AFIT/ENP THESIS PRIMER: A DOCUMENT IN LaTeX

THESIS

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AFIT/GAP/ENP/10-??

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AFIT/GAP/ENP/10-??

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THESIS

Presented to the Faculty

Department of Engineering Physics

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

in Partial Fulfillment of the Requirements for the

Degree of Master of Science in Applied Physics

Amy L. Magnus, B.S.E.E., M.S.E.E., PhD

Maj (ret), USAF

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THESIS

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Committee Membership:

Dr. I. M. Smart
Chair

Dr. M. E. Too
Member

Maj S. D. Sharp, PhD
Member

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Abstract

This primer aids the AFIT student in generating the first draft of their thesis using LaTeX. The primer is produced according the tenets described within the document. All source code is provided in a zip file posted to L:\Courses\PHYS\LaTeX. The file structure of this zip file demonstrates a practical way to organize a thesis with its supporting materials and—further—illustrates how your document can be produced with version control.

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List of Figures

Preface

Welcome to the world of LaTeX! Learn LaTeX and you can rapidly produce papers tailored for a wide variety of publications. When you create a digital document... whether you use a "what you see is what you get" (WYSIWYG) interface like Microsoft Word or a typesetting system like LaTeX ... you are writing a program. In the realm of academic publishing, LaTeX helps us write a better program.

The best reasons to write with LaTeX are high quality equations, superior graphics, and the automated generation of table of contents, lists, and bibliographies. We can create clean 50+ page documents that reformat in a snap. Additionally, due to the fact that the LaTeX typesetting system was written by and for academics, many of its tools are free and run on Microsoft Windows, Mac OS X, and Linux.

So let's get started. Download a LaTeX distribution for your computer platform, set up your editor and compiler and we'll get cracking.

AFIT/ENP THESIS PRIMER:

A DOCUMENT IN LaTeX

I. The First Steps

Take the first steps in writing your thesis using the simple programs described in this chapter as a guide. The source code and support files can be found on the student drive L:\Courses\PHYS\LaTeX. With a current LaTeX distribution[1], you will be able to compile these programs without hiccup.

The directory tree below provides a recommended file structure for the papers generated in your research. Directories follow ">" signs; standared files are specified in parentheses.

```
> myLatexDocuments
  >> afitStyleFiles (afitThesis.sty)
  >> Figures (afitlogo.pdf, afitlogo.eps)
  >> Thesis  (myThesis.tex)
     >>> Preamble (titlePage.tex,myFigures.tex)
     >>> Front (abstract.tex)
     >>> Chapter01 (sectionOne,sectionTwo,...)
     >>> Chapter02
     . . .
     >>> Appendix01
     . . .
  >> Archived Draft of Thesis
  >> Archived Perspectus
  >> Paper One
  >> Paper Two
```

In a parent directory, create three directories "afitStyleFiles", "Figures", and "Thesis". Place your graphics (such as afitlogo.pdf) in the directory Figures, your LaTeX

[1] LaTeX distributions update annually in June. As of June 2014, the current LaTeX distributions are MiKTeX 2.9 for Windows, TeX Live 2014 for Linux, and MacTeX 2014 for Macintosh.

