Date.** The date will consist of current month and year.

f. **Type of Report and Period Covered.** Indicate if the TR is interim, final, etc. The period covered will be the beginning and ending date of the project.

g. **Distribution Statements.** All reports must carry limited distribution statements (see attachment 3) if they have not been approved by the Public Affairs Office or the Scientific and Technical Information Officer (STINFO) for unlimited distribution. Distribution Statement A will be used on all unclassified reports that have been approved for unlimited distribution. Under no circumstances will classified reports carry a Distribution Statement A. Abstracts of classified reports will be judged separately from the classified reports; and, the limited distribution statement applies to them only if the abstracts qualify for limited distribution. Personnel conducting the review and selecting the distribution statement may consult with WL/MNOI or the STINFO focal points. A list of distribution statements, and a corresponding list of standard reasons for use in Statements B through E, have been included in attachment 3.

h. **Export Control Warning Notice.** Consult AFRs 80-34 and 83-3 and AFP 80-30 for guidance in placing export control and related distribution availability statements on technical data. All technical documents that are determined to contain export-control technical data must be marked as follows:

> "**WARNING** - This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., Sec. 2751, et seq.) or the Export Administration Act of 1979, as amended (Title 50, U.S.C., App. 2401, et, seq.). Violations of these export laws are subject to severe criminal penalties."

i **Destruction Notice.** Documents containing export-controlled data must also bear the following marking:

> "**DESTRUCTION NOTICE**--For classified documents, follow the procedures in DOD 5220.22-M, Industrial Security Manual, Section II-19 or DOD 5200.1-R, Information Security Program Regulation, Chapter IX."

> "**DESTRUCTION NOTICE**--For unclassified, limited documents, destroy by any method that will prevent disclosure of contents or reconstruction of the document."

j Security Classification. Front covers of classified reports will also show security classification (center top and bottom), security classification authority, downgrading (unless the report contains "Restricted Data" or "Formerly Restricted Data"), and declassification schedule, and special markings such as: "Not Releasable to Foreign Nationals"(NOFORN), "Warning Notice--Intelligence Sources or Methods Involved", (WNINTEL) etc. (DOD 5200.1-R/AFR 205-1). The back cover will be marked with the security classification on center top and bottom.

**4. NOTICE PAGE.** Special notices such as reproduction limitations, legal information, safety precautions, disclaimers, compliance with special regulations, or disposition instructions will be included on the Notice page A review and approval statement, with appropriate signature, will also be included. The Notice page will be printed on the back of the front cover and will not be page numbered.

**5. STANDARD FORM (SF) 298, REPORT DOCUMENTATION PAGE.** SF 298 is mandatory and will be the first page of the front matter. Instructions for the preparation of this form are printed on the reverse and a sample has been included as attachment 4. The SF 298 will not carry a page number, although it occupies pages i and ii.

**6. SUMMARY:**

a. A summary is optional but may be included to provide a digest of the report, explain the reason for initiating the work, or outline principal conclusions and recommendations. The summary will present more information on the content of a report than can be contained in the abstract on the SF 298.

b. If used, the summary will always be the first page after the SF 298 and numbered iii/iv (Blank).

**7. PREFACE:**

a. The preface will include necessary administrative information such as contractor name, contractor address, contract number, inclusive dates of research reported, project manager, office symbol, credit for use of copyrighted material, and acknowledgment of significant assistance received. Also, report numbers and titles of associated efforts will be included (attachment 5).

b. The preface will be page iii/iv (Blank), if a summary is not used. If necessary, the preface can be continued on the reverse (page iv). If a summary is used, the preface page is v/vi.

**8. TABLE OF CONTENTS.** Each TR will have a table of contents. Column headings will be: Section, Title, and Page. The section title and paragraph titles must be shown. Further breakdown (subparagraphs) is not necessary but is acceptable. Titles must be listed exactly as they appear in the report (attachment 6). The table of contents must begin on a right-hand page.

**9. LIST OF FIGURES.** If figures are included in the TR, a list of figures is required and will begin on a new page. List figure number, title, and page number for each illustration (attachment 7). This list should be consistent with the titles listed under the figures.

**10. LIST OF TABLES.** If tables are included in the TR, a list of tables is required and will begin on a new page unless there are only five or less tables. List table number, title, and page number for each table (attachment 8). The list of tables will follow the list of figures and will be consistent with the titles listed over the tables.

**11. GLOSSARY OF TERMINOLOGY.** Define unusual terms either in the text or as a footnote the first time they are used in the text. When many such terms are used, list them in alphabetical order with definitions in a Glossary of Terminology (attachment 9).

**12. LIST OF SYMBOLS, ABBREVIATIONS, AND ACRONYMS.** Define symbols, abbreviations, and acronyms when first introduced in the text. If they are numerous, include a list in the front matter (attachments 10 and 11).

## SECTION III

## BODY OF REPORT

**13. INTRODUCTION.** An introduction is required to acquaint the reader with the work being described, regardless of previous knowledge, and to show the relation between the present task and previous or current work. It also indicates the value of the results achieved.

**14. MAIN TEXT.** This is a mandatory requirement for any technical report. It must include information concerning materials, equipment, and techniques used and circumstances (environment, etc.) involved in the work. This allows individuals qualified in the field to reproduce the work with the same results.

**15. CONCLUSIONS.** It is impossible to obtain results from experiments without reaching conclusions. It is mandatory that these conclusions (positive, negative, or neutral) be included.

**16. RECOMMENDATIONS.** This is optional. However, if recommendations are the logical outgrowth of the work, they should be stated under this heading so they will have maximum visibility.

