FORMAL REPORT FORMATS

FORMAL REPORT USES

Various types of reports are employed in the engineering profession (e.g., memos, status reports, interim reports, final reports), but each category has a fairly standard format. This document presents a more formal report format. The *formal report* format might be used to report work performed on a long-term project, to present work performed for a client, or to present results for publication in technical journals. An example of a *formal report* is presented at this Web site (http://wwweng.uwyo.edu/classes/meref/). This example embodies many of the concepts discussed in other Web site Reference Materials. Note, all reports in Mechanical Engineering (ME) classes should be "sent" with a **Letter of Transmittal** and formal reports should contain an **Informative Abstract**. These two items are of singular importance because they are common across all professions and used throughout technical written communication. Each requires clarity and brevity, and the **Letter of Transmittal** is also an exercise in solid, person-to-person communication. The **Letter of Transmittal** gives a record of what was submitted and gives the recipient concise information on what is contained in the report and what action is required. The **Informative Abstract** is a concise description of the background, the results, the conclusions, and recommendations of the report. The **Informative Abstract** is commonly used in research and allows readers to judge the pertinence and value of the report without reading the entire report. Both the **Letter of Transmittal** and the **Informative Abstract** should be considered as separate from the *formal report*, i.e. the *formal report* should be complete without either of these two components.

Letter of Transmittal

The **Letter of Transmittal**, in formal block format, sends the report, stating the report title, establishing the purpose of the report, informing or reminding the reader of who authorized the report, why and when the report was requested, what the main subject of the report is, who else contributed to the report, and what you want the reader to do. It is the first item the reader sees; therefore, it is placed ***before*** the enclosed report.

Informative Abstract

An **Informative Abstract** must be a *self-contained synopsis* of the report which *concisely* summarizes the objectives, procedure, pertinent results, and the inferred conclusions. The **Informative Abstract** includes introductory material to give the context of the work, and it is the *last* item that is written since its emphasis is on the results and conclusions. Students often have difficulty comprehending what constitutes a reasonable **Informative Abstract**. Some examples are therefore presented in the **Informative Abstract Examples** section of these guidelines. Often the author is required to provide **Keywords** that describe the subject matter of the report and are used by search engines. It should be noted that the **Title**, the **Informative Abstract**, and **Keywords** are very important in these days of electronic retrieval of archival materials. Readers of archival material may vary widely in background and be from diverse cultures. Great care should be exercised to make your **Informative Abstract** as precise, concise, and clear as possible.

FORMAL REPORT GUIDELINES

A formal report contains many of the same elements as the memo report, but includes more of the details as well as additional information. Informative abstracts, appendices and glossaries (Lists of Symbols) are not usually included in memo (short) reports, but are normally included in formal reports.

Memo reports are usually also "sent" with a letter of transmittal. A typical format is provided in the following section **"Listing of the Different Elements to be Included in a Formal Report"**. While there is less flexibility in the formal report format than the memo format, there is some. For instance, all of the indicated generic **Subsections** may not be required in a particular report, and the headings should be changed to more descriptive titles that may or may not contain the generic Subsection wording. In a formal report, section headings must follow the format given by Reep (2009, p. 147).

Reports, including equations, figures, graphs and tables, must be computer generated. All reports must be written in third person with consistent tense structure. Use the spelling, thesaurus, and grammar check capabilities that word processors possess as well as the services that UW's Writing Center provides to find and correct mechanical and content errors. Such errors not only will reduce the grades assigned to a writing assignment, but will reflect poorly on the writer's credibility in a work situation. As noted in the typical Formal Report Checklist, a significant percentage of academic grades is based on the technical content of the reports. Consequently, any physically absurd data or results that are not detected by the author(s) will incur severe grade penalties. Results should be reported in terms of their mean value and maximum probable error. SI units are preferred, but the report should serve the needs of the client or audience and consistently use the system of units appropriate for the project. Sometimes dual systems of units are reported with the secondary set of values and units presented in parentheses after each primary value and unit designation.

Listing of the Different Elements to be Included in a Formal Report

Formal reports are composed of several sections, not all of which are necessarily present in any one formal report. Do not strain to include a section that is not needed, such as including an **Experiment** subsection only to state, "No experiments were required for this work." On the other hand, do not exclude any section that is necessary for the reader to fully understand your work. Occasionally, elements not covered in the following list may be required, and it is up to the writer to recognize and include such sections.

Title Page

This is the first page of the fore matter pages. These pages are numbered with small Roman numerals, so this is Page i. However, the page number is not displayed on this page. The Title Page contains:

Descriptive Title. Center the Descriptive Title in the top third of the remainder of the page not occupied by the Informative Abstract.