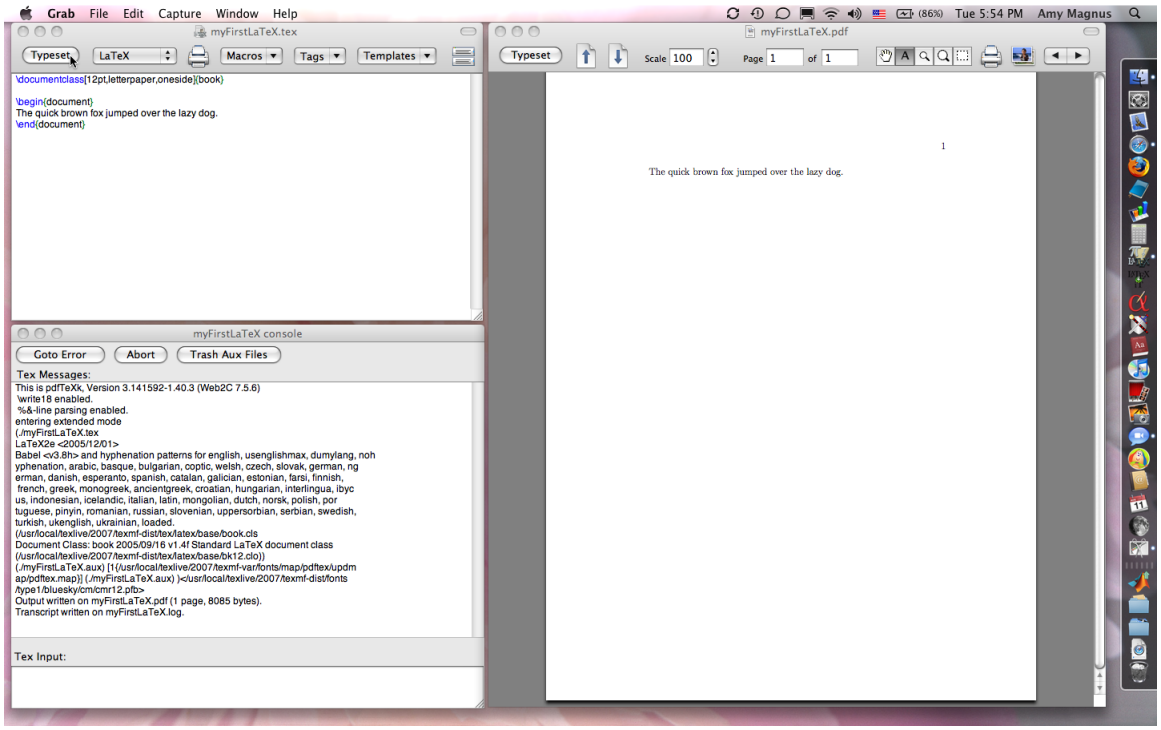

Figure 1. Compile a very simple document.

style files (afitThesis.sty, sf298.sty, sf298.dtx, and sf298.ins) in afitStyleFiles, and the latex code for your thesis document in Thesis. Organized in this way, the files in the Figures directory and the afitStyleFiles directory can be used by your thesis, perspectus, archived drafts, and other publications. Typically, graphics account for most of the memory taken up by a digital document, and this efficiency in sharing saves significant disk space.

1.1 LaTeX a simple document

To compile a LaTex document, start simple with the code listed below. Store the code as a .tex file in your Thesis directory. Then compile the code to test the set up of your LaTeX distribution and compiler[2]. Figure 1 provides a screen shot of the typeset document with its compilation aids.

[2]Popular compilers include TeXworks and TeXShop.