## SECTION IV

## GUIDELINES FOR PRESENTATION

**17. REPORT TEXT.** The text will be divided into logically separate parts which will be called sections. Each section will be designated by a sequential uppercase Roman numeral and a short heading. The heading will be centered and typed in capital letters, two lines below the section number. The text will begin three lines below the heading and the type will not be reduced. Excessive spacing between words and after punctuation is not acceptable. In other words, do not justify the right margin. Number headings and subheadings only when needed for clarity. If numbered, follow the outline in attachment 12. Company names will not be mentioned in the text unless absolutely necessary for clarity and understanding of the material or in a comparative study. These are mentioned in the preface, SF 298, and on the cover. Section I will be typed on the right-hand page. Succeeding sections will be typed on a new page, either a right or left-hand page.

a. **Sentence/Paragraph Phrasing.** Make your sentences and paragraphs effective. Long sentences and paragraphs discourage the reader and should be avoided; however, short choppy sentences should also be avoided. Strive for good lead sentences, and achieve readability and emphasis by varying the types of sentences used. Do not try to crowd a paragraph of information into one sentence by the use of connectives. If there can be any question as to technical meaning, simplify the sentence by making two or more sentences. Use parallel construction to strengthen equivalent ideas. This results in balance, control, and clear sentences.

b. **Spelling and Grammar:**

(1) Explain esoteric words, acronyms, and expressions with the first usage. Writing in the active voice is more direct and eliminates unnecessary words. An example of active voice is: WL/MN conducts research on nonnuclear conventional weapons; passive voice--research of nonnuclear conventional weapons is conducted by WL/MN.

(2) When Air Force nomenclature is used for equipment, use the official nomenclature first. A shortened name may be used throughout the report if it is explained in a footnote or in parentheses after its first usage. Acronyms should be written out the first time cited and then the acronym typed in parentheses.

(3) Spelling must be correct. Carelessness can affect technical accuracy. Example: adsorption and absorption.

(4) Be sure pronouns refer clearly to their antecedents. Misuse of "this" and "it" can change or obscure technical meaning. Be sure nouns and verbs agree in number.

(5) Watch tenses of verbs. Generally, the work has already been accomplished. Therefore, the most logical tense is the past tense when reporting the activity. However, use the present tense when a condition, a parameter, a physical law, etc., is true, exists, or is in effect without regard to the information in the report. Use future tense as conditions of the work and equipment demand for that which is in the future.

(6) Use adjectives instead of a series of nouns as adjectives. Such a series creates sentences that are hard to understand.

(7) Review attachment 1 before starting work on any report.

**18. INTERNAL REFERENCES.** When citing references in the text, type the word, Reference, followed by its number; e.g., Reference 4, not just the number in the super position. Also, the references must be cited consecutively.

**19. MATHEMATICAL WORK:**

a. Important equations will be displayed, that is, placed on separate lines from the text and numbered for reference. A series of displayed equations will be aligned on the equality signs and centered on the page. A sample equation displayed on a page of text is shown as attachment 13. Derivations of equations, methods of calculation, and other support mathematical work will usually be placed in an appendix. The equations will be numbered consecutively on the right side of the page, but not in the margin. When calling out equations, use the word Equation followed by its number; e.g., Equation 3.

b Handwritten symbols and the letters which they closely resemble pose a problem for editing and composing personnel. When submitting a draft report, write all mathematical expressions clearly. Greek letters should be clearly designated by name in blue pencil in the margin; all symbols must be carefully written and checked; and the difference between capital and lower case letters should be clearly indicated. Confusion between zero (0) and the letter "o," between the numerical one (1) and the letter "l," between "alpha" and "a," and other expressions which resemble each other can be avoided if due care is exercised in writing and marking the copy. Subscripts and superscripts should be clearly indicated as subscripts and superscripts on the drafts.

**20. FIGURES:**

a. Treat figures consistently throughout a report. Prepare them so that details and callouts (labels) will be clearly legible after final reduction. The text will be no smaller than 6 point for final reproduction. When practical, crop or mask photographs to eliminate insignificant detail. Do not add a border or a frame, or use background tones in line drawings unless they contribute substantially to clarity. Rough pencil line art may be submitted for in-house reports. Submit only clean line art and only original black and white glossy photographs for camera-ready copy. If veloxes of photographs are submitted, they should be no greater than 60-line quality.

b. Good line drawings, schematics, graphs, sketches, etc., should be drawn in India ink on white bond, art board, or vellum. Color will not be used unless specifically authorized by the program manager as the only means of presenting data clearly. Screen, crosshatching, reverses, dots, or similar techniques can be effective substitutes for color.

c. Size-for-size art may be line drawings or photographs to be reproduced the same size as the original. Oversize art is any illustrative copy such as graphs, tables, schematics, etc., that is larger than the final page or the space provided. All reductions will be proportionate, dimension for dimension, to the nearest one-eighth of an inch.

d. Continuous tone black and white photographs will be submitted as unscreened, glossy, single weight prints identified by figure and page number. Glossy photographs will not be taped to the page. A layout page will be typed showing the figure number and title. The screened photograph will be mounted on this page. Photographs should have no distracting or superfluous details to detract from the informational value of the picture. People should not be included except for size comparison or when needed to point out or emphasize a part of the subject. If the photograph contains material which does not clarify or enhance the text, crop the extraneous matter.

e. When reducing cropped copy to the space allotted in the page layout, use the dimensions of the picture outlined by the crop lines. These dimensions must be used because the cropped picture may not be proportionate, dimension for dimension, to the original. Make the crop arrow or lines with blue pencil in the margins or on a tissue overlay. Identify the top of the photograph, page number, and figure number.

f. Place illustrations (as near as possible) after the first text reference except in special situations, such as a report containing only a few text pages and many illustrations. In such cases, place the illustrations in numerical sequences in back of the text. Unless it is not possible to do so and maintain readability, place illustrations so that they may be reviewed without turning the page sideways. If

this is not possible, place the illustrations sideways so that they can be seen by rotating the page clockwise. A sample is shown in attachment 14.

