FSEA PROJECT PLANS

January 18, 2000

THE HYDRAULIC LIFT
HL1

Applicable Grades	9th through 12th
Number of Members Per Team	Two
Number of Lifts Per Team	One
Number of Sessions	Eight to Twelve

SKILLS AND ENGINEERING CONCEPTS DEVELOPED:

Depending on the device designed, concepts developed include: energy, friction and friction loss, pumps, pressure, torque, mass, mechanical advantage, gears, screws, levers, gravity, and acceleration.

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Opinions expressed are those of the authors and not necessarily those of the foundation.

INTRODUCTION

Water projects have been famous all through history. In ancient Iraq (Babylon) there was running water in hotels high above the source, the river Tigris. In the early 1930s, hydraulic engineers struggled with the most efficient way to move water from the Colorado River bed to the rim of the Grand Canyon, a difference in elevation of over a mile. Today, in tall skyscrapers, engineers have designed elaborate water systems with pumping stations and isolated floors to insure a fairly constant at-the-faucet water pressure on all floors of buildings as tall as 100 floors or more. Application of the principles of hydraulics, combined with an understanding of the laws of gravity, has often resulted in the most innovative solutions to the most daunting problems.

OBJECTIVE

Build a device that can raise a certain volume of water to a higher elevation using only the gravitational potential energy of the water.

RESEARCH

The research of concepts such as pressure, energy transfer, mechanical advantage, hydraulics and gravitation will be helpful in the completion of the project.

PROJECT DESCRIPTION

- Each team is allowed exactly one liter of water.
- The only source of energy allowed in the movement of the water is the potential energy in the water due to the earth's gravitational attraction and the atmospheric pressure inherent to the test site.
- The final resting place for the water following the transfer must be six inches above the original resting place.
- The original resting place for the water may not be more than three feet from the floor.
- Any type of mechanism is acceptable as long as there is no source of energy in the mechanism that contributes to lifting the water.
- Any type of energy conversion system is acceptable.
- The transfer must be completed within five minutes of the starting time.
- The system must be in equilibrium prior to the introduction of the water.
- The introduction of the water may unbalance the system, but the design of the system must eventually effect transfer.
- Storage problems may arise, and student teams are allowed to take their projects home.

MATERIALS

FSEA will provide:
Graph paper

FSEA will not provide any of the actual material used in the construction of the Hydraulic Lifts. However, FSEA will reimburse each team for up to $25.00 for the cost of material (receipts will be collected and submitted by the mentor).

DESIGN

The teams should develop conceptual designs. Mentors will determine the legality of the design. The team will acquire its own material. The maximum budget for each team will be $25.00. The mentors will establish the machine cost based on receipts for purchased materials. They will use their best judgement if receipts are not provided. Teams are required to make up drawings, and include with those drawings a parts list.

COMPETITION

One liter of water can be placed at any desired height up to three feet above the floor. The mechanism cannot provide any source of energy, including gravity energy, except that provided by the weight of the water. Any type of mechanism or energy conversion system is acceptable. To start the system, water will be introduced into the system. The movement of water to the six inches higher location must be completed within five minutes. The machine may not be touched after the water has been introduced to activate the system, with the exception of the turning off or turning on of a valve.

The volume of the water that has been raised six inches will be measured. The team which successfully moves the most water six inches vertically will win.

Receipts for all material purchased by the team must be submitted. Teams must be able to demonstrate that they did not spend more than $25.00.

See Appendix A for a graphic of the competition.

LESSON PLAN BY SESSIONS

This is a guide only.

Session #1

Introduce the project.
Teams begin to brainstorm and research their device.

Session #2

Teams continue research, and begin to analyze their ideas.

Session #3

Teams should begin the design drawings of their devices.

Session #4

Teams should begin constructing their devices.

Session #5

Testing, re-design, and construction continues.

Session #6

Testing, re-design and construction continues.

Session #7

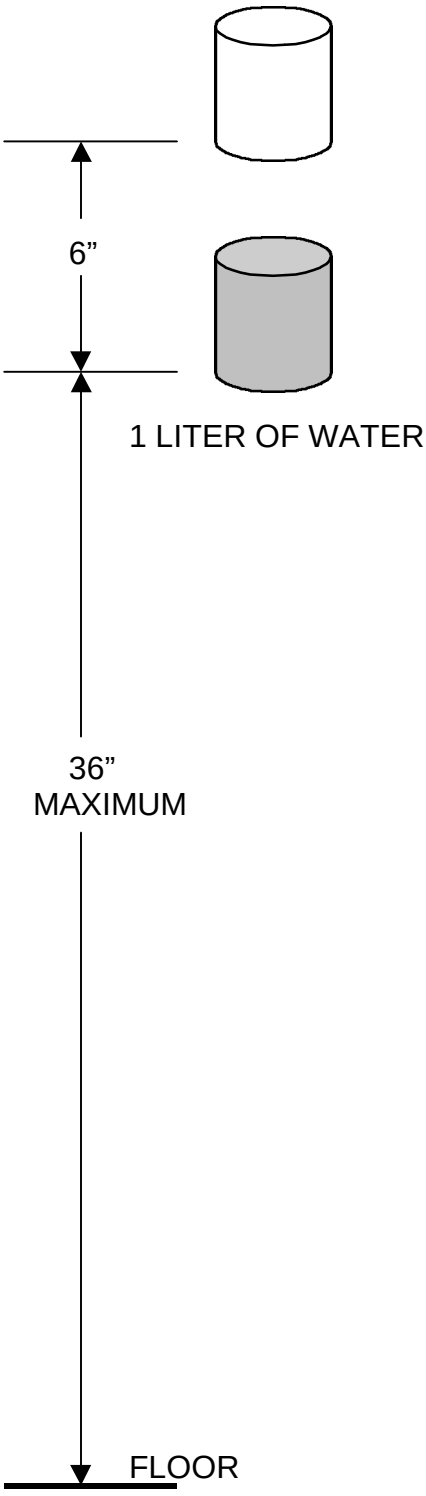
Hold the competition.

Session #8

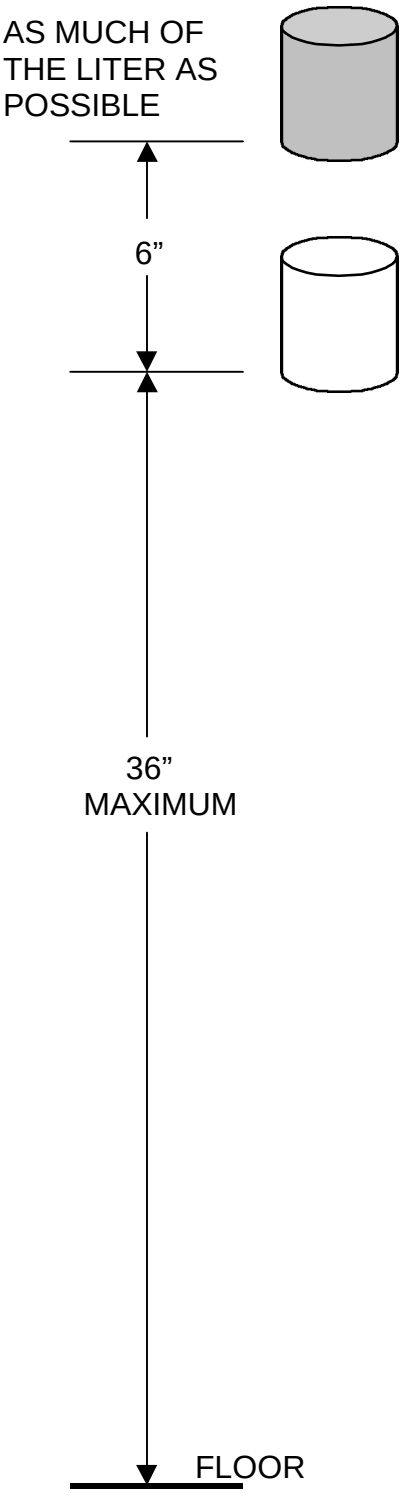
Awards ceremony. Post Competition discussion, discuss what did and did not work, and why.

APPENDIX A

START OF THE COMPETITION



END OF THE COMPETITION



FAX (714) 229-2228

PLEASE ALLOW FOURTEEN DAYS FOR DELIVERY

NAME♦	PHONE♦
COMPANY NAME (IF NOT THE SCHOOL) ♦	
ADDRESS♦	
CITY♦	ST♦ ZIP♦
MY SCHOOL IS♦	
TODAY'S DATE♦ / /	DATE NEEDED♦ / /

FILL IN YOUR ORDER BELOW. STEPS 1,2,3 (SEE CATALOG FOR PROJECT INFORMATION)

PROJECT NAME	CODE	# OF STUDENTS
STEP 1 (EXAMPLE) **LAND YACHT**	STEP 2 **LY1**	STEP 3 **30**

PLEASE, NO MORE THAN TWO PROJECTS PER ORDER FORM

EACH PROJECT SHIPMENT INCLUDES 3 SETS OF RIBBONS, CERTIFICATES, AND EVALUATION FORMS

T-shirts	Small	Medium	Large	X Large	
Girls					
Boys					
				Total	
Hats	One Size Fits All				

Membership Cards	Qty	Miscellaneous	Qty.
Engineer Technician		Extra Ribbons	
Junior Engineer		Extra Certificates	
Engineer		Portfolios	
Senior Engineer			
Engineer Specialist			

Other: