

CHAPTER FOUR

ASSEMBLING A S&T DOCUMENT

- To have **an effective S&T document or talk** requires committing ideas to paper with considerable effort, and **the hardest task is getting started!**
- The **process** of producing a S&T document is a **repetitious** task which contains **continuous** revising and editing.
- The seven primary parts of the **preparation process** are
 - **focusing** on the subject
 - **gathering** information about the subject
 - **selecting** the material to be used
 - **planning** the document
 - the sequencing
 - the details
 - **writing**
 - **revising**
- **No particular order** must be used for every attempt to produce a S&T document.
 - ★ After gathering information about the subject, you may wish to revise the way you want to present the information.
 - ★ You may wish to alter the subject in minor or sometimes in major ways.
 - ★ You might start by preparing an outline for the document, but after gathering information about the subject, you may want to amend it.
 - ★ While putting the words onto paper, you may need to go back for more material and fill in the gaps with specific information.
 - ⇔ The process is a **fluid** one requiring continued **interchange** of the various steps.

THE PLANNING PROCESS - GUIDELINES

- Write down your **thoughts and intentions**
- **Rewriting and revising** the first draft (often several times) are normal and desired activities.
 - ★ **REMEMBER:** Writing needs to be continually shaped before it is presentable.
- Now you have a **basis** to consider - not necessarily in final form!

- Make an **outline** - the most tedious part, but also, the most important part of developing a good document.



Writing an outline may seem **highly unpleasant**.



A **well thought out outline** can increase the **effectiveness** of a document by factors of 10 or more!