g. Whenever possible, avoid the use of oversized illustrations that must be folded. Often a large illustration can be divided to appear on facing pages. When foldouts cannot be avoided, begin them on a right-hand page and number as one page. The reverse will be blank. The next page will be an odd-numbered page. Refer to attachment 15.

h. If you are submitting illustrations to be used as camera-ready copies, identify each illustration. A nonphotographic blue pencil may be used to identify figure number and legend on line art. Place photographs in envelopes and list identifying information on the outside. Do not type or write on photographs. Do not roll or bend photographs.

i. Company names, trademarks, corporate seals, or logos will not be placed on illustrations.

j. When mounting illustrations, use only one layer of tape to attach an illustration to the page. Stacking tape is not acceptable since it produces a gray area when printed. The tape should be placed all across the top and bottom of the illustration. The sides do not need to be taped all the way down. Avoid overlapping tape.

**21. TABLES:**

a. Tables should be as simple as possible so that the reader can easily grasp the meaning of the data. Avoid vertical and horizontal lines whenever spacing can be used effectively (attachment 16).

b. Locate tables as near as possible after their first text reference except in special situations; e.g., when a report contains only a few text pages and many tables. In such cases, place the tables in numerical sequence in back of the text. Unless it is impossible to do so and maintain readability, place tables so that they may be viewed without turning the page sideways.

c. Give applicable units of measure or degrees in the column headings to tables. It is desira. .o use metric (SI) units with English in parentheses.

**22. COMPUTER RUNS.** Computer printouts will be kept to a minimum. When their use is required, the quality of these printouts will be the same as that for camera-ready copies. They will be run on unlined paper and either will conform to the printing area (6 1/2 by 8 3/4 inches) requirements or will be suitable for reduction to meet those requirements. A computer run can be used in the text or as an appendix, depending upon its use; e.g., computer software (coding or programming instructions).

**23. COMPUTER-GENERATED GRAPHICS.** The use of computer-generated graphics is permitted, but these images must be submitted photographically, either through photographic mechanical transfer, by transfer of the terminal; e.g., Matrix System, or through a laser slot output. Computer-generated graphics submitted on silver oxide paper or reproduced copies will not be accepted.

**24. SECURITY AND WARNING NOTICE MARKINGS:**

a. Security classification markings will be as illustrated below. Space will be utilized to the maximum extent within the printing area limitations. Portions of pages will not be left blank for the purpose of beginning a major paragraph or subsection on a new page.

SECTION (U)

INTRODUCTION (U)

1. (S) FIRST POSITION HEADING

a. (C) Second Position Subheading

(1) (U) Third Position Subheading

(a) (C) Fourth Position Subheading

(2) (U) Third Position Subheading

b. (U) Second Position Subheading

2. (C) FIRST POSITION HEADING

b. Every element (heading, subheading, caption, paragraph, figure, and table) in a classified report will be marked individually with the appropriate classification of the information contained in that particular element. The classification of a paragraph will be shown at the beginning of the paragraph in parentheses. The following abbreviations will be used: (U) for UNCLASSIFIED, (C) for CONFIDENTIAL, (S) for SECRET. The classification of each subparagraph will be marked. The classification of a figure or table will be shown under the figure or table on the lower right side in letters larger than the print in the illustration so that the marking will be conspicuous (bold print) and will be reproduced on any copies made. Abbreviated classification in parentheses is required between the figure or table number and the respective title. Each page will carry the classification of the highest classified paragraph.

c. Warning Notices (NOFORN, WNINTEL, PROPIN, etc.) for pages will be shown once in short form on the lower right side of the page (between the last line of text and the page number). Restrictive markings for paragraphs will be shown in conjunction with the paragraph classification (S-NF, C-WN, U-PR, etc.) at the beginning of each paragraph.

d. "Classified By" and "Declassify On" instructions must appear on the cover page of a classified document, unless the information is Restricted Data (RD) or Formerly Restricted Data (FRD). The RD and FRD will not be declassified without approval of the Department of Energy; therefore, the "Declassify On" line will be omitted. If a security classification guide is used to classify the document, cite by title, date of the guide, and any changes thereto. If multiple sources are used to classify a document, list them at the end of the report.

e. A technical report may be classified to protect a compilation of information or to protect the source of information rather than the information itself. In such cases, marking paragraphs or illustrations individually would be misleading. Instead, the overall classification of the report will be marked on the center top and bottom of the cover and on the front page of the SF 298. An explanation of the basis for the assigned classification will be included in the Preface to the report.

f. Classified information and references WILL NOT be included in reports having Distribution Statement A. Classified reports will be prepared according to DOD 5200.1-R/AFR 205-1, Information Security Program Regulation.

g. The format for an unclassified table of contents, list of figures, and list of tables is as follows:

TABLE OF CONTENTS (U)



LIST OF FIGURES (U)



LIST OF TABLES (U)

## SECTION V

## REFERENCE MATERIAL

**25. APPENDICES.** Appendices may be used for material related to or additional to the report such as material not essential to understanding the text but which provides additional information to the critical reader, detailed descriptions or explanations of some points in the text, extensive test data, and complex and detailed justification of a report assumption. Appendices might also be used to explain derivations of unfamiliar formulas used in the text, tabulations referenced frequently throughout the report, details of special instrumentation, and lists of materials when contracts require that lists be included in the report. However, an appendix will not include information which logically belongs in the text specifications, exhibits, or project work requirements. The appendix number and caption will be positioned on the page in the same manner as section headings. The paragraph format will be the same as used in the text. Begin the first appendix on a right-hand page and each subsequent appendix on a full page. Each appendix will have a fly page preceding the first page of the appendix. The appendix identification and title will be typed in all capitals on the fly page; e.g., APPENDIX C (and title centered under Appendix C). The fly page will be a right-hand page. Page numbering is a continuation of text page numbering. Figures, tables, equations, and references in the appendices will be numbered with the letter designation of the appendix in which they appear, followed by a dash and the sequential number of the figure, table, equation, or reference in the appendix; e.g., Figure A-1, Table B-2, Equation A-7, Reference B-4. If there is only one appendix, it will be identified as The Appendix, not as Appendix A. The references cited in an appendix must be listed as the last page of the appendix.

