SYSTEMS ENGINEERING THESIS
RESEARCH GUIDE

Systems Engineering Department

and the

Wayne E. Meyer Institute of Systems Engineering

Version 1.0

4 July 2013
# Table of Contents

1.0 Introduction ............................................................................................................................................. 3  
   1.1 Overview of the thesis requirement .................................................................................................... 3  

2.0 Selecting a Thesis Topic ......................................................................................................................... 5  
   2.1 The research study should be interesting to the student ............................................................... 5  
   2.2 There should be a clear need for the research .............................................................................. 5  
   2.3 The topic should be researChable .................................................................................................... 6  
   2.3.1 Many sources should be consulted in selecting a topic .......................................................... 6  

3.0 Roles and Responsibilities in the Thesis Process.................................................................................... 8  
   3.1 The Academic Associate .................................................................................................................. 8  
   3.2 The Thesis Advisor ......................................................................................................................... 8  
   3.2.1 Requirements for serving as a Thesis Advisor ........................................................................ 9  
   3.2.2 Requirements for serving as a Co-Advisor .......................................................................... 9  
   3.2.3 Requirements regarding academic degrees .......................................................................... 9  
   3.3 The Second Reader ......................................................................................................................... 9  
   3.4 The Department Chair ..................................................................................................................... 10  
   3.5 The Thesis Sponsor ......................................................................................................................... 10  
   3.6 The Program Office ......................................................................................................................... 10  
   3.6.1 The Educational Technician .................................................................................................... 10  
   3.7 Department Writing Instructors .................................................................................................... 11  
   3.8 The Thesis Processing Office ......................................................................................................... 11  
   3.8.1 Thesis Editors and Formatters ................................................................................................. 12  
   3.9 The Student ................................................................................................................................... 12  
   3.9.1 Research Involving Human Subjects ....................................................................................... 12  
   3.9.2 Academic Integrity .................................................................................................................... 13  
   3.9.3 Other Student Responsibilities ............................................................................................... 14  

4.0 The Thesis Proposal .............................................................................................................................. 16  
   4.1 Planning and Conducting the Thesis Project .................................................................................. 16  
   4.1.1 Quarters 1 and 2 of 8: Consider Thesis Interests ...................................................................... 17  
   4.1.2 Quarter 3 of 8: Thesis Topic Selection Stage .......................................................................... 17  
   4.1.3 Quarter 4 of 8: Thesis Proposal Stage .................................................................................... 17
<table>
<thead>
<tr>
<th>Quarter</th>
<th>Stage</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 of 8</td>
<td>Thesis Writing Stage</td>
<td>18</td>
</tr>
<tr>
<td>6 of 8</td>
<td>Thesis Writing Stage</td>
<td>18</td>
</tr>
<tr>
<td>7 of 8</td>
<td>Thesis Writing Stage</td>
<td>18</td>
</tr>
<tr>
<td>8 of 8</td>
<td>Thesis Approval Stage</td>
<td>19</td>
</tr>
</tbody>
</table>

5.0 Major Sections of the Thesis

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>Abstract and Executive Summary</td>
<td>20</td>
</tr>
<tr>
<td>Chapter I</td>
<td>Introduction</td>
<td>20</td>
</tr>
<tr>
<td>Chapter II</td>
<td>Literature Review/Theoretical Framework</td>
<td>22</td>
</tr>
<tr>
<td>Chapter III</td>
<td>Presentation of Data</td>
<td>22</td>
</tr>
<tr>
<td>Chapter IV</td>
<td>Data Analysis/ Interpretation</td>
<td>23</td>
</tr>
<tr>
<td>Chapter V</td>
<td>Conclusions</td>
<td>23</td>
</tr>
<tr>
<td>List of References</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>Appendices</td>
<td></td>
<td>24</td>
</tr>
</tbody>
</table>
1.0 Introduction

This guide has been prepared for Systems Engineering (SE) students to assist them in completing the Master’s thesis. The guide focuses on the preparation, the proposal and the research element of the project, describes the roles and responsibilities for those involved in the project, and provides an outline for the major sections of a thesis.

The forms, format, and processes for archiving and distributing the thesis are not discussed in detail within this guide, as they are explicitly addressed within the Naval Postgraduate School (NPS) Thesis Processing Office (TPO) website. All SE theses must follow the procedures outlined by the TPO for the thesis to be accepted by the department and at NPS.

In addition to the guidelines on writing found in this guide, students are to review “A Guide for Systems Engineering Graduate Work” (also called the SE Writing Guide or SEWG) for a more complete discussion of department writing related requirements.

A note on authorship: this guide has been produced by building off of and directly drawing from other NPS departments’ thesis guides, in consultation with members of the Dudley Knox Library, the staff of the Thesis Processing Office, the Institutional Review Board Office, and from suggestions from SE department faculty, staff, and students. Many thanks are due to the invisible hands contributing to this document!

1.1 Overview of the thesis requirement

Most programs at NPS require completion of an acceptable thesis for the award of the Master’s degree. The thesis is an integral part of the Master's degree program, where the primary objective is to further the student’s education, building and strengthening independent abilities of inquiry. As a secondary objective, the thesis may contribute to the professional body of knowledge in the field through the resolution of a problem, a clearer understanding of relationships, or the improvement of a process.