Target Audience. This is the Name, Title, Company of Primary Reader(s), the Course Number and Title for a class report, or the like. The Target Audience is centered in middle third of the remainder of the page.

Author(s). The Name(s), Title(s), and Companies of the writer(s) are centered in bottom third of the remainder of the page, and are followed by:

Partner(s). Name any individuals who contributed to or collaborated on the work.

- Client(s)
- Date(s) of Work or Experiment
- Submission Date (centered, below the writer(s)' name(s))

Informative Abstract. Place the Informative Abstracts immediately above the bottom margin of the Title Page. The Informative Abstract should be no more than 350 words in length.

Table of Contents (TOC)

The TOC should have an outline form that corresponds to the heading hierarchy of the report. The individual entries should have dot leaders to the page numbers, and the page numbers should be right justified at the right margin. TOCs can be automatically generated in WORD™. This feature will help to eliminate page number errors in the TOC.

List of Figures (LOF)

The LOF is optional, but it must be included when there are a two or more figures. The format of the LOF is similar to the TOC.

List of Tables (LOT)

The LOT is optional, but it must be included when there are two or more tables. The format of the LOT is similar to the TOC.

Symbol List (LOS)

All symbols should be placed in an alphabetized list with their respective definitions and units. Place the English symbols first followed by any Greek symbols alphabetizing in a-Z and α-Ω order, i.e. t_a is followed by T_z and δ_a is followed by Δ_z. Symbols should be left justified on the left margin, and a column of corresponding symbol definitions and their respective units should be tabbed a suitable distance to the right of the symbols. This section is sometimes placed immediately after the **Reference** section, but usually is part of the fore matter and follows the **TOC,** the **LOF,** and the **LOT**.

Introduction

This section states the author's objective in terms of the broad context and the particular project, problem, physical phenomena, or hypothesis that was the subject of the work. It does *not* include any details of the experimental procedure, the design, or the problem solution, although it should contain an overview of the general approach. The Introduction should close with what the writer is asking of the reader, as stated in the Letter of Transmittal. For example, in engineering the writer is commonly asking the reader to approve the work up to a certain point, so the project can proceed according to a preset plan. These approvals are called “milestones” in project management terms.

Theoretical/Problem Discussion

This segment discusses the theoretical basis of the problem and usually in engineering presents a mathematical development of the appropriate equations that are specific to the problem modeling in question. General equations, applicable to a broad range of problems, for example $F=ma$, are not acceptable except as starting points to develop the specific equations. If the mathematical development is long and involved, the details of an involved analysis should be placed in an appendix. This section must contain at a minimum sufficient mathematical content to understand the problem and theoretical approach without requiring the reader to read the appendix. All related appendices must be referenced and described in the **Theoretical/Problem Discussion** section, and they should contain the full details of the mathematical development. However, the author cannot anticipate that the reader will carefully read an appendix. Equations, whenever an equals sign exists in a mathematical expression, must be computer generated, be placed on a separate line, be indented from the normal text, and be numbered sequentially with the numbers being on the right margin. The requirements for appendices are discussed in a subsequent **Appendices** section.

Data Acquisition

Certain data will be required to solve the mathematical models developed in the **Theoretical/Problem Discussion** section. This segment discusses the sources of the data, and if data must be obtained experimentally, one or more **Experiment** subsections must be included in this segment. If a particular experiment requires further mathematical development and that development is long and involved, the details of that involved analysis should be placed in an appendix. The **Experiment** subsection must contain at a minimum sufficient mathematical content to understand the problem and experimental approach without requiring the reader to read the appendix. The appendix should contain the full details of the mathematical development, but the author cannot anticipate that the reader will carefully read the appendix. Each **Experiment** subsection contains the following information:

- **Procedures –** Some experiments may not be the primary focus of the formal report, and may have procedures that are long and involved. In such cases the details of the procedure should be placed in an appendix. The **Experiment** subsection must contain at a minimum sufficient procedural content for the reader to understand how the experiment was conducted without requiring the reader to read the appendix. The appendix should contain the full details of the experimental procedure, but the author cannot anticipate that the reader will carefully read the appendix.
    - *Apparatus Description* – This section must include neat computer-generated drawings that detail all the major components of the experimental apparatus.
    - *Instruments* – The identification number of the instruments used to perform the required measurements must be listed with their respective accuracy and, if available, the manufacturer, type or model, and serial number.
    - *Experimental Methods* – The experimental procedures must be described in sufficient detail such that someone else *can completely replicate the experiment and obtain the same results within the quoted experimental precision*.