**26. REFERENCES.** When references are cited, they must appear in a list on the last page of the report (attachment 17) or the second to the last page if there is a bibliography. Within the report the reference number will be cited in the text with the word Reference preceding the number; e.g., Reference 8 On all unlimited documents, references cited must be in the public domain or have been cleared for public release.

**27. BIBLIOGRAPHY.** This list includes additional supplemental material not specifically referenced. These entries will be listed on a page after References. The items in the Bibliography include the same information required for References except entries are arranged alphabetically by author and are not numbered (attachment 18).

## SECTION VI

## INFORMATION FROM OTHER SOURCES

**28. COPYRIGHTED MATERIAL (AFR 110-8).** Brief excerpts from copyrighted material can be included in TRs without written permission of the copyright holder if the use falls within the judicially recognized doctrine of fair use. In general, this doctrine permits use of limited portions of the material, such as quotations for scholarly purposes, which do not interfere with the copyright holder's expected economical return. Any doubt regarding the fairness of a particular use should be referred to the local Staff Judge Advocate.

a. Copyright holders are often willing to give permission to the Government to use their material. AFR 110-8 prescribes Air Force publications concerning use of copyrighted material, shows how to obtain permission, and furnishes a sample request letter. Refer to this regulation and consult with the local Staff Judge Advocate when copyrighted data is used.

b. Copyrighted material used in a report will be specifically identified and a statement incorporated as follows: Reprinted from (title of copyrighted work) by (author) by permission of (name of copyright owner). Copyrighted (date). Prior use of copyrighted material in another Government publication does not constitute permission to use it again.

**29. LIMITED RIGHTS.** Because the inclusion of limited rights restricts the distribution of a TR, only such information that is mandatory to an understanding of the report will be used. Limited rights will be included only after coordination and approval by the author and the PCO. This will be accomplished prior to submission of the TR for editing. When a report contains limited rights data, the individual paragraphs, illustrations, and pages will be identified as Proprietary. Mark each paragraph as (PR) at the beginning. Illustrations are labeled Proprietary on the lower right side. Each page will be marked PROPIN in bold print on the lower right side, two lines below the last line of typing. Distribution will be limited by the appropriate distribution statement, and the Limited Rights Legend will be inserted in the TR (attachment 3).

**30. TRADE NAMES (AFR 110-8).** The indiscriminate use of a trade name in place of the proper descriptive term may turn the trade name into a generic term with loss of trademark protection to the owner. Accordingly, the proprietary nature of the trade name will be respected and the use of such terms will be limited. If a trade name must be used, include a suitable acknowledgment that the goods are sold under that trade name, or by setting off the term in quotation marks.

## SECTION VII

## ERRATA/TYPOGRAPHY

**31. ERRATA.** Errors are normally corrected during proofing. If an error does become printed into final copy, an errata is written making the required corrections. The errata is sent to all recipients of the original document.

**32. TYPOGRAPHY:**

a. **Paper Size and Image Area.** Paper size will be 8 1/2 by [illegible] inches, good quality 50-pound white bond stock. The image area should be 6 1/2- by 8 3/4-inch dimensions exclusive of page numbers which will be placed at least two lines below the last line of text copy at page center. All margins must be at least 1 inch on all sides of text pages, plus two lines at the bottom.

b. **Type Size and Line Spacing.** The size of type for the [illegible] shall provide for final copy in which letters and numbers will be as large as 10-point type but not larger than 12-point type. Although any standard typeface is acceptable, unusual type styles such as capitals, italics, script, etc., will not be used. The print must be of high quality--not ragged, broken, or light and be the same font throughout the text. Dot matrix, laser, etc., may be used if letter quality. The unbound camera-ready copy will be typed on one side of the paper with 1 1/2 line spacing or single spacing, except where the inclusion of equations or symbols dictates the use of double spacing. Draft manuscripts will be 1 1/2 line spacing.

c. **Reproduction.** Reproduction of the report will be accomplished by the most economical method available providing the final result is according to the guidance of this pamphlet. Reports will usually be reproduced by the offset method and will contain no more than 375 pages. If the TR contains more pages, it will be divided into volumes.

d. **Figure Numbering.** Figures will be numbered consecutively in Arabic numerals with the word Figure preceding each number. Section numbers (III-I) will not be used in the figure number. The figure number and title will be centered two lines below the illustration and typed with initial capitals (attachment 14). A series of illustrations constituting one figure will carry the full title at the bottom of each illustration: "Figure 1. Title" followed by "(Continued)" will be used if the figure is more than one page; "Figure 1. Title" followed by "(Concluded)" will be used on the last page of the figure. Subtitles, designated (a), (b), (c), etc., will be given to each of the parts.

e. **Table Numbering.** Tables will be numbered consecutively in Arabic numerals. The table number and caption will be centered two spaces above the table and typed in all capitals (attachment 16). Tables consisting of more than one page will be treated the same as figures, which is explained in the preceding paragraph.

f. **Equations.** Important equations will be displayed, that is, placed on separate lines from the text and numbered consecutively on the right, enclosed in parentheses (1). Equations will be centered on the page (attachment 13).

g. **Pagination.** Section numbers (II-12) will not be used in the page numbering. All pages (including the appendices) will be numbered consecutively--1, 2, 3, etc. Section I will be page 1 as it is a right-hand page.