The thesis is a scholarly report of research and not a staff study. Because of its scholarly nature, it must meet the rigorous academic requirements and standards highlighted below:

1. The thesis must be focused, addressing a research question or hypothesis within a conceptual framework or theoretical body of knowledge.
2. The research question should be specific, reasonable in scope, intellectually challenging, and capable of being answered through sound research.
3. The information used in the thesis must be obtained from primary sources and reliable secondary sources.
4. The research method(s) must be consistent with the theoretical framework.
5. The use of statistical techniques or methods to support the analysis must be suitable and sound, with an account given of how and why the chosen methods are used.
6. The analysis must use the information collected, the conclusions must be supported by the analysis, and all recommendations must relate to the findings and conclusions in a logical and consistent manner.
7. The thesis should flow smoothly and be grammatically correct. When sources are used to provide materials, information, and ideas that are not those of the thesis writer, these should be cited using the author-date method described in the CMS.

8. The researcher must strive to remain objective in the analysis and writing of the research report. When the thesis writer includes his/her interpretations of the data presented, the researcher should identify when he/she is providing subjectively based assessments.
2.0 Selecting a Thesis Topic

A topic that serves as the appropriate subject matter for an SE thesis can come from a variety of sources.

A student's thesis can be sponsored by a specific professor doing research in a particular field or by an outside command. Other sources for topics include seminars and lectures (especially those from DoD activities), problem areas observed in previous tours (i.e., problems in the fleet), or topics of current interest for the DoD.

Successful thesis management results from an early identification of the topic, a clear definition of the scope, and thorough consultation with advisors. Members of the Program Office, the Department Chair, and department faculty members are available throughout the process, should the student require additional help.

Several points should be considered in the process of selecting an area for research.

2.1 The research study should be interesting to the student

The student should be motivated to pursue the project vigorously and with a level of dedication required to overcome the low periods that may be experienced when parts of the process become difficult. As this is perhaps the most significant research effort the student will complete for some time, it should have meaning and importance to the student.

2.2 There should be a clear need for the research

A clear need for the research means that the effort will in some way further the solution to a problem or advance the state of knowledge in the field. The need for the thesis research can be explored by communicating with the Academic Associate, a potential advisor, potential sponsors, and authorities in the field.

For example, a thesis may:

1. Contribute to resolving a known problem
2. Put a problem in perspective.
3. Assess the impact of certain policies or procedures.
4. Evaluate policy or procedures.
5. Trace the history of management events and decisions or make observations concerning implications of these decisions.
6. Develop a model or assess an existing model.
7. Develop an implementation methodology.
8. Come up with a final product which might be a model, case analysis, computer program or process.
9. Participate in major experimental and analytical efforts sponsored by a key military or DoD organization.
A thesis written for an SE degree may take the form of a qualitative analysis, a quantitative analysis, or a mixture of both; it may be an expository analysis or examine case studies; it might also be design based, and generate new knowledge. The methodology used to shape the thesis and the research methods required to substantiate its claims are topics that should be discussed with the thesis advisor.

2.3 The topic should be researchable

Materials should be available in open literature (e.g., in published articles, books, or reports) and data should be accessible. Difficulties may be encountered if the data sought are classified, proprietary, sensitive, highly controlled or if restrictions are placed on usage. Difficulties may also arise if points of contact (POCs) are not forthcoming with information. Corporation or company proprietary data may be a particular problem. The student may have to consider classifying the thesis, although it is recommended that this be avoided to permit broader application and use by others.

To gain some understanding of the literature available, use the Dudley Knox Library (DKL) to gain access to the periodicals, journals, proceedings of research symposia and other collections of research related to SE topics. The library provides access to article databases and electronic indexes of literature in the field, as well as the research tools necessary to search for the technical materials needed to support the paper.

2.3.1 Many sources should be consulted in selecting a topic

Here is a list of suggestions for searching out a thesis topic.

1. Review any materials suggested by the Academic Associate, other professors, or from courses (such as textbooks, lecture notes, and slides) where problems or issues of interest have been identified.
2. Listen for topics to be announced in classes as current topics of interest to the Navy or the DoD or that are reported “word of mouth” by other students.
3. Discuss candidate ideas and resources with any of the NPS reference librarians.
4. Use Calhoun or Bosun to find and read recent SE theses and other technical reports and review the “areas for further research” stated in the final chapters of these reports.
5. Consult with a librarian for assistance reviewing the periodicals and journals in the field of SE, using the Systems Engineering LibGuide webpage.
6. Review publications from major SE professional organizations such as the International Council on Systems Engineering (INCOSE) or the Institute of Electrical and Electronics Engineers (IEEE).
7. Search the NPS repository of curriculum vitae (CVs) for an individual professor's CV, or consult faculty Web pages or other Internet compilations of topic ideas.
8. Examine the subject matter bibliographies created by organizations such as the Defense Logistics Studies Information Exchange (DLSIE), the Defense Technical Information Center (DTIC), and the National Technical Information System (NTIS).
9. Look for the lists of published reports from research groups such as the RAND Corporation, the Office of Naval Research (ONR) and the Logistics Management Institute (LMI).
10. If a student knows his or her assignment following graduation, the student’s new office could be consulted for issues of interest. Principle offices in the students’ area of expertise could be contacted to see if there are areas in need of intensive research.

11. Consider experiences from previous tours of duty as areas for research.

(In addition to the suggestions presented here, resident students in SE 580 curriculum will have their spring quarter SE 3810 seminar devoted to thesis topic presentations by faculty present on the Monterey campus.)