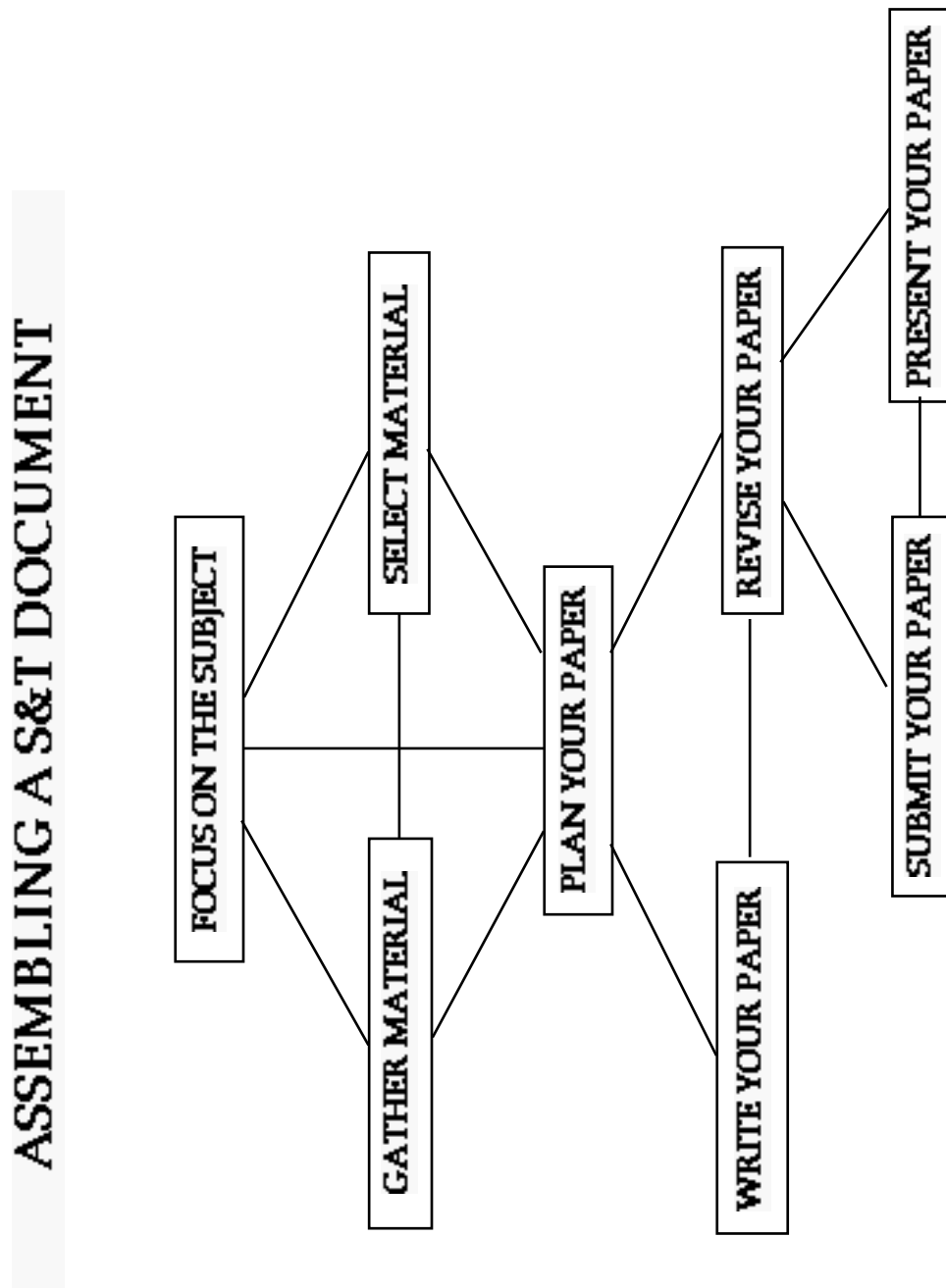


Diagram showing important steps in assembling a S&T document.

- ✓ The first part of the planning process should include the answers to three (as always, write out the numbers!) questions:
1. What is the **subject**?
 2. What is the **purpose** of the project?
 3. Who will be the **audience**?

SUBJECT

- Frequently the subject seems obvious, such as,
 - A scientist writing a paper about the results of his/her project knows exactly what to write about.
 - A student is sometimes assigned a subject that should be addressed in a talk or paper.
 - An employee may be asked/required to present information about a specific topic - there is no choice!
- Even if you are given the subject, you still need to decide the **focus**.
 - e. g. I am asked to write an informative short paper on **biomedical imaging** - a very broad subject. Biomedical imaging includes computerized tomography (conventional, spiral, etc.), magnetic resonance tomography, ultrasound imaging (A-mode, B-mode, M-mode, Doppler, etc.), angiography, ...
 - ✗ Can anyone present the basics and application principles of every method in 5 pages?

SOLUTION:

- ★ I pick a category or a specific application
- ★ I do a library search.
- ★ I make an outline.

PURPOSE

- Quite often, the purpose also seems obvious, such as,
 - A scientist wishes to publish research results that are new or add information to the body of knowledge in that science.
 - A student is required to write a term paper to pass a course OR a student wants to write a paper because of his/her interest in a subject.

- A manager might be planning an oral presentation to convince others about the worthiness of a project.
- ✓ Considering the **PURPOSE** focus on
 - ★ what you will **describe**
 - ★ what you want to **prove**
 - ★ what you want to **explain**
 - ★ are you trying to **provide information**?
 - ★ are you trying to **change someone's mind**?
 - ★ all of the above?

AUDIENCE

- Is your audience **interested** in the subject already or are you trying to make them interested?
- Do they already **have an opinion** about the matter?
- Are you trying to **change that opinion** or **reinforce** it?
- Will **your audience** consist of your superiors, peers, colleagues, or subordinates?
- Why should the audience get the information from you and **what qualifies you to provide** it?
- What **special information** do you have that will be of interest to the audience?
- Are your readers likely to be **lacking knowledge** about the material or are they **well aware** of the topic?
- ★ When you have a **clear idea** of the answers to these questions, you are ready to actually begin the process of preparing your document or presentation.