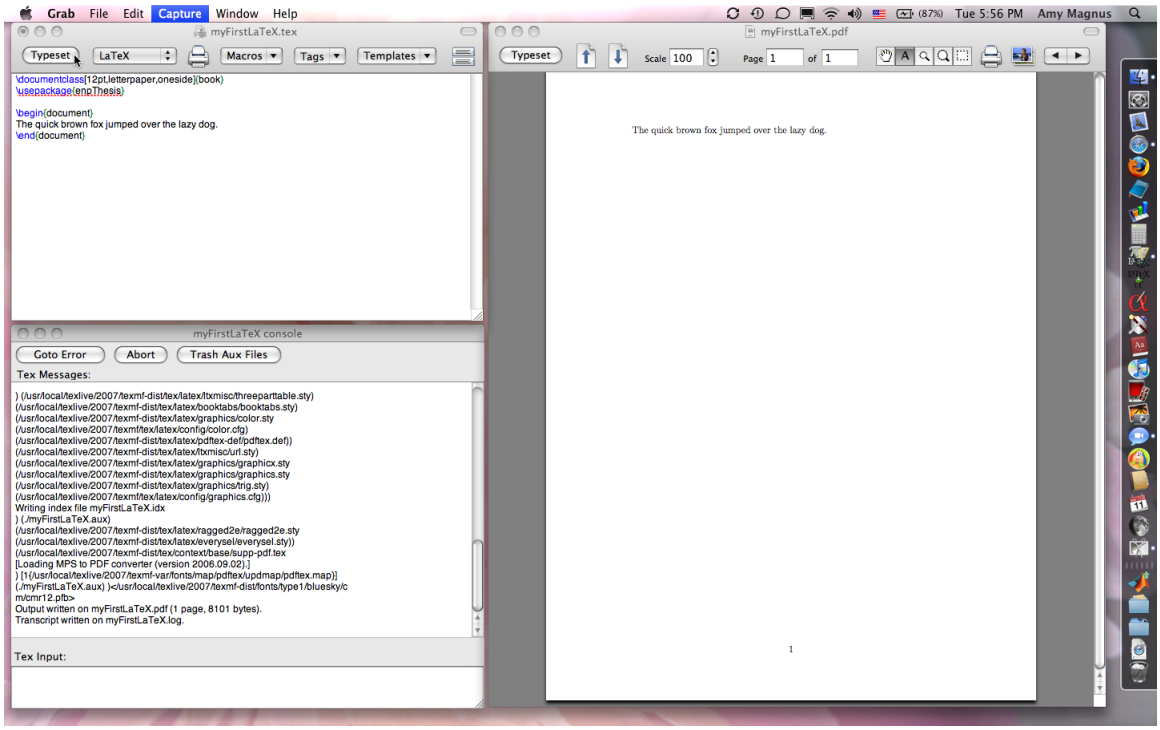

Figure 2. Recompile using afitThesis.sty, the AFIT thesis style file.

```
\documentclass[12pt,letterpaper,oneside]{book}

\begin{document}
The quick brown fox jumped over the lazy dog.
\end{document}
```

The code has two parts: the preamble and the body. The preamble establishes the default formatting for the document; the body holds the content. The preamble starts with a **\documentclass** declaration and ends at the **\begin{document}** command. The body is placed in between the **\begin{document}** and **\end{document}** commands.

In the preamble of this first document, Here we have selected a one sided, 12-pt font book format. In the body, let us enter a short phrase—just to get a feel for how content is added—that includes all characters in the Roman alphabet.

1.2 Add a style file

Next, we add the style file afitThesis.sty to the preamble and recompile. The style file implements the AFIT thesis format and is added via the command **usepackage**.

```
\documentclass[12pt,letterpaper,oneside]{book}
\usepackage{../afitStyleFiles/afitThesis}

\begin{document}
The quick brown fox jumped over the lazy dog.
\end{document}
```

Note the resulting changes to the document in Figure 2. Some adjustments are immediately apparent: The margins have changed and a page number is now located at the bottom of the page.

1.3 Add the front matter

The style file *afitThesis.sty* contains code that generates the first, standardized pages of the thesis document. Theses pages are the flyleaf, disclaimer page, the title page, and the committee page. For each thesis, we customize these four pages by editing a tex file called *titlePage.tex*. The customizable items for a thesis are:

- Author
- Rank
- Graduation Date
- Document Designator
- Flypage title
- Title
- Previous degrees
- Academic degree upon AFIT graduation
- Committee membership
- Department granting your degree
- School address
- Distribution statement
- Disclaimer

Add this information to *titlePage.tex* as you obtain it. One item to include as soon as possible is the distribution statement; ask your advisor which distribution statement is appropriate for your draft document.

If your document is something other than a thesis, you can set a flag at the beginning of *titlePage.tex*. Use the % symbol to comment out unused flags and remove the % from the line of the appropriate flag. In this way, the correct flag will execute at compilation. The available flags correspond to the following documents:

Document	**Flag**
Thesis	**afitthesis**
Report	**afitreport**
Dissertation	**dissertation**
Prospectus	**prospectus**

Once you customize the *titlePage.tex* file, we can typeset the first four pages of an AFIT thesis: the flypage, the disclaimer page, the title page and the committee page.

We must add a few lines to our typesetting program. Within the document environment, we list the first four pages (See line 7-11) under front matter. The flypage includes our first graphic—the AFIT logo—so we provide a path to our figures by using the **graphicspath** command[3] in the preamble. Note line 3 below where we set the path. The *titlePage.tex* provides customization, not content, so it is called in the preamble; call the file by using the command **input** as in line 4 of the code below. In all, we have added seven lines of code to our short program to create a four page document.

```
\documentclass[12pt,letterpaper,oneside]{book}
\usepackage{afitThesis}
\graphicspath{{..\Figures}}
\input{Preamble/titlepage}

\begin{document}
\frontmatter
        \flyleaf
        \disclaimerpage
        \titlepageAFIT
        \committeepage
\end{document}
```