- **Discussion of Results** – Even if the detailed procedures for an experiment are presented in an appendix, the corresponding **Experiment** subsection must contain a discussion of the results.
    - *Data Presentation* – Present the pertinent experimental data in a concise manner. Graphs and charts are the preferred modes when appropriate. Tables should also be utilized and may contain footnotes. A discussion of the problems and the possible sources of errors that were encountered during the experiment should be included. Raw data should be included in an appendix if it is extensive.
    - *Analysis* – Outline what calculations were performed. A description of the different analyses performed should be given with the details of involved analyses placed in appendices; repetitive calculations should utilize software such as spreadsheets or equation solvers. Representative sample calculations must be included, preferably utilizing the equations from the model development to show the calculation with measured values from the experiments. If FE analyses are performed, a clear concise description of the boundary conditions must be included. A statistical analysis of the results to determine their uncertainty *must* be performed.
    - *Discussion of Overall Results* – The final results should be presented in the most condensed form possible (tables, graphs, charts and/or empirical correlation) and the reliability of these results addressed. Any inappropriate or unexpected results should be noted here.
    - *Assess Your Results* – Compare your experimental results to known values, theoretical predictions, models and/or other experimental results.

Results – The overall final results of the project should be presented in the most condensed form possible (tables, graphs, charts and/or empirical correlation) and the reliability of these results addressed. Any inappropriate or unexpected results should be noted here.

Conclusions - This section *summarizes* what the results indicate, their limitations, reliability and possible applications and extension of this information. The inferences and implication of the results should be discussed. These observations should be related to the objectives outlined in the **Introduction**.

References - *All* the sources of information that *are* utilized in the report should be cataloged in this section with quotes placed around any material that was copied. The References sections should begin on a new page. A particular reference in the body of a report is denoted with the author's name, date of publication, and referenced page number within parentheses. The following is an example reference format for the source consulted in the preparation of this appendix (Reep, 2009, p. 320):

> Reep, D.C. (2009). *Technical Writing: Principles, Strategies, & Reading.* (7th ed.), New York, NY: Pearson Longman.

This referencing style is based on the APA reference style with some minor modifications. Referencing formats for other types of references can be found in Reep (2009, p. 264-274) and in the Referencing Styles document on the ME Reference Web site:
http://wwweng.uwyo.edu/classes/meref/ReferenceStylesForEngineeringReportsDNC.pdf.
The ME referencing styles document is the primary source. When writing reports for organizations or individuals other than ME, it is the author's responsibility to ascertain the preferred or required reference style of the audience.

Appendices - The appendices contain supplemental material, materials that are too detailed to be conveniently included in the main body of the report, such as long mathematical derivations, calculations and computer programs, raw data, or "information that some readers need and others do not" [Reep, 2009, p. 317]. *One* of these appendices *must* present sample calculations to permit the reader to verify that the correct equations, numerical values, units and assumptions were employed. The appendix with sample calculations must be computer generated (Equations written with Microsoft Equation 3.0) or inserted with the Equation menu in the Insert Tab. *Each appendix must have a descriptive title*.

Plagiarism/Academic Dishonesty (Galbreath, 2010, p. 3)

"Presenting someone else's work or ideas as your own is considered academic dishonesty (as is assisting another student is such misrepresentation). Plagiarized writing will receive an F, will jeopardize your chances of passing this course, and the university may assess serious penalties against you (University Regulation 802, Revision 2). Ultimately, it is your responsibility to know what constitutes academic dishonesty as well as its consequences."

Mechanical Engineering endorses Dr. Galbreath's stance on plagiarism and academic dishonesty. Failure to cite sources of information, even inadvertently, is plagiarism. As Dr. Galbrath (2010, p. 3) states, "Academic dishonesty can also include purchasing a paper, using without permission a paper that you wrote in another class, or suing a paper written by someone else."

If you have questions about plagiarism and academic dishonesty, or after reading the reference materials you have questions about how to cite a source, please ask.

REFERENCES

Galbreath, Pam (2010). *Writing in Technology and the Sciences – English 2005-01,* (Spring 2010 Course Packet), Laramie, WY: The Copy Center.

Reep, D.C. (2009). *Technical Writing: Principles, Strategies, & Reading.* (7th ed.), New York, NY: Pearson Longman.