With the help of a reference librarian or a thesis advisor, establish limits for the subject of the research and define as carefully as possible the boundaries or scope of the research. The key to good topic selection is choosing a subject limited enough to allow focused research, yet wide enough to provide room for the student to develop his/her own concepts, ideas, or propositions.

Once a topic area is selected, get as much exposure as possible to the materials published on the topic — major studies, journal articles, books and other NPS theses.

*Read exhaustively.* It is particularly important to become familiar with Masters theses as a particular type of writing. Read several NPS theses so as to understand what goes into a thesis, particularly with respect to the role of an Abstract and an Executive Summary, how introductory and concluding sections are crafted, and how a thesis flows together when chapter summaries are included, preparing a reader for how to move from one section of the thesis to the next.
3.0 Roles and Responsibilities in the Thesis Process

This section discusses individuals involved in the thesis process and their particular roles and responsibilities. The section ends with a summary of the responsibilities of the student in conducting thesis research, including his or her duties in relation to research involving human subjects and academic integrity.

The following paragraphs outline the primary responsibilities of the various parties in the thesis process. As in most relationships, there is always some room for negotiation between parties.

3.1 The Academic Associate

The Academic Associate will:

1. Provide counsel on the appropriateness of thesis topics, or assist in reducing the range of choices to those most suitable.
2. Assist in identifying an appropriate advisor and in selecting a second reader for the thesis.
3. Maintain on-going contact throughout the thesis process to provide assistance and support when needed.

3.2 The Thesis Advisor

The thesis advisor (or co-advisor) has the primary responsibility for guiding the research content. The advisor will examine the research for validity and soundness of analysis and conclusions, the logical flow and development of material and rationale, and the appropriateness of recommendations.

The advisor will:

1. Assist in determining what is feasible for the student to research in the available time.
2. Discuss and document a schedule of milestones to assess progress.
3. Suggest published resources and documents for the student to read and people to contact.
4. Meet with the student regularly to monitor progress and provide consultation and direction. Joint meetings should occur at least weekly during the final quarter.
5. Review and critique the thesis outline.
6. Review and critique the student’s work, offer suggestions for necessary revisions, and check for accuracy and completeness. (Note: the advisor will not undertake responsibility for major editing or rewriting. For help in this area, students may consult with SE faculty members, Ms. Mary Vizzini or Ms. Barbara Berlitz. See Section 3.7 for more on this topic.)

It is very important for the student to be clear as to what standards the advisor expects the student to meet and to understand any constraints that will exist during the process.

Some questions to ask: What milestones does the advisor require? How quick will the turnaround times be for draft chapters to be reviewed? Will the advisor be absent for any significant period? If so, does the student still want to have that individual as an advisor?
3.2.1 Requirements for serving as a Thesis Advisor

The primary thesis advisor must be a permanent member of the faculty (i.e., not a military faculty member on a tour of duty at NPS). The primary advisor can be from the SE or other department (see Section 3.2.3).

3.2.2 Requirements for serving as a Co-Advisor

A co-advisor may also be used, if desired, from any NPS department, or even outside of NPS. For a co-advisor outside of NPS, a resume or CV must be provided when the thesis proposal form is submitted to document the co-advisor’s related expertise.

3.2.3 Requirements regarding academic degrees

The SE department will assign a second reader. One member of the thesis team — advisor, co-advisor, or second reader — must have a terminal degree in a discipline appropriate to the thesis research (e.g., a Doctor of Philosophy (Ph.D.), a Doctor of Science (DSc.), a Doctor of Public Administration (DPA), or a Doctor of Engineering (D.Eng.)), and one must be a permanent member of the SE department faculty.

3.3 The Second Reader

The role of the second reader differs substantially from the advisor. The role of the second reader is to perform an independent peer review, determining if the thesis research is appropriate for the topic, is well-written and conforms to the required style. The second reader reviews the work after the advisor is satisfied with the thesis.

The duties of the second reader include:

1. Ensuring that important approaches or sources of information are not overlooked.
2. Providing quality control of the written product to verify that it meets NPS and SE standards.
3. Confirming that the thesis clearly and adequately communicates the research to someone who is not closely involved with the work.

It is important to know what standards the second reader will use in determining whether a thesis is acceptable. The student must determine the second reader's particular expectations with regard to thesis form preferred for review (e.g., a paper or digital copy), turnaround time, supporting materials, etc.

Choosing an advisor and a second reader is a critical step. The student should choose advisors on the basis of their expertise or contribution to the field. Second readers are appointed by the SE Department Chair. Advisors are normally chosen from the NPS faculty. One of the two, either advisor or second reader, must be from within the SE department. Exceptions can be approved by the Department Chair. For instance, it may be desirable to have a sponsor as a co-advisor. The Academic Associate should be consulted in the process of choosing an advisor (or co-advisor).
3.4 The Department Chair

The Chair of the Department has the ultimate responsibility for certifying that SE theses meet NPS standards and academic integrity requirements. The administrative process for approval of topic selection and the final written product is designed to facilitate the production effort and to ensure that quality standards are maintained. Specifically, the Chair will approve outside advisors, select a Second Reader for the thesis, and sign the final thesis. Theses need to be submitted to the Chair the first day of the month a student is scheduled to graduate.

3.5 The Thesis Sponsor

A sponsor is anyone who agrees to provide support to the student in his/her thesis effort. Such support can take many forms, e.g., letters of introduction, personal interviews, computer time and support, access to data, and funding (travel, per-diem, and equipment). Typical sponsors include functional or project offices, NPS faculty currently working on research grants, professional associations and institutes or an industry association.