titlePage.tex

Typeset | LaTeX | Macros | Tags | Templates

```
%% Customize your document with your personal information
%% First, comment out the approapriate document type
\afitthesis %%default
% \afitreport
% \dissertation
% \prospectus

\author{Amy L. Magnus}
\rank{Maj (ret), USAF} % If a civilian, comment out this line.

\docdesignator{AFIT/GAP/ENP/10-??}
\department{Department of Engineering Physics}
\graduationdate{\today}

\flytitle{AFIT/ENP THESIS PRIMER:\\ A DOCUMENT IN \LaTeX}
\title{\MakeUppercase{AFIT/ENP Thesis Primer:}\\
    \MakeUppercase{ a document in \LaTeX}}
                % Note, if you use \MakeUppercase to put
                % the title in all uppercase as the style
                % guide demands, understand that the
                % command does not allow page breaks ``\\"
                % within its brackets.
\previousdegrees{B.S.E.E., M.S.E.E., PhD}
\acdegree{Master of Science in Applied Physics}

\committee{{Dr. I. M. Smart\\Chair},
        {Dr. M. E. Too\\Member},
        {Maj S. D. Sharp, PhD\\Member}}

\address{2950 Hobson Way\\ Air Force Institute of Technology \\
Wright-Patterson AFB, OH 45433}

\distribution{DISTRIBUTION STATEMENT A\\[-10pt]
\MakeUppercase{Approved for Public Release; distribution unlimited.}
}

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United States Air Force, the United States Department of Defense or
the United States Government.  This material is declared a work of the
U.S. Government and is not subject to copyright protection in the
United States.}

% International students may consider using the following disclaimer
% statement: \dislaimer{The views expressed in this document are those
% of the author(s) and do not reflect the official policy or position
% of the United States Air Force, Department of Defense, United States
% Government, the corresponding agencies of any other government,
% NATO, or any other defense organization.}
```

Figure 3. Enter student data in titlePage.tex to customize the document's first pages.

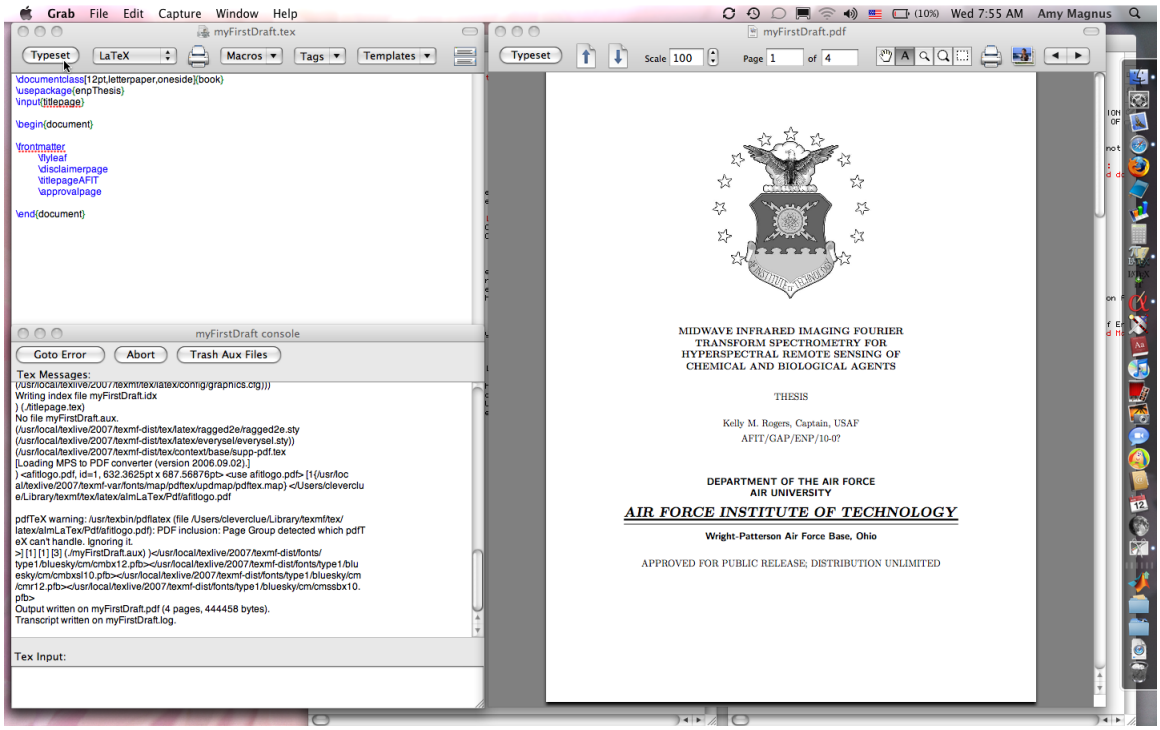

Figure 4. Here we have compiled the first four page of a thesis.

