One Possible Outline for the Written Proposal

1. Introduction and Background.

The introduction is where you define the problem/topic to be addressed and show significance. The significance of the problem/topic does not necessarily mean that the world will be saved by your hands, but rather that some new knowledge; concept or development significant to your area of research can come from your proposed study. The National Science Foundation refers to proposal significance as being related to ‘transformative concepts’, meaning that if your proposed work is successful, then the way scientists and engineers think about your topic or use your topic or apply your topic will be transformed. That is a pretty lofty goal for a two page section, but you do want to show that something important can come from study of your topic.

The background discussion is meant to build a basis for the proposal hypothesis and objective section to follow. The background section will reveal how your proposal meshes with prior work from the literature. It will define what is known, and thus what is unknown, about your topic. The unknown part is then what you will address in the following section. This is meant to lead the reviewer to the conclusion that something needs to be done about our ignorance of this important issue.

It is extremely rare that a scientific endeavor does not build upon the work of someone before you, even if you do not realize it. Don’t let your committee members do a two hour Google search on your topic and surprise you with the fact that what you propose has already been done, or that you have left out a key concept published previously. You should always be reviewing the literature regarding your topic and certainly be more familiar with the relevant literature than the committee.

1. Objective and Hypothesis.

The main purpose of this section is to state and explain your hypothesis. The hypothesis should be

1. Non-trivial
2. Original
3. Testable
4. Based on the foundation you laid in the introduction/background section.

You should be aware of what ‘testable’ means. Almost always, this will require that your hypothesis predict a series of quantitative outcomes as a function of independent variable(s). You then compare your experimental results (which should be in the form of numbers) to the numbers predicted by the hypothesis. The details of your experiment/analysis should be saved for the ‘Methods’ section to follow.

1. Proposed Work and Methods.

This section is to describe your proposed work, especially the proposed “critical experiment” to produce data that can be compared with the quantitative predictions of your hypothesis. Together with an appropriate statistical analysis, this should be presented as a way to prove, or disprove the hypothesis. The methods to be used should be discussed and the error associated with the methods should be estimated. However, it is not required that an educational essay on experimental techniques be given. For example, if you are going to use EDS to estimate chemical compositions, it is not necessary that you describe the way the EDS detector works, but you should try to estimate the error in the composition measurement, or discuss how you will determine the error in the composition measurement.

1. Preliminary Results (if you have them, not required)
2. Summary