Some sponsors may agree to supply data or information as part of the research effort. Typically, there are data that are unique to a specific research effort and not readily available in one of the generally accessible databases. Professional associations, companies and industry/trade associations are frequently excellent sources of information.

General support sponsorship primarily focuses on opening doors within government agencies or civilian companies by demonstrating interest in the research results and asking that assistance and cooperation be extended to the researcher. When coordinating with an agency for sponsorship, ensure that agreements are documented in written format, such as a letter of introduction. In addition, the student will want to provide updates to the thesis sponsor on a regular basis.

3.6 The Program Office

The role of the Program Office is primarily one of administrative support and monitoring. Members of the Program Office include the Program Officer, Academic Associate and Educational Technician (Ed Tech) for each curriculum, and the Department Chair. (If a student does not know who his or her Academic Associate is, or does not know what person is fulfilling each role in the Program Office, the student may contact the Ed Tech for his or her curriculum to obtain up to date information.)

3.6.1 The Educational Technician

The Ed Tech for a student’s curriculum is part of the Program Office, and is responsible for assisting the student in routing the thesis proposal, getting the required signatures and maintaining a copy of the approved proposal. When students work with the TPO on formatting of the thesis, the Ed Tech should be copied on all correspondence. The Ed Tech submits the thesis for the Chair’s review, and so the Ed Tech is responsible for routing the thesis for final signatures and for performing a standardized review for plagiarism.
3.6.2 Filing for an extension

In some rare cases, a student may need to file for an extension. Make every attempt not to allow this to happen, as the success rate of those individuals in completing their theses as time progresses is very low.

1. A student who detaches from NPS before completing his/her thesis will be granted an extension of one year upon filling out the thesis extension request form, available from the Ed Tech.
2. The thesis extension request needs to be submitted for approval along with the approved and signed thesis proposal form.
3. The first thesis extension submitted (prior to graduation) is good for only one year!
4. If the student has not completed the thesis within that first year extension, the student must submit a second request to the Program Office early enough for approval before the expiration of the first extension.
5. A student may apply for up to two additional one-year thesis extensions. Requests for these extensions should include a progress report, an endorsement from the thesis advisor and any other relevant information.
6. Requests for a third thesis extension will be granted only if the student has made significant progress towards completion of the thesis, as certified by the thesis advisor.
7. The student bears full responsibility for maintaining the viability of his/her candidacy. If a student's extension expires, candidacy has lapsed and the degree cannot be awarded at any time in the future.

3.7 Department Writing Instructors

The duties of the advisor and the second reader do not include a focus on writing, organizing, editing, and verifying that sources used in the thesis are used with proper attribution. Students may consult with SE department faculty who are dedicated to working with students on academic writing — Barbara Berlitz or Mary Vizzini, and carefully review the SEWG. Working with a department writing instructor can occur at any time during a student’s program, and one-on-one instruction can be arranged via email.

By working with an instructor on organizing, articulating, and documenting sources as chapters are being written, the student and his/her advisor will be able to focus on the content of the thesis research. In addition, the student will be preparing a polished and well written thesis for the Chair’s review, which will increase the probability of the thesis being accepted for the degree requirement without the need for last minute or substantial re-writing.

3.8 The Thesis Processing Office

Because the TPO’s role in the thesis process concerns formatting, distributing, and archiving the thesis, the thesis process begins and ends with a student interacting with the office.

At the beginning, the student familiarizes him/herself with the information contained on the TPO’s website concerning thesis format. When 2 to 3 chapters of the thesis are written, the student will contact thesis processing and submit draft chapters to the TPO for a format check and will be assigned a thesis
processor. For more on this, please review the TPO website: it is updated quarterly, providing information concerning the specifics of this process.

The thesis will undergo an initial format review (with subsequent review cycles with the thesis processor assigned to the student). Any changes the thesis processor requires will be made by the student. The student then submits the thesis to his/her advisor, second reader, and the Chair. Once it is accepted by these parties, the approved thesis is then re-submitted to the TPO.

3.8.1 Thesis Editors and Formatters

If the student chooses to do so, an editor or formatter can be hired. A thesis editor will copyedit the thesis, which means the editor will correct spelling, grammar, and punctuation errors. A thesis formatter, on the other hand, can be hired to ensure that the thesis is formatted according to the TPO’s specifications for document layout and assist with challenges formatting citations in a List of References or working with the required template. A thesis editor or formatter can be found by asking the TPO for the list of NPS-approved thesis editors/formatters.

3.9 The Student

In conducting thesis research, a student must be concerned with research ethics and with academic integrity. These two topics are discussed here, first with a description of a student’s responsibility when it comes to determining if his or her research involves human subjects, and then his or her duties when it comes to writing with academic integrity and avoiding plagiarism.

3.9.1 Research Involving Human Subjects

Research involving human subjects is an activity overseen by the NPS Institutional Review Board (IRB) Office. Projects are generally considered to involve human subjects when three criteria are met: the research activity is systematic, the information derived from it is generalizable beyond the immediate context of the original research, and it involves an interaction with human subjects.