WRITING THE OUTLINE

- ★ How **familiar** are you with the subject?
- ★ **Preliminary library research** may be necessary before you can **develop your focus on the topic**.
- ★ If you are writing about research you have **worked on intensely**, you may feel **qualified** enough to begin the outline from **information you have assimilated** from your work.

Title

- Pick a **tentative title** that is **informative** so that your audience knows precisely what subject you will discuss/address.
- Compose the **final title** after you write the document, because the focus of your topic may change as you gather and assemble information.
- **DO NOT** pick a **flashy title** that has little to do with the actual topic. You may **lose potential audience** interested in the subject. Your title should contain a few key words for those interested in the subject.
 - e. g. The title of a paper on ***teaching engineering skills to deaf students*** is **“Deaf Students Can Survive Engineering”**.
- **DO NOT** pick a title that is too **complex**, too **long** and contains **many key words**.
 - e. g. The title of a paper on **surface studies of special films using photo acoustic and spectroscopic methods** is **“Surface Studies of Dehydrofluorinated PVF₂ Films Using Photo Acoustic (PA) and Attenuated Total Reflectance (ATR) Fourier Transform Infrared (FT-IR) Spectroscopy”**.

Introduction

- Present **background information** and an introduction to your document or presentation.
- State the **objective/purpose** and the **theme** clearly so that the audience will know your intentions.
- Place your **statements in thesis form** preceding the body of the outline.
- You may want to state the aspects of the topic that will not be discussed in your work, and why they will not be discussed.

Body of Presentation

- Present the **major thrust of the subject** as well as the **general and specific points** that will be discussed.
- If relevant, present the **materials and methods**, possible complications and how you propose to deal with those during your study/experimental work, etc.
- If relevant, **compare** your materials and methods to **previously published work**. Objectively discuss similarities, superiorities, limitations, advantages, and disadvantages.

Conclusion

- **Summarize** any arguments regarding various points in the body of the presentation. **Recommendations** for action to be taken are often **beneficial**.

FORMAT OF OUTLINES

Preliminary

- The **rough outline** may be a list of important topics that tentatively will be included in the document. No particular format is necessary.

Example:

«Lasers» I. What is a laser? II. Review of quantum physics III. Review of optics IV. Components of a typical laser V. Operating principles of lasers VI. Types of lasers VII. History of lasers VIII. New developments in laser technology IX. Various laser applications
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- × After doing some preliminary research, you may realize that the subject chosen is rather large for a typical paper of about 10 pages.
- Narrow down the scope of the topic to only a few of the items listed in the rough outline.
- You may want to change arrangement of the topics.
- ★ Even while you are working your document, you may wish to rewrite/revise the outline continually.
- ★ When you have a good idea of the major topics to be covered in the document, you will need to become more specific.
- ** By organizing the material well and in some detail, you can start the actual writing process.

OUTLINE STYLES AND LABELING

- **Topic Outline - Decimal System**

Title	
1. Major Heading	
1.1 Subheading of topic 1	
1.2 Subheading of topic 1	
1.2.1 Subheading of topic 1.2	
1.2.2 Subheading of topic 1.2	
1.2.2.1 Subheading of topic 1.2.2	
...	

Example:

Fluorescence ¹	
1. Introduction to Fluorescence	
1.1 Jablonski Diagram	
1.2 Characteristics of Fluorescence Emission	
1.2.1 Stoke's Shift	
1.2.2 Invariance of Emission Spectrum with Excitation Wavelength	
1.2.3 Mirror Image Rule	
1.3 Fluorescence Lifetimes	
1.4 Fluorescence Anisotropy	
1.5 Time Scale of Molecular Processes in Solution	
1.6 Fluorophores	
...	

¹ J. R. Lakowicz. Principles of Fluorescence Spectroscopy. Plenum Press. New York. 1983.

- **Topic Outline - Alphanumeric System 1**

Title	
I. Major Heading	
A. Subheading of topic 1	
B. Subheading of topic 1	
1. Subheading of topic B	
2. Subheading of topic B	
a. Subheading of topic 2.	
...	

