

**The Center for Teaching and Learning at SUNY Orange**  
**LEARNING INNOVATION GRANT 2006/2007**  
**STEP 2: PROPOSAL FORM**

**Title of Project:** Engine Blueprinting and Measurement Analysis

**Project Description:** Please provide a brief summary of the project in approximately 50-75 words.

This project will provide students with a real-life industrial/ technical experience at the beginning of their first freshman semester. They will take apart a small combustion engine and make accurate and meaningful measurements of the engine components. This process is called “Engine Blueprinting” and it will introduce students the important concepts of measurement, accuracy, and tolerance limits while also getting them collaboratively interested in science and engineering by providing them with the tactile experience of disassembling and measuring a real gasoline engine.

**Statement of Need:** Provide a brief summary of why this project is important and/or necessary; why it should be funded.

It is important that students in science and industry understand both the power and limitation of measurement and be able to interpret these measurements accurately using a variety of different instruments. The equipment that will be provided by this grant will give students a highly enriching tactile experience that introduces them to the important concepts of Measurement, Unit Conversions, Precision, Accuracy, Tolerance Limits, and Specifications. They will also learn the crucial task of organizing and recording such data in a coherent fashion so that it can be interpreted easily by others. The students will learn to work collaboratively in groups of four on this project which will help them to foster a sense of teamwork and collegiality early in the semester.

**Description of Activities & Implementation:** Please provide an outline/timeline of the process and activities that will lead to implementation.

- The equipment required for the Blueprinting exercise would be ordered at the beginning of the Spring 07 semester.

- The laboratory instructions and worksheets will be completed by the spring of 07.
- Engine Blueprinting Lab should be ready for implementation at the beginning of the Fall 07 semester.

**Outcomes of Project:** Please highlight the primary outcomes of the project.

- Students will work collaboratively in groups of four to disassemble and measure the engine.
- Students will demonstrate the technical competence to use various instruments to make accurate and meaningful measurements.
- Students will clearly summarize their findings regarding the condition of their engine.

**Evaluation:** Describe how the outcomes will be assessed.

- Collaborative work will be assessed by observation of the instructor and by the ability of the groups to complete the project in the allotted time.
- The accuracy of the measurements will be assessed by reviewing the student's sketches and tolerance limits.
- The quality of the student's findings will be assessed by a written report that summarizes the findings.

**Dissemination:** Describe how this project can be shared with colleagues or modified by others at the college for future use.

The project can be used by any of the science and technology laboratory courses. It has immediate uses in Physics for Engineering, General Physics with and without calc, Physical Science, and Applied Physics. Further the modularization of this experiment can provide a model for future projects.

Students in the course Engineering 1 could use the measurements as part of their drafting studies. The students would make Autocad drawings of the engine parts and include all of their measurements and tolerance limits on the drawings as part of their final report.

## **Purpose and Equipment Summary.**

### **Engine Blueprinting and Measurement Analysis**

The students will work collaboratively in groups of four with one engine blueprinting kit assigned to each group. The engine kits will be enclosed inside of a large aluminum case that will be sitting in the center of the workstation designated for each group. The students do not open the case until it is time to begin working on the engine. The students do not know the contents of the case. After a preliminary discussion on measurements and error analysis the students will be told what is in the box. It is hoped that the mystique of the unknown contents of the case will stimulate and maintain the student's interest during the lecture.

The students will disassemble the engine and take measurements of the internal components of a small gasoline engine. The engines are clean and degreased ahead of time and stripped down to the bare essential components to facilitate the disassembly process.

The students will organize and complete worksheets that allow them to determine the clearance fits between the components. They will then determine if their engine is within the allowable specifications for that engine. This process is generically called "Blueprinting".

Upon completion the students will write a professional quality summary of their findings regarding the condition of their engine. If possible the students will make detailed Autocad drawings of the components to include in the report.

#### **Equipment:**

Six inch Vernier Caliper	15.99
Six inch Digital Caliper	16.99
Digital Micrometer	19.99
Machine Square	17.99
Telescoping Gage Set	15.99
Tool Kit	24.99
Plasti-gage	15.00
Aluminum Case	29.99
<hr/> Sub total per set	<hr/> 156.93
Six sets required	941.58
<u>Shipping</u>	<u>11.99</u>
Grand Total	953.57

The small gasoline weedwacker or leafblower engines are being donated by the SEARS repair center. They will be cleaned and disassembled by faculty prior to inclusion inside of the kit.

The Kits will be reused each semester without the need for replacement. As such the recurrent supplies and materials costs are zero. The lifespan of the kits is many years.

In summary, this exercise will be the first experiment that the students perform. Getting the students working collaboratively early in the semester is crucial to student success.

The tactile experience associated with the disassembly of an actual gasoline engine coupled with the technological aspects of taking detailed accurate measurements should provide students with a highly enriching and rewarding motivational experience.