A human subject is defined as a living individual about whom an investigator obtains data through an interaction or intervention with or from whom the researcher obtains identifiable private information. When research asks a question that can be phrased as a question about people, i.e., an “about whom” question, it is considered to be research that involves human subjects. On the other hand, research does not involve human subjects when it asks an “about what” question — where the subject of an inquiry is a system, process, or organization, rather than the individual from whom the data are collected.

Dr. Larry Shattuck, NPS's IRB Chair, provides an example from the field of human systems integration that can illustrate an “about whom” type of research question (as distinct from the “about what” type):

Here is an ‘about whom’ example. We are asked to evaluate a system by examining the cognitive workload of an operator. We collect cognitive workload data (e.g., NASA-TLX). The system is the stimulus that creates the workload but the data we are collecting is the cognitive workload of the operator. The cognitive workload is the subject of the research and therefore this data collection activity would be considered ‘about whom.’
Alternatively, if I ask an operator about the workload required by two different systems based on their designs, that is more likely to be an ‘about what’ question.

When conducting or anticipating thesis research, if there is a question about whether or not the research involves human subjects, NPS has individuals who may be consulted about IRB questions. The IRB website's frequently asked questions page may be consulted, and questions can be directed to Dr. Larry Shattuck (x2473) or Ms. Rikki Nguyen (x2998).

It is important for the thesis researcher and for NPS's reputation as a research university that a determination about whether or not research involves human subjects is made by the Office of Human Research Protection prior to any activity beginning, rather than for a student or faculty member to make his or her own determination, only to be incorrect have this discovered this later.

To ensure that correct determinations are made, all students who write a thesis are required to do the “Protection of Human Subjects” training, available through the Research Office’s supplemental training menu. Before beginning thesis research, a determination must be made about whether or not research involves human subjects. Students are not to interview stakeholders interested in or supporting the research effort in a formal way without completing IRB training and having made a determination about human subjects research.

When research does ask a question about a person — an “about whom” question — researchers must submit a human subjects research protocol. The research protocol forms can be downloaded from the NPS Office of Human Protection website. Once the forms have been completed and submitted, students will need to allow approximately three weeks for processing.

### 3.9.2 Academic Integrity

NPS university policy on the issue of academic integrity is described in Naval Postgraduate School Instruction 5370.4b, the NPS Academic Honor Code (NPS INST 5370.4B.) In signing and submitting the Thesis Proposal Approval Form, the student promises to abide by the NPS Honor Code, affirming that the thesis will not violate academic integrity by plagiarizing.

Plagiarism is defined as presenting someone else’s unique words or ideas as though they are the student’s own; this includes failing to use quotation marks and a parenthetical reference citation to indicate when a source’s exact words are used. Students must consult both the SEWG and the CMS to learn the requirements for providing due credit to the original sources of words or ideas.

To prevent plagiarism when writing an SE thesis, students are required to use in-text citations. This means that the author of a source, as well as the year or date of publication must be provided for each source of information used in the thesis: for places where the thesis writer is using a sources exact words, quotation marks must be used to indicate this, and a page number must be provided for to precisely locate where the original words appeared (in the absence of page numbers, a section name or number may be used, or some other locating information may be provided). In addition to providing parenthetical reference citations for sources referred to within the body of a paper, students must provide complete publication information for these sources in a list of references at the end of the paper, formatted according to the author-date method described in the CMS.
When conducting research, students should be sure to record:

1. The name of the author, authors, or organization responsible for the source
2. The title of the source
3. The name of the volume or webpage that includes the source
4. The date of the volume or website’s publication
5. For use in-text citations, the page numbers associated with quoted or paraphrased material

When writing the thesis, follow these guidelines for documenting sources adequately:

1. When using **four or more words in a row** from a source in the thesis, enclose these words in quotation marks and provide an in-text citation to identify the original place in the source where the words appear
2. When paraphrasing a source, i.e., restating another person’s point of view or information in the new setting of the thesis, ensure that the original wording of the source is not reproduced word for word without attribution
3. Provide an in-text citation to signal when words or ideas originally appearing in another source are being paraphrased
4. Provide an in-text citation when an idea is associated with (1) a specific person or (2) when the idea is new enough not to be part of a field’s common knowledge
5. Make sure to cite any materials downloaded from the Internet, even when free or publically available

### 3.9.3 Other Student Responsibilities

In sum, students writing a thesis must:

1. Study and understand this document, as well as the requirements stipulated by the TPO, the SEWG and NPS INST 5370.4B
2. Select a thesis topic.
3. Select an advisor (and co-advisor, if used)
4. Prepare a thesis proposal
5. Report to the advisor regularly, informing him/her of progress or of any difficulties encountered in the research and writing
6. Research the literature to discover what others have done on areas related to the thesis topic
7. Make necessary contacts to get information, data, computer assistance or other resources
8. Conduct the research that forms the substance of the thesis
9. Ensure all sources are properly cited in the body of the thesis, with complete publication information included in the list of references, and that analysis conducted within the thesis is the student’s own original work
10. Write the thesis and submit it to the advisor(s) in a timely fashion
11. Provide the thesis to the second reader in a timely fashion
12. Consult with SE department faculty who assist with academic/technical writing
13. If desired, hire an editor or formatter, using the list of NPS approved editors and formatters
14. Rewrite the thesis as requested by the advisor or second reader
15. Work with the TPO at the beginning, throughout, and at the end of the thesis process to arrange for the appropriate formatting of the final product

16. Work with the Ed Tech to acquire the necessary signatures and fill out all the required forms (for the thesis proposal and for the final thesis.)