- **Topic Outline - Alphanumeric System 2**

Title	
I. Major Heading	
A. Subheading of topic 1	
B. Subheading of topic 1	
i. Subheading of topic B	
ii. Subheading of topic B	
A. Subheading of topic ii	
...	

GATHERING DATA

- Two major sources of raw data for a written report or an oral presentation are
 - **experimental results** entered into a laboratory notebook
 - previously **published information** obtained from library research
- Honesty and integrity are essential parts of a written S&T report, and all sources of data must be available for assessment and evaluation by colleagues.

× We will discuss “**The Laboratory Notebook**” later on in the semester!

FINDING PUBLISHED INFORMATION - **THE LIBRARY**

- Whether you are doing a report
 - on **original research**, or
 - on a **specified topic** for
 - a class, or
 - a job related task,the **most important resource** is the nearest **library**.
- Searching the **existing literature** is the first step in gaining **background on the subject**.
- Searching the literature can help you
 - narrow
 - refine
 - definethe scope of the research topic.
- If the task is to initiate a laboratory or experimental project, it is **absolutely necessary** to find out what has already been done on the subject; because
 - it is a waste of time to “reinvent the wheel”.
 - it is very valuable to learn what others have attempted or achieved in the area of interest.

- A search of resources will assist you in focusing upon the correct aspect of the topic, if you are writing a summary of existing knowledge.
- It may sound trivial, but you must become familiar with the layout of the library and the extent of its resources.

BOOKS

- the **most obvious**, but not the only, source of information in a library

Thus: Try the **card catalog** first!

- In the card catalog the holdings are classified according to either
 - the **Dewey Decimal system**,

000: General Works	500: Pure Science
100: Philosophy and Related Fields	600: Technology and Applied Sciences
200: Religion	700: The Arts
300: Social Sciences	800: Literature
400: Language	900: History, Geography, and Biography

- or, the **Library of Congress system** which groups materials into 20 basic categories, designating the groups by letters.

A: General Works	M: Music
B: Philosophy, Psychology and Religion	N: Fine Arts
C: History and Related Subjects	P: Languages and Literature
D: History and Topography	Q: Science
E, F: American History	R: Medicine
G: Geography, Anthropology	S: Agriculture, Plant and Animal Husbandry
H: Social Science	T: Technology
J: Political Science	U: Military Science
K: Law	V: Naval Science
L: Education	Z: Bibliography and Library Science

- The card catalog is an index to the books a library contains. It is a file on cards of every book in the library. Many libraries have three cards in their card catalogs for every book:
 - **an author card**
 - **a title card**
 - **a subject card**
- Some other guides to books:

- American Book Publishing Record (1960 -)
- Books in Print
- Cumulative Book Index
- International Catalog of Scientific Literature
- Library of Congress Catalog
- National Referral Center for Science and Technology
- Publisher's Trade List Annual (1948 -)
- Subject Guide to Books in Print (1857 -)
- Technical Book Review Index (1935 -)

PERIODICAL INDEXES

- A research project seldom can be completed without the use of articles appearing in professional journals, particularly because these publications contain the most recent information.
- A researcher's first task is to find out what periodicals are published in a particular field.
- The chief bibliographies of periodicals are

- Catalog of the Scientific and Technical Periodicals
- International Periodicals Directory (1932 -)
- World List of Scientific Periodicals Published in Years 1900-1960

★ Generally, the information available from the entries in a typical index is **highly abbreviated**.

✓ If the name of the scientific and technical periodicals cannot be identified by abbreviation, **an alphabetical list of all published scientific and technical periodicals and their abbreviations** can be found in the **prefatory pages** of the *Index*.

