EAA Hybrid Engine, Battery, Emissions & Efficiency

This laboratory investigates the production of motive power from chemical energy to examine the conversion efficiency and emissions associated different forms of energy sources, transfer and storage. The activity will use a gas internal combustion engine coupled to a hybrid battery powered system which is in turn coupled to a rotating flywheel. The project will examine the individual efficiencies of the components of a hybrid system that included a gas-powered generator coupled to a flywheel at variable speeds and a hybrid-electric system coupled to regenerative brake with a lithium ion battery. The analysis will include calculating the system level efficiency of converting natural gas to flywheel kinetic energy and subsequently to storage within a lithium ion battery. Various design considerations will include the production of noxious and greenhouse gas emissions, efficiency of the Otto cycle and power and energy density of lithium ion batteries. The work will be conducted in the Hopkinson lab and will require the use of student individual laptops to run a Matlab computer simulation.

Future physical lab:

This lab examines the conversion of chemical energy to motive work as well as emissions associated different forms of energy sources. The activity will examine an internal combustion engine coupled to a hybrid battery powered system. The project will investigate the components of a hybrid system that included a gas-powered generator coupled to a flywheel with an applied brake of variable load and a hybrid-electric system coupled to regenerative brake with a lithium-ion battery storage. The analysis will include calculating the system level efficiency of converting natural gas to flywheel kinetic energy and subsequently to storage within a lithium-ion battery. Various design considerations will include the production of noxious and greenhouse gas emissions, efficiency of the Otto cycle from gas sources (natural gas and hydrogen) and power and energy density of lithium-ion batteries.