STUDENT DESIGN COMPETITION at AEES 2006

INTRODUCTION

This describes the student design competition to be sponsored by AEES and held at the society's annual meeting. The competition will be modeled after other successful engineering design competitions but will be based on the unique qualities of ecological engineering. Since the designs in ecological engineering are living ecosystems constructed by engineers, the AEES design competition will involve student teams creating ecosystems which are then judged by established criteria. The first annual competition will be held at the AEES meeting in Berkeley, California during April 2006. The format of the competition event will evolve over time with input from the membership of the Society.

THE COMPETITORS

The competitors will be groups of university students (either graduate or undergraduate) with an interest in ecological engineering. Initially, teams will consist of at least two student members with a faculty advisor, all from the same university and members of AEES. All members of the team must attend the meeting and participate in the event. The students will do all of the design work at the event. The faculty advisor will not participate during the event but will help organize and advise the team before the event. Teams should do some preparation at their home institutions before the event, such as practicing the set up of the design microcosm. Students and faculty might be from capstone design courses at their home universities and the competition might be part of the course requirement.

An individual student from a university that does not have a team can join a team at another university but this participation must be coordinated well in advance of the competition. Teams formed in this way must be able to communicate well enough to share in the preparations for the competition.

THE DESIGN

The design will initially consist of an aquatic microcosm to be constructed at the conference site for the competition at Berkeley and may be modified in scope each year. Each team will be given a ten gallon (40 liter) aquarium at the start of the event which must be part of the design. The entire design can be constructed inside this aquarium. Other components (such as other tanks, pumps, and other equipment) can used but must be physically connected to the aquarium. The aquaria are important because ecosystem metabolism will be measured using the diurnal oxygen curve method as part of the design evaluation. Also, the ten gallon (40 liters) aquarium provides an element of standardization and a point of departure for the design so that teams can practice before the competition.

An aquatic microcosm will be constructed using the aquarium with water and seeding of biota from local sources at the conference site. Any water source can be used and any chemical compounds can be added to the water during the set-up period at the start of the conference. Thus, water quality (salinity, nutrients, aeration, pH, and other parameters that define the quality

of water) is part of the design. Also, any aquatic biota can be used in the design as long as it is collected locally. Vertebrates (fish and herptiles) must not be incorporated into the designs due to institutional animal care and use liability. Collections for local biota must be made during the set-up period. Creativity in the microcosm designs come from the mix of species seeded into the system and any additional hardware components added to the ten gallon (40 liter) aquarium.

THE EVENT

The design competition event will take place during the annual AEES conference. The first stage will be the set-up of the design microcosms which should take place the day before the conference or the morning before if the conference starts in the afternoon or evening. All basic construction including hardware design, biota collections, and other preparations must be completed during the set-up period of 4 to 8 hours, depending on the conference schedule. Add-on hardware for the standard aquaria can be brought with the team from the home university, but it must be attached to the aquarium during the set-up period. This period of microcosm construction will be like the "Junkyard Wars" TV program with students scrambling to find and connect hardware and collect biota during a limited time period.

After the set-up period, the microcosms will be incubated under the control of the judges using the ambient conditions at the conference facilities. This location will be determined by the conference program committee at the university hosting the conference. The microcosms may be displayed in the poster area during the conference for examination by the attendees and to build anticipation for future contests. The designs will be evaluated near the end of the conference by the judges. This will allow for approximately two days of incubation. Student groups will be asked to make oral presentations on their designs at the time of judging. These presentations should describe the biota and hardware of the design along with any special features that characterize the constructed ecosystem. The award winners will be announced at the AEES business meeting or closing ceremony.

It is recognized that two days is not really enough time for much ecological self organization to take place inside the microcosms. This is a practical constraint and a limitation on the quality of the designs. However, the designs will be whole ecosystems with multiple trophic levels and at least short-term metabolism and associated biogeochemistry.

JUDGING THE DESIGNS

Designs will be evaluated by a panel of pre-selected judges appointed by the Vice President of AEES, and who are members of the AEES. The AEES Committee on the Student Ecological Engineering Design Contest will interview and recommend judges to the Vice President, which may include members of the Committee. At least three (3) judges will be engaged and an effort will be made to include representatives from academia, practice, and government or industry (regulation, research, or administration). Faculty advisors of the teams will not be judges to avoid conflict-of-interests.

Three criteria will be used to evaluate the designs: (1) magnitude of ecosystem metabolism, (2) species richness or diversity of identified species, and (3) overall creativity of the design. Each of these criteria will be assessed separately by the judges and will be combined into a composite score. All of the composite scores from the judges will be averaged and the team with

the highest average composite score wins the competition. The AEES Committee on the Student Ecological Engineering Design Contest may develop weighting factors and scoring forms beforehand, as long as these preparations allow the judges to take into account innovative or unusual events observed during the competition.

Ecosystem metabolism will be measured by the diurnal curve method based on dawn-dusk-dawn measures of dissolved oxygen in the water of the ten gallon (40 liter) aquaria. Scores for this criterion will be objectively assessed so that the design microcosm with the highest metabolism gets the highest score for this criterion.

Richness diversity will be assessed based on a list of species that have been identified from the design microcosm by the student team. This list will be given to the judges at the time of the design evaluation. Scores for this criterion will be objectively assessed so that the design microcosm with the highest diversity gets the highest score for this criterion. Local teams will have an advantage for this criterion if they work out the taxonomy of species in their design microcosm before the event and this advantage can be compensated for by the judges.

Creativity of the design must be assessed subjectively and fairly by the judges. This criterion will evaluate the mix of biota and the add-on features such as special habitat elements, hydraulic microenvironments, and other factors that may arise in the assessment by the judges.

A plaque with the names of each teammate will be awarded to the winning team. The plaque will be displayed in the academic department of the winners in recognition of the team effort. The Secretary of AEES will maintain a roster of all past winners and add the winners each year to that roster of honor.