## SECTION VIII

## REQUIREMENTS FOR SPECIAL REPORTS

**33. REPORTS IN PARTS.** Sometimes it may be desirable to publish a report on one subject, but in separate parts, each being under separate cover. In such cases, each part bears the same basic report number and title. The basic report number and the part number shall appear on the SF 298. Beginning with the first part, an appropriate statement outlining the situation shall be included in the Preface of each part. Page numbering will be separate and individual for each part.

**34. REPORTS IN VOLUMES.** Occasionally in the case of a voluminous report (more than 375 pages), the TR will be published in two or more volumes. The volumes should be made approximately the same length if practicable. The division should be made at the end of a major section of text, at the end of the text if there are voluminous appendices, or at some other logical point. Each volume shall bear the same basic report number, title and subtitle. The report number and the volume designation shall appear in block 10 of the SF 298. The title, volume number, and subtitle will appear in block 4 of the SF 298 (attachment 4). Each volume will contain an SF 298, Preface (stating which volume it is and how many volumes are included in the TR), Table of Contents, and other appropriate front matter. Page numbering is a continuation of text page numbering.

## SECTION IX

## DISTRIBUTION OF TECHNICAL REPORTS

**35. APPROVED MASTER LIST.** The PE/PM should obtain an approved master distribution list from the division/directorate secretary and circle appropriate addressees of those receiving the technical report. To reduce the risk of undesired transfer of technical data on documents that have limited distribution statements, only those addressees that the PE/PM considers essential and within the boundaries of the limitations are to be included (see AFP 80-30). WL/MNOI will check the distribution list to ensure mandatory addressees are included. Copies of report may only be distributed to authorized data custodians as appears in DD Form 2345 (Military Critical Technical Data Agreement). No addressee will be deleted unless the PE/PM is informed. If additional addressees are desired, complete names, addresses, zip codes, and number of copies will be added to the bottom of the master list and circled before it is submitted to WL/MNOI.

**36. RESTRICTED INTELLIGENCE DISTRIBUTION.** All technical publications that contain intelligence information ("Warning Notice - Intelligence Sources or Methods Involved," "Caution - Proprietary Information Involved," "Dissemination and Extraction of Information Controlled by Originator," "Not Releasable To Contractors/Consultants," "Not Releasable To Foreign Nationals,"and some "Restricted Data" and "Formerly Restricted Data") may not be distributed to the Defense Technical Information Center (DTIC). Approval must be obtained from the Senior Intelligence Officer to distribute any technical publication to any U.S. Contractor.

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**KENNETH E. STATEN, Major General, USAF**
**Commander**

**MICHELE M. OHOTNICKY, Captain, USAF**
**Director of Information Management**

## ORDER OF ELEMENTS

A technical report will contain the following parts arranged in the order listed:

### FRONT MATTER

| | |
|---|---|
| Front Cover | Required |
| Notice Page | Required |
| SF 298, Report Documentation Page | Required |
| Summary | Optional |
| Preface | Required |
| Table of Contents | Required |
| List of Figures | Required (if 5 or more) |
| List of Tables | Required (if 5 or more) |
| Glossary of Terminology | When applicable |
| List of Symbols, Abbreviations, and Acronyms | When applicable |

### BODY OF REPORT

| | |
|---|---|
| Introduction | Required |
| Main Text | Required |
| Conclusions | Required |
| Recommendations | Optional |

### REFERENCE MATERIAL

| | |
|---|---|
| Appendices | When applicable |
| References | When applicable |
| Bibliography | When applicable |
| Back Cover | Required |

## SAMPLE LETTER OF TRANSMITTAL

SUBJECT: Request for Editing Technical Publication Draft

TO: WL/MN/MNOI

1. Attached is an interim/final, in-house/contractor technical document entitled: _____
Requiring: (Contractor Format_____) or (AFDTCP Format_____)/DTIC Submittal_____

2. Engineer/office symbol/extension: _____
I certify that the DD Form 250 has not been executed.

3. Contract Number _____ ILIR: SBIR: _____ /PE NUMBER: _____
WL/MN JON (See AFSC Form 4080) _____
AFDTC Project Number (See DD Form 1498) _____

4. Beginning and ending dates of project: _____ to _____.
If more than 45 days have elapsed since end of project, attach a letter of justification for delinquency.

5. This report contains Air Force owned software: Yes_____ No_____.

6. The following distribution statement and reason were selected (A, B, C, D, E, F, X). (For guidance, consult AFP 80-30). Reason: _____.

7. Using AFP 80-30 or AFR 83-3, I have determined that the data in the report should be marked with the Export Control Warning Notice: Yes_____ No_____. If yes, provide the CCAL certification number for non-Government agencies. Copies of report will be mailed only to authorized data custodians as appears in the DD Form 2345.

8. A completed Standard Form 298, Report Documentation Page, and a Preface are included in the draft.

9. Was the latest Security Classification Guide used? If there are changes thereto, please list. Yes_____ No_____. Is a Multiple Source List included (if this is the source for classification)? Yes_____ No_____.

10. An approved accurate and current distribution list (in accordance with selected distribution statement) is attached. To reduce the risk of undesired transfer of technical data on documents that have limited distribution statements, only those addressees the PE/PM considers essential and within the boundaries of the limitation are included. For non-Government addressees, provide the DOD Dissemination Authorization List (DAL) User Code Number.

11. DTIC is authorized copies of this report: Yes_____ No_____. (If DTIC is not authorized copies, state reason).

(Supervisor's Signature)

## SAMPLE DISTRIBUTION STATEMENTS

**DISTRIBUTION STATEMENT A**

Approved for public release; distribution is unlimited.

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Distribution authorized to US Government agencies only: (fill in reason); (date of determination). Other requests for this document shall be referred to (insert controlling DOD office).

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For limited rights (proprietary information) Distribution Statement B will be used. Also, the following Limited Rights Legend will appear in the prefatory material.

