

Solar Powered Boat

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Type: Design Problem
Student Time: 10 weeks
Location: Take home

Summary

This system design is to be completed by a team of first year students in engineering. It is intended to involve the team in various aspects of design and assist them in developing a design methodology.

The team is to design, document, and construct a balsa wood boat which measures no more than nine inches fore to aft and is no more than four inches wide and three inches high. The wood, solar cells and a small DC motor will be provided. The drive train and propeller, not to exceed two inches in diameter, will be part of the design effort.

Team competition will consist of racing on a straight path for a distance of fifteen feet.

ABET Descriptors

Engr Sci Content: First Year Engineering
Type: System
Functions: Synthesis, evaluate alternatives, documentation, planning, preliminary analysis, construction, testing
Features: Design methodology, creativity, open ended, teamwork, communication
Constraints: Limited materials, economics, time, aesthetics
Effort: Team

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Project Statement

Four member teams are to design, document and construct a balsa wood boat which is powered by solar cells. The teams will compete by racing in a straight path for fifteen feet.

Each team will be supplied a block of balsa wood, solar cells and a small DC motor. The design must satisfy the following:

1. The dimensions shall not exceed nine inches from fore to aft and be no more than four inches in width and three inches high.
2. The propeller shall be no more than two inches in diameter.
3. The design of the drive train and shaft are open. They must be constructed using the facilities that are available at the home institution.
4. Aesthetics and reliability of the design are to be considered.
5. A written report and a twenty minute classroom presentation are required. These reports should emphasize the team's design methodology.

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Engineering Notes:

Comments:

The primary purpose of this project is to develop teamwork and involve the students in various aspects of open ended engineering design. Performance, economics, reliability, aesthetics, and manufacturing processes can be factors in using "Quality Function Deployment" to select the final design from the various alternatives.

Expected Results:

Graphical documentation of the final design will be included in the written and verbal reports. These reports will also include a discussion of the various design activities, or methodology, that lead to the final design.

Discussion/Follow-on:

Explain to the student how their academic program will prepare them to deal more effectively with problems of this general nature. Consider non-technical as well as technical courses in answering this question.

Have the students, as they complete all their future courses, briefly document how each course could have been helpful in completing this project. This log can be part of their academic portfolio. They can also include in this log the helpfulness of courses which they have already completed.

The instructor should encourage the team to read pertinent materials from basic engineering texts. This independent "research" is intended to have the team consider problems related to their design. Buoyancy, stability of floating bodies, area moment of inertia, geometrical symmetry, location of the center of gravity, drive shaft seals, shape versus drag, solar cell and DC motor principles are just examples of topics to be considered. The independent reading is not intended to result in the depth of understanding that is expected in courses such as statics or fluid mechanics. It does provide exposure to such future courses and accentuates their presence in the engineering program.