17. File for an extension, if needed

18. Inform the Program Office upon completing the thesis. The Program Office will then generate the paperwork needed to nominate the student for a degree

The above delineation of the duties and responsibilities of the key people involved with the thesis effort clearly gives the student the bulk of the workload. However cooperation and communication with all parties involved will make the somewhat complicated process of writing a quality Master’s thesis possible.
4.0 The Thesis Proposal

The process of selecting a topic involves participation in seminars, personal interviews with faculty, and a substantial review of the literature published on the topic. The topic selection phase culminates in the writing of a thesis proposal.

The thesis proposal is the key document in organizing and planning the project as a whole.

In it, the student:

1. States the focus of the research
2. Specifies primary and secondary research questions
3. Describes the methodologies to be used in the research
4. Identifies the scope and limitations of the work
5. Outlines a timeline for the execution of the project

The thesis proposal also:

1. Identifies resources needed to complete the research work and lays out the nature and extent of resources that a potential sponsor may have to contribute
2. Assists in identifying resources and articles in published literature published on or related to the thesis topic
3. Serves as a record for peers and future thesis students, as proposals are kept on file in the Program Office

Any changes in the thesis project which may be required as the project matures can be made by referring to the proposal. These changes may be to the research design or methodology or to the scope of the thesis.

All the parties involved in the thesis (the student, advisors, Second Reader, Academic Associate, Chair, and Program Officer) will sign and date the thesis proposal.

More detailed instructions on completing the thesis proposal are found in the Thesis Proposal Approval Form itself, located on the SE LibGuide page and also available from the Program Office or Ed Tech.

Before moving on to a discussion of the major sections of a thesis, a timeline of when to conduct various activities related to the thesis will be offered to facilitate thesis planning. Students should use what is presented in Section 4.1: Planning and Conducting the Thesis Project when developing the timeline discussed in the Thesis Proposal Approval Form formally submitted in Quarter 5 of an 8 quarter program.

4.1 Planning and Conducting the Thesis Project

To complete an SE thesis, planning is crucial. This section is for students to use when developing a schedule for thesis related activities in an eight quarter program.
4.1.1 Quarters 1 and 2 of 8: Consider Thesis Interests

In the first two quarters of an eight quarter program, students should focus on coursework while considering potential thesis interests or topics.

4.1.2 Quarter 3 of 8: Thesis Topic Selection Stage

In this quarter, students should be in the topic selection stage of their research.

Necessary activities for this quarter are:

1. Consider what level of classification or distribution statement the thesis will need
2. Begin research to find topic
3. Use the NPS library to review previously written NPS theses
4. Contact NPS librarian to find library resources on the topic
5. Meet with members of the Program Office to brainstorm thesis topic ideas and about potential advisors
6. Interact with other NPS faculty, staff and students for advice on getting an advisor
7. Engage with professional contacts and other NPS faculty who might sponsor thesis research
8. Complete “Protection of Human Subjects” training
9. Figure out if the thesis will require IRB approval
10. Review the TPO website
11. Read the NPS INST 5370.4B
12. Read the Thesis Proposal Approval Form
13. Read the SEWG

4.1.3 Quarter 4 of 8: Thesis Proposal Stage

In Quarter 4 of 8, the thesis proposal stage, students should complete the activities listed below, as applicable:

1. Select thesis topic
2. Find faculty member to serve as thesis advisor
3. Get thesis advisor’s approval on the thesis topic
4. Develop a milestone plan for completion
5. Conduct more initial thesis research/continue literature review
6. Develop research approach/methodology
7. Write the thesis proposal and get thesis advisor’s approval on the thesis proposal
8. Completed the IRB checklist (part of the thesis proposal package)
9. File IRB paperwork with the IRB Office
10. Obtain signatures on the thesis proposal from thesis advisor(s) and/or the Second Reader, the Academic Associate, the Program Officer, and the Chair
4.1.4 Quarter 5 of 8: Thesis Writing Stage

In Quarter 5 of 8, students should begin writing the thesis in earnest. A non-negotiable deadline occurs during this quarter: the signed thesis proposal, which was the work of Quarter 4, is due at the beginning of the fifth quarter. The signed thesis proposal and its affiliated paperwork are due and must be filed by the Ed Tech.

1. File signed thesis proposal with Ed Tech
2. Begin using TPO’s thesis template
3. Continue to develop research approach/methodology
4. Continue to conduct a literature search
5. Gather data (i.e., develop questionnaire, conduct interviews, find existing data, conduct research travel)
6. Analyze data (develop data analysis techniques, use computer programs/tools)
7. Begin to draft thesis
8. Provide thesis chapters for advisor review
9. Obtain technical writing assistance from SE writing faculty

4.1.5 Quarter 6 of 8: Thesis Writing Stage

In this quarter, the thesis writing stage continues. During this quarter, students should:

1. Continue thesis research and writing
2. Provide draft chapters for advisor review
3. Obtain technical writing assistance from SE writing faculty

4.1.6 Quarter 7 of 8: Thesis Writing Stage

The non-negotiable deadline which occurs in Quarter 7 of 8 is that a draft of the thesis (with at least 2-3 chapters completed) is due to the TPO for the initial format check. The deadlines are based on the student’s month of graduation:

<table>
<thead>
<tr>
<th>Graduation</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>September</td>
<td>1 August</td>
</tr>
<tr>
<td>December</td>
<td>1 November</td>
</tr>
<tr>
<td>March</td>
<td>1 February</td>
</tr>
<tr>
<td>June</td>
<td>1 May</td>
</tr>
</tbody>
</table>

During this quarter, students should:

1. Submit 2-3 draft chapters to the TPO
2. Provide draft chapters for advisor review
3. Obtain technical writing assistance from SE writing faculty
4. Obtain advisor’s acceptance of completed thesis
5. Provide thesis for Second Reader’s review
4.1.7 Quarter 8 of 8: Thesis Approval Stage

In the final quarter of the program, a final, non-negotiable deadline occurs, which is that the completed thesis needs to be reviewed by the Chair by the first day of the month of graduation: for a September Graduation, 1 September; for a December graduation, 1 December; for a March graduation, 1 March; for a June graduation, 1 June.