The next section to add to the front matter is an abstract. Create a file *abstract.tex* and place the text for the abstract between the commands **\begin{abstract}** and **\end{abstract}** as below.

```
\begin{abstract}
    Midwave Infrared Imaging Fourier Transform Spectrometry analysis of
    plume data lends itself to an understanding of the combustion
    chemistry involved with the source. ...
\end{abstract}
```

Above, we use a construct called an environment. There are several enviroments: figure, itemize, verbatim, quote, equation to name a few. LaTeX friendly editors will help you build these environments. The abstract environment is actually a customized environment created in the *afitThesis.sty* file; thus, it will not be found in the common LaTeX literature or tools; but, as you can see above, it is simple to implement.

[3]Note the double brackets used in the graphicspath command; they are necessary for the command to execute properly with some compilers.

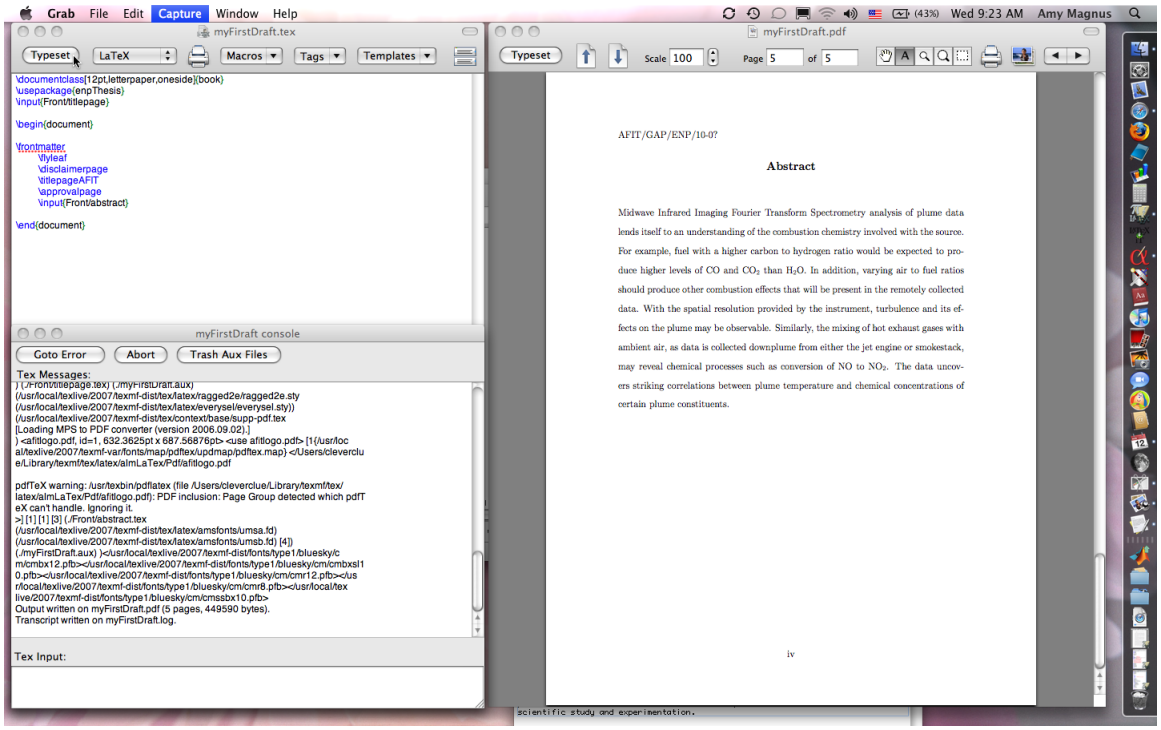

Figure 5. Add an abstract to the front matter of your thesis.

Other common items that can be added to the front matter are acknowledgements, the table of contents and lists of figures and tables. The acknowledgements can be added in the same manner as the abstract; use the environment commands for the Acknowledgement: **\begin{acknowledgement}** and **\end{acknowledgement}**. The table of contents and other lists build automatically as you add sections, figures, and tables and are placed in the front matter using the commands below.

```
\frontmatter
        \flyleaf
        \disclaimerpage
        \titlepageAFIT
        \committeepage
        \input{Front/abstract}
        \input{Front/acknowledgement}
        \tableofcontents
        \listoffigures
        \listoftables
```

The order follows the AFIT style guide[**?**]. The *afitThesis.sty* defines additional environments and lists. We will describe how to implement those items in the next chapter. For now, we will simply keep the abstract and perhaps the list of figures in our front matter as we move on to the main body of the thesis.