**LIMITED RIGHTS LEGEND**

Contract No: _____

Contractor: _____

_____

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The restrictions governing the use of technical data marked with this legend are set forth in the definition of "Limited Rights" in DFARS 27.471. This legend, together with the indications of the portions of this data which are subject to limited rights, shall be included on any reproduction hereof which includes any part of the portions subject to such limited rights. The limited rights legend shall be honored only as long as the data continues to meet the definition of limited rights.

## SAMPLE SF 298 - REPORT DOCUMENTATION PAGE

### REPORT DOCUMENTATION PAGE

*Form Approved*
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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 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 Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

| 1. AGENCY USE ONLY (Leave blank) | 2. REPORT DATE | 3. REPORT TYPE AND DATES COVERED |
|---|---|---|
| | 1986 December | Final Jan 84 - Dec 85 |

**4. TITLE AND SUBTITLE**

Turbine Engine Structural Life Prediction Program

**5. FUNDING NUMBERS**

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PE: 63202F
PR: 668A
TA: 03
WU: 08

**6. AUTHOR(S)**

M. L. Robertson and L. F. Sagendorph
Program Manager--John Doe, ASD/YJ 882-1234

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

General Electric Company
Aircraft Engine Business Group
Cincinnati, OH 45215

**8. PERFORMING ORGANIZATION REPORT NUMBER**

**9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)**

Aeromechanics Division
Air Force Armament Laboratory
Eglin Air Force Base, Florida 32542-5434

**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**

AFDTC-TR-91-03

**11. SUPPLEMENTARY NOTES**

SUBJECT TO EXPORT CONTROL LAWS

Availability of this report is specified on verso of front cover.

**12a. DISTRIBUTION/AVAILABILITY STATEMENT**

Distribution authorized to U.S. Government Agencies only; this report documents test and evaluation; December 1985. Other requests for this document shall be referred to ASD/YJ, Eglin AFB, FL 32542-5453.

**12b. DISTRIBUTION CODE**

N/A

**13. ABSTRACT** *(Maximum 200 words)*

The objective of this report was to critically evaluate and verify the best available state-of-the-art methods for predicting life exhaustion of cold military gas turbin components, due to low cycle fatique, on a mission utilization basis. To this end typical missions of an advanced fighter engine were evaluated and a representative mission cycle synthesized. The extremely complex radical inflow 7th stage compressor disk from the GE23 engine was selected as the test vehicle. Detailed 3-D heat transfer and stress analyses were conducted, including a 3-D photoelastic analysis of the rotational stresses. Same parts data was obtained for components life prediction and a combination of analytical and experimental techniques were used for the life prediction. To verify the disk life prediction, a rotating thermal mechanical cyclic rig was developed to simulate the actual disk environment during the rig test. In order to ensure that the rig test would be representative of actual engine conditions, environmental data was taken during a GE23 engine test.

| 14. SUBJECT TERMS | 15. NUMBER OF PAGES |
|---|---|
| Structural Life Prediction<br>Accelerated Life Test<br>Crack Growth Prediction | 375<br>16. PRICE CODE |

| 17. SECURITY CLASSIFICATION OF REPORT | 18. SECURITY CLASSIFICATION OF THIS PAGE | 19. SECURITY CLASSIFICATION OF ABSTRACT | 20. LIMITATION OF ABSTRACT |
|---|---|---|---|
| UNCLASSIFIED | UNCLASSIFIED | UNCLASSIFIED | SAR |

NSN 7540-01-280-5500 Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18
298-102

## SAMPLE PREFACE

This program was conducted by the (name of c ractor and address), under Contract F08635-(insert remainder of contract number) with (AFDTC or \ /MN), Eglin Air Force Base, FL 32542-5434. (Name of project engineer and office symbol) managed the program for the (Armament Directorate or Air Force Development Test Center). The program was conducted during the period from (date started and completed).

## SAMPLE TABLE OF CONTENTS

## SAMPLE LIST OF FIGURES

## SAMPLE LIST OF TABLES

## SAMPLE GLOSSARY OF TERMINOLOGY

| | |
|---|---|
| Apex Box | The box on the sending surface which encloses the apex of the Mach hyperbola associated with the receiving box |
| Area Ratio | On-planform fraction of a box which is cut by the planform boundary. |
| Box Grid | Nondimensional geometric array of boxes which extent is determined by the geometry properties of the planforms. The term grid embraces the arrays on both surfaces. |
| Control Point | The location at which a receiving box is deemed to be influenced by other boxes. In general, the center of the receiving box. |
| Global Coordinate System | System X aft, Y right, Z up. Y = 0 at centerline of airplane. |
| Leading Edge Diaphragm | All diaphragms on which 0 = 0. |
| Longitudinal Separation | Streamwise distance between the trailing edge of the wing and the leading edge of the tail, measured along the centerline. |

## SAMPLE LIST OF SYMBOLS

| | |
|---|---|
| A | constant |
| b | disc radius |
| $C_M$ | mass transfer Stanton number |
| h | enthalphy, thickness |
| k | optical constant, reaction rate constant |
| p | pressure, power |
| Pr | Prandtl number |
| w | mass rate |
| Z | mass fraction |
| V | absorptivity, absorption coefficient, coefficient of thermal expansion |
| J | thickness |
| m | emissivity, strain |

## SAMPLE LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AGE | Aerospace Ground Equipment |
| Alt | Altitude |
| ASD | Aeronautical Systems Division |
| ATC | Air Traffic Control |
| AWADS | Adverse Weather Aerial Delivery System |
| CAZ | Cursor Azimuth |
| CR | Cursor Range |
| DT&E | Development Test and Evaluation |
| DZ | Drop Zone |
| J boxes | Junction boxes |
| LEDs | Light Emitting Diodes |
| MAC | Military Airlift Command |
| mm | millimeter |
| MSL | Mean Sea Level |
| OAP | Offset Aiming Point |
| PPI | Planned Position Indicator |
| ROC | Required Operational Capability |
| ROMs | Read Only Memories |

## NUMBERING PARAGRAPH HEADINGS AND SUBHEADINGS

### SECTION I

### INDIVIDUAL COMPONENT DEVELOPMENT

1. BACKGROUND

As early as 1939 it was known .....

a. Positive Electrode

The positive side of the bipolar electrode .....