In this quarter, the thesis must be:

1. Accepted by advisor and Second Reader
2. Thesis is provided to the Chair
3. Chair reviews thesis
4. If Chair makes recommendations or comments on areas in need of correction, student revises thesis and resubmits thesis for final Chair approval
5. The thesis, signed by advisor, Second Reader, and the Chair is submitted to the TPO for final processing (this is done by the Ed Tech)
5.0 Major Sections of the Thesis

This part of the guide is intended to provide advice on structuring the thesis. Not all theses look alike, and this structure need not be followed precisely. While the structure will vary based on the student’s perspective or the subject matter of the thesis, this outline can provide a useful paradigm.

The actual writing of the thesis does not have to be accomplished in chapter order. In fact, it may be more appropriate first to draft an outline rather than narrative introduction, write the main body of the thesis, and save the writing of the finished introduction, abstract and executive summary for last.

The thesis length varies depending on the breadth of the research questions, the methodologies selected for data collection and analysis, the type of data presented, and other factors. As a general guideline, an SE thesis tends to be between sixty and 200 pages of text in the actual body chapters of the paper (when formatted using the TPO template,) and the number of items included in a list of references ranges between twenty and 100. (These page numbers do not include front matter (the table of contents, executive summary, et cetera) or end matter (the list of references and appendices).

5.1 Abstract and Executive Summary

The main purpose of the abstract is to enable another researcher to determine if the thesis is relevant to his/her work. The limit for NPS theses is 200 words. The abstract should describe the nature of the issue or problem researched, the focus of the thesis and its objectives, and the major conclusions and recommendations brought out in the research. If there is room, mention should be made of any important contribution, such as the development of a model or guide. In addition to the abstract, an executive summary is required. An executive summary is normally a two to three page summary of the thesis, which more fully explains the most significant points of the thesis, identifies the major recommendations emerging from the research, and presents a clear statement of the results.

5.2 Chapter I: Introduction

The purpose of the introduction is to set the scene; to prepare the reader for what is to come. This chapter should first identify the purpose and direction of the thesis. The approach to the research question should be explained, as well as how the research was performed. The importance of the student’s thesis research to the general body of knowledge of the field should be explained. A preliminary summary of the research findings, recommendations and conclusions should be presented here.

The introductory chapter includes sections that present a general description of the project, the objectives of the research, the research question, the scope, limitations and assumptions of the research project, a brief description of the research methodology, a literature review, a list of definitions and abbreviations, a summary of findings, and a description of the organization of the study.

5.2.1 Background

In the background section, the area of research is identified. This section should provide the broad environment within which the research was conducted. This section usually describes the field of study
and identifies the importance of the research effort and how it fits into the general scheme of the field of study. This section should be brief.

5.2.2 Objectives

The objectives section is more specific. It tells the reader in more precise terms what the goals of the research are and what will be examined.

5.2.3 The Research Question

The logical extension of the objectives section is the statement of the research questions posed in the thesis. Here, the student will present the primary and secondary research questions. In the course of writing the thesis, the student may find that his/her research questions change, because (1) the data were not available; (2) the topic was found to be too broad; or (3) a more relevant issue surfaced which would be a more appropriate application for the data collected. In spite of the fact that research questions may change, research questions are a part of a thesis insofar as they organize and encapsulate the inquiry conducted in the thesis research. Therefore, primary and secondary research questions should be included in the introductory chapter.

5.2.4 Scope, Limitations and Assumptions

In this section, three separate issues are identified. The scope identifies the boundaries of the subjects: what was focused on, what was not focused on and a brief explanation of why.

In contrast to the conscious definition of the research effort expressed under the scope, limitations are other types of factors that limited the research effort. Circumstances such as a strike, the unavailability of certain data, regulations and laws that are currently being changed, and the uncertainty of the impact of new regulations are factors that might constrain the research effort and be collected in a section describing limitations. A specific explanation of how these constraints affected the research should be included.

A section outlining the assumptions made by the thesis researcher should be provided. Examples of assumptions might be in regard to the level of knowledge of the reader, the existence of related laws, or the impact of various organizational structures on subject matter of the thesis.

5.2.5 Literature Review and Methodology

Because the thesis research might be based on the results of previous researchers’ work, a brief discussion of the significance of prior work conducted on the topic (presumably discovered during the student’s literature review) should be presented. The relationship between the student’s current effort to previously published work on the topic should be explained. The student should also provide a brief description of the research methods used.