Sample Informative Abstracts

GREAT DODGE VIPER 1:36-SCALE PULLBACK CAR RALLY PARAMETERS

Gamesters Desktop Rallies, £td., (GDR£) plans to develop and market a desktop rally using a 1:36-scale Dodge Viper GTS-R pullback car manufactured by KiNSMART™. The final leg of the rally consists of pulling back the car to store energy in the spring motor and then releasing the car to accelerate up a ramp. The car then leaves the end of the ramp and is airborne over a gap before landing on a run out surface and coasting to a stop at the finish line, which is a specified distance from the gap. On January 11, 2010 GDR£ commissioned UW Steamboat Engineering (UWSE) to optimize the pull back distance, acceleration distance and ramp angle with the goal of minimizing the uncertainty of stopping at the finish line. UWSE researched this problem during the spring 2010 semester in the ME/ESE 2020 laboratory, finding the gear ratio of 5.568 between the forward and backward directions, the friction characteristics, and the spring motor characteristics for the pull back car in order to determine the uncertainty of the run out distance. The rolling friction for car number G11 was 0.0231 ± 0.002, the conservatively estimated aerodynamic drag of 0.0130 ± 0.0017 N was determined to be negligible compared to the estimated 0.185 ± 0.0130 N acceleration force on the car from the spring motor, and the spring motor had a spring constant of 4.16 ± 0.516 N/m and a preload force of 4.16 ± 0.516 N. All uncertainties for experimental quantity were evaluated with a minimum confidence interval of 95%. These quantities were then used to calculate the optimum pullback distance of 8.47 inches, acceleration distance of 43.4 inches, and ramp angle of 3.3 degrees to achieve a run out distance of 96.2 ± 12.2 inches. Because the uncertainty of stopping on the finish line is rather large and the performance of the car jumping over the gap was very poor, UWSE recommends GDR£ either change the course or the car to achieve a satisfactory desktop rally.

MOONBUGGY SPECIFICATION, DESIGN, AND PLANS

In September 2008, Elemental Engineering was awarded the complete design of a two passenger, human powered, moon-rover type vehicle to compete in the 2009 NASA Great Moonbuggy Race. NASA provided design specifications for the competition, which, in conjunction with Elemental Engineering's own specifications, led to the design morphology of key moonbuggy systems. These designs were further refined with mathematical models to ensure the vehicle meets all design specifications and is capable of traversing rough, inclined terrain. From the final designs, detailed plans and specifications were produced to describe each piece needed to manufacture the moonbuggy. Elemental Engineering has decided to use an articulated-frame design constructed of 4130 alloy steel, while utilizing common bicycle components to manufacture the vehicle. Riders will be positioned back to back with the rear rider facing backward. The project was funded by The Wyoming NASA Space Grant Consortium who provided a $5000 grant to help cover design and fabrication costs as well as travel expenses to the competition in Huntsville, Alabama. Elemental Engineering placed 3rd at the competition with a race run that was slowed greatly by a crash where the rear half of the moonbuggy rolled just seconds from the finish line.

MARS ROCK RETRIEVING ROBOT

Every year the American Society of Mechanical Engineers (ASME) hosts a design challenge to showcase the talents of mechanical engineering students from across the nation and allow students to present solutions to design problems. The 2009 ASME Design Challenge was entitled "Mars Rocks!" For this competition, students were to design and build a remote control vehicle capable traversing obstacles, retrieving small rocks, and depositing them in a receiving area. Rock'n Robotics Engineering (RRE) assembled with the goal of designing and fabricating a robot to compete in the 2009 ASME

Design Challenge in Arlington, Texas and winning the competition for the University of Wyoming's ASME district, designing a robot that utilized a tank tread drive system along with a conveyor mechanism for loading and unloading rocks. The forward end of the robot was used to crossing barriers and the rear end was used for retrieving and depositing the rocks. A prototype robot was built and tested from the final design. The prototype robot met all the design specifications and was very effective at crossing barriers, and retrieving and depositing rocks. The rock retrieving robot, named Sherman, was entered in the 2009 ASME student design competition in Arlington, Texas. At the competition, Sherman was able to retrieve all the rocks and place them within the receiving area, but Sherman was slightly heavier and less power efficient than other robots at the competition. RRE with their robot Sherman took third place at the competition.

Sample Uninformative Abstracts

HIGH/LOW BATH SEAT PROJECT

With the vast number of handicap people in the world, innovation has become a necessity in order to help people suffering from disabilities that are acquired either from birth or from an unfortunate accident. Many countries contribute to improving the quality of life of the disabled. The United States of America has consistently pushed for a better life for the disabled. Since the *Americans With Disabilities Act* was passed it has been such an important issue that universities emphasize its importance to university students by not only exposing the students to the current issues, but also encouraging student projects that involve creating new ideas to help the disabled community. One such project, which will be presented in this report, is called the *High/Low Bath Seat Project*. This project focuses on designing a device that functions as a lift to make bathtubs more accessible for disabled people. With the assistance of faculty and staff primarily from the University of Wyoming Mechanical Engineering Department, a design for this project was created and is presented in this report.