1.4 Add figures to the main matter and start writing

To concentrate on your research, consider organizing your figures first. Build the document around your figures, and you will be able to concentrate on the story of your contribution—not the work that has gone on before.

To organizing your figures, it is helpful to define them in a common file. See *myFigures.tex* depicted in Figure 6 and stored in the Preamble subdirectory. In this way, you may:

- Readily write new figures using earlier examples.
- Isolate code and minimize the risk of introducing bugs in the final editing process. Moving around one line of code is easy and safe.
- Standardize figures without having to locate them throughout the document.
- Reuse figures in other papers. ← The best reason!

In *myFigures.tex*, use **newcommand** to define a command for each figure as below:

```
\newcommand{\figmyFigures}{
    \begin{figure}[htbp]
        \begin{center}
            \includegraphics[width=6in]{myFigures}
            \caption{A sample tex file where figures are defined.}
            \label{fig:myFigures}
        \end{center}
    \end{figure}
}
```

myFigures.tex

```
%% myFigures.tex
% A common file to store all figure definitions
%
% In preparing your thesis, one of the first things you should do is
% organize your figures.  Then, one of the last things you'll do is
% reorder your figures so they display where you want them to in the
% text.  Organizing figure definitions in a common files helps:
%
%   1. Write new figures using earlier examples.
%
%   2.  Isolate code and minimize the risk of introducing bugs in the
%   final editing process.  Trust me, moving around just one line of
%   code is easier.
%
%   3.  Reuse figures in other papers.  <=== the best reason!
%
% Note command names can not include numbers and special characters.
%
% To make the file more searchable, use naming conventions that map
% the graphics filename labSetup.jpg to the command name \figlabSetup to the
% figure label fig:labSetup.
%

\newcommand{\figMyFirstLaTeX}{\begin{figure}[tbp]
 \begin{center}
    \includegraphics[width=6in]{myFirstLaTeXCursor}
     \caption[\LaTeX a very simple document]{Compile a very simple document.}
     \label{fig:MyFirstLaTeX}
 \end{center}
\end{figure}
}


\newcommand{\figenpStyle}{\begin{figure}[tbp]
 \begin{center}
    \includegraphics[width=6in]{myFirstLaTeXenp}
     \caption{Recompile using enpThesis.sty, the ENP
     thesis style file.}
     \label{fig:enpStyle}
 \end{center}
\end{figure}
}


\newcommand{\figtitlePage}{\begin{figure}[tbp]
 \begin{center}
    \includegraphics[width=2.9in]{titlePage}
     \caption{Enter student data in titlePage.tex to customize the
     document's first pages.}
     \label{fig:titlePage}
 \end{center}
\end{figure}
}

\newcommand{\figmyFlypage}{\begin{figure}[tbp]
 \begin{center}
    \includegraphics[width=6in]{myFlypage}
     \caption{Here we have compiled the first four page of a thesis.}
     \label{fig:myFlypage}
 \end{center}
\end{figure}
}
```

Figure 6. Consider defining all your figures in one file.

For a command, chose a naming convention that intuitively links the command to the graphic file and the figure label. For example, above we have defined a command **figmyFigures** to position a figure containing graphic myFigures.png. Note command names cannot include numbers or special characters.

Now, in the preamble of your code, input *myFigures.tex* in the same manner as you input *titlepage.tex*. Now we are ready to add the main body of the thesis. Initiate the main body of your document by calling the **mainmatter** command. Next, call the figures that you have defined and compile. Note, once you add a chapter, you can remove **thispagestyle{plain}** which precedes the **mainmatter** command.

```
\documentclass[12pt,letterpaper,oneside]{book}
\usepackage{afitThesis}
\graphicspath{{..\Figures}}
\input{Preamble/titlepage}
\input{Preamble/myFigures}

\begin{document}
\frontmatter
        \flyleaf
        \disclaimerpage
        \titlepageAFIT
        \committeepage
        \input{Front/abstract}
        \tableofcontents
        \listoffigures
\mainmatter
        \figMyFirstLaTeX
        \figafitStyle
        \figtitlePage
        \figmyFlypage
        \figmyFirstAbstract
        \figmyFigures
        \figmyFirstFigures
\end{document}
```