- The principal indexes to articles appearing in scientific and technical periodicals that are of interest to engineers and basic scientists are

- Applied Science and Technology Index
- Current Index to Conference Papers in Chemistry (1969 -)
- Current Index to Conference Papers in Engineering (1969 -)
- Current Index to Conference Papers in the Life Sciences (1969-)
- Current Index to Conference Papers: Science and Technology (1970 -)
- Current Papers in Electrical and Electronics Engineering (1969-)
- Current Papers in Physics (1966 -)
- Current Papers on Computers and Control (1969 -)
- Engineering Index (1906 -)
- NASA Index of Technical Publications
- Pandex Current Index of Scientific and Technical Literature (1969 -)
- Science Citation Index SCI (1961 -)

ABSTRACTS

- Abstracts are short **informative guides** to source material presented in the papers published in professional periodicals.
- Examination of the abstracts is a means of **determining whether it will be worthwhile to run down a particular article** for study.
- According to “A Guide to the World's Abstracting and Indexing Services in Science and Technology”, published in the USA in 1963, **a complete listing of abstracting and indexing services includes over 2000 entries**.

- The principal indexes to abstracts of papers appearing in scientific and technical periodicals that are of interest to engineers and basic scientists are

- Aeronautical Engineering Index (1947-)
- Air Pollution Abstracts(1970 -)
- Applied Mechanics Reviews (1947 -)
- Astronomy and Astrophysics (1969 -)
- Chemical Abstracts (1907 -)
- Computer Abstracts (1957 -)
- Computer and Control Abstracts (1969 -)
- Current Abstracts of Chemistry and Index Chemicus (1960 -)
- Dissertation Abstracts International (1938 -)
- Electrical and Electronics Abstracts (1903 -)
- Electroanalytical Abstracts (1963 -)
- Electronics and Communications Journal (1967 -)
- Engineering Abstracts (1900 -)
- Engineering Index (1969 -)
- Environmental Abstracts (1871 -)
- Environment Index (1971 -)
- Food Science and Technology Abstracts (1969 -)
- Gas Chromatography Literature Abstracts and Index (1959 -)
- International Abstracts of Biological Sciences (1954 -)
- International Aerospace Abstracts (1969 -)
- Mathematical Reviews (1950 -)
- Meteorological and Geophysical Abstracts (1950 -)
- Mineralogical Abstracts (1920 -)
- Nuclear Science Abstracts (1948 -)
- Petroleum Abstracts (1961 -)
- Physics Abstracts (1898 -)
- Pollution Abstracts (1970 -)
- Science Abstracts (1898 -)
- Section A: Physics
- Section B: Electrical and Electronic Engineering
- Section C: Computer Control
- Scientific and Technical Aerospace Reports (1963 -)
- Solid State Abstracts (1960 -)
- Theoretical Chemical Engineering Abstracts (1964 -)
- Water Pollution Abstracts (1927 -)

BIBLIOGRAPHIES

- Sometimes, you may want information about what bibliographies are available in your field of interest.
- However, the bibliographies nowadays are so numerous, that bibliographies of bibliographies are published.
- The principal bibliographies of bibliographies are

- **Bestermen's** A World Bibliography of Bibliographies
- Bibliographic Index, A Cumulative Bibliography of Bibliographies (1938 -)
- **Dalton's** Sources of Engineering Information
- **Holmstrom's** Records and Research in Engineering and Industrial Science

REFERENCE WORKS

- For science and engineering related research, special S&T reference works, special S&T dictionaries, and biographical reference books may be the best source to find answers to difficult questions.

ENCYCLOPEDIAS

- The principal encyclopedias that may be of interest to engineers and basic scientists are

- Encyclopedia of Chemical Technology
- Encyclopedia of Engineering Signs and Symbols
- Encyclopedia of Polymer Science and Technology
- Engineering Encyclopedia
- Harper Encyclopedia of Science
- McGraw-Hill Encyclopedia of Science and Technology
- Van Nostrand's Scientific Encyclopedia

DICTIONARIES

- The principal dictionaries that may be of interest to engineers and basic scientists are