(1) Processing

Processing of the positive side of .....

(a) Procedure

Starting with .....

SAMPLE MATHEMATICAL EQUATION

$$U - iV \Big|_{Z = Z_k} = \left[ A - \frac{i}{2\pi} \sum_{\substack{j=1 \\ j \neq k}}^{N} \left( \frac{T_j}{\lambda_k - \lambda_j} \right) + \frac{i}{2\pi} \sum_{\substack{j=1 \\ j \neq k}}^{N} \frac{T_j}{\lambda_k - \lambda_j^k} \right] \tag{7}$$

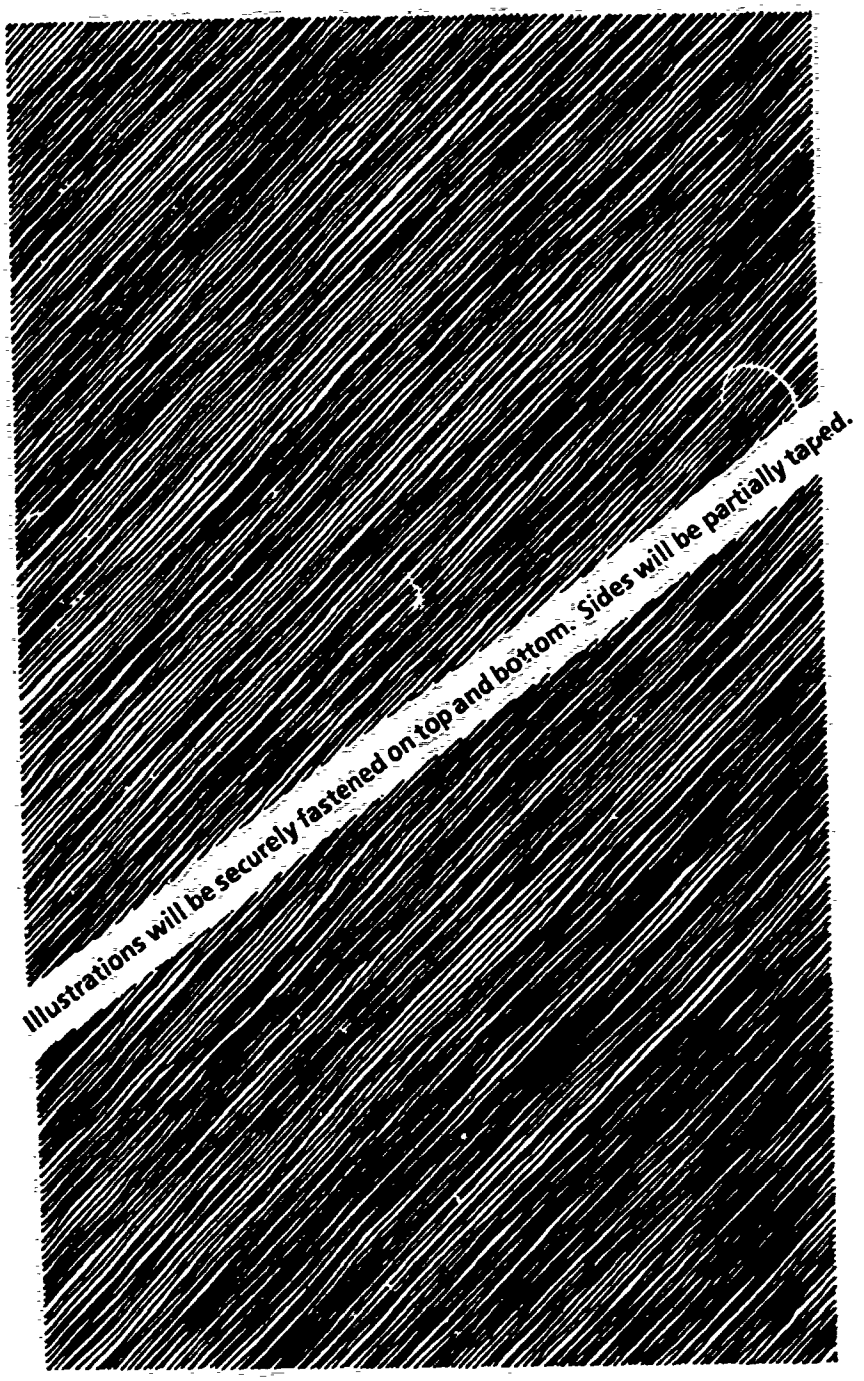
$$f^1 \left( Z_k \right) - i \frac{T_k}{4} f^{11} \left( Z_k \right) \Big/ f^1 \left( Z_k \right)$$

## PLACEMENT OF PHOTOGRAPHIC FIGURES

Place figure number and caption in this position under the figure.

(Follow above sample when using a horizontal layout.)

PLACEMENT OF PHOTOGRAPHIC FIGURES




Place figure number and caption in this position under the figure.

(Follow the above sample when using a vertical layout.)