From here, add text around your figures. To produce this document, we used the following code:

```
\documentclass[12pt,letterpaper,oneside]{book}
\usepackage{afitThesis}
\graphicspath{{../Figures/}}

\input{Preamble/titlepage}
\input{Preamble/myFigures}
\input{Preamble/commonSymbols}

\begin{document}
\frontmatter
        \flyleaf
        \disclaimerpage
        \titlepageAFIT
        \committeepage
        \input{Front/abstract}
        \tableofcontents
        \listoffigures
        \input{Front/preface}
\mainmatter
        \chapter{The First Steps}
                \input{chapter01/mySetup}
                \figMyFirstLaTeX
                \section{\Latex a simple document}
                \input{chapter01/startSimple}

                \figafitStyle
                \section{Add a style file}
                \input{chapter01/addStyle}

                \figtitlePage
                \section{Add the front matter}
                \input{chapter01/addFrontMatter}
                \figmyFlypage
                \input{chapter01/addAbstract}
                \figmyFirstAbstract
                \input{chapter01/addMoreFrontMatter}

                \section{Add figures to the main matter and start writing}
                \figmyFigures
                \input{chapter01/addFirstResults}
                \figmyFirstFigures
                \input{chapter01/addMainMatter}
\end{document}
```

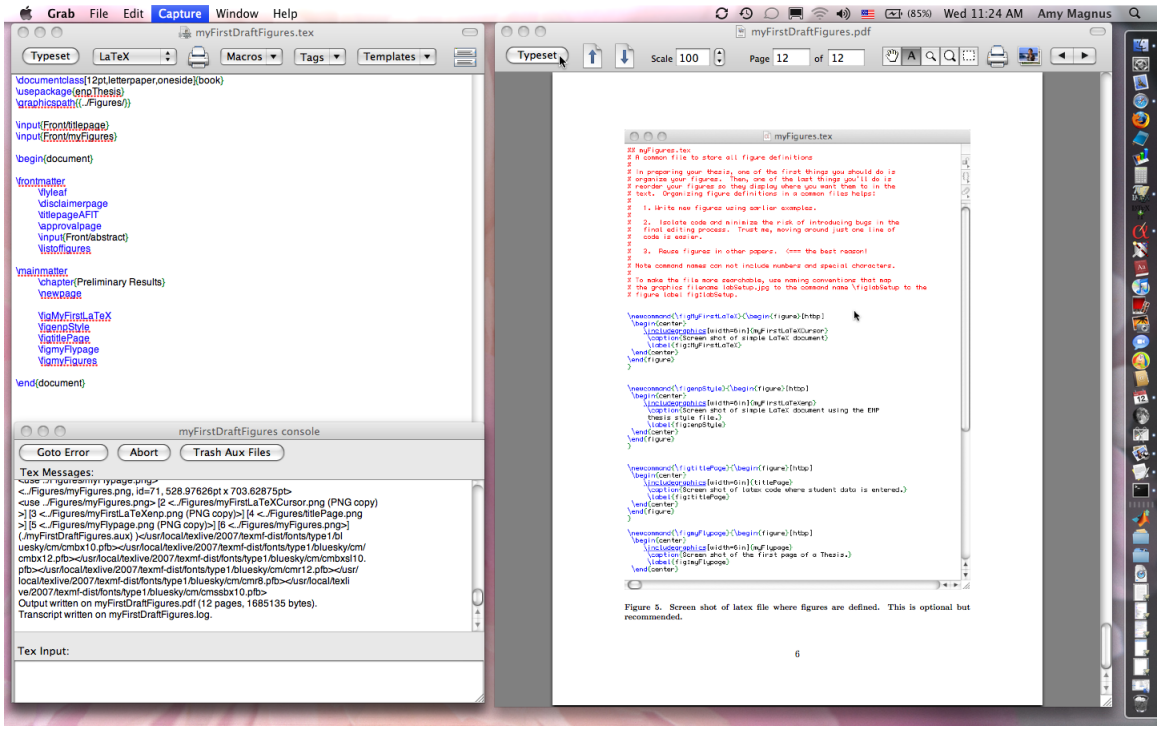

Figure 7. Add figures in the main matter of your document; fill in the document around your graphics.

II. Customized Environments

This chapter covers the customized environments and commands implemented by the afitThesis style file.

2.1 Customized lists

LaTeX provides macros that automatically generate lists. These lists are the table of contents, the list of figures, and list of tables; they are generally placed in the front of the document. The afitThesis style file defines two more lists: a list of abbreviations and a list of symbols. These lists are not required in an AFIT publication but may prove useful. In this section, we show how to implement these lists in your document.