- The Basic Dictionary of Science
- Chamber's Dictionary of Science and Technology
- Compton's Dictionary of Natural Sciences
- Condensed Chemical Dictionary
- Crispin's Dictionary of Technical Terms
- Dictionary of Biological Terms
- Dictionary of Electronics
- Dictionary of Scientific and Technical Terms
- Encyclopedic Dictionary of Physics
- Henderson's Dictionary of Scientific Terms
- Hough's Scientific Dictionary
- International Dictionary of Applied Mathematics
- International Dictionary of Physics and Electronics
- Mathematics Dictionary
- New Dictionary of Physics

INFORMATION RETRIEVAL SYSTEMS (IRS)

- Currently the most popular ones are the computerized CD ROM and online library facilities because
 - speedy access to millions of citations
 - in periodical indexes
 - in very specialized areasis made possible through interconnecting data bases.
- To use CD ROM IRS you must do some preliminary searching among abstracts and indexes available in our library (check out <http://www.library.itu.edu.tr/menu/200.html> for electronic databases, e-journals, and online access to many resources)
 - to narrow yourself to abstracts and indexes in your immediate area of concern
 - to find subject and title key words to help you focus in your immediate area of concern

USING THE SOURCES AND TAKING NOTES

- Once you have found **appropriate** books and journal articles, it is time to use them.
- First, you make photocopies of information pertinent to your topic. Make sure that you write all of the **bibliographical data** on the photocopies for **reference purposes** later on when you sit down to write your S&T document.
- If you found **a lot of information** pertinent to your topic, you may want to **index** them in your own preferred way.
- Read each article or book chapter **quickly for an overview** of the information contained.
- Summarize the material in your own words (**paraphrase**) and write it down with all of the pertinent information about the source in which you found it.
- If you found statistics, tables, expressions or other information that you think you may use, write them down exactly as they appear in the source. Be sure to indicate the exact page on which the material was found.
- You must **be sure to give credit** to the source from which you obtained the data.

Sample Format for Citing References

Books:

Author(s). *Title of the Book*. Publisher's Name, Publisher's Location, year.

Book Chapter/Section:

Author(s). "Title of Chapter/Section" in *Title of the Book*. Publisher's Name, Publisher's Location. Pages, year.

Journal Articles:

Author_1, Author_2, ... Author_n. and Author_n+1. "Title of Published Paper," Name of Journal year: volume(number): pages.

Conference Proceedings:

Author_1, Author_2, ... Author_n. and Author_n+1. "Title of Conference Talk," in *Name of Conference Session* Proceedings of Conference, year: volume: pages.

Conference Abstracts:

Author_1, Author_2, ... Author_n. and Author_n+1. "Title of Conference Talk," Proceedings of Conference, year: volume: page(s).

Dissertations:

Author. "Title of Dissertation," Ph.D. Dissertation, Name of Program where the doctoral work was completed, Name of the University, Location of the University, year.

MS Theses:

Author. "Title of Thesis," MS Thesis, Name of Program where the doctoral work was completed, Name of the University, Location of the University, year.

Technical Reports:

Author_1, Author_2, ... Author_n. and Author_n+1. "Title of Report." Final Report. Location where the project was completed. Report Number. year.

Technical Magazine Article:

Author_1, Author_2, ... Author_n. and Author_n+1. "Title of Article." Name of Technical Magazine issue year: pages.

Technical/Reference Manuals:

Title of the Manual. year.

Lecture Notes:

Author. "Title of Lecture Notes." Name of Program where the lectures were given, Name of the University, Location of the University, year.

Private Communication:

Author. Private communication during *Occasion*. year.

References:

Cain, B. E. (1988). The Basics of Technical Communication. Washington, DC, American Chemical Society, Chs. 5-7.

Day, R. A. (1988). How to Write & Publish a Scientific Paper. Phoenix, AZ, ORYX Press, Chs. 4, 11.

Mills, G. H. and J. A. Walter (1978). Technical Writing. New York, Holt, Reinhart and Winston, Ch. 22.