5.2.6 Definitions and Abbreviations

Some concepts related to the research may need to be explained by the student, and these may be provided as working definitions of terms used in the thesis. Certain terms or concepts may have several
economic, theoretical or business definitions, and so, in this section, the student can explain how he or she is applying the terms used in the report. If the list of working definitions used in the thesis becomes extensive, it can be presented as a glossary. A glossary of abbreviations and/or acronyms can also be included as an appendix.

5.2.7 Organization of Study
This paragraph provides a brief description of how the remaining thesis chapters fit together and what is addressed in each. Such a description at this point gives the reader a broad perspective of how the thesis flows and what is to be expected in the presentation of the data.

5.3 Chapter II: Literature Review/Theoretical Framework
A review of literature pertinent to the theoretical framework of the research is presented at this point as Chapter II. If a model has been developed, the concept of the model should be explained. If there is a discussion of a model in the literature of the field, this should be summarized and presented here.

The conceptual framework for the study should be discussed here, and the contribution of the thesis research to the general body of knowledge of the field should be described.

5.3.1 Background
This section orients the reader to the specific background issues rather than the general theoretical issues important to the research results. A chronology of events tracing the history of an issue permits the student to explore how that issue has developed into its current circumstances.

5.3.2 Methodology
This section describes the methods used for executing the research design and the structure of the analysis. Archival research, survey methods, observational procedures or experimental procedures are examples of research methods. Personal or telephone interview questions should be presented in the text. Questionnaires can be included in an appendix. Description of sample size and demographics are essential. If changes in methodology occur in the thesis, they should be explained and justified in this section.

5.4 Chapter III: Presentation of Data
In this chapter, the student presents the facts. In this chapter, the measuring devices or analytical tools used in the research effort will be fully described. Any tables or charts depicting the nature of the data or the frequency of events should be presented here by means of time lines, decision trees, figures and graphs. If a questionnaire was used for collecting the data, a table of the responses or simply a report of the responses could go in this chapter. Specific case examples are often appropriate here as a method of illustrating what is discussed as the thesis’s subject.
5.5 Chapter IV: Data Analysis/ Interpretation

The appropriate sequence for presenting Chapter IV begins with the problem or issue of under analysis. In this chapter, an interpretation of data is provided by the student, using inductive, deductive, or a combination of the two types of reasoning.

The style of presentation is an important concern. Students should consider how word choice and phrasing communicate when a student is offering his/her interpretation of data, and when ideas, facts, or opinions are coming from literature that has been published on the topic or from other sources, such as from personal interviews or questionnaires.

The writing style used in this chapter should show the line between data that has been collected, and observations and interpretations of the data, as well as comments about the implications of those interpretations. A phrase such as “the researcher observes that” could be used to preface the student’s original analysis.

Other examples for how a student might preface his/her interpretations of data are:

1. The data suggest…
2. It can be observed from… that…
3. The results imply…
4. A conclusion to be drawn is…

To indicate that opinions, facts, or data are coming from other researchers or sources, it will be important to use signal phrases, such as:

1. As has been stated in Jones (2010, 16), [summary of source]
2. Smith, Williams, and Everson (2001) found that [summary of source]
3. The methodology has been used to [summary of source] (Wilson et al. 2004, 66-75)

5.6 Chapter V: Conclusions

Conclusions of a thesis should not be elaborate and grand, but rather should be concise interpretations of the facts as they were presented. The final chapter is not the place to present new information, but should summarize the results presented in the chapters of the thesis where analysis was conducted. The body of the paper should present sufficient data to substantiate the conclusions made in the thesis. Most of the conclusions should seem obvious, as they will emerge directly from what has been discussed in the body of the paper.

5.6.1 Results and Recommendations

This last chapter draws the report together and presents conclusions drawn from the analysis conducted in the body of the paper. This chapter should contain a section where the student has collected the results of the analysis together into one section, so that the reader can easily grasp the main ideas and concepts of the study. The recommendations section should provide short, concise statements followed by an
explanation of the recommendation. Recommendations can be proposals for action that emerge from the thesis research. Suggestions for how recommendations can be implemented should be made. Each recommendation should be as practical as possible. Sweeping statements should be carefully avoided.

5.6.2 Restatement of Research Questions

Following the discussion of results and recommendations, brief restatements of the research questions, plus affiliated answers to the research questions, should be presented. The research questions used to frame the research in Chapter I can be briefly restated here in order to demonstrate how well (or if) the research questions were answered in the course of the project.

5.6.3 Conclusions

The final chapter should have a section marking out areas for further research. In this section, mention should be made of issues which fell outside of the present research area, but which are significant for the field of study. The topics listed in the areas of future research are issues that warrant future in-depth research, but were not within the range or scope of the study at hand.

5.7 List of References

This section lists, in alphabetical order, all items cited in the document. These entries will be formatted following the author-date method of citing sources (parenthetical-Reference List style) described in the CMS.

5.8 Appendices

Appendices are useful for presenting information data that would have been distracting if included in the body of the thesis, but which is nevertheless important for the reader's understanding of the research. Appendices can include glossaries (in alphabetical order by terms, acronyms or abbreviations); interview questions with aggregated answers; copies of letters of introduction or documents such as memos, regulations, laws, reports, point papers not easily obtained by the reader; and case studies too long for inclusion in the text. Compilations of data in figures and tables can also be included here (i.e., results from modeling and simulation analyses, or information captured in Excel spreadsheets.) Interviewees and their corresponding organizations should be listed in this section. Any other items, such as technical notes to explain points that are not generally understood, or a tabulation of a chronology of reports or studies, can be usefully placed in an appendix.