Creating a list of abbreviations.

Given the diversity of acronyms in defense publications, it may be wise to add a glossary that defines the abbreviations used in a document. Use the following commands to implement a list of abbreviations:

\listofabbreviations

Produces a list of abbreviations with entries from all the \abbreviation and \abbreviationFull commands in the body of the document.

\abbreviation[*definition*]{*acronym*}

Adds *acronym* to text and the *acronym* and optional *definition* to the list of abbreviations.

\abbreviationFull[*definition*]{*acronym*}

Use \abbreviationFull as an alternate to \abbreviation when you wish to place the *definition* followed by its *acronym* in parentheses in the text.

To implement the abbreviation commands within your text, the code below...

```
Here is an example of using $\backslash${abbreviation}:
              \abbreviation[As Soon As Possible]{ASAP}.
Here is an example of using $\backslash${abbreviationFull}:
              \abbreviationFull[As Soon As Possible]{ASAP}.
```

...implements the following two lines.

Here is an example of using \abbreviation: ASAP.

Here is an example of using \abbreviationFull: As Soon As Possible (ASAP).

If a \listofabbreviations command is added to the front matter, these lines of code will automatically add two entrees to the list.

You may wish to adjust the spacing in the list of abbreviations. To change the spacing between the abbreviation and its definition, look for the following lines of code in the *afitThesis.sty* file and adjust "7em" using a smaller or larger number.

```
\def\l@abbreviation{\pagebreak[3]
\vskip \lofSpace
\@dottedtocline{1}{0em}{7em}}
```

Creating a list of symbols.

Scientific publications may also benefit from a glossary that defines the mathematical symbols used in the document. Use the following commands to implement a list of symbols:

\listofsymbols

Produces a list of symbols with entries from all the \symbol commands in the body of the document.

\symbol[*definition*]{*abbre*}

Adds the *symbol* to text and the *symbol* and optional *definition* to the list of symbols.

The \symbol command acts like the \abbreviation.

Again, you may wish to adjust the spacing in the list of symbols. To change the spacing between the symbol and its definition, look for the following lines of code in the *afitThesis.sty* file and adjust "5em" using a smaller or larger number.

```
\def\l@symbol{\pagebreak[3]
\vskip \lofSpace
\@dottedtocline{1}{0em}{5em}}
```

2.2 Customized environments

The afitThesis style file defines the customized environments for the front matter, main matter, and back matter. The three front matter environments are the dedication, acknowledgements, and preface. The three main matter environments are comment, quotation, and quote. The one back matter environment is the vita. Each environment follows the same syntax:

```
\begin{environment_name}
    Enter text here...
\end{environment_name}
```

Below we discuss the intention of each customized environment starting with the front matter environments.

Custom front matter environments.

The three front matter environments are the dedication, acknowledgements, and preface. These environments each define a new page for their specific content:

The dedication environment is used to provide a short tribute.

The acknowledgements are used to thank those who contributed to the writing of the document. The intension of the acknowledgement is to thank those who made a technical contributions and these people can be named. Family members may be thanked but do not use their name in full or part.

The preface introduces the material in a tone that is more more editorial than that used the abstract.

Custom main matter environments.

The three main matter environments are comment, quotation, and quote. The customized main matter environments are used to set text apart. The comment is the least subtle and is used for warnings. When compiled, the comment preceded by a boxed an exclamation point. The text that follows is not indented.

Quotation and quote result in similar forms. Each environment uses narrow left and right margins to set off the quote from the surrounding text. The first line of a quotation is indented while the quote is not.

Custom back matter environment.

The back matter environment is the vita. The vita environment provides information on the author. The content should focus on the author's professional career.

This concludes a brief tour of the customized lists and environments implemented by the afitThesis style file. Except where noted, we encourage you to implement your own customizatons in a separate file such as the file commonSymbols.tex found in the

Preamble folder.

III. Conclusion

This primer is intended to give a masters or PhD student the basics of preparing a LaTeX document according to the AFIT style guide[**?**]. If you have further questions on this topic, please contact the author (Maj Amy Magnus x4555) or the office the Dean of Research for more information. [**?**, **?**]

Bibliography

1. Style guide for afit dissertations, theses and graduate research papers. Technical report, Air Force Institute of Technology, 2013.

2. Another A. Name. *Book Title*. College Publishing, Anytown, State, 2008.

3. Authors Name. Article title. *Journel Title*, 1(1):201–208, 2009.