## FOLDOUTS AND PHOTOGRAPHIC PLACEMENTS

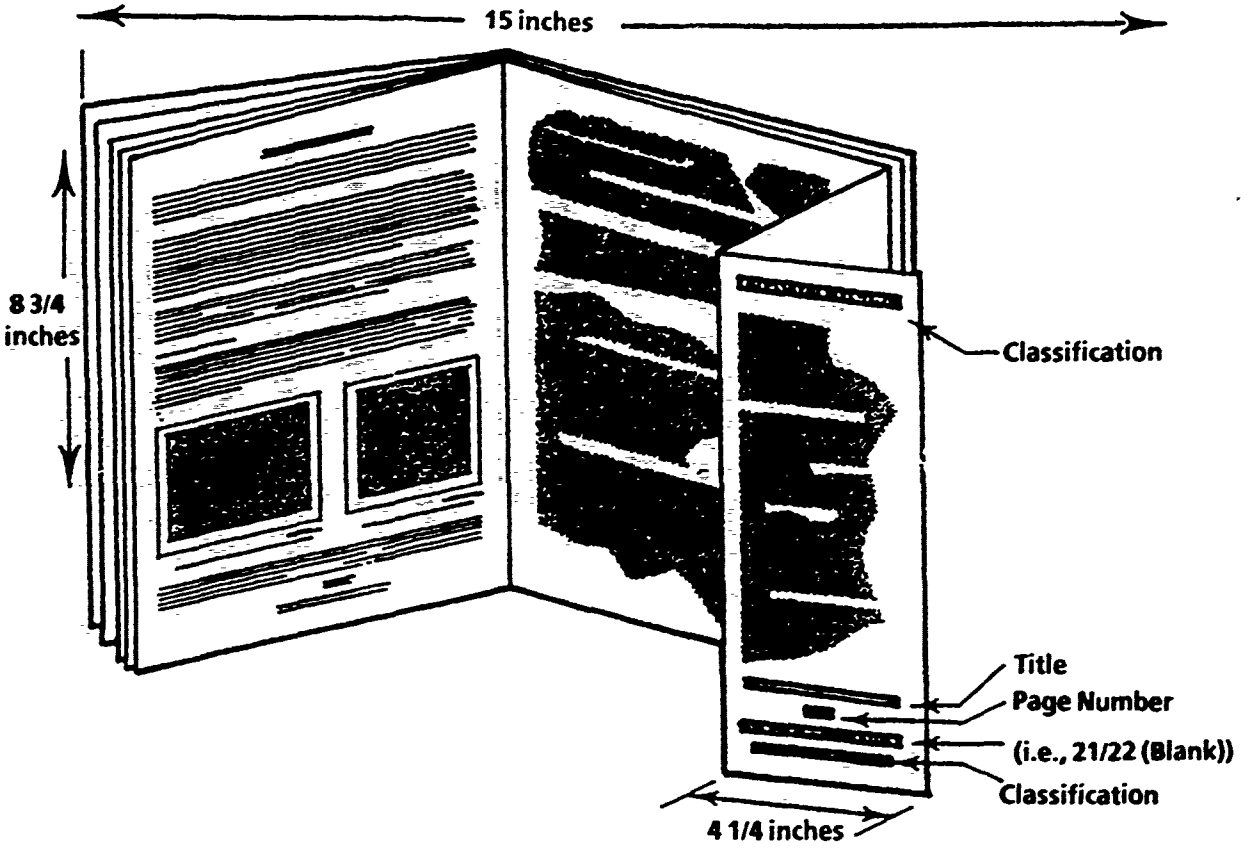



**Figure 1. (U) Unclassified Sample Format**

Figure captions will be typed in upper and lower case (initial caps only) two spaces below the figure as viewed. Each figure will have a DIFFERENT number and caption.

The foldout printing area will be 8-3/4-inches long and 15-inches wide.

Do not crease the foldout. The printing plant will accomplish this.

## TABLE EXAMPLE

### TABLE 1. GEOMETRIC DATA FOR SELECTED BODY STATIONS

| Station | x (inches) | $\left(\frac{X}{L}\right)$ | Radius (inches) |
|---|---|---|---|
| 1 | 3.0 | 0.27 | 0.64 |
| 2 | 5.0 | 0.46 | 0.89 |
| 3 | 7.0 | 0.64 | 1.12 |

## SAMPLE REFERENCES

1. G. Birkhoff, D.P. MacDougal, E.M. Pugh, and G.I. Taylor, Journal of Applied Physics, Vol 19, Page 563, 1948.

2. W.W. Allen and J.W. Rogers, "Penetration of a Rod Into A Semi-Infinite Target," Journal of Franklin Institute, 1961.

3. L. Wilson, Armor Penetration Tests, WL/MN Internal Research Project 25020617, Air Force Armament Directorate, Eglin AFB FL 32542-5434, 1970.

4 V. Hohler and A.J. Stilp, Penetration of Steel and High Density Rods in Semi-Infinite Steel Targets, Erns Mach Institute, March 1977.

5. G.A. Tyler, D.L. Fried, and G.C. Myers, Advanced Wavefront Analysis, AFWL-TR-82-112, Air Force Weapons Laboratory, Kirtland Air Force Base, New Mexico 87117-6008, December 1982.

## SAMPLE BIBLIOGRAPHY

Allen, W.A, and Rogers, J.W., "Penetration of a Rod Into A Semi-Infinite Target," Journal of Franklin Institute, 1961.

Birkhoff, G., MacDougal, D.P., Pugh, E.M., and Taylor, G.I., Journal ofApplied Phy .s, Vol 19, Page 563, 1948.

Hohler, V., and Stilp, A.J , Penetration of Steel and High Density Rods in Semi-Infinite Steel Targets, Erns Mach Institute, March 1977.

Tyler, G.A., Froed. D.L., and Myers, G.C., Advanced Wavefront Analysis, AFWL-TR-82-112, Air Force Weapons Laboratory, Kirtland Air Force Base, New Mexico 87117-6008, December 1982.

Wilson, L., Armor Penetration Tests, WL/MN Internal Research Project 25020617, Air Force Armament Directorate, Eglin AFB FL 32542-5000, 1970.