Research Plan/Project Summary

This document is to serve as a guide to students writing a Research Plan/Project Summary for ISEF. You will notice specific additional notes for students conducting engineering work. For example, engineers may not necessarily have a "research question" but will instead have an "engineering goal". Please email me, <u>pspiess@norwich.edu</u>, with specific questions.

We recommend you use a header on all pages of your Research Plan/Project Summary (RP). We recommend you use the following header for each page of your Research Plan, left-justified:

Your name, your grade (either as "Grade 10," or "10th Grade.") **Your school**

We recommend you put **page numbers** on your Research Plan.

With the above procedure, all the essential information is immediately available to the reviewer.

The Research Plan Instructions on the ISEF website on what headings to use are not totally clear. Please organize the information in your RP into the sections and subsections outlined below. They eliminate confusion and duplication of information. Furthermore, the judges are tasked with making sure that all of the requested information is included in the RP. It is easiest to do this if you organize the information that you provide to match the template the judges will be using. Please use the numbering and lettering system below for each section and subsection. Bold each section or subsection as seen below. Please Left Justify all writing (including section/subsection headings). I've only indented them here to better demonstrate the overall outline of the RP document.

A. Rationale

B.1. Research Question or Engineering Goal(s)

B.2. Hypothesis(es) or Expected Outcomes (for engineering projects only)

C. Description

C.1. Procedures C.1.a. Materials C.1.b. Methods C.2. Risk and Safety Considerations C.3. Data Analysis

D. Bibliography

Using the above sections/subsections as a guide, I've included ISEF requirements and our own helpful descriptions of what should be included in each below:

A. Rationale

Include a brief synopsis of the background that supports your research problem and explain why this research is important and if applicable, explain any societal impact of your research. We suggest 1-2 paragraph limit.

B.1. Research Question or Engineering Goal(s)

The objective of your study or a problem to be solved by your research/project. This is one of the first steps when starting research. Accurately and clearly define the question/goal in a few sentences or less.

B.2. Hypothesis(es) or Expected Outcomes (for engineering projects only)

C. Description

C.1. Procedures

C.1.a. Materials

Your materials list goes here.

You should list the materials and stimuli you will use.

You should identify the approximate quantity of all your materials, no matter how trivial some items may seem. For unusual materials or equipment, you should also identify the brand name or source. As you perform the experiment, pay attention to the possibility that you have missed materials that belong here and add them to your list.

C.1.b. Methods

We recommend that your Methods be written so that they could be easily and correctly performed by others who have not seen your setup. Putting your steps in list form is one possibility. The Scientific Method is so successful because it includes an element of reproducibility. If results of a particular experiment are controversial, the description contained in Methods enables anyone interested in challenging or, alternatively, confirming the results, to do so with confidence that the original experiment has been faithfully reproduced. Beginning students find this to be a difficult task. A good exercise for you to follow is to ask one or two classmates who know nothing of the experiment to read your Methods and then explain what they understood the Methods entailed. This technique will quickly reveal holes in the Methods description. It will also hone your critical thinking skills and those of your classmate(s).

C.2. Risk and Safety Considerations

Identify any potential risks and safety precautions needed. If you are using Human Participants, Vertebrate Animals, PHBA, or any tissues, then you WILL have something here. Even if you don't use any of the above, try to determine BEFORE you start your research/project if anything is dangerous or could go wrong.

C.3. Data Analysis

Particular care should be paid to this subsection. The data analysis section should discuss what data you will collect, how you will collect it, how many repeated samples / measurements you will take, how you will analyze the data collected, and how you will determine if the trends observed in the data collected are significant enough to validate or

invalidate your hypothesis and how you will present these results (e.g., as"graphs," or "number tables,") so they can be quickly grasped by the judges or anyone else interested in your project.

Often the details of the graphs or numbers tables produced by the experiment can't be fully anticipated until the results come in. However, it is valuable to think in broad terms about how the results could be conveyed graphically and verbally ahead of the results. Sometimes such pre-planning can even influence experimental design. With computers, the options for presentation of the results are many. Often the difference between a good project and an outstanding one boils down to how well the outcome is portrayed in the graphics and descriptions. It's especially true that the more quickly the graphics unambiguously convey the results to the reviewer (judge), the higher the score the student is likely to receive.

D. Bibliography

List major references (e.g. science journal articles, books, internet sites) from your literature review. If you plan to use vertebrate animals, one of these references must be an animal care reference. As you continue working on your project, be sure you standardize the entries using the <u>APA format</u> or <u>MLA format</u>. When using web-based sources, it is important to also include the full URL.

Abstract

Don't forget to bring your Abstract and make sure it conforms to the ISEF rules. If you win, you <u>will</u> have to comply with these rules and go on line to fill in the abstract form that follows this format. The abstract you used for the VSTEM Fair will undoubtedly have parts that you can simply cut and paste into the ISEF form, but there will be information required by ISEF that is not required by VSTEM Fair. Below is an overview of what is required by ISEF:

It is recommended that the abstract include the following:

- a. purpose of the experiment
- b. procedure
- c. data
- d. conclusions

It may also include any possible research applications. Only minimal reference to previous work may be included.

An abstract must not include the following:

- a. acknowledgments (including naming the research institution and/or mentor with which you were working), or self-promotions and external endorsements
- b. logos or proper names of commercial products
- c. work or procedures done by the mentor

******Additional subject-specific guidelines for additional items to be included, as applicable.******

Human participants research:

a. Participants:

Describe age range, gender, racial/ethnic composition of participants. Identify vulnerable populations (minors, pregnant women, prisoners, mentally disabled or economically disadvantaged).

b. Recruitment:

Where will you find your participants? How will they be invited to participate? <u>c. Methods:</u>

What will participants be asked to do? Will you use any surveys, questionnaires or tests? If yes and not your own, how did you obtain? Did it require permissions? If so, explain. What is the frequency and length of time involved for each subject?

d. Risk Assessment:

What are the risks or potential discomforts (physical, psychological, time involved, social, legal, etc.) to participants? How will you minimize risks? List any benefits to society or participants.

e. Protection of Privacy:

Will identifiable information (e.g., names, telephone numbers, birth dates, email addresses) be collected? Will data be confidential/anonymous? If anonymous, describe how the data will be collected. If not anonymous, what procedures are in place for safeguarding confidentiality? Where will data be stored? Who will have access to the data? What will you do with the data after the study?

f. Informed Consent Process:

Describe how you will inform participants about the purpose of the study, what they will be asked to do, that their participation is voluntary and they have the right to stop at any time.

Vertebrate animal research:

a. Discuss potential ALTERNATIVES to vertebrate animal use and present justification for use of vertebrates.

b. Explain potential impact or contribution of this research.

c. Detail all procedures to be used, including methods used to minimize potential discomfort, distress, pain and injury to the animals and detailed chemical concentrations and drug dosages.

d. Detail animal numbers, species, strain, sex, age, source, etc., include justification of the numbers planned.

e. Describe housing and oversight of daily care.

f. Discuss disposition of the animals at the end of the study.

Potentially hazardous biological agents research:

a. Give source of the organism and describe BSL assessment process and BSL determination.

b. Detail safety precautions and discuss methods of disposal.

Hazardous chemicals, activities & devices:

• Describe Risk Assessment process, supervision, safety precautions and methods of disposal.

• Material Safety Data Sheets are not necessary